

This file is part of the following work:

Cenderadewi, Muthia (2024) *Unintentional drowning in Indonesia: mortality rates, risk factors, and prevention*. PhD Thesis, James Cook University.

Access to this file is available from:

<https://doi.org/10.25903/jgf0%2Dn652>

Copyright © 2024 Muthia Cenderadewi

The author has certified to JCU that they have made a reasonable effort to gain permission and acknowledge the owners of any third party copyright material included in this document. If you believe that this is not the case, please email

researchonline@jcu.edu.au

Unintentional Drowning in Indonesia: Mortality Rates, Risk Factors, and Prevention

Submitted by

Muthia Cenderadewi

Medical Doctor, University of Mataram - Indonesia

Master Public Health and Tropical Medicine, James Cook University - Australia

In fulfilment of the requirements for the degree of

Doctor of Philosophy (Health)

College of Public Health, Medical and Veterinary Sciences

James Cook University

November 2024

Abstract

Background

Drowning is a significant global public health issue, disproportionately affecting populations in low- and middle-income countries, including Indonesia. With its vast geography, large population, and high disaster risk, Indonesia is particularly susceptible to unintentional drowning. However, limited information is available on drowning in Indonesia. This study aimed to investigate mortality rates, risk factors, and prevention of unintentional drowning in Indonesia, as well as their interconnectedness with socio-ecological approaches to health promotion.

Methods

This study was conducted as an explanatory sequential mixed methods study, comprising three phases: 1) scoping review; 2) population-based retrospective cohort study; and 3) exploratory qualitative study. The scoping review gathered peer-reviewed studies and grey literature on unintentional, water transport-related, and disaster-related drowning in Indonesia. The cohort study analysed the Global Burden of Disease (GBD) 2019 Study data to assess drowning trends, mortality rates, risk factors, and burden at both national and sub-national levels. Focus group discussions were conducted in West Nusa Tenggara, one of the most drowning-prone areas, with parents and village community leaders.

Results

The study identified the urgent need to advance drowning prevention through robust data collection, and to tailor drowning prevention strategies to address the heightened risk among children, particularly in less developed provinces of Indonesia. The study also highlighted the need for low-cost, culturally appropriate community-based prevention interventions to reduce drowning risks, especially in Indonesian rural communities.

Conclusion

The study highlighted the need to: i) standardise and integrate national reporting on health, mortality, and disaster data; ii) develop cost-effective, culturally sensitive community-based prevention strategies for high-risk populations; iii) build resilience in disaster-prone communities; and iv) integrate drowning prevention into regulatory frameworks across water safety, disaster risk management, climate change mitigation and adaptation, boating and maritime safety, early childhood care, education, health, development planning, and efforts to alleviate socioeconomic disparities in Indonesia.

Acknowledgements

I extend the first acknowledgment and my heartfelt appreciation to my Advisors, Associate Professor Sue Devine and Professor Richard Franklin, for their unwavering support. I sincerely thank both of you for the invaluable wealth of expertise and experience, guidance, time, support, and understanding you have been continuously providing me with throughout my PhD candidature.

I am deeply grateful for the honour and privilege of witnessing firsthand your great commitment to prioritising students and their learning experience, growth, and well-being. Your dedication to creating a supportive and enriching academic environment for every student is truly admirable. You serve as stellar examples of academics and scholars who not only strive for academic and scientific excellence, but also prioritise inclusivity and growth by carefully considering the diverse needs of individuals in the learning process. Your guidance has shaped me profoundly, both personally and professionally, and I am forever grateful for your guidance and mentorship. Thank you for instilling in me the importance of giving back to the community and making a meaningful difference where it truly matters.

I extend my sincere gratitude to all participants who contributed to this research study. Your valuable insights and life experiences have been essential in shaping the understanding of this research area of unintentional drowning burden, risk, and prevention in Indonesia.

I would also like to express my sincere gratitude to the James Cook University (JCU) Division of Tropical Health and Medicine Cohort Doctoral Studies Program, specifically to Associate Professor Melissa Crowe, Dr. Diana Mendez, and Associate Professor Meryl Churchill, and to Professor Elizabeth Tynan of JCU Graduate Research School (GRS). Your advice and support throughout my study have been invaluable. In addition, I am most grateful to the staff of the JCU Graduate Research School (GRS) and College of Public Health, Medical and Veterinary Sciences (CPHMVS) Higher Degree by Research (HDR) for their assistance and support. Thank you for your contributions to my academic journey.

And lastly, I would like to dedicate this thesis to my soul, my beloved Mother and Father. For everything I am and all that I have yet to become, I owe it to you and the sacrifices you have made for me.

Statement of the Contribution of Others

This thesis represents original work by the candidate, with due acknowledgment given to the contributions of others in the publications. No portion of this thesis has been submitted for any other academic award or University or Institution. Throughout the study, Associate Professor Sue Devine and Professor Richard Franklin, as my advisory panel, provided guidance on study design, data collection, analyses, and reporting, as well as continuous review and editorial guidance on the thesis. All co-authors of the publications included in this thesis have provided their consent for inclusion. The contributions of others are detailed in the table provided below.

Nature of contribution	Details of contribution	Name of contributors
Formal intellectual support	<ul style="list-style-type: none"> Supervision, guidance, mentorship, and evaluation on study conceptualisation, data curation, formal analysis, methodology, resources, funding acquisition, visualisation, and reporting of publications, thesis chapters, and all other material contained in this thesis Supervision, guidance, mentorship, and evaluation of professional development 	<ul style="list-style-type: none"> A/Prof Sue Devine Prof Richard Franklin
Informal intellectual support	<ul style="list-style-type: none"> Guidance and advice on conducting research, professional development, and managing one's academic progress and candidature 	<ul style="list-style-type: none"> A/Prof Sue Devine Prof Richard Franklin A/Prof Melissa Crowe, Dr Diana Mendez, A/Prof Meryl Churchill of Cohort Doctoral Studies Program, JCU Division of Tropical Health and Medicine, Prof Elizabeth Tynan of JCU Graduate Research School
Data collection	<ul style="list-style-type: none"> Co-contributors on data collection, validation, and analysis 	<ul style="list-style-type: none"> Prima B. Fathana, MD, Pulmonologist Dian P Sari, MD, MMedEdu Dr Amy E Peden
Financial support	<ul style="list-style-type: none"> JCU International Research Training Program Scholarship Higher Degree by Research Enhancement Scheme Grant JCU College of Public Health, Medical and Veterinary Sciences' Scholarship 	<ul style="list-style-type: none"> JCU JCU Graduate Research School JCU College of Public Health, Medical and Veterinary Sciences
Editorial assistance	<ul style="list-style-type: none"> Final review and editing of thesis 	<ul style="list-style-type: none"> A/Prof Sue Devine Prof Richard Franklin

Note: A/Prof. = Associate Professor; Prof. = Professor; Dr = Doctor; JCU = James Cook University.

Statement of the Use of Generative AI

Generative AI technology was not used in the preparation of any part of this thesis.

Executive Summary

Background

Drowning is a significant global public health issue, disproportionately affecting populations in low- and middle-income countries (LMICs), including Indonesia. Indonesia's vast geography, comprising 17,500 islands, and a population exceeding 270 million, combined with its status as one of the world's most disaster-prone areas—experiencing an average of 3,615 natural disasters annually, with a high risk for tsunamis and floods—increases the risk of unintentional drowning, disaster-related drowning, and water-transport-related drowning. However, limited information is available on unintentional drowning in Indonesia.

Research Aims

This study aimed to investigate mortality rates, risk factors and prevention of unintentional drowning deaths in Indonesia, as well as the interconnection of these aspects with socio-ecological approaches of health promotion.

Research Questions

This study answered these following questions:

1. What are unintentional drowning mortality rates in Indonesia?
2. What are unintentional drowning risk factors in Indonesia?
3. What drowning prevention strategies and water safety regulations have been implemented in Indonesia?
4. What are Indonesian parents' and community perceptions and practices regarding child drowning risk and prevention?
5. What gaps exist in unintentional drowning prevention strategies in Indonesia from a health promotion perspective?

Methods

This study was conducted as an explanatory sequential mixed methods study, comprising three phases: 1) scoping review; 2) population-based retrospective cohort study; and 3) exploratory qualitative study. The scoping review was conducted to analyse peer-reviewed studies, government reports and policy documents on unintentional drowning, water transport-related drowning, and disaster-related drowning, published in English and Indonesian language, using MEDLINE (Ovid),

CINAHL, Informit, PsycINFO (ProQuest), Scopus, SafetyLit, BioMed Central and Google Scholar, Indonesian journal databases, and government agencies' websites. The search included all relevant literature published up until May 2023 to capture as extensive a range of information as possible on drowning incidences and prevention measures in Indonesia.

The quantitative phase was undertaken as a population-based retrospective cohort study, analysing unintentional drowning data sourced from the Global Burden of Disease (GBD) 2019 Study database to generate estimates of mortality and incidence rates, trends, years lived with disability (YLDs), and disability adjusted life years (DALYs) for unintentional drowning at national and sub-national level of 34 provinces of Indonesia between 2005 and 2019. The population-based retrospective cohort study identified under-five children as being at particular risk for drowning, hence the exploratory qualitative study was designed to further explore drowning in this priority group.

Focus group discussions were conducted with parents of children under-five years and village community leaders, recruited with purposive and snowball sampling, residing in villages of West Nusa Tenggara Province, one of the most drowning-prone settings in Indonesia with high under-five drowning mortality rates and one of the poorest health-performing provinces nationwide with high rates of all-cause mortality among under-five children. Thematic analysis was guided by Braun and Clarke's framework, using both deductive and inductive approaches.

Results

The study identified a paucity of information on unintentional, water transport-related, and disaster-related drowning rates, risk factors, and prevention in Indonesia. A decline in unintentional drowning mortality rates was observed between 2005 and 2019, with an average annual mortality rate of 2.58/100,000. However, incidence rates were constant.

Males in Indonesia were 1.81 (95% CI: 1.79 - 1.84) times more likely than females to fatally drown. The highest rate of mortality was consistently identified among the under-five populations, with average annual mortality rates of 9.67/100,000 across both sexes. Children under five years of age, individuals aged 70 years and older, and children aged 5-14 years were 3.67 (95% CI: 3.63 - 3.72), 2.5 (95% CI: 2.45 - 2.56), and 1.97 (95% CI: 1.94 – 2.00) times more likely to fatally drown, respectively, compared to those aged 15 to 49 years old. Distributions of drowning deaths vary depending on region, with mortality higher in provinces of Kalimantan, Papua, Sulawesi, Maluku, Nusa Tenggara, and Sumatra. This study identified the urgent need to advance drowning prevention through robust data collection, and tailor drowning prevention strategies to address the heightened risk among children under five, particularly in less developed provinces in central and eastern Indonesia.

The qualitative study identified limited community understanding of the preventability, vulnerability, and risk factors of child drowning; limited community concerns regarding water-related disasters as relevant drowning risk factors; and the need for low-cost and culturally appropriate community-based drowning prevention interventions to reduce the risk of child drowning, particularly in rural areas of Indonesia

The study findings underlined the urgent need for further investigation and strengthening of: i) standardised and integrated national reporting structures for health, mortality, and disaster data; ii) risk identification and targeted prevention; iii) enhancing self-efficacy through educational interventions; iv) development of cost-effective and culturally appropriate community-based child drowning prevention interventions; v) resilience building in disaster-prone communities; and vi) systematic effort to integrate drowning prevention into regulatory frameworks related to water safety, disaster risk management, boating and maritime safety, early childhood caregiving, education, health, development planning, and efforts to alleviate socioeconomic disparities in Indonesia, with clear obligations, responsibilities, and coordination mechanisms between government agencies and stakeholders.

Conclusions

The study highlighted the need for advancing drowning prevention through robust data collection and strengthening research to better understand local contexts and socio-ecological determinants of drowning as well as delivery of drowning prevention programs. Further policy development and research focusing on integrating water safety, boating and maritime safety, and disaster risk management policy instruments and programs that reflect a socio-ecological approach to drowning prevention is imperative in Indonesia.

Originality

To my knowledge, this study is the first to report on the unintentional drowning profile in Indonesia, and the poorly explored water transport-related drowning and disaster-related drowning, at both national and sub-national levels. Hence, this study provides vital insights for understanding the burden and risks associated with unintentional drowning, setting priorities for drowning prevention, and informing the development, implementation, and evaluation of water safety policies and drowning prevention programs in Indonesia, particularly in relation to children under the age of five years. By upholding the principles of health promotion, this study contributes valuable knowledge

to the international health promotion and drowning prevention community, shedding light on the unique challenges of promoting water safety in resource-limited settings of LMICs.

Table of Contents

Abstract.....	ii
Acknowledgements.....	iii
Statement of the Contribution of Others	iv
Statement of the Use of Generative AI.....	v
Executive Summary.....	vi
Background.....	vi
Research Aims	vi
Research Questions	vi
Methods.....	vi
Results.....	vii
Conclusions.....	viii
Originality	viii
Table of Contents	x
List of Tables.....	xviii
List of Figures.....	xix
List of Abbreviations	xx
Positioning the Researcher.....	xxii
Conference Presentations on PhD Study Findings	xxiii
Thesis Outline.....	xxiv
Chapter 1 Introduction	xxvi
Chapter 2 Methodology and Methods	xxvi
Chapter 3 Scoping Review	xxvi
Chapter 4 Population-Based Retrospective Cohort Study	xxvii
Chapter 5 Community Perceptions on Child Drowning: Defining the Public Health Problem and Identifying Risk Factors.....	xxvii
Chapter 6 Child Drowning Prevention: A Community-Informed Health Promotion Perspective	xxviii
Chapter 7 Community Perspectives on Disaster-Related Drowning Risks	xxviii
Chapter 8 Contextualising WHO-Recommended Strategies to Indonesia	xxviii
Chapter 9 Final Discussion, Recommendations, and Conclusions	xxviii
Appendices	xxix
Chapter 1 Introduction.....	1
1.1. Overview	1
1.2. History of Drowning: From Mythological to Medical	1
1.3. Definition of Drowning: The Path to Global Health Consensus.....	4
1.4. Defining Unintentional Drowning: Inclusions and Exclusions	7

1.5.	The Progress of Drowning Rate Reduction: Disparities between High-Income and Low-Income Nations.....	9
1.6.	Bridging the Gap: Global Initiatives on Drowning Prevention.....	12
1.7.	Indonesia: Why Does It Matter?.....	15
1.8.	Through the Lens of Public Health: Converging Injury Prevention and Health Promotion.....	21
1.9.	Health Promotion: A Socio-Ecological Approach to Drowning Prevention.....	23
1.10.	Health Belief Model: Understanding Water Safety Behaviours.....	25
1.11.	Statement of the Problem.....	26
1.12.	Significance of the Study.....	27
1.13.	Research Aims.....	28
1.14.	Research Questions.....	28
1.15.	Conceptual Framework.....	28
Chapter 2	Methodology and Methods.....	31
2.1.	Philosophical Perspectives: Setting Ontological and Epistemological Position.....	31
2.2.	Research Methodology.....	33
2.3.	Methods and Theoretical Underpinnings.....	35
2.3.1.	Phase One: Scoping Review.....	35
2.3.1.1.	Research Aims.....	36
2.3.1.2.	Research Questions.....	36
2.3.1.3.	Search Strategy.....	37
2.3.1.4.	Review Strategy.....	39
2.3.1.5.	Data Abstraction.....	40
2.3.1.6.	Analysis.....	40
2.3.1.7.	Ethical Consideration.....	41
2.3.2.	Phase Two: Population-Based Retrospective Cohort Study.....	41
2.3.2.1.	Research Aims.....	42
2.3.2.2.	Research Questions.....	42
2.3.2.3.	Data Collection.....	43
2.3.2.4.	Data Abstraction.....	44
2.3.2.5.	Analysis.....	44
2.3.2.6.	Strengths and Limitations.....	45
2.3.2.7.	Ethical Consideration.....	46
2.3.3.	Phase Three: Exploratory Qualitative Study.....	46
2.3.3.1.	Research Aims.....	48
2.3.3.2.	Research Questions.....	48
2.3.3.3.	Study Site.....	48
2.3.3.4.	Sample Selection and Recruitment.....	51

2.3.3.5. Data Collection	53
2.3.3.6. Analysis.....	57
2.3.3.7. Rigor	59
2.3.3.8. Ethical Considerations.....	63
2.4. Ethical Aspects of the Research: Researcher Reflexivity on Positionality	64
Chapter 3 Scoping Review	67
3.1. Overview.....	67
3.2. Abstract.....	68
3.3. Contribution to Health Promotion	69
3.4. Background	69
3.5. Research Aims.....	70
3.7. Research Questions	70
3.8. Methods.....	71
3.8.1. Search Strategy.....	71
3.8.2. Literature Update	76
3.8.3. Review Strategy	77
3.8.4. Data Abstraction	78
3.8.5. Synthesis/Analysis	79
3.8.6. Ethics Approval	79
3.9. Results.....	79
3.9.1. Numbers and Rates of Unintentional Drowning Death in Indonesia	80
3.9.1.1. Accidental Drowning Deaths.....	80
3.9.1.2. Disaster-Related Drowning Deaths	80
3.9.1.3. Water Transport-Related Drowning Deaths	81
3.9.2. Risk Factors of Fatal Unintentional Drowning in Indonesia	82
3.9.3. Drowning Prevention in Indonesia	86
3.10. Discussion	92
3.10.1. Drowning Mortality Data across Indonesia: The Disparity on Data Availability	92
3.10.2. Drowning Risk Factors in Indonesia: A Knowledge Gap	92
3.10.3. Understanding the Linkage between Drowning Prevention and Health Promotion.....	93
3.11. Implications for Policy, Practice, and Future Research	93
3.11.1. Policy.....	93
3.11.1.1. Contributing to Situational Assessment on Drowning Prevention in Indonesia.....	94
3.11.2. Practice	95
3.11.3. Future Research.....	96

3.12.	Strengths and Limitations.....	96
3.13.	Conclusion	97
3.14.	Supplementary Table.....	98
Chapter 4	Population-Based Retrospective Cohort Study	106
4.1.	Overview.....	106
4.2.	Abstract.....	107
4.3.	Key Messages.....	108
4.4.	Introduction	109
4.5.	Methods.....	109
4.5.1.	Data Abstraction	110
4.5.2.	Analysis	111
4.5.3.	Ethics Approval	111
4.5.4.	Funding	111
4.6.	Results.....	112
4.6.1.	Incidence and Mortality Rates.....	112
4.6.1.1.	Mortality Rates by Age Group and Gender.....	114
4.6.1.2.	Mortality rates by province.....	116
4.6.2.	YLDs and DALYs.....	120
4.6.3.	Risk Factors	120
4.7.	Discussion	122
4.7.1.	The Rates and Trends of Unintentional Drowning in Indonesia.....	122
4.7.2.	The Risk of Drowning among Males in Indonesia: Informing Preventive Measures	123
4.7.3.	Unintentional Drowning as a Leading Cause of Injury Death for Indonesian Children	123
4.7.4.	Fatal Unintentional Drowning among Elderly Indonesians	124
4.7.5.	Jurisdiction as a Determinant for Unintentional Drowning in Indonesia.....	124
4.7.6.	Recommendations.....	124
4.7.6.1.1.	Future Research.....	124
4.7.6.1.2.	Policy Development.....	125
4.7.6.1.3.	Practice	125
4.8.	Strengths and Limitations.....	125
4.9.	Conclusions	126
4.10.	Supplementary Tables	127
Chapter 5	Community Perceptions on Child Drowning: Defining the Public Health Problem and Identifying Risk Factors.....	151
5.1.	Overview	151
5.2.	Abstract.....	152

5.3.	Contribution to Health Promotion	153
5.4.	Introduction	153
5.4.1.	Research Aims	154
5.4.2.	Research Questions	154
5.5.	Methods.....	154
5.5.1.	Study Design	154
5.5.2.	Research Setting	155
5.5.3.	Sample Selection and Recruitment	156
5.5.4.	Data Collection	156
5.5.5.	Analysis	158
5.5.6.	Researcher reflexivity on positionality	159
5.5.7.	Rigor.....	159
5.5.8.	Ethics Approval	159
5.6.	Results.....	159
5.6.1.	Theme 1 – Concepts of Drowning as an Issue	160
5.6.2.	Theme 2 – Perceived Preventability of Child Drowning.....	163
5.6.3.	Theme 3 – Drowning Risk Factors	164
5.6.4.	Theme 4 – Implications of Cultural Norms and Collectivism in Childrearing Practice on Drowning Risk	169
5.7.	Discussion	174
5.8.	Strengths and Limitations.....	176
5.9.	Conclusion	177
Chapter 6	Child Drowning Prevention: A Community-Informed Health Promotion Perspective	178
6.1.	Overview	178
6.2.	Abstract.....	179
6.3.	Introduction	180
6.3.1.	Research Aims	181
6.3.2.	Research Questions	181
6.4.	Methods.....	181
6.4.1.	Study Design	181
6.4.2.	Research Setting	181
6.4.3.	Sample Selection and Recruitment	182
6.4.4.	Data Collection	182
6.4.5.	Analysis	183
6.4.6.	Ethics approval	183
6.5.	Results.....	183
6.5.1.	Theme 1 – Stakeholders in Drowning Prevention Responsibility.....	184

6.5.2. Theme 2 – Health Information and Communication Agents	185
6.5.3. Theme 3 – Community Education and Skills Development.....	185
6.5.4. Theme 4 – Community Action	187
6.5.5. Theme 5 – Policy Development and Enforcement	187
6.6. Discussion	191
6.7. Strengths and Limitations.....	193
6.8. Conclusion	193
Chapter 7 Community Perspectives on Disaster-Related Drowning Risks.....	194
7.1. Overview.....	194
7.2. Abstract.....	195
7.3. Research in Context.....	196
7.3.1. Evidence before this study	196
7.3.2. Added value of this study	196
7.3.3. Implications of all the available evidence	196
7.4. Introduction	196
7.5. Methods.....	200
7.5.1. Study Design	200
7.5.2. Research Setting	200
7.5.3. Sample Selection and Recruitment	200
7.5.4. Data Collection	201
7.5.5. Data Analysis	201
7.5.6. Ethics Approval	202
7.6. Results.....	202
7.6.1. Theme 1 – Perceptions of Vulnerability	202
7.6.2. Theme 2 – Sense of Powerlessness and Fear during Disaster Event.....	204
7.6.3. Theme 3 – Factors Influencing the Decision to Evacuate.....	205
7.7. Discussion	209
7.8. Strengths and Limitations.....	211
7.9. Conclusion	211
Chapter 8 Contextualising WHO-Recommended Strategies to Indonesia.....	213
8.1. Overview.....	213
8.2. Abstract.....	214
8.3. Introduction	215
8.3.1. Research Aims	216
8.3.2. Research Questions	216
8.4. Methods.....	216
8.4.1. Study Design	216

8.4.2. Research Setting	217
8.4.3. Sample Selection and Recruitment	217
8.4.4. Data Collection	217
8.4.5. Data Analysis	218
8.4.6. Ethics approval	218
8.5. Results.....	218
8.5.1. Theme 1 – Perceptions of acceptability towards WHO-recommended interventions	219
8.5.2. Theme 2 – Barriers of Drowning Intervention Implementation	220
8.5.3. Theme 3 – Sociocultural Considerations of Implementing Interventions.....	222
8.5.4. Theme 4 – Enablers that Facilitate Participation in Interventions	223
8.6. Discussion	228
8.7. Limitations	230
8.8. Conclusion	230
8.9. Implications and contributions.....	230
Chapter 9 Final Discussion, Recommendations, and Conclusion.....	231
9.1. Overview: Reflection on Research Questions	231
9.2. Justification of the Research Methodology.....	232
9.3. Key Findings of the Three Study Phases	234
9.4. Concluding Discussions: Establishing Priorities for National Drowning Prevention Efforts in Indonesia.....	239
9.4.1. Priority 1: Advancing Drowning Prevention through Robust Data Collection ..	239
9.4.2. Priority 2: Prioritising Intervention Strategies to Prevent Child Drowning	242
9.4.2.1. Increasing Parental Awareness of Child Drowning Risk and Prevention	243
9.4.2.2. Integrating Survival Swimming Training into School Curricula	245
9.4.2.3. Installing Barriers to Limit Children’s Access to Bodies of Water	247
9.4.2.4. Promoting a Multi-Strategy, Community-Based Approach to Child Drowning Prevention	248
9.4.3. Priority 3: Developing Contextualised and Culturally Appropriate Interventions	250
9.4.4. Priority 4: Enhancing Risk Identification, Prevention, and Community Resilience Against Disaster-Related Drowning.....	252
9.4.5. Priority 5: Advancing Research on Socio-Ecological Determinants of Drowning to Inform Policy Integration and Intervention Development	254
9.5. Contribution to International Community: Insights for Global Drowning Prevention Efforts	256
9.6. Research Strengths and Limitations	256
9.6.1. Methodology	256
9.6.2. Applicability	259

9.7. Future Directions	260
9.8. Conclusion	261
References.....	263
Appendices.....	296
Appendix 1: Peer-Reviewed Publication – ‘Fatal Drowning in Indonesia: Understanding Knowledge Gaps Through a Scoping Review’	296
Appendix 2: Peer-Reviewed Publication – ‘The burden of unintentional drowning in Indonesia: Insights from the Global Burden of Disease Study 2019’	319
Appendix 3: Peer-Reviewed Publication – ‘Child drowning in Indonesia: Insights from parental and community perspectives and practices’	350
Appendix 4: University of Mataram Human Research Ethics Committee – Letters of Approval	366
Scoping Review	366
Population-Based Retrospective Cohort Study	367
Qualitative Study	368
Appendix 5: James Cook University Human Research Ethics Committee – Letters of Acknowledgment of External HREC Approval	369
Appendix 6: Focus Group Moderator Guide in English	371
Appendix 7: Participant Information Sheet in English.....	373
Appendix 8: Consent Form in English.....	375
Appendix 9: Household Demographic Questionnaire in English.....	376

List of Tables

Table 2.1.	Inclusion and Exclusion Criteria	39
Table 2.2.	Focus group moderator guide's domains of enquiry and examples of follow-up questions and probes	55
Table 2.3.	COREQ (Consolidated Criteria for Reporting Qualitative Research) Checklist	61
Table 3.1.	Search Strings Used for Each Database	72
Table 3.2.	Studies on Risk Factors of Unintentional Drowning in Indonesia	83
Table 3.3.	Analysis of Prevention Interventions Investigated in Indonesia using the Health Promotion Framework	87
Table 4.1.	Drowning Incidence, Mortality, YLLs, YLDs, and DALYs in Indonesia 2005-2019	113
Table 4.2.	Risk Factors of Fatal Unintentional Drowning in Indonesia	121
Table 5.1.	Focus Group Moderator Guide's Domains of Enquiry and Examples of Follow-Up Questions	157
Table 5.2.	Focus Group Participants' Characteristics and Home Environment	160
Table 5.3.	Definitions of Themes and Illustrative Quotes Supporting Interpretations of Themes	171
Table 6.1.	Definitions of Themes and Illustrative Quotes Supporting Interpretations of Themes	189
Table 7.1.	Definitions of Themes and Illustrative Quotes Supporting Interpretations of Themes	208
Table 8.1.	Definition and Illustrative Quotes Supporting Interpretations of Themes	225
Supplementary Table 3.14.1.	Summary of Studies Reviewed.....	98
Supplementary Table 4.10.1.	Mortality Rates of Unintentional Drowning by Sex, Age Group and Province in Indonesia between 2005 and 2019.....	127
Supplementary Table 4.10.2.	The Trend of Unintentional Drowning Mortality Rates by Sex and Age Group in Indonesia between 2005 and 2019.....	150

List of Figures

Figure 1.1.	Indonesia's Geographical Position in Relation to Asia and Australia.....	16
Figure 1.2.	Indonesian Provinces.....	19
Figure 1.3.	The Public Health Model.....	22
Figure 1.4.	The Health Promotion Framework.....	25
Figure 1.5.	The Health Belief Model.....	26
Figure 1.6.	Conceptual Framework of the Study.....	30
Figure 2.1	Research Flowchart.....	35
Figure 2.2.	Map of Study Sites in West Nusa Tenggara, Indonesia.....	51
Figure 3.1.	The PRISMA-ScR 2020 Flow Diagram for Scoping Review.....	78
Figure 4.1.	Thirty-Four Indonesian Provinces Investigated in the Study.....	111
Figure 4.2.	Unintentional Drowning Mortality Rates by Age Group and Gender in Indonesia 2005-2019.....	115
Figure 4.3.	The 2019 Mortality Rates of Unintentional Drowning of All Ages by Sex and Province in Indonesia.....	117
Figure 4.4.	The 2019 Under-Five Unintentional Drowning Mortality Rates by Sex and Province in Indonesia.....	119
Figure 5.1.	Examples of Water Bodies in Participants' Community and Home.....	166
Figure 8.1.	Future Research on Socio-Ecological Determinants of Child Drowning in Indonesia	229
Figure 9.1.	Informing Future Research and Policy Integration: Socio-Ecological Determinants of Drowning in Indonesia.....	255

List of Abbreviations

Abbreviation	Meaning
CDC	Centers for Disease Control and Prevention
CI	Confidence interval
CPHMVS	College of Public Health, Medical and Veterinary Sciences
CPR	Cardiopulmonary Resuscitation
DALY	Disability adjusted life years
DRI	Disaster Risk Index
DRR	Disaster Risk Reduction
DTHM	Division of Tropical Health and Medicine
FGDs	Focus group discussions
GBD	Global Burden of Disease
GDP	Gross Domestic Product
GHDx	Global Health Data Exchange
GRS	Graduate Research School
HBM	Health Belief Model
HDR	Higher Degree by Research
HPF	Health Promotion Framework
HIC	High-income countries
HREC	Human Research Ethics Committee
ICD	International Classification of Diseases and Related Health Problems
IHME	Institute for Health Metrics and Evaluation
ILCOR	International Liaison Committee on Resuscitation
JI	Joanna Briggs Institute
JCU	James Cook University
LMICs	Low- and middle-income countries
NGO	Non-governmental organisation
NHMRC	National Health and Medical Research Council
OR	Odds Ratio
PRECISE	Promoting Child Safe Environments
PRISMA-ScR	Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews
RR	Relative risk
SDGs	Sustainable Development Goals
SOLID	Saving of Lives from Drowning

Abbreviation	Meaning
TA	Thematic analysis
TTM	Transtheoretical Model
UN	United Nations
UNICEF	United Nations International Children's Emergency Fund
WHO	World Health Organization
WNT	West Nusa Tenggara
YLD	Years of healthy life lost due to disability
YLL	Years of life lost from mortality

Positioning the Researcher

Following the completion of my Bachelor of Medicine and Medical Doctor degrees, I have devoted over 14 years to serving as a lecturer and practitioner in the fields of public health and tropical medicine within the province of West Nusa Tenggara, Indonesia—the very region in which I was raised. Working in the archipelagic and rural setting of West Nusa Tenggara, one of the most susceptible areas for drowning in Indonesia, has heightened my awareness of the magnitude of unintentional drowning as a public health issue across Indonesia. My involvement in medical education and healthcare services in West Nusa Tenggara has also further exposed me to the intricate social determinants of health. This province consistently ranks among the poorest performing in terms of health outcomes in Indonesia, and economically disadvantaged children residing in its rural areas constitute a high-risk population, encountering barriers to accessing adequate and equal healthcare and education.^{1,2}

Consisting of a chain of islands situated in eastern Indonesia, West Nusa Tenggara had a population of 5.5 million in 2023.¹⁻⁴ It ranks eighth in population density and has the second lowest GDP per capita among Indonesia's 38 provinces.¹⁻⁴ Situated in the 'Pacific Ring of Fire', West Nusa Tenggara faces numerous disasters, including seismic activities such as earthquakes, tsunamis, volcanic eruptions, and landslides, and hydrometeorological events including floods, tropical cyclones, droughts, coastal erosion, and sea-level rise.³⁻⁵ With over 1.7 million children, constituting 36% of the total population, West Nusa Tenggara has significant child poverty rates, with approximately 20% of the children in West Nusa Tenggara living below the national poverty threshold, which is defined as living on less than USD 0.70 per day.¹ Despite facing numerous challenges, my work with health workers, volunteers, and communities in West Nusa Tenggara has revealed the community's unwavering strength and resilience. This experience has highlighted the commitment of local communities to empower themselves to address health and social disparities. With a keen awareness of how social determinants impact health, I remain dedicated to working with local communities and stakeholders, including educating future medical professionals in the region and across Indonesia.

My experience in living and working in West Nusa Tenggara has influenced my understanding on the significance of drowning as a public health issue, particularly in less developed rural areas of eastern Indonesia. The ever-present environmental and sociodemographic risk factors for unintentional drowning, disaster-related drowning, and water transport-related drowning heighten Indonesians' vulnerability to drowning. This has inspired my research to deepen the understanding of unintentional drowning mortality rates, risk factors, and prevention interventions in Indonesia. By identifying strategies to address this pressing public health issue, I aim to contribute to creating safer environments for local communities and reducing health inequalities and inequities.

Conference Presentations on PhD Study Findings

2023 World Conference on Drowning Prevention, 4-7 December 2023 in Perth, Australia

- Cenderadewi M, Devine SG, Peden AE, Franklin RC. Indonesia: Vulnerability to fatal unintentional drowning. Paper presented at: World Conference on Drowning Prevention 2023; Perth. <https://wcdp2023.com/wp-content/uploads/2023/12/World-Conference-on-Drowning-Prevention-2023---Abstract-book-1.pdf>.
- Cenderadewi M, Devine SG, Franklin RC. Indonesian drowning prevention interventions, a review: Protecting vulnerable populations across the nation. Paper presented at: World Conference on Drowning Prevention 2023; Perth. <https://wcdp2023.com/wp-content/uploads/2023/12/World-Conference-on-Drowning-Prevention-2023---Abstract-book-1.pdf>.
- Cenderadewi M, Devine SG, Franklin RC. An Indonesian qualitative study of parents' and community perception of child drowning. Paper presented at: World Conference on Drowning Prevention 2023; Perth. <https://wcdp2023.com/wp-content/uploads/2023/12/World-Conference-on-Drowning-Prevention-2023---Abstract-book-1.pdf>.

2022 The 14th World Conference on Injury Prevention and Safety Promotion (Safety 2022), 27-30 November 2022 in Adelaide, Australia

- Cenderadewi, M., Franklin, R., & Devine, S. (2022). 75 Informing unintentional drowning prevention in Indonesia: Global Burden of Disease 2019 Study. *Injury Prevention*, 28(Suppl 2), A8-A9. doi:10.1136/injuryprev-2022-safety2022.25
- Cenderadewi, M., Franklin, R., Devine, S., & Sari, D. P. (2022). 74 Fatal drowning in Indonesia: Understanding the gap of knowledge through scoping review. *Injury Prevention*, 28(Suppl 2), A8-A8. doi:10.1136/injuryprev-2022-safety2022.24

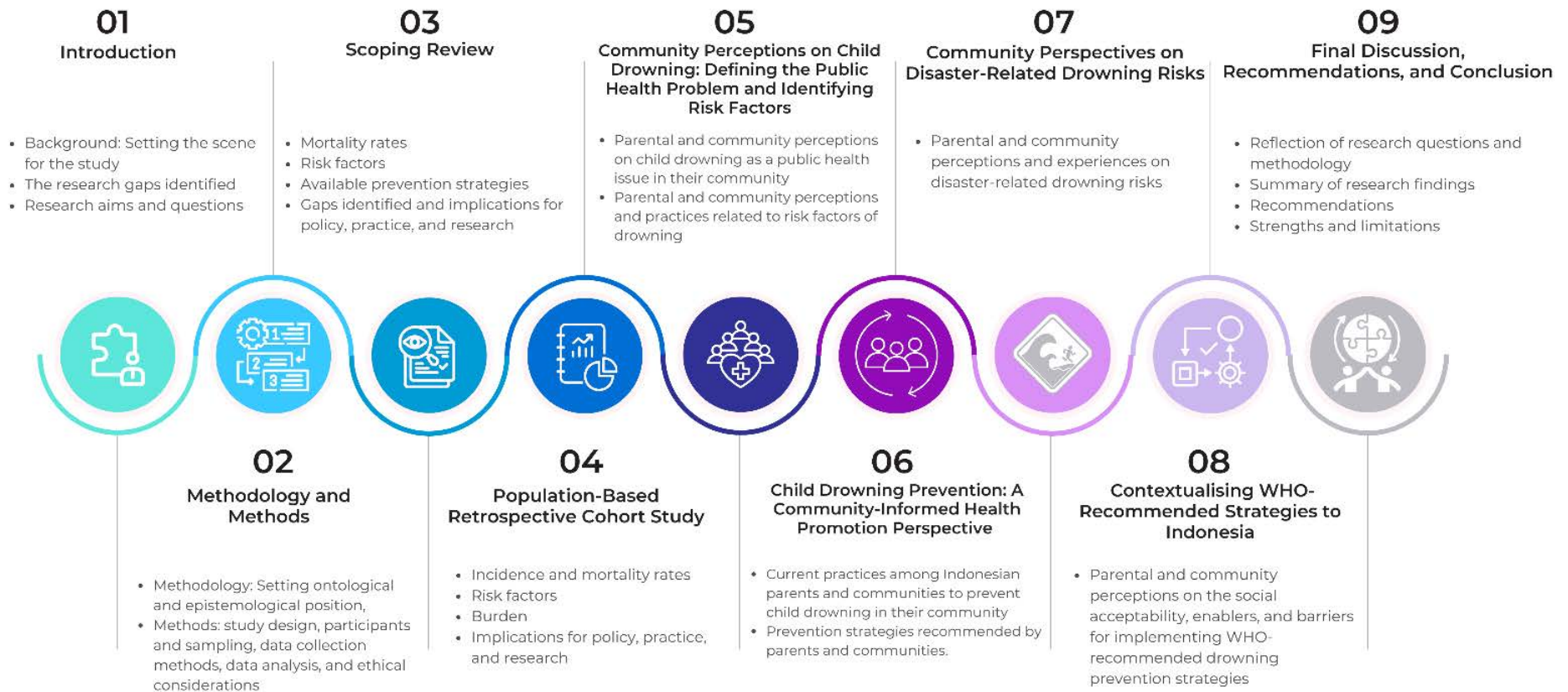
2021 Virtual Pre-Conference Global Injury Prevention Showcase, 22-26 March 2021

- Cenderadewi, M. (2021). P3.002 The socio-ecological nature of drowning in LMICs: Review informing health promotion approaches. *Injury Prevention*, 27(Suppl 2), A48-A48. doi:10.1136/injuryprev-2021-safety.146
- Cenderadewi, M., Franklin, R., & Devine, S. (2021). P3.001 Fatal unintentional drowning in Indonesia. *Injury Prevention*, 27(Suppl 2), A48-A48. doi:10.1136/injuryprev-2021-safety.14

Thesis Outline

This PhD thesis by publication comprises nine chapters, six of which are presented as manuscripts for publication. The structure of the thesis and a summary of each chapter's outline are provided below, along with a visual representation in the thesis outline figure. Each chapter starts with a figure that reflects the thesis outline, aiding the reader in navigating the thesis document more effectively.

Thesis Outline



Chapter 1 Introduction

Chapter 1 introduces the study by establishing its context and highlighting the importance of understanding the burden of unintentional drowning in Indonesia, the world's largest archipelagic country and fourth most populous nation, which faces significant risks from hydrometeorological and geological hazards. It outlines the significance of the study in identifying risks and setting agendas for drowning prevention efforts, as well as advancing evidence-based regulatory frameworks for water safety, maritime and boating safety, and disaster and climate risk management. The study's relevance is further supported by its alignment with key international initiatives such as the United Nations (UN) General Assembly Resolution on global drowning prevention, the 2017 World Health Organisation (WHO) guide on preventing drowning, and the Sustainable Development Goals. In addition, the chapter connects drowning prevention efforts to health promotion strategies by utilising the Health Promotion Framework, and to behavioural science theories through the application of the Health Belief Model. In addition, Chapter 1 identifies research gaps, serving as a needs assessment for drowning prevention in Indonesia, which informs the research aims and questions. Furthermore, it delineates the study's scope and limitations through a conceptual framework, guiding the subsequent phases of the research.

Chapter 2 Methodology and Methods

Chapter 2 establishes the ontological and epistemological stance of the study and defines the approach of inquiry, thereby providing justification for the chosen methodology and methods. This chapter further details the study design, including participant selection and sampling procedures, data collection methods, data analysis techniques, and ethical considerations for all three study phases: 1) a scoping review, 2) a population-based retrospective cohort study, and 3) an exploratory qualitative study. The chapter concludes with a discussion of the ethical aspects of the research, including researcher reflexivity and positionality.

Chapter 3 Scoping Review

Publication title: "Fatal drowning in Indonesia: Understanding knowledge gaps through a scoping review"

This chapter starts with an overview of the publication of the chapter, followed by background information that contextualises the study and addresses research gaps. It then outlines the research aims and questions. The methods section covers study design, systematic search strategy, inclusion and exclusion criteria, review strategy, data abstraction, analysis and synthesis, and ethical

considerations. The scoping review findings are then presented into sections on epidemiological findings, risk factors, and existing water safety and drowning prevention strategies. It concludes with an analysis of the implications for policy, practice, and further research, and a summary of the key points.

Chapter 4 Population-Based Retrospective Cohort Study

Publication title: “The burden of unintentional drowning in Indonesia: Insights from the Global Burden of Disease Study 2019”

Similar to the previous chapter, Chapter 4 begins with an overview of the publication of the chapter. It then provides background information to set the scene for the quantitative study, addressing research gaps identified in the literature reported in Chapter 3, which are translated into the chapter’s research aims and questions. The methods section covers study design, population selection, inclusion and exclusion criteria, data collection methods, data abstraction, and data analysis. The chapter then presents quantitative findings in sections on incidence and mortality rates, burden of drowning, and risk factors. It concludes with an analysis of implications for policy, practice, and future research, followed by a summary of the key points.

Chapter 5 Community Perceptions on Child Drowning: Defining the Public Health Problem and Identifying Risk Factors

Publication title: “Child drowning in Indonesia: Insights from parental and community perspectives and practices”

This chapter delineates the qualitative arm of the study and commences with an overview of the publication of the chapter. It proceeds to provide background information aimed at contextualising and expanding upon the quantitative findings presented in Chapters 3 and 4, thereby informing the research purpose and questions for this chapter. The qualitative methodology and methods are then elaborated upon, encompassing the study design, research setting, sample selection and recruitment, data collection methods, analysis procedures, and ethical considerations.

Subsequently, the chapter outlines the qualitative findings derived from thematic analysis, which employed both deductive and inductive approaches. These findings are presented across Chapters 5 to 8, with Chapter 5 focusing on exploring community perceptions on child drowning as a public health problem in their community, as well as identifying child drowning risk factors.

Chapter 6 Child Drowning Prevention: A Community-Informed Health Promotion Perspective

Publication title: “Preventing child drowning in Indonesia: A community-informed health promotion perspective “

This chapter follows Chapter 5, which presented qualitative findings intended to inform child drowning prevention efforts in Indonesia. Utilising the Health Promotion Framework as a guiding framework, this chapter specifically aims to investigate current practices and prevention strategies recommended by Indonesian parents and communities to prevent child drowning in their community.

Chapter 7 Community Perspectives on Disaster-Related Drowning Risks

Publication title: “The seawater is rising!”: Community perspectives on water-related disaster and drowning risks in Lombok, Indonesia

This chapter follows Chapters 5 and 6, where qualitative findings are presented to inform drowning prevention efforts in Indonesia. During the qualitative research, a key theme emerged on the community’s concerns and experiences on disaster-related drowning risks in their communities. Therefore, this chapter specifically explores community perceptions and experiences on disaster-related drowning risks in their community.

Chapter 8 Contextualising WHO-Recommended Strategies to Indonesia

Publication title: “Identifying enablers and barriers for implementing WHO-recommended drowning prevention strategies for children: Lessons from Indonesia for LMICs”

As the last chapter reporting qualitative findings on community perceptions of child drowning risk and prevention, this section aims to explore the acceptability, enablers, and barriers for implementing WHO-recommended drowning prevention strategies within Indonesian communities, to guide the development, implementation, and evaluation of context-specific child drowning prevention strategies in Indonesia.

Chapter 9 Final Discussion, Recommendations, and Conclusions

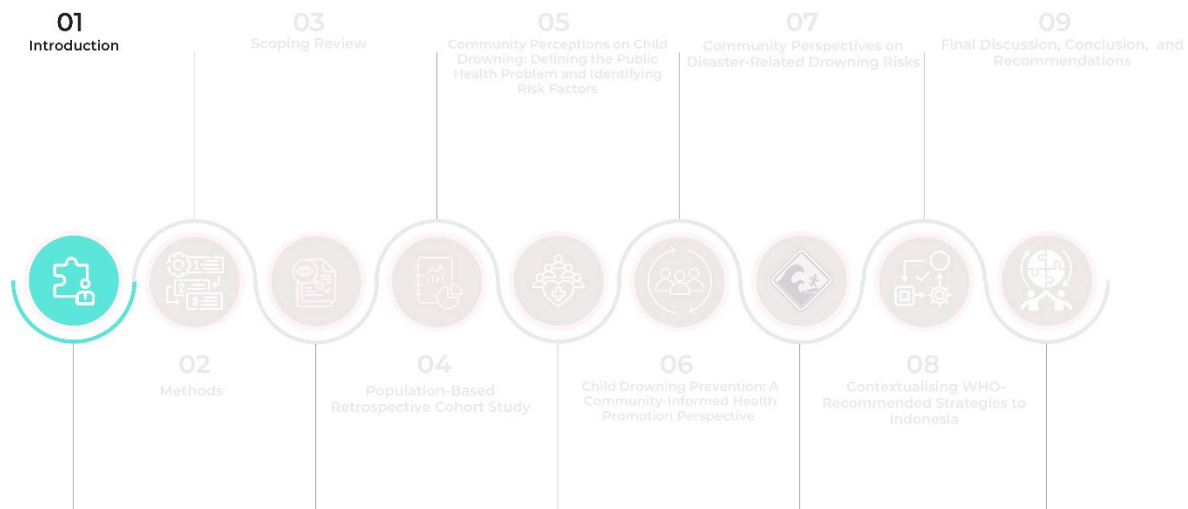
This concluding chapter reflects on the research questions, their importance, and whether they have been answered, by drawing together and synthesising the findings from the preceding chapters. The chapter also critically evaluates the research methodology in supporting evidence synthesis, discussing both the strengths and limitations of the research. Furthermore, it discusses the implications of these findings for informing effective and sustainable drowning prevention efforts in

Indonesia, providing a series of recommendations. In addition, it outlines the contribution of the research findings for informing drowning prevention and water safety promotion efforts in other countries, particularly LMICs.

Appendices

The Appendices include published articles, ethics approvals, focus group discussion moderator guide, participant information sheet, participant consent form, and participant household demographic questionnaire.

Chapter 1 Introduction



1.1. Overview

Drowning presents a significant challenge to global public health.⁶⁻⁸ In 2021, drowning accounted for 274,230 deaths worldwide, with a mortality rate of 3.5 per 100,000 population, disproportionately affecting children under five years old.⁹ More than 90% of unintentional drowning deaths occur in low- and middle-income countries (LMICs), with over half of these incidents occurred in Western Pacific and South-East Asia regions.^{6,8,10} Despite the high prevalence of drowning in LMICs, there is limited understanding of unintentional drowning deaths in Indonesia, the world's largest archipelagic state and the fourth most populated nation which faces frequent hydrometeorological disasters.¹¹

This chapter situates the research within the broader context of global drowning concerns, with a specific focus on Indonesia. It explores the definition of drowning, the global burden it imposes, worldwide progress in reducing drowning mortality, and its intersection with health promotion and social determinants of health. In addition, the chapter outlines the rationale behind the research, elucidates its aims, and delineates the research questions guiding the study.

1.2. History of Drowning: From Mythological to Medical

The history of drowning is a reflection of human civilisation's evolving understanding and response to the complex phenomenon that is drowning. From ancient myths and superstitions to

modern scientific advancements, the story of drowning encompasses a rich tapestry of cultural, societal, and technological influences, shaping its perception and management.¹²

References to drowning can be traced back to ancient civilisations such as Ancient Egypt, Assyria, Byzantium, and Greece, and Rome, with historical records dating as far back as around 1500 BCE.¹²⁻¹⁵ An illustration from 1237 BC depicts the King of Aleppo being held upside down following a submersion incident, a practice aimed at expelling water from the respiratory tract, highlighting an early recognition of methods for treating non-fatal drowning incidents.¹² A study on burial practices during Ancient Egypt also reported that bodies retrieved from drowning in the Nile River were embalmed with particular care, reflecting a profound recognition of drowning as a significant cause of death in the region.¹⁶ In addition, anthropologists have reported that drowning was the traditional method of infanticide of deformed infants in Ancient Rome during the 3rd century CE, highlighting the early civilisation's recognition of the fatal consequence of drowning.^{14,15}

In ancient civilisations, drowning was often viewed through a mythical or religious lens, frequently linked to notions of divine miracles and punishment, mirroring cultural beliefs regarding water and its spiritual importance.^{12,13,15} Two of the most frequently cited early depictions of drowning are the biblical narratives of Noah's Flood in the Book of Genesis and the parting of the Red Sea in the Book of Exodus, which some modern scholars proposed to be inspired by a catastrophic flooding event of the Black Sea and the Babylonian Exile in the 6th century BCE, respectively, although the historical accuracy and dating of the text remain the subject of scholarly inquiry and debate.¹⁷⁻²¹ During Ancient Greece and Hellenistic periods, drowning continued to be associated with mythological and religious beliefs, with drowning widely perceived as acts of Gods, including through natural disasters, although there were records of unintentional drowning incidents associated with various human activities, particularly around naval expeditions and warfare.²²

During the Middle Ages through the Early Modern period, although continued to be associated with punishment and superstition, drowning took on additional legal and social dimensions.²³⁻²⁵ The period of European-wide witch-hunts, spanning from 1480 to 1650, saw the emergence of trial by ordeal, when the method of "swimming a witch," also known as "ducking", was commonly employed to ascertain guilt or innocence among those accused of witchcraft, involving subjecting accused individuals to drowning ordeals to determine their fate. The belief underpinning this practice was that the purity of water, as observed in baptismal rituals, would reject those who had turned away from God, hence, those who were able to remain afloat during the swimming test were deemed guilty of practicing witchcraft.²³⁻²⁵

The understanding of drowning evolved from mythological interpretations to medical explanations as advancements were made in anatomy and physiology during the 17th and 18th centuries, with anatomists such as Giovanni Battista Morgagni significantly contributing to this transition.²⁶⁻³⁰ Morgagni's experiments around drowning and his observations of subsequent respiratory disorders provided early insights into the pathophysiology of drowning.³⁰ The period between 18th and 19th century witnessed further advancement of scientific approaches to understanding drowning, with medical practitioners further exploring the physiological mechanisms of drowning and developing rudimentary resuscitation techniques.²⁶⁻²⁸

The shift in the drowning prevention paradigm gained momentum following William Tossach's documentation of successful mouth-to-mouth resuscitation in 1744.²⁶ This practice gained further traction through advocacy efforts led by John Fothergill and other proponents, as well as prompting widespread adoption of the methods by authorities across Europe in mid-18th century.^{26,31} King Louis XV of France was the first to acknowledge the importance of government involvement in rescuing and treating drowning victims. This included ordering that the publications on saving drowning victims by de Réaumur, Tissot, and Portal, be disseminated throughout France.³²

The founding of the Dutch Society to Rescue People from Drowning in Amsterdam in 1767 played a pivotal role in promoting wide adoption of expired air ventilation through mouth-to-mouth resuscitation and encouraging the establishment of similar societies across Europe, particularly in maritime cities with high drowning rates.^{12,26} In Britain, physicians such as William Hawes advocated for the establishment of organised lifesaving societies, including the Society for the Recovery of Persons Apparently Drowned, which later became the Royal Humane Society in 1774. Other significant organisations followed, including the Royal National Lifeboat Institution in 1824 and the Royal Life Saving Society in 1891, each spearheading transnational efforts to promote knowledge sharing of lifesaving techniques.^{26-28,33}

Throughout the 20th century, drowning was increasingly recognised as a preventable public health issue.^{32,34,35} Medical advancements, such as the widespread use of oxygen supply, led to the development of more effective resuscitation techniques. Further formation and increased contributions of international lifesaving organisations, such as Royal Life Saving Society, Surf Life Saving, the International Life Saving Federation, and the International Federation of Red Cross and Red Crescent Societies, contributed to the dissemination of lifesaving skills and the promotion of water safety education, enhancing the efficiency of rescue operations and the provision of adequate emergency medical attention to improve the outcomes for drowning victims and contributing to the reduction of drowning-related fatalities.³²⁻³⁵ The establishment of the WHO, United Nations

International Children's Emergency Fund (UNICEF), and the formalisation of the Commonwealth of Nations, an alliance primarily composed of countries that were formerly part of the British Empire, further advanced global drowning prevention efforts through research, advocacy, and policy development, fostering international and transdisciplinary collaboration to reduce drowning-related fatalities worldwide.³⁶

In the 21st century, global efforts to prevent drowning have encompassed various strategies, including public education campaigns, the enforcement of safety regulations, and innovative technologies for surveillance, water rescue, cardiopulmonary resuscitation (CPR), and emergency medical care.^{37,38} These initiatives, combined with socioeconomic advancements and a growing global consensus on the importance of drowning prevention, have led to a decline in drowning mortality rates worldwide.^{6,39} However, despite these strides, vulnerable populations across LMICs, including in Indonesia, continue to face significant challenges in their efforts in preventing drowning.^{6,7,37,39-42}

1.3. Definition of Drowning: The Path to Global Health Consensus

The concept and definition of drowning has evolved significantly over time, reflecting advances in medical science, epidemiology, and public health, and highlighting their implications for drowning prevention and management.⁴³ Historically, the term 'drowning' has been used broadly to describe various water-related incidents, resulting in divergent interpretations across medical, public health, and medico-legal contexts. Early descriptions of drowning were often vague and lacked specificity, resulting in inconsistent reporting and data collection practices.⁴³

The transition from cultural and religious interpretations of drowning to medical and medico-legal understandings occurred gradually, paralleling advancements in anatomy, physiology, and forensic medicine.²⁹ In the early 18th century, drowning was generally perceived through a medical lens, primarily understood as a form of asphyxia resulting from respiratory impairment which led to cardiac arrest and brain injury, and, consequently, treated as a "disease".²⁹ Concurrently, another aspect of the debate emerged focusing on the medico-legal implications of drowning. This began in France in the early 18th century alongside its judicial reforms, which necessitated a more thorough legal documentation for the determination of liability. Extensive research was then conducted to establish clearer legal and diagnostic criteria, and by the late 18th century, medico-legal experts asserted the presence of water in the lungs as the definitive indicator for diagnosing drowning.²⁹

During the 19th and early 20th centuries, definitions of drowning started integrating medical observations, yet they remained diverse among different regions and fields.⁴³ The introduction of various terms around drowning added layers of complexity and confusion to understanding drowning

incidents. These terms included "near-drowning" and "drowning", differentiating between fatal and non-fatal drowning incidents; "salt water drowning" and "freshwater drowning", referring to drowning in salt water and freshwater environments respectively, to distinguish how the salinity of the aspirated fluid affects the body's physiological response; "wet drowning" and "dry drowning", specifying whether a significant amount of water entered the airway or only a small amount, respectively; "secondary drowning" or "delayed drowning", describing instances where fluid entered the lungs however symptoms emerged later; "silent drowning", referring to drowning incidents where victims could not signal distress due to the presence of fluid in the airway preventing vocalisation, and "passive drowning", referring to situations where victims do not display the typical active struggle associated with distress in water, possibly due to loss of consciousness, exhaustion, or related to substance use prior to drowning.^{43,44}

In 1971, Modell proposed several definitions of drowning to streamline the terminology and better distinguish between fatal and non-fatal drowning incidents, including "drowning with or without aspiration," which pertains to death by asphyxia while being submerged in a fluid medium, with or without secondary pathophysiological changes due to the aspiration of fluid; and "near-drowning with or without aspiration", referring to surviving asphyxia, with or without the inhalation of fluid, following being submerged in a fluid medium.^{43,45-49} However, these pathophysiology-focused definitions presented challenges for drowning surveillance, and the distinction between fatal and non-fatal drowning incidents could contribute to the under-representation of the true burden of drowning.⁴³

In the late 20th century, there was a growing acknowledgment of epidemiology's vital role in providing evidence-based guidance to decision-makers, spurring efforts to quantify incidents at the population level, yielding valuable insights into rates, risk factors, and contextual determinants of health.⁵⁰ Furthermore, the WHO and other international entities played a crucial role in shaping global agendas for drowning prevention, emphasising the importance of data-driven interventions and data sharing to facilitate transnational collaboration.^{7,36} This acknowledgment of the significance of reliable data further underlined the considerable challenges stemming from inconsistencies in the terminology and classification of drowning, prompting calls for a global consensus on a standardised definition of drowning that can be universally applied.⁴³

The quest for a standardised definition of drowning gained momentum in the early 21st century.^{43,51} The turning point occurred in 2002 during the inaugural World Conference on Drowning Prevention. At this event, a diverse panel comprising clinicians, epidemiologists, injury prevention experts, and rescue practitioners, convened to address the necessity for a revised definition of

drowning. This discussion encompassed various existing definitions, such as Modell's, along with the new definition put forth by the International Liaison Committee on Resuscitation (ILCOR) and the American Heart Organization in 2000.

The consensus reached was that the new definition of drowning should be straightforward and comprehensive, while also being precise and aligned with the Utstein style of reporting.^{43,51} The Utstein style of reporting, originally created as a standardised framework for cardiac arrest and other medical emergencies, has been widely applied as a systematic approach to document and analyse drowning incidents across various facilities.⁵¹ It ensures consistent recording of essential predictors such as prior events, response times, resuscitation efforts, and health outcomes, to improve evidence-based practices in drowning prevention and management.⁵¹ Therefore, to ensure clarity and comparability of drowning data, it was decided to remove terms such as "near", "salt water", "freshwater", "wet", "dry", "secondary", "delayed", "silent", and "passive" from the definition of drowning, as these terms often led to confusion. Instead, the outcomes of drowning were categorised simply as "death, morbidity, and no morbidity" to ensure clarity, consistency, and inclusivity in the definition.^{43,51,52} After extensive deliberations, the panel proposed a new, simplified definition of drowning:

"Drowning is the process of experiencing respiratory impairment from submersion/immersion in liquid" (van Beeck et al., 2005, p.854).

The finalised definition was subsequently announced in the November 2005 issue of the WHO Bulletin.⁴³ Despite the overall acceptance of the consensus definition by many organisations, the progress in the adoption of the new definition varied across regions, including in LMICs where resources and training might be limited, as integrating the new definition into legal and medical frameworks required time and effort.⁵³⁻⁵⁵ In addition, assessing the adoption of the new definition and its impact within the policy field has proven to be more challenging.⁵⁴

While challenges remain in ensuring consistent application across diverse contexts, the consensus definition provides a solid foundation for ongoing efforts to reduce drowning mortality and morbidity worldwide.⁵⁴ The standardised definition focuses on the process of respiratory impairment to unify and simplify reporting, hence improving the accuracy of drowning data collection and research, enabling researchers and public health practitioners to reliably track drowning incidents, identify trends, and evaluate the effectiveness of prevention strategies, providing evidence-based recommendations for decision-makers.^{54,56-58} Furthermore, the consensus definition has facilitated better communication and collaboration among stakeholders, allowing international authoritative bodies such as the WHO, researchers, policymakers, and local civic organisations to speak a common

language, enabling data comparisons and enhancing the sharing of best practices and the coordination of prevention efforts across various regions and jurisdictions.⁵⁴

1.4. Defining Unintentional Drowning: Inclusions and Exclusions

The standardised 2005 definition of drowning served as the foundation for the discussion in this thesis. However, this thesis was specifically focused on unintentional drowning incidents in Indonesia, encompassing unintentional, disaster-related, and water transport-related drowning cases. The selection of these categories was driven by their particular relevance to the Indonesian context, where varied environmental, social, and occupational factors contribute to distinct drowning risks.^{7,59} Furthermore, these categories align with the International Classification of Diseases and Related Health Problems (ICD) coding system, which is widely utilised in global health data reporting, including in Indonesia which relied heavily upon health facility-based reporting, and across various international health databases such as the Global Burden of Disease (GBD) Study, both of which were examined in this study.⁶⁰⁻⁶²

Unintentional drowning, as defined in this thesis, refers to drowning incidents that occur without evidence of predetermined intent, covering a spectrum of circumstances from drowning during recreational water activities and occupational tasks to natural disaster-related events.^{63,64} Such incidents may take place in various water bodies, including both man-made structures such as swimming pools, bathtubs, and ponds, as well as natural bodies of water such as lakes, rivers, beaches, and open seas. Importantly, intentional acts, including self-harm or assault, are explicitly excluded from this category.⁶³

Within the ICD system, both the intent and nature of drowning deaths are considered when coding, providing a clear distinction between accidental drowning incidents and those related to natural disasters, watercrafts, assaults, intentional self-harm, and cases of undetermined intent.⁶⁵ Disaster-related drowning refers to drowning incidents that occur as a direct result of natural disasters, such as floods, tsunamis, hurricanes, or other extreme weather events. These events often involve sudden and overwhelming water exposure, leading to increased risk of drowning among affected populations. Meanwhile, according to ICD-10, water transport-related drowning includes drowning incidents that occur in connection with watercraft, regardless of whether an accident involving the watercraft has occurred.⁶⁵ Therefore, for consistency, this thesis examines unintentional drowning, disaster-related drowning, and water transport-related drowning as distinct categories.

Furthermore, throughout this thesis, the term 'unintentional' is used rather than 'accidental' to emphasise that these drowning events, while occurring without intent, are nonetheless

preventable. Injuries, including drowning, demonstrate repetitive, observable patterns that make them predictable and, therefore, preventable.^{64,66,67} In contrast, the term 'accidental' implies an unavoidable or unforeseen occurrence, which does not align with the principles of injury prevention. Thus, the use of the term 'unintentional drowning' is preferred to more accurately convey the preventable nature of these incidents.^{64,66,67} In fact, the push to discontinue the use of the term 'accidental' in relation to unintentional injury events has been advocated since the 1970s, although inconsistencies in injury data reporting continue to be observed in many parts of the world, including within the ICD system.⁶⁸ In the broader field of injury prevention, the 'unintentional injury' has been widely used in public health discourse, including by the Centers for Disease Control and Prevention (CDC) and the WHO, to reinforce the preventability of such events.^{64,66,67}

In total, unintentional drowning incidents are classified under the following ICD-10 codes: 1) "accidental non-transport drowning and submersion" (W65-W74): 'W65' for "drowning and submersion while in bathtub"; 'W66' for "drowning and submersion following fall into bath-tub", 'W67' for "drowning and submersion while in swimming-pool"; 'W68' for "drowning and submersion following fall into swimming-pool"; 'W69' for "drowning and submersion while in natural water"; 'W70' for "drowning and submersion following fall into natural water"; 'W73' for "other specified drowning and submersion"; and 'W74' for "unspecified drowning and submersion"; 2) "related to exposure to forces of nature" (X34-X39): 'X34' for "earthquake"; 'X35' for "volcanic eruption"; 'X36' for "avalanche, landslide and other earth movement"; 'X37' for "cataclysmic storm"; 'X38' for "flood"; and 'X39' for "exposure to other forces of nature"; please note that these codes encompass a broader range of disasters beyond just flooding, reflecting the diverse types of water-related disasters often occur in Indonesia; and 3) "water transport accidents" (V90.-, V92.-): 'V90' for "accident to watercraft causing drowning and submersion"; and 'V92' for "drowning and submersion without accident to watercraft". In addition, incidents where the manner of death cannot be determined are coded as "drowning and submersion, undetermined intent" (Y21). Other health impacts of non-fatal drowning incidents are classified under the code T75.1 for "unspecified effects of drowning and nonfatal submersion".⁶⁵

Meanwhile, depending on the manner of death, intentional drowning incidents are coded in the ICD-10 system as "intentional self-harm by drowning and submersion" ('X71.-') or "assault by drowning and submersion" ('X92.-').⁶⁵ Incidents related to military operations could be coded separately as either "operations of war" (Y36.-) or "injury to military personnel occurring during peacetime military operations" (Y37.-).⁶⁵ Due to limited data availability in Indonesia, these categories

of drowning were not explored in this thesis. Consequently, the potential underestimation of the overall magnitude of drowning in Indonesia in this thesis is taken into consideration.⁶¹

The GBD Study database was established by the Institute for Health Metrics and Evaluation (IHME), as an autonomous research hub of the University of Washington dedicated to global health, through the Global Health Data Exchange (GHDx) website.^{39,62,69} The GBD Study data on drowning, which is analysed in Chapter 4, focus on unintentional drowning as defined by ICD-9 and ICD-10 codes, including the ICD-9 code of 'E910' for "accidental drowning and submersion"; and ICD-10 codes of 'W65-W74' for "accidental non-transport drowning and submersion".^{6,39,52} However, the GBD Study data on drowning excludes unintentional drowning related to water transportation and disasters, as well as drowning of intentional or undetermined intent. Hence, the potential underrepresentation of the overall burden of drowning in Indonesia presented in this thesis is acknowledged.^{52,63}

1.5. The Progress of Drowning Rate Reduction: Disparities between High-Income and Low-Income Nations

Drowning poses a significant global public health challenge.^{6-8,59,70} In 2019, approximately 236,000 lives were lost to drowning, equating to a mortality rate of 3.1 per 100,000 population.^{8,39} Despite ongoing global efforts, drowning remains a leading preventable cause of death among young children worldwide, ranking among the top 5 causes of death for children aged 1–14 years in 48 countries.^{7,8} In addition, the elderly population aged 70 years and above faced notably high drowning mortality rates, with a global mortality rate of 7.6 per 100,000 population across both sexes in 2019.³⁹ Furthermore, global drowning mortality rates were disproportionately higher among males compared to females, with a rate of 4.3 per 100,000 for males and 1.8 per 100,000 for females in 2019.³⁹

Drowning disproportionately affects populations across LMICs, where over 90% of unintentional drownings occur.^{7,8} Among all LMICs, the combined drowning deaths in four nations—China, India, Pakistan, and Bangladesh—constituted 51.2% of the total in 2017.⁶ In 2019, the highest drowning mortality rates were observed in the WHO Western Pacific and South-East Asian Regions, with rates of 4.2 per 100,000 and 4.1 per 100,000 population, respectively.³⁹ In 2019, drowning accounted for 74,075 fatalities in the Western Pacific Region, the highest among all WHO regions, with more than one-fifth of these fatalities occurring among children under the age of 15.⁷¹ Furthermore, Oceania recorded the highest rate of age-standardised Years of Life Lost (YLLs) from drowning in 2017, registering 45,434 YLLs per 100,000 population.⁶ In 2019, drowning was attributed as a cause of 70,034 deaths in the WHO South-East Asia Region, the second highest following the Western Pacific, with over 33% of these fatalities occurred among children under the age of 15 years.¹⁰

The global burden of unintentional drowning significantly decreased from 1990 to 2019.^{6,39} The global drowning mortality rate, which was 8.1 per 100,000 population in 1990, declined by 61.5% to 3.1 per 100,000 in 2019.³⁹ Similarly, the Disability-Adjusted Life Years (DALYs) rate attributed to drowning also decreased by 68.2%, dropping from 553 per 100,000 in 1990 to 175.9 per 100,000 in 2019.³⁹ Reductions in drowning mortality rates were particularly notable in the Western Pacific and South-East Asia Regions.³⁹ In addition, the global under-five drowning mortality rate declined significantly by 81.1%, from 29.1 per 100,000 in 1990 to 5.5 per 100,000 in 2019.³⁹

Several factors have been suggested as the main contributors to the declining burden of drowning worldwide.⁷ First, the importance of infrastructure development, including the construction of bridges, flood defences, safe drinking water facilities, and sanitation programs, in reducing exposure to unsafe aquatic environments, has been proposed as a vital contributor to the global reduction of drowning fatalities.^{7,72,73} Secondly, the implementation of drowning intervention programs and policy instruments has played a crucial role in reducing drowning rates.^{7,10,71} Educational initiatives and social marketing campaigns targeting public awareness of water safety have been proposed as significant contributors to reducing drowning fatalities, as reported by studies in Iran, China, and Thailand.^{10,72-74} In addition, swimming training and supervision for children, have also been recognised as important factors in this reduction, such as reported in Bangladesh.^{10,75,76} The provision of lifeguards and resuscitation training for first responders, coupled with advancements in technologies for water rescue and emergency medical treatment, critical care, and advanced life support, has also been reported as contributing to reducing drowning fatalities.^{7,10,37,38,59,71,77,78}

Policy setting and enforcement, including regulations on pool fencing, designated swimming areas, boating safety, life jacket use, and alcohol consumption, have also been identified as contributing factors to the reduction in drowning rates in high-income countries (HICs) such as Australia and the United States.⁷⁹⁻⁸⁵ Furthermore, improvements in social determinants of health, including increases in Gross Domestic Product (GDP) per capita, healthcare expenditure, and educational attainment, particularly across LMICs, are recognised as significant drivers in reducing the global burden of drowning mortality.³⁹

However, while infrastructure development, targeted interventions, and education and awareness initiatives have proven effective in reducing drowning rates worldwide, broader social and economic contexts also play a pivotal role in shaping access to water safety measures.³⁹ Commercial determinants of health, including the privatisation of water safety education and the commercialisation of water-adjacent areas, can impact drowning risk. For example, privatised swimming lessons and safety programs often come with high costs, making them less accessible for

lower-income families and worsening inequalities in drowning prevention.^{86,87} In addition, corporate-led land and water development—such as waterfront projects that restrict access to safe public water areas and may lack adequate safety measures—can heighten drowning risks, as observed in countries like Senegal and Canada.⁸⁸

Furthermore, social determinants of health also contribute to disparities in drowning prevention progress between HICs and LMICs.^{39,89} For instance, while the Western Pacific Region saw a commendable 65% reduction in drowning mortality rates between 1990 and 2019, it is crucial to highlight the disparity between LMICs and HICs within the region, with rates in LMICs nearly four times higher than those in HICs.^{39,71} Similarly, despite the significant 61.3% decline in drowning mortality rates in South-East Asia between 1990 and 2019, it is noteworthy that from 2014 to 2018, eight out of the region's 11 countries, all LMICs, saw no significant reduction in drowning fatalities. These disparities underline the varied progress of drowning prevention efforts across the two regions.^{10,39} Moreover, it is also important to acknowledge how social determinants of health, such as socioeconomic background, rurality, living proximity to open water bodies, indigenous status, ethnic minority status, and migrant or visitor status, contribute to the substantial variability in the reduction of the drowning burden even within HICs and LMICs, as reported in Australia, Taiwan, China, Bangladesh, and other countries.⁹⁰⁻⁹⁴

Despite global progress on drowning prevention, resource limited LMICs still encounter significant challenges in their efforts to prevent drowning.^{6,7,37,39-42} 'Wicked problems' such as socioeconomic disparities and the impacts of climate change persistently hinder effective drowning prevention in these regions, including Indonesia.^{6,7,37,39-42} In addition, there is a lack of exploration on the availability, effectiveness, and sustainability of drowning prevention programs and policies in LMICs, with this investigation primarily conducted in HICs.⁷ Among LMICs, five countries—Bangladesh, India, China, Pakistan, and Turkey—were noted as the primary contributors to publications on unintentional drowning, while there is a dearth of information on the rest, highlighting the disparities in research capacities and the implementation of drowning prevention interventions across these countries.⁴¹

Furthermore, while national water safety strategy plans, aimed at coordinating national drowning prevention and water safety promotion efforts, have been widely implemented in HICs such as Australia, the United Kingdom and the United States, their establishment continues to lag in LMICs.^{7,10,59,95-97} Some LMICs, such as Thailand and Sri Lanka, have incorporated drowning prevention strategies into their national strategic plans for injury prevention, and subnational efforts of drowning prevention are evident in some LMICs, such as India. However, there is a lack of information for the

rest of the LMICs, including Indonesia.⁹⁸ This highlights the urgent need to address gaps in reducing drowning fatalities and to strengthen prevention efforts across LMICs, to ensure equitable safety measures for vulnerable populations in these regions.

1.6. Bridging the Gap: Global Initiatives on Drowning Prevention

While HICs have made significant strides in reducing drowning fatalities through comprehensive strategies, stringent safety regulations, and the deployment of advanced technologies, the disparity between HICs and LMICs in terms of drowning prevention remains stark. This disparity necessitates a concerted global effort to bridge this gap.^{6,7,37,39-42} One of the key initiatives addressing drowning rates globally is the WHO's Global Report on Drowning, published in 2014.⁷ This report not only highlighted the alarming rates of drowning deaths but also elevated the issue onto the global agenda. While it provided a framework for action that LMICs could adopt, the report primarily emphasised the need for a broader response applicable to all countries.⁷

The report subsequently expanded on the recommendations made in the 2017 Implementation Guide for Preventing Drowning, offering detailed and strategic steps and best practices for implementing drowning prevention interventions at national and subnational levels.^{7,59} Through these resources, the WHO advocates for implementing evidence-based strategies to address the substantial global burden of drowning, considering cost-effectiveness, community involvement and empowerment, cultural contextualisation, and tailored communication to enhance adoptability. These multidimensional strategies also acknowledge the complex nature of drowning, incorporating measures to reduce disaster-related and water transport-related drowning—issues pertinent to many disaster-prone LMICs as well as HICs.^{7,59}

The comprehensive approach to drowning prevention promoted by the WHO emphasises a combination of direct key interventions and supporting strategies to effectively address the complex issue of drowning.^{7,59,70,99} The six key interventions include: (i) establishing community daycare centres for preschool children, where children are supervised by trained adults, to reduce the likelihood of young children accessing open water bodies; (ii) installation of physical barriers, such as erecting fences, covers, and other barriers around water bodies, particularly in rural and peri-urban areas where children often play unsupervised; (iii) swimming lessons and water safety skills for school-age children aged six years and above, by providing community-based, structured swimming programs, particularly in rural regions with high exposure to water hazards; (iv) resilience building and flood risk management, by developing and implementing community-based disaster risk reduction plans, including enhancing early warning systems, emergency response plans, and community education on

flood risks and safety measures; (v) training bystanders in safe rescue and cardiopulmonary resuscitation, to increase survival rates during drowning emergencies; and (vi) enforcing boating and maritime safety regulations, including by mandating the use of lifejackets, regulating alcohol consumption on boats, and enforcing vessel safety inspections, reducing drowning incidents among boaters, fishermen, and passengers.^{7,59,70,99}

In addition, the WHO advocates for four supporting strategies to ensure successful intervention: (a) multisectoral collaboration, by engaging all relevant stakeholders, particularly from health, education, transportation, environmental, and community organisations, to develop and implement comprehensive drowning prevention strategies; (b) strategic communications, by utilising mass media campaigns, community outreach programs, and school-based education to increase public awareness and encourage safe practices around water; (c) establishment of national water safety plans, to outline specific goals, strategies, and responsibilities across different stakeholders, tailored to the country's specific context and needs; and (d) advancing research to generate evidence to inform policy and practice in drowning prevention.^{7,59}

The WHO extended its recommendations by offering practical guidance for implementing community-based daycare services, swimming and water safety skills training, and safe rescue and resuscitation training in their 2021 guideline and 2022 practical guidance documents.^{70,99} These documents provide detailed frameworks of action, thorough instructions, and best practices, to assist countries, including LMICs, in adopting these strategies.^{70,99} Despite these recommendations, however, there remains insufficient understanding regarding the social acceptability, effectiveness, and sustainability of these strategies in LMICs, including Indonesia. Therefore, it is crucial to delve deeper into the factors that influence the adoption and implementation of WHO-recommended strategies within Indonesian communities, as discussed in Chapter 8 of this thesis.

In April 2021, the UN General Assembly passed its first-ever resolution regarding global drowning prevention, signifying its commitment to recognising drowning as a prominent cause of injury-related death and disability worldwide.¹⁰⁰ This landmark resolution calls for intensified international cooperation and urges all UN member states, including Indonesia, to invest more significantly in drowning prevention efforts. In addition, the resolution stresses the critical importance for all member states to implement the 2017 WHO Implementation Guide for Preventing Drowning, reinforcing the necessity for every nation, with technical support from WHO and other UN bodies, to establish a national drowning prevention plan and develop drowning prevention programs which are aligned with WHO-recommended prevention strategies.^{59,100,101}

The resolution also acknowledges the multifaceted nature of drowning prevention and its alignment with the UN 2030 Agenda for Sustainable Development.¹⁰⁰⁻¹⁰² This suggests that solutions for drowning prevention may be found within broader societal and environmental determinants of health, as outlined in the UN's Sustainable Development Goals (SDGs). Progress in achieving specific SDGs, such as those related to protecting children's well-being and ensuring access to clean water and sanitation, is expected to directly contribute to reducing drowning incidents. Reciprocally, since the highest drowning mortality rates have been consistently observed among children under five years of age, reducing drowning rates in this age group also aligns with achieving SDGs in ensuring children's health, safety, and well-being.^{59,100-105}

Recalling the UN General Assembly's resolution, during the 76th World Health Assembly in May 2023 at the UN Office in Geneva, the WHO put forth a global initiative to expedite drowning prevention efforts.¹⁰⁶ This included a proposal to the UN Director-General to offer support to Member States in implementing and evaluating drowning prevention policies. The support encompasses capacity building, knowledge and data sharing, and the formation of a global coalition for drowning prevention, in collaboration with UN agencies, international partners, and non-governmental organisations (NGOs).¹⁰⁶ Thus, on July 25th, 2023, World Drowning Prevention Day, the WHO inaugurated the Global Alliance for Drowning Prevention.¹⁰⁷ This initiative seeks to unite stakeholders worldwide to exchange expertise, resources, and effective strategies in drowning prevention, to expedite efforts in preventing drowning, particularly in LMICs, by fostering collaborative approaches.^{107,108} In their report "Hidden Depths: The Global Investment Case for Drowning Prevention," the WHO outlines the evidence of health and economic advantages of deploying two evidence-based strategies—community day-care and swimming training for children—to alleviate the drowning burden in heavily affected LMICs, urging investment in and expansion of these initiatives in LMICs.¹⁰⁹

Partnerships between local governments, international authoritative bodies such as UN agencies, international societies and donors, as well as local NGOs, are pivotal in improving data collection and research capacities in LMICs, by providing technical assistance and funding, and sharing best practices.^{36,101,105,110} The Bloomberg Philanthropies' Drowning Prevention Program serves as an illustration of how international donor agencies, through technical assistance and funding, have accelerated drowning prevention efforts in LMICs.¹¹¹ Through funding drowning prevention programs in several LMICs, such as Bangladesh, Ghana, India, Uganda, and Vietnam, the program has supported the establishment of community-based daycare centres, survival swimming and rescue training programs, public awareness campaigns, and advancement of data collection and research capacities

through multisectoral collaboration, significantly reducing drowning incidents in targeted areas at a low-cost.¹¹¹ This underlines the essential need for concerted global efforts, inclusion of evidence-based strategies, collaborative partnerships, and targeted investments, for effectively bridging the gap in drowning reduction progress between LMICs and HICs, ensuring equitable access to life-saving interventions and, ultimately, saving countless lives worldwide.

1.7. Indonesia: Why Does It Matter?

The focus of the discussion in this thesis encompassed unintentional, disaster-related, and water transport-related drowning cases, which are pertinent to the Indonesian context. As the world's largest archipelagic and fourth most populous country, and one of the most disaster-prone, these three drowning categories are particularly relevant in Indonesia. Despite this vulnerability, there is a dearth of information on unintentional drowning in Indonesia.⁴¹ Furthermore, research into disaster-related and water-transport related drowning events is often overlooked in global studies, including within Indonesia.^{40-42,61}

Located in Southeast Asia, Indonesia has a pivotal geographical position at the intersection of the Indian and Pacific oceans, bridging the continents of Asia and Australia (Figure 1.1). This contributes to its strategic geopolitical, economic, and security importance, particularly concerning Indo-Asia-Pacific interests.¹¹²⁻¹¹⁶



Figure 1.1. Indonesia's Geographical Position in Relation to Asia and Australia

["Indonesia on the globe \(Southeast Asia centred\)"](#) by [TUBS](#) is shared under a [CC BY-SA 3.0](#) license via [Wikimedia Commons](#).

This distinctive geographical location also contributes to the nation's vulnerability to a wide range of disasters.¹¹⁷⁻¹¹⁹ The Indonesian archipelago sits at the junction of three of Earth's largest tectonic plates—the Eurasian, the Indo-Australian, and the Pacific Plates—contributing to its susceptibility to devastating occurrences of earthquakes and, consequently, tsunamis.¹²⁰⁻¹²³ One instance is the 2004 Great Sumatra-Andaman Earthquake, with a magnitude ranging from 9.1 to 9.3, followed by the devastating Indian Ocean Tsunami, which greatly impacted Indonesian populations, particularly in Aceh Province.^{120,123} This event took place along the fault boundary between the Indo-Australian and southeastern Eurasian plates and stands as one of the deadliest natural disasters of the 21st century. The tsunami alone resulted in over 227,000 fatalities, with 165,000 occurring in Indonesia.^{120,123} In 2023, Indonesia registered a significantly high Disaster Risk Index (DRI) score of 9.7 out of ten points specifically for tsunamis, and 8.1 for floods.^{4,124}

Indonesia's vulnerability to natural disasters is further compounded by its extensive coastline, spanning 91,363.65 kilometres—the second longest globally—presenting higher exposure to various hydrometeorological disasters, including floodings, tropical cyclones, and storm surges.^{120,125,126}

Indonesia, alongside China, India, and the Philippines, stands as one of the nations with the highest frequency of flooding and flood-induced fatalities worldwide, heightening the risk of disaster-related drowning for its populations.¹²⁶ Being situated in the tropics, with its string of islands scattered across the equator, Indonesia is also prone to heavy rainfall and associated landslides, while, paradoxically, also being prone to drought and water scarcity, further increasing the risk of drowning through inundation and the adoption of riskier behaviours around water or to acquire water for livelihood.^{40,42,125}

Indonesia is the world's largest archipelagic state, comprising between 13,000 and over 18,000 islands, with 6,000 of them inhabited, extending over 5,000 kilometres from the West to East and 1,770 kilometres along the equator from North to South.^{11,127} The exact number of Indonesian islands has continuously been debated. The Indonesian National Institute of Aeronautics and Space's 2002 census reported 18,307 islands, while various Indonesian ministries, including the Ministry of Internal Affairs, reference 17,508 islands, and a 2022 study using satellite images documented 13,558 islands, with discrepancies attributed to differing definitions of islands, variations in sea level points during measurement, and geopolitical factors.^{128,129} Despite these discrepancies, Indonesia is still identified as the world's largest country comprised solely of islands.^{127,130}

Indonesia's extensive territory encompasses 6,159,032 square kilometres of water area, triple the expanse of its 1,919,440 square kilometres of land area, which also include 93,000 square kilometres of inland seas.^{131,132} The substantial water area in Indonesia presents a significant risk of drowning for its population, including due to factors such as climate change-induced sea level rise and drowning incidents related to disasters and water transportation.¹³¹⁻¹³⁷

Indonesia is the world's fourth most populous nation, with over 270,200,000 populations and a density of 141 people per square kilometre.¹³² In addition to its vast geography and large population, Indonesia boasts immense cultural diversity, encompassing over 633 ethnic groups.¹³⁸ Among these, 15 are particularly prominent, namely Javanese, Sundanese, Malay, Batak, Madurese, Betawi, Minangkabau, Buginese, Bantenese, Banjarese, Balinese, Acehnese, Dayak, Sasak, and Chinese, together accounting for 84.9% of the population.¹³⁹ In addition, Indonesia is a linguistic kaleidoscope. While Bahasa Indonesia holds the mantle of national language and lingua franca, a plethora of over 700 regional languages and more than 1,100 dialects grace the country's linguistic landscape.¹⁴⁰ This diversity reflects Indonesia's intricate history of migration and colonisation, where each language embodies a distinct cultural legacy, moulded by centuries of interaction with neighbouring communities and external influences.¹⁴⁰

Furthermore, Indonesia's religious landscape is far from monolithic, with Islam, Protestantism, Catholicism, Hinduism, Buddhism, and Confucianism being the major faiths practiced across the archipelago.^{11,139} This diverse religious tapestry reflects Indonesia's long history of cultural exchange and religious syncretism, where different faiths have coexisted and influenced each other for centuries.^{138,141} Islam is the most widely followed religion in Indonesia, with approximately 87% (242 million) of the population identifying as Muslim, making Indonesia the country with the largest Muslim population worldwide.¹¹ Meanwhile, significant minority populations adhere to Christianity (11%, or 29.7 million), Hinduism (1.7% or 4.6 million), Buddhism (0.9% or 2.4 million), and various indigenous belief systems.^{11,139} This extensive cultural and religious diversity in Indonesia poses further challenges in devising drowning prevention interventions that are appropriate for each region, cultural, and religious context.

Indonesia is a democratic republic with a political system based on a presidential model, where the President acts as both the head of state and head of government.¹⁴² The President is elected through a direct vote for a five-year term and possesses considerable executive authority, including to appoint ministers and implement policies. Indonesia's political system features a multi-party democracy, where political parties compete in elections to represent the interests of the electorate. The legislative branch consists of the People's Representative Council and the Regional Representative Council, which represent the interests of the Indonesian people and provinces, respectively.¹⁴²

The Indonesian country is divided into provinces, each with its own governor and legislative council.^{142,143} Previously, Indonesia was divided into 34 provinces. However, in 2022, four new provinces were added: South Papua Province, Central Papua Province, Papua Mountains Province, and Southwest Papua Province, aimed to better recognise the need for equitable development and improving public services for Indigenous populations of Papua; bringing the total number of provinces to 38 (Figure 1.2).¹⁴⁴



Figure 1.2. Indonesian Provinces

["Indonesia, administrative divisions - mg - monochrome.svg"](#) by [Sardon](#), adapted from an [original map by Yug](#), is shared under a [CC BY-SA 3.0](#) licence via [Wikimedia Commons](#).

Indonesia's governance structure comprises three levels: i) provinces ('provinsi'), ii) regencies ('kabupaten') or cities ('kota'), and iii) villages.^{142,145} Each province is governed by a governor who oversees the executive branch. Each province also has its own Regional People's Representatives Assembly, which constitutes the legislative branch. Both the governor and the representatives are elected every five years through a popular vote. Regencies and cities have their own distinct local governments, with the executive branch overseen by a regent in regencies ('bupati') or a mayor in cities ('walikota'), while the legislative branch consists of local representatives, both elected for five-year terms. Villages exist in both rural and urban areas, with leaders elected through popular vote.^{142,145}

The 38 Indonesian provinces exhibit significant diversity in terms of population, geography, and socio-economic development.^{142,143} While urban provinces in Java Island, the most developed island in Indonesia, such as Jakarta, West Java, and East Java, are relatively more developed and urbanised, others, particularly those in eastern Indonesia such as Papua, Maluku, and the Nusa Tenggara regions, face greater challenges in infrastructure development, poverty rates, and access to basic services including healthcare and education.¹⁴³ These disparities stem from various factors, including historical legacies, geographical remoteness, and resource endowments.^{143,146,147}

Efforts to address these disparities between provinces have been made through regional autonomy policies, which aim to empower local governments and promote development tailored to each province's unique needs.¹⁴⁷⁻¹⁵⁰ However, implementation challenges, bureaucratic inefficiencies,

limited funding, and lack of transparency and accountability, have hindered progress in narrowing the development gap between provinces, further widening the disparities of drowning prevention capacities between provinces in Indonesia.¹⁴⁷⁻¹⁵⁰

Indonesia, with its sprawling archipelago, is not only a land of diverse traditions but also a complex economic mosaic, posing distinctive challenges for effective and sustainable implementation of drowning prevention interventions.¹⁵¹ Over the past few decades, Indonesia has witnessed consistent economic growth, fuelled by several factors including robust domestic consumption, exports of natural resources, infrastructure development, and expansion of services, particularly in trade, transportation, tourism, and the information and communication sectors.¹⁵¹ However, despite strides in economic development, Indonesia grapples with significant income inequality, with 9.4% of Indonesia's population still living below the national poverty line in 2023, highlighting the stark disparities within the country.¹⁵² More than one-third of Indonesians still face economic insecurity, leaving them vulnerable to falling into poverty in public health crises such as the COVID-19 pandemic or natural disasters.¹⁵³

In addition, although agriculture and low-value-added services remain pivotal in Indonesia, the nature of these occupations often lacks efficiency, failing to offer a viable pathway out of poverty.¹⁵³ The scarcity of skilled employment opportunities in Indonesia further impedes avenues for economic stability. Moreover, many Indonesian women find themselves marginalised in the workforce due to cultural norms and traditional gender roles that prioritise household and caregiving duties, further constraining household income prospects. In addition, while advancements in human capital are evident, they still lag behind those of comparable nations, particularly in Eastern Indonesian provinces, exacerbating inequality and hampering the population's overall productivity potential.¹⁵³

Furthermore, climate change poses ongoing challenges for Indonesia, especially in coastal areas, impacting disaster preparedness, recovery, and climate adaptation efforts, and, subsequently, drowning prevention.¹⁵³ These challenges, coupled with the devastating effects of disasters, including loss of life, infrastructure damage, and displacement, are expected to exacerbate poverty and socio-economic disparities.^{152,154-156}

Indonesia's vast diversity, extensive geography, and large population size present ongoing challenges for ensuring the effectiveness, sustainability, and cultural sensitivity of drowning prevention interventions. The wide disparities in Indonesia heighten the risk of drowning due to unequal access to resources, infrastructure, and education, leaving marginalised communities more vulnerable to the impacts of water and disaster hazards. Without targeted interventions to address

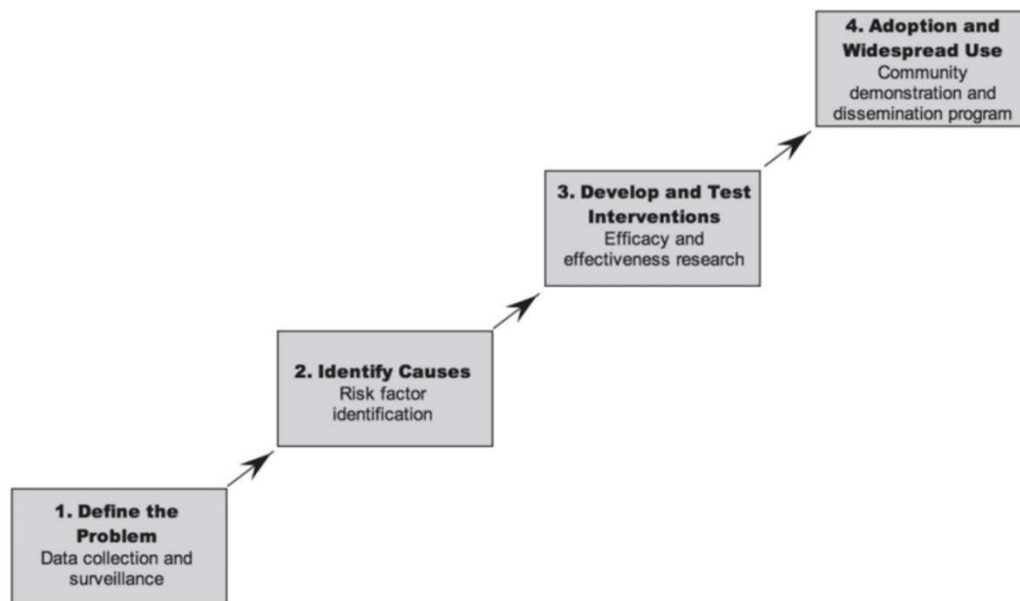
these disparities, the risk of drowning will continue to disproportionately affect the most vulnerable populations in Indonesia.

1.8. Through the Lens of Public Health: Converging Injury Prevention and Health Promotion

Drowning is a multifaceted issue influenced by a myriad of factors spanning individual behaviours, environmental conditions, socio-economic disparities, and cultural norms.¹⁵⁷⁻¹⁵⁹ Beyond the simplistic portrayal of drowning as a mere consequence of lack of swimming skills, its complexity encompasses a range of interconnected determinants, including inadequate supervision, access to unsafe water bodies, risk-taking practices, and socio-economic and gender inequalities.^{160,161} Cultural perceptions, attitudes towards water hazards, and regional differences in safety infrastructure and climate risk further contribute to drowning risk.^{40,162} Recognising this complexity is crucial for developing comprehensive prevention strategies tailored to diverse populations, hence it is imperative to view drowning prevention through the lens of public health.^{163,164}

In the realm of public health, the integration of injury prevention and health promotion emerges as a pivotal endeavour, addressing not only the immediate causes of drowning injuries but also the broader social, economic, political, and environmental determinants that influence health outcomes.^{157,161,163,164} Thus, the convergence of injury prevention and health promotion represents a synergistic effort towards achieving optimal public health outcomes of reduction of drowning fatalities.^{163,164} To grasp how public health contributes to merging injury prevention and health promotion, particularly in addressing public health concerns such as drowning, the Public Health Model (PHM) of injury prevention serves as a valuable framework.^{164,165}

The PHM is a systematic framework that guides the development and implementation of strategies aimed at alleviating the burden of diseases on both individuals and communities.^{165,166} The framework encompasses a comprehensive and methodical continuum of research, beginning with issue identification and progressing towards the effective implementation of interventions within the broader society (Figure 1.3).^{165,166} The terms 'Public Health Model (PHM)' and 'Public Health Approach' are often used interchangeably in the literature, both referring to the same framework within public health that addresses health issues, including injury prevention. The model recognises the importance of engaging researchers, practitioners, policy makers, and the community from the outset and throughout the process of defining the problem, identifying causes, developing and testing interventions, and disseminating and implementing best practices, advocating for collaborative approach.^{165,166}



Note: The Public Health Model. Reprinted from "Closing the gap between injury prevention research and community safety promotion practice: Revisiting the Public Health Model" by Dale W. Hanson, Caroline F. Finch, John P. Allegrante, and David Sleet. D. W. Hanson, C. F. Finch, J. P. Allegrante, and D. Sleet, 2012, *Public Health Reports*, Volume 127, p.148. Copyright © 2012 by Sage Publications. Reprinted with permission.

Figure 1.3. The Public Health Model¹⁶⁶

This model encompasses several key components, including: 1) defining the public health problem through data collection and surveillance, to monitor trends and patterns in drowning injuries and deaths, identifying high-risk populations, geographic areas, and fatality of drowning; 2) risk factor identification, to understand the underlying causes and contributing demographic, biological, behavioural, environmental, and societal factors of drowning injuries and deaths, informing the development of evidence-based interventions tailored to address specific risk factors and populations; 3) developing and implementation of prevention programs, including assessing their efficacy and effectiveness, providing scientific evidence-based recommendations for decisionmakers; and 4) Adoption and widespread use, a critical component which involves assessing the effectiveness, reach, and impact of interventions, guiding decision-making, informing program improvement, and facilitating the dissemination of best practices.^{166,167} Therefore, the PHM serves as a vital bridge between the often-siloed worlds of injury prevention research and health promotion practices.¹⁶⁶

Health promotion is an inclusive approach that enables individuals and communities to manage their health effectively through awareness and active involvement in health-related choices.¹⁶⁸⁻¹⁷¹ This is achieved by developing supportive environments through policies, enhancing

individual and community capabilities through education, and nurturing community participation to improve the well-being and safety of individuals, communities, and society as a whole.¹⁶⁸⁻¹⁷¹ Hence, the PHM serves to connect injury prevention and health promotion by fostering collaboration and dialogue among researchers, practitioners, policymakers, and the community, recognising the unique perspectives and expertise each stakeholder brings to the table.¹⁶⁶ This ensures that interventions are contextually relevant, tailored to the specific needs and characteristics of target communities and promotes the mutual exchange of evidence between stakeholders, valuing both injury research-based evidence and health promotion practice-based insights. Through establishing a shared understanding of the problem and negotiating socially acceptable solutions, the PHM empowers communities to take ownership of their health and safety, with support from health promotion practitioners in community engagement and consensus-building.¹⁶⁶ Therefore, the model was utilised to guide Chapter 5 of this thesis.

When viewed through the lens of public health, drowning prevention efforts should prioritise a collaborative, contextually sensitive, and integrated approach, engaging all stakeholders to gain a comprehensive understanding of the socio-ecological determinants of drowning.¹⁶⁶ By leveraging their expertise, efforts can be focused on improving the translation of research-to-practice, facilitating widespread adoption and effective implementation of strategies to reduce drowning fatalities and incidents.¹⁶⁶

1.9. Health Promotion: A Socio-Ecological Approach to Drowning Prevention

Drowning prevention necessitates understanding and addressing various underlying determinants, including the availability of safe waterways, regulations for development of rural and urban areas, boating safety, disaster risk reduction, and occupational health, socio-economic equality, and access to education, swimming lessons, and other preventive measures.¹⁷²⁻¹⁷⁵ These comprehensive aspects underline the breadth of preventive measures against drowning, spanning individual-focused approaches such as swimming training programs, the use of personal flotation devices (PFDs), and avoiding alcohol consumption while undertaking recreational activities in water; interpersonal-focused approaches such as enhancing supervision of children near water, teaching bystanders rescue skills, encouraging open communication about water safety within families, and fostering peer support for safe swimming practices; community-based actions such as community initiatives on installing barriers around open water bodies, organising community swimming lessons and childcare facilities, and conducting public awareness campaigns; as well as measures at the societal level, which involve broader systemic changes and policies aimed at addressing the underlying

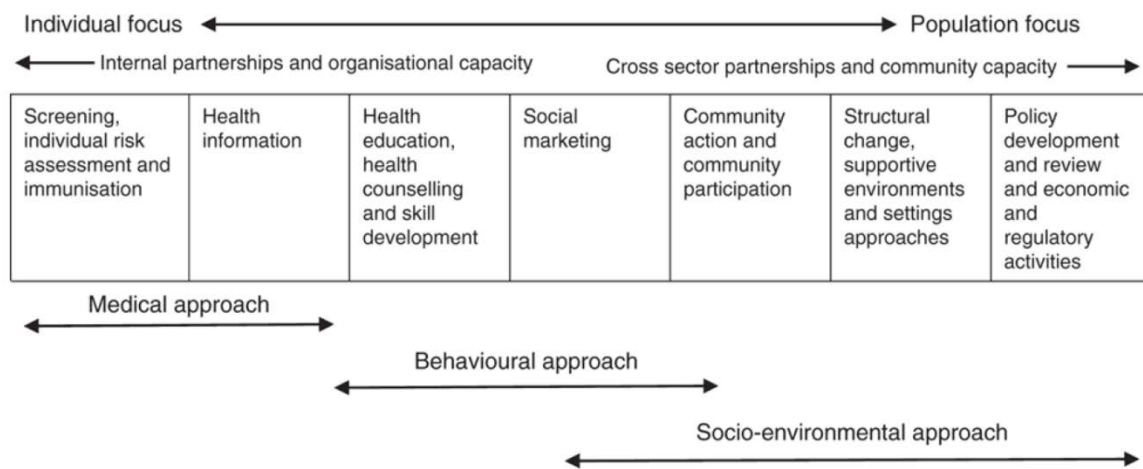
determinants of drowning risk, including implementing and enforcing water safety regulations, improving access to swimming facilities and education, and advocating for equitable access to water safety, education, and health resources.^{37,176-178} This highlights the necessity of integrated strategies across upstream, midstream, and downstream intervention, underscoring the shared principles between drowning prevention and health promotion.^{7,163,168,179-182}

Health promotion is a holistic approach that acknowledges the intricate connections between social, economic, environmental, and behavioural determinants of health.¹⁶⁸⁻¹⁷¹ Informed by the socio-ecological model, health promotion strategies acknowledge that health outcomes are shaped by various factors across different levels, including individual, interpersonal, community, societal, and environmental influences.¹⁶⁸⁻¹⁷¹ The health promotion approach spans from individual to population levels, across a continuum that encompasses downstream, midstream, and upstream strategies. Its primary goal is to empower individuals to manage their health by making informed choices within environments that support these choices.¹⁶⁸⁻¹⁷¹

Education plays a crucial role in health promotion by providing people with accurate information about health risks, prevention, and healthy lifestyles, enabling them to make better decisions.¹⁶⁸⁻¹⁷¹ Moreover, health promotion involves creating supportive environments conducive to healthy behaviours. Implementing policies and regulations that encourage healthy choices and making such options more accessible and affordable are also essential. Community engagement is another key aspect, with initiatives aiming to involve community members in planning and implementing health programs. This approach ensures that initiatives meet the specific needs of communities, fostering a sense of ownership and empowerment among participants.¹⁶⁸⁻¹⁷¹ Therefore, converging drowning prevention with health promotion offers a more comprehensive perspective on drowning prevention, encompassing empowering individuals and communities to manage their own water safety-related behaviours and practices.^{37,183,184}

Talbot and Verrinder¹⁶⁸ exemplify the principles of health promotion within the Health Promotion Framework (HPF), which encompasses: 1) medical strategies, encompassing screening, individual risk evaluation, and health education (downstream strategies); and 2) behavioural strategies, encompassing individual-focused approaches focused on increasing internal partnerships and organisational capacity, such as health education, skill development, and social marketing (midstream strategies); and 3) socio-environmental approaches, which include population-focused approaches with focus on increasing cross-sector partnerships and community capacity, including community action, community participation, structural changes, creation of supportive environments, policy development and evaluation, and economic and regulatory activities (upstream strategies). This

framework, which is presented in Figure 1.4, was used throughout this thesis, particularly in Chapters 3 and 6, to assess availability and gap of drowning prevention approaches in Indonesia.¹⁶⁸



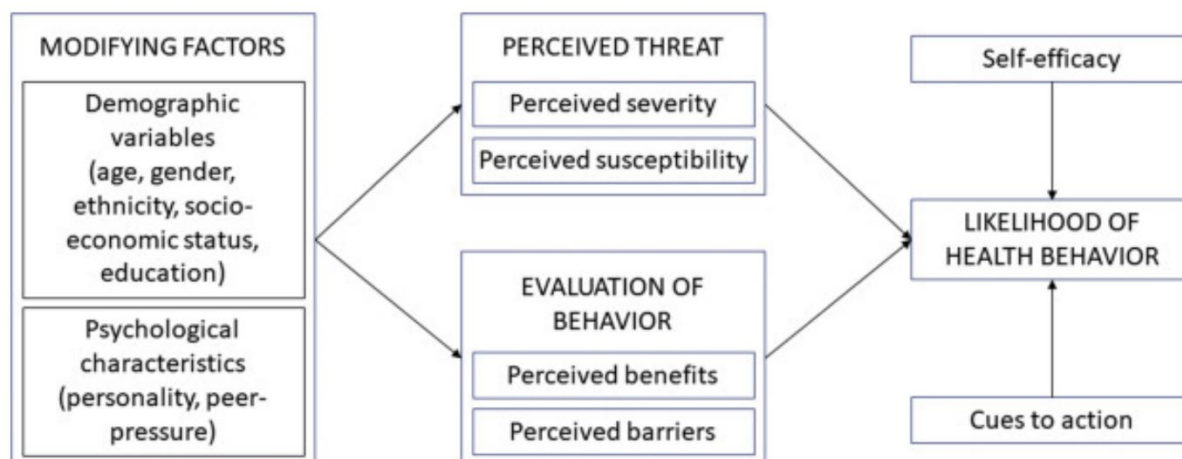
Note: Continuum of health promotion practice. Reprinted from "Promoting health: The primary health care approach 6th ed" by Talbot L and Verrinder G. Talbot L, Verrinder G, 2017, Elsevier Health Sciences, 30-33. Copyright © 2017 by Elsevier. Reprinted with permission.

Figure 1.4. The Health Promotion Framework¹⁶⁸

1.10. Health Belief Model: Understanding Water Safety Behaviours

Growing evidence highlights the advantages of incorporating behavioural science theories to enhance the efficacy of health promotion and injury intervention efforts.¹⁸⁵ Given the multifaceted nature of injury, which involves behaviours across natural, physical, and social contexts, integrating concepts from behavioural frameworks, such as through the utilisation of the Health Belief Model (HBM), can provide valuable insights into promoting and empowering individuals to adopt safety behavioural changes.¹⁸⁵⁻¹⁸⁷

The HBM is a theoretical framework used to understand and predict health-related behaviours by examining individuals' beliefs and perceptions.¹⁸⁵⁻¹⁸⁷ At its core, the HBM posits that individual's motivation to engage in health-promoting behaviour is influenced by their perceptions of susceptibility to an issue and its severity, and the perceived benefits and barriers to action, as well as their confidence in the ability to perform the action (self-efficacy) (Figure 1.5).^{186,187}



Note: The Health Belief Model. Reprinted from “Chapter 90 - Implementation research. Translational Surgery” by James C Etheridge, Robert D. Sinyard, and Mary E. Brindle. Etheridge, J. C., et al., 2023. Copyright © 2023 by Elsevier. Reprinted with permission.

Figure 1.5. The Health Belief Model¹⁸⁶

According to the HBM, individuals are more likely to participate in undertaking preventive efforts when facing a threat or risk that is perceived as personal to them, but only if the benefit of such actions outweighs the risk or perceived barriers.^{187,188} Hence, the HBM proposes that for a behavioural change intervention to be efficacious, it needs to address an individual’s perceptions about susceptibility, severity, benefits, barriers, and self-efficacy, and take individual and local socio-cultural, historical, and religious context into careful consideration.¹⁸⁹ Therefore, the constructs of HBM were utilised throughout this thesis, particularly in Chapters 5 to 8, to improve comprehension of perceptions regarding safety behaviours in aquatic environments, informing the development of tailored water safety promotion interventions aimed at empowering both individuals and communities to adopt water safety practices effectively within their local context.^{187,190}

1.11. Statement of the Problem

Indonesia’s extensive archipelagic geography, large and diverse population, and high vulnerability to hydrometeorological disasters underlines the importance of unintentional drowning as a pressing public health concern. Despite this urgency, there is limited research examining the epidemiology, risk factors, and prevention strategies associated with drowning in the country.⁴¹

To address this gap, this study aimed to examine drowning mortality rates, risk factors, and preventive measures in Indonesia. In addition, it aimed to examine how these factors intersect with socio-ecological dynamics of health promotion. Furthermore, the research endeavoured to explore

the perceptions and practices of Indonesian communities concerning the risks and prevention of child drowning.

Expanding on this knowledge, the research set out to construct an empirically grounded foundation on the magnitude and significance of unintentional drowning in Indonesia, identification of risk factors, and setting agendas for action to facilitate the development of integrated policies and instruments to promote water safety effectively and sustainably.

1.12. Significance of the Study

To my knowledge, this study is the first to report on the unintentional drowning profile in Indonesia, providing substantial baseline information on the magnitude of unintentional drowning as a public health problem in Indonesia. The evaluation of the differences of unintentional drowning deaths across demographic characteristics, jurisdictions, and other predictors also highlighted important risk factors of unintentional drowning in Indonesia. This information can inform planning, implementation, and evaluation of drowning preventive interventions, as well as water safety policy development and research in the future.

In addition, by recognising the gap in data recording, analysis, reporting and dissemination, this study also sought to contribute to the development of national and regional drowning surveillance systems, which are currently non-existent at both the national and provincial levels. The importance of understanding unintentional drowning fatalities in Indonesia, as the world's largest archipelagic state with high risk for various natural hazards, also underlined the potential of this study to advance the evidence-based setting, enforcement, and integration of water safety regulations, safe boating and maritime regulations, and disaster risk reduction and mitigation efforts, not only in Indonesia but also for other LMICs with similar settings. Disseminating information on the scale of fatal unintentional drowning in Indonesia can contribute to the enhancement of public awareness, community participation and action, and multisectoral collaboration in creating safe environments and advocating for drowning prevention and water safety policy making.

Despite the vulnerability to drowning, according to the 2021 WHO Regional Status Report on Drowning in South-East Asia, Indonesia does not have a national coordination mechanism for drowning prevention and water safety.¹⁰ In addition, Indonesia does not have a coordinated national death registry from which national and subnational drowning data can be collected.¹⁰ This lack of coordination mechanism and action framework corresponds with the estimation of underrepresentation of drowning deaths data in LMICs, including in Indonesia, due to substandard data collection and insufficient continuity of data.^{7,179,181} Furthermore, for Indonesia, as well as other

resource limited LMICs with conservative dependence on health facility-based reporting systems, the ICD coding system for drowning incidents, which excludes drowning cases related to natural disasters and water transport incidents, and those of intentional and undetermined intent from specific drowning codes, also potentially further undermines the reported magnitude of drowning.^{7,63,191}

By identifying this gap of drowning data and prevention framework availability, this study sought to make tangible contributions to the field of drowning prevention and water safety promotion in Indonesia through advocating for evidence-based, integrated, and sustainable water safety measures. Furthermore, this study strived to contribute to the achievement of the 2021 UN General Assembly Resolution and the 2023 WHO call for global efforts to accelerate drowning prevention across all UN member states, and the achievement of the UN's SDGs, particularly in promoting population health, safety, and well-being, and reducing preventable deaths.^{59,100-106}

1.13. Research Aims

This study aimed to investigate mortality rates, risk factors, and prevention of unintentional drowning deaths in Indonesia, as well as the interconnection of these aspects with socio-ecological approaches of health promotion.

1.14. Research Questions

This study answered these following questions:

1. What are unintentional drowning mortality rates in Indonesia?
2. What are unintentional drowning risk factors in Indonesia?
3. What drowning prevention strategies and water safety regulations have been implemented in Indonesia?
4. What are Indonesian parents' and community perceptions and practices regarding child drowning risk and prevention?
5. What gaps exist in unintentional drowning prevention strategies in Indonesia from a health promotion perspective?

1.15. Conceptual Framework

The conceptual framework developed in this thesis served to justify why the research was conducted within the selected context, by illustrating the current state of knowledge and identified gaps in understanding the phenomenon of drowning in Indonesia, guiding the methodological

underpinnings of the study, as well as delineating its scope and delimitations.¹⁹²⁻¹⁹⁴ Focusing on three domains—risk factors, moderators, and the negative health outcomes of fatal and non-fatal drowning incidents—this thesis posited their interdependence in influencing the prevention of drowning incidents.¹⁹⁵

Risk factors encompassed variables and conditions that increase the likelihood of the occurrence of a drowning event, with four primary categories of variables explored in this thesis: demographic, biological, psychological, and environmental.^{37,176-178,195} Meanwhile, moderators encompassed factors which influence the strength or direction of the relationship between two variables. For example, how swimming skills can moderate the relationship between access to water and drowning risk.¹⁹⁵ In this thesis, in addition to investigating individual- and community-focused drowning prevention strategies as moderators of drowning, contextual factors specific to Indonesian communities were also examined to further elucidate under what conditions or for whom the relationship between drowning hazards and drowning risk holds true.¹⁹⁵ For instance, swimming skill can moderate the relationship between access to water and drowning risk, if the individual has access to swimming skill training and perceive it as important and appropriate.^{90,180,195,196} These factors, extracted from the HBM constructs, include perceptions of susceptibility to drowning, severity of drowning consequences, barriers, and benefits of implementing prevention strategies, and self-confidence in adopting water safety-promoting behaviours to prevent drowning.^{186,187} To enhance understanding of these perceptions, socio-cultural, historical, and religious contexts were also taken into consideration.^{186,187} By integrating these elements, this thesis aimed to provide a comprehensive understanding for addressing drowning incidents in Indonesian communities.

Mediators, which acted as intermediaries between the occurrence of drowning incidents and the outcomes of drowning deaths, such as pulmonary oedema, cardiac arrest, and impaired neurological functions, were not explored in this thesis.¹⁹⁷⁻¹⁹⁹ Furthermore, this thesis did not examine moderators that closely influenced the direction of mediators, such as the availability of timely and efficient rescue efforts, cardiopulmonary resuscitation, emergency response systems, and advanced medical care.¹⁹⁷⁻¹⁹⁹

The conceptual framework of the study can be seen in Figure 1.6.

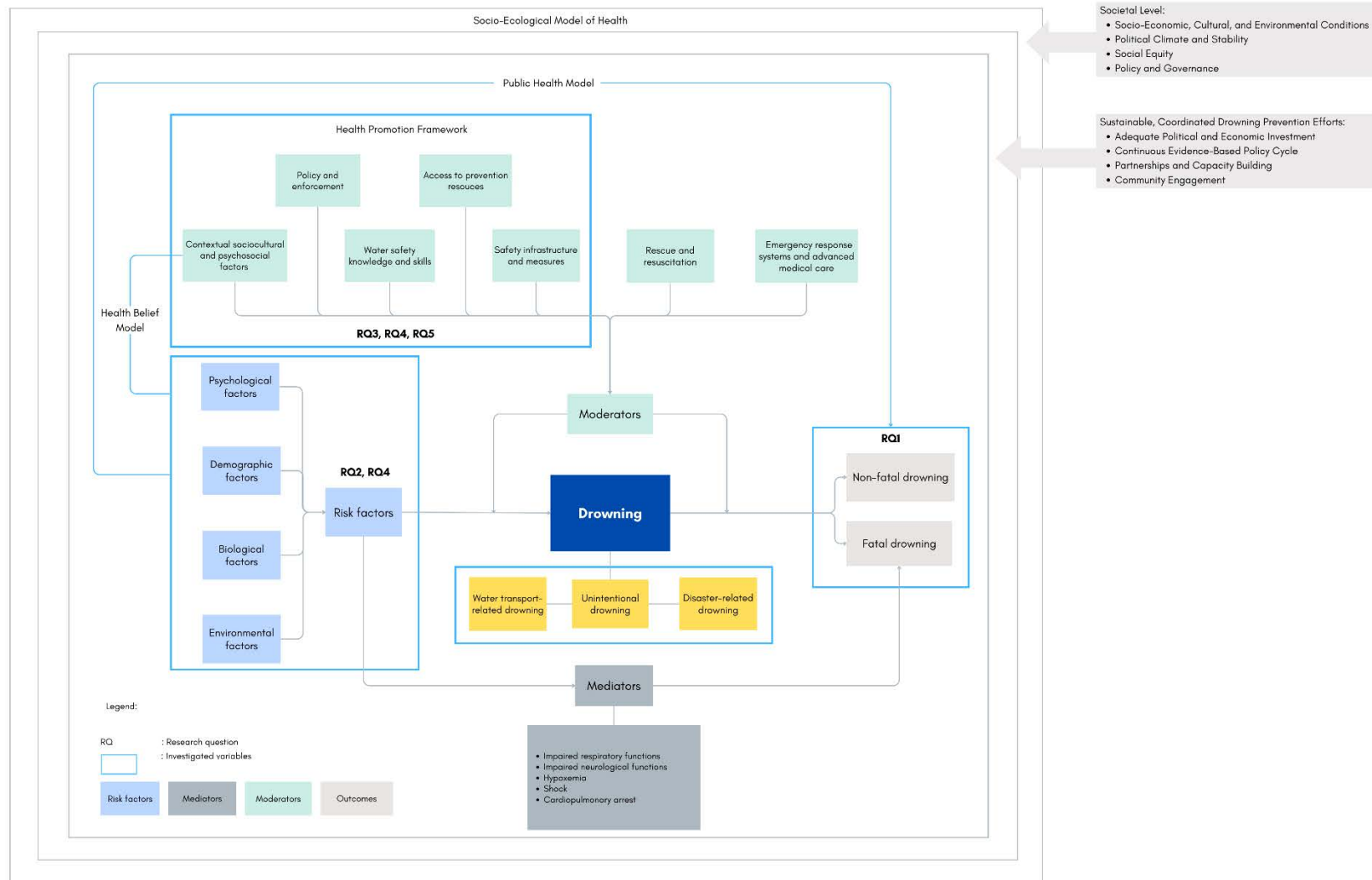
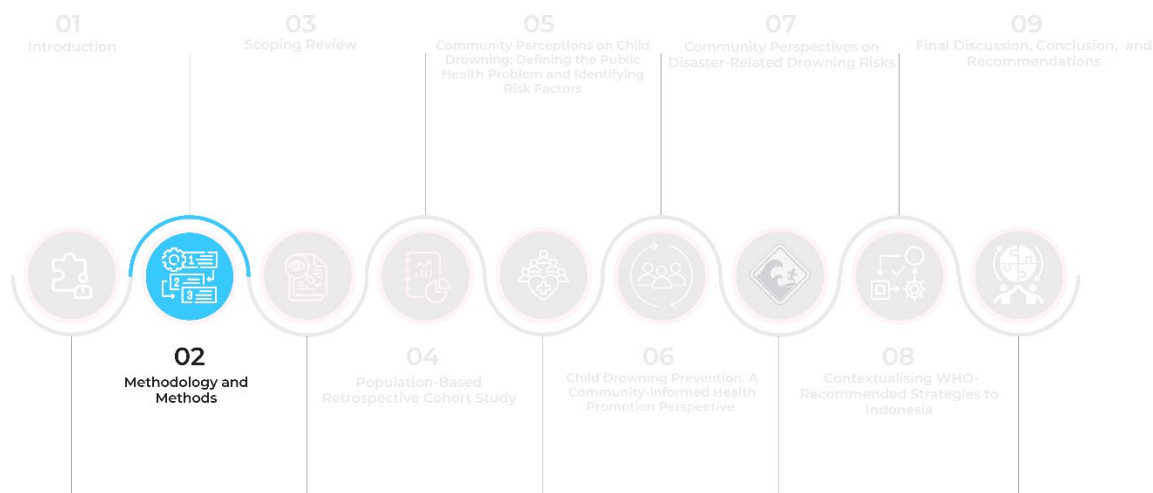


Figure 1.6. Conceptual Framework of the Study

Chapter 2 Methodology and Methods



2.1. Philosophical Perspectives: Setting Ontological and Epistemological Position

Research involves creating novel knowledge, leveraging existing knowledge to generate new theories, refine methods of inquiries, and provide better comprehension to address a particular research problem.²⁰⁰ Creation of a novel knowledge demands more than just enthusiasm; it requires the meticulous development of a well-structured plan aimed at attaining the study's objectives.^{201,202} To achieve the research objectives, three crucial elements within the framework of research design must be meticulously planned and rigorously justified in advance: 1) philosophical perspectives; 2) approaches to investigation; and 3) methods and techniques for gathering, analysing, and interpreting data.²⁰² Establishing these three components not only streamlines the research planning process but also bolsters the validity and reliability of the study findings.²⁰²

Research philosophy constitutes the fundamental underpinning of any scholarly inquiry, providing the theoretical framework within which research questions are formulated, methods are chosen, and findings are interpreted.²⁰²⁻²⁰⁷ At its core, research philosophy encompasses ontological and epistemological considerations, addressing questions about the nature of reality and the process of knowledge acquisition. Ontology delves into inquiries regarding the existence of entities and the nature of reality, shaping researchers' understanding of what can be studied and known. Epistemology, on the other hand, investigates the nature and scope of knowledge, exploring how knowledge is acquired, justified, and validated. These two philosophical perspectives serve as guiding

principles that inform this study's choice of research methodology, data collection techniques, and analytical approaches.^{202,204-208}

Moreover, research philosophy encompasses axiological considerations, which involve researchers' values, ethics, and subjective judgments.^{202,204,206-212} Axiology addresses questions about the role of values in research, the ethical implications of research practices, and the researcher's responsibility to uphold principles of integrity and honesty. Therefore, researchers are required to engage in reflexive thinking to acknowledge and address their own subjectivity, positionality, and potential biases that may affect the research process and the interpretation of findings.^{202,204,206-212} This aspect is discussed on the last section of this chapter titled: 'Ethical Aspects of the Research: Researcher Reflexivity and Positionality'.

The choice of research philosophy is not arbitrary and is influenced by various factors, including the nature of the research problem, the researcher's disciplinary background, and the broader theoretical frameworks within which the research is situated.^{202,204,206-208,210-213} Each research paradigm, such as positivism, interpretivism, and critical realism, embody distinct ontological, epistemological, and axiological assumptions, each offering unique perspectives on the nature of reality and the acquisition of knowledge.^{202,204,206-208,210-213}

In delving into the nature of reality, ontological viewpoints can be placed on a continuum.^{202,204,206-208,210-213} Objectivism maintains that universal truths and facts exist regardless of individual viewpoints or interpretations. Meanwhile, at the other end, constructivism proposes that reality is not an objective, pre-existing entity but rather is constructed by individual perceptions and interpretations, with individuals actively constructing their understanding of reality through cognitive processes such as perception, reflection, and social interaction.^{202,204,206-208,210-213} In exploring the nature of knowledge, epistemological positions can also be positioned along a continuum, and it is influenced by the researcher's ontological perspective. On one end, positivism holds that knowledge can be acquired through direct observation and measurement, with an emphasis on objectivity, quantifiability, and verifiability in research. Meanwhile, interpretivism views reality as socially constructed and subjective, shaped by human perceptions, experiences, and interactions. Therefore, positivism, which adopts an objectivist ontology, posits the existence of an objective reality that can be observed and measured through empirical inquiry, relying on quantitative studies. In contrast, interpretivism embraces a constructivist ontology, recognising the socially constructed nature of reality and the importance of subjective meanings and interpretations, hence favouring qualitative research method to explore the complexities of human experience and social phenomena.^{202,204,206-208,210-213}

On the other hand, realism acknowledges that there exists a reality beyond human perception, though it is inherently challenging to fully grasp.^{202,204,206-208,210-213} Realism aims to unveil the hidden structures and mechanisms influencing the occurrence of events that we can observe, blending aspects of both positivism and interpretivism. Critical realism, a distinct philosophical stance building upon realism, adds further nuances. It acknowledges the existence of an external reality while acknowledging human limitations in understanding it fully. Critical realism proposes a layered reality: the observable realm (empirical), the causal realm (actual), and the underlying realm (real). It emphasises the distinction between what is empirical, which consists of observable phenomena, and what is real, which consists of underlying structures and mechanisms that may not be directly observable but have causal powers that influence observable phenomena. This perspective leads critical realists to endorse methodological pluralism, valuing both quantitative and qualitative methods. By employing various approaches, they seek to transcend mere description, aiming for deeper insights into the fundamental causes and mechanisms shaping observable phenomena.
^{202,204,206-208,210-213}

Therefore, the general methodology for undertaking this research project was predicated on critical realism, which endorsed methodological pluralism, to investigate the underlying structures, determinants, and contexts shaping the observable phenomenon of drowning incidents.^{202,204,206-208,210-213} In line with this, the study acknowledged the existence of an objective reality, reflected in measurable data such as mortality and incidence rates of unintentional drowning in Indonesia. This guided the quantitative phase of the study, which followed positivist principles for rigorous data collection and analysis to ensure reliability and validity. Conversely, the study also recognised the existence of multiple subjective social realities surrounding unintentional drowning in Indonesia. This informed the qualitative phase, aimed at exploring parental and community understandings, viewpoints, and experiences concerning drowning. This phase was undertaken under interpretivist assumptions, acknowledging that participants' realities are subjectively constructed based on their lived experiences, interpretations, and unique social and cultural contexts. Thus, a mixed methods approach was adopted to comprehensively address these distinct layers of reality, facilitating a robust exploration of both objective data and subjective social constructs surrounding drowning risk and prevention in Indonesia.^{202,204-208,210-215}

2.2. Research Methodology

This study was undertaken using a mixed methods approach. A mixed methods study combines quantitative and qualitative research methodologies in one, integrated study, providing a holistic understanding of the research problem.²¹⁵⁻²²¹ This strategy enables researchers to investigate

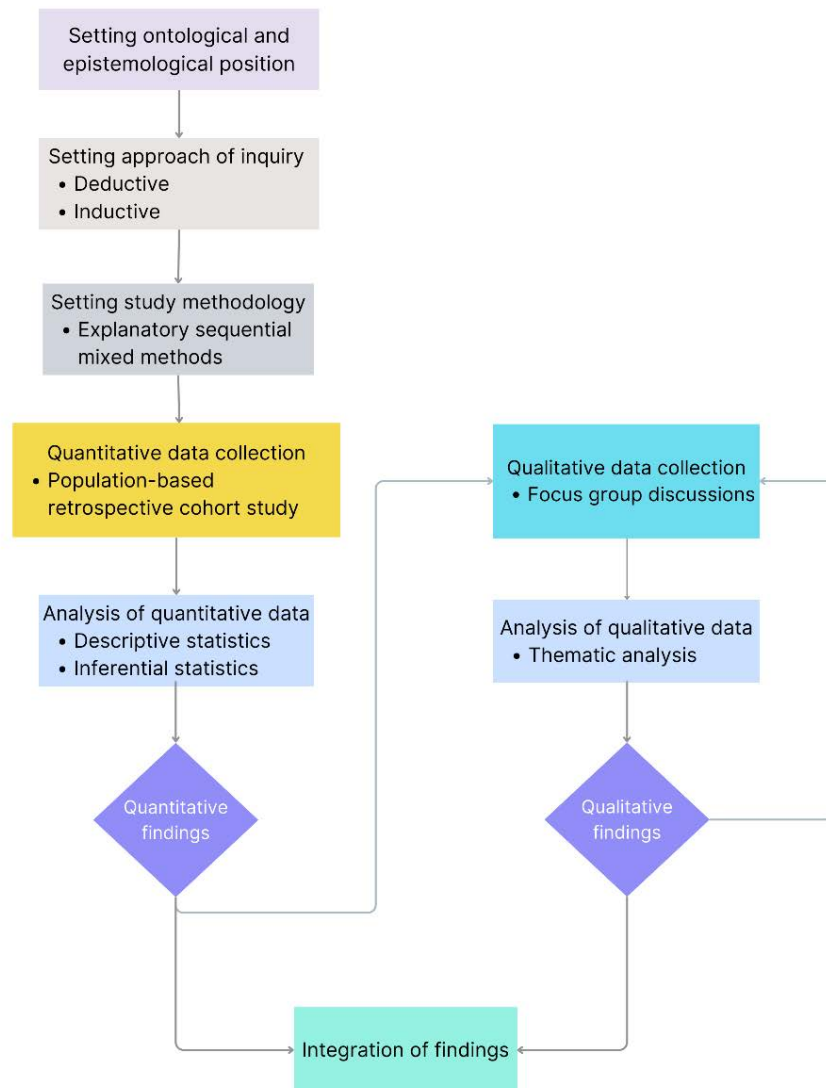
various aspects of the phenomenon under examination, leveraging the strengths of both quantitative and qualitative methods. While quantitative methods allow the collection and analysis of numerical data to discern patterns, relationships, and trends, qualitative methods delve into the meanings, experiences, and perspectives of participants through methods such as in-depth interviews, focus group discussions, observations, or textual analysis. Through mixed methods approach, researchers can triangulate findings from diverse sources, enhancing the validity and reliability of their results. Therefore, mixed methods studies empower researchers to tackle complex research questions that may not be adequately addressed by a single methodological approach, thus broadening the scope and depth of research outcomes.^{202,215-221}

This study was conducted as an explanatory sequential mixed methods study, a research design that involves the sequential integration of quantitative and qualitative data collection and analysis within a single study.^{202,205,215,217,219,221} The purpose of this design is to elaborate, enhance, and clarify the findings obtained from one method with insights gained from the other. In this study, connection rather than embedding was employed, with the two-tier design of explanatory sequential mixed methods consisted of the collection and analysis of quantitative data using deductive reasoning; followed by the collection and analysis of qualitative data by inductive reasoning, to explain and further expand quantitative findings. This study design was chosen as it is suitable to collect, analyse, and integrate the findings of both quantitative and qualitative studies to gain a deeper understanding of unintentional drowning mortality rates, risk factors, and prevention in Indonesia, a complex phenomenon that cannot be adequately answered using just one methodological approach.^{202,205,215,217,219,221}

In this study, the quantitative data provided a comprehensive overview of unintentional drowning rates and risk factors across the entire Indonesian population. Meanwhile, the qualitative phase, though conducted in a single province, was equally integral to the study, offering essential depth regarding the social and contextual nuances that influenced the patterns observed in the quantitative findings. The results from each phase were then integrated in the discussion and interpretation stages (Chapter 9 of this thesis), where insights from the qualitative phase enriched the understanding of patterns observed in the quantitative outcomes. This approach allowed for a holistic view, capturing both national trends and local nuances simultaneously.

This explanatory sequential mixed method study consisted of three phases: 1) a scoping review, 2) a population-based, retrospective cohort quantitative study, and 3) an exploratory qualitative study. The theoretical underpinnings of each phase are detailed in the subsequent

subchapter titled 'Methods and Theoretical Underpinnings'. The workflow of the study is depicted in Figure 2.1.



Note: Workflow of Explanatory Sequential Design of Mixed Methods Research. Adapted from "Explanatory sequential design of mixed methods research: Phases and challenges" by Toyon MAS. Toyon MAS, 2021, International Journal of Research in Business and Social Science (2147- 4478), 10(5), 253-260. CC BY-SA 4.0 © 2021 by Toyon MAS.

Figure 2.1. Research Flowchart²⁰⁵

2.3. Methods and Theoretical Underpinnings

2.3.1. Phase One: Scoping Review

This review was conducted using a scoping review methodology, following the Arksey and O'Malley methodological framework, the Joanna Briggs Institute (JBI) guideline, and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-

ScR).²²²⁻²²⁶ The review process involved outlining scoping review questions, conducting a systematic search to identify relevant studies, selecting studies based on inclusion criteria, extracting and charting the data, and finally, analysing, synthesising, and reporting the results.²²²⁻²²⁶

Scoping review is a rigorous methodological approach used to systematically map existing literature on a particular topic, providing an overview of the breadth and depth of available evidence.²²² Unlike traditional systematic reviews, which focus on specific research questions and employ strict predefined inclusion and exclusion criteria, scoping reviews aim to identify a wide range of evidence sources to comprehensively explore a research area which has not been widely explored before, offering flexibility to involve diverse search designs to allow all emerging evidence to be gathered to synthesise a new and expanded knowledge.²²⁷ By providing a panoramic view of the literature, scoping reviews offer valuable insights into the state of knowledge, identify gaps in the research, and inform future research directions and policy development.^{222,227,228}

Therefore, a scoping review design was deemed suitable for this study. The approach allowed the clarification and identification of crucial concepts, characteristics, and factors pertinent to unintentional drowning in Indonesia—an underexplored domain in literature—by systematically mapping evidence from both research and non-research sources.^{222,226-228} This inclusive approach also encompassed grey literature, such as policy statements and issues, government and non-government reports, academic papers, theses, dissertations, and conference proceedings. By synthesising a wide array of information, the review provided a comprehensive overview of unintentional drowning and its prevention in Indonesia while highlighting knowledge gaps for future evidence syntheses.^{222,226-228}

2.3.1.1. Research Aims

The scoping review aimed to describe the epidemiology and risk factors of unintentional drowning in Indonesia and explore health promotion and prevention approaches currently in place.

2.3.1.2. Research Questions

This study answered the following questions:

1. What information is available on fatal unintentional drowning mortality numbers and rates in Indonesia?
2. What is known about risk factors for unintentional drowning in Indonesia?
3. What prevention and health promotion approaches are currently being used in Indonesia to reduce unintentional drowning deaths?

4. How can the HPF¹⁶⁸ be applied to inform strategy development to prevent unintentional drowning Indonesia?

2.3.1.3. Search Strategy

The systematic search was conducted to identify all relevant literature on unintentional drowning in Indonesia, published from the earliest available year up to May 2023, without restricting the publication year. The following databases were systematically searched: 1) Eight international journal databases, namely MEDLINE (Ovid), CINAHL, Informit, PsycINFO (ProQuest), Scopus, SafetyLit, BioMed Central, and Google Scholar, selected for their comprehensive coverage and relevance to publications on drowning-related injuries; 2) Two Indonesian journal databases, Sinta and Garuda, which are also linked to Google Scholar Indonesia ('Google Cendekia') and all Indonesian journals indexed by the Indonesian Ministry of Education, to capture local publications that may not have been indexed in international databases; and 3) Websites of Indonesian government agencies identified in previous studies as important entities for documenting and addressing drowning events in Indonesia, including the Indonesian Ministry of Health, the Ministry of Education, Culture, Research and Technology, the Ministry of Marine Affairs and Fisheries, the Ministry of Transportation, the National Disaster Management Agency, and the National Search and Rescue Agency.²²⁹⁻²³⁵

The searches were conducted to locate all documents published in both English and Indonesian languages, aiming to capture as much information as possible on drowning events and prevention in Indonesia. To achieve this, the most relevant and exhaustive search terms were employed, tailored to each database utilised. The following is a summarised version of the search terms utilised in this study. For the complete search strings, please refer to Chapter 3, Section 3.8.1. Search Strategy.

1. General English terms for MEDLINE (Ovid), CINAHL, Informit, PsycINFO (ProQuest), Scopus, SafetyLit, and BioMed Central databases: Core terms used include: (*drown**), (*swim**), (*maritime*), (*flood**), (*disaster**), (*(hurricane*) OR (cyclone*) OR (typhoon*) OR (monsoon*)*), (*water rescue*), (*rescue*), and (*(boat*) OR (ship*)*). These terms are combined with *AND Indonesia* to target region-specific records. In databases utilising Medical Subject Headings (MeSH), queries are formulated using a combination of MeSH terms (such as "*Drowning*", "*Swimming*", and "*Natural Disasters*"), combined with "*AND Indonesia*".

2. General Indonesian terms for MEDLINE (Ovid), CINAHL, Informit, PsycINFO (ProQuest), Scopus, SafetyLit, BioMed Central, Sinta, and Garuda databases: Core terms used were around: (*tenggelam*), (*renang OR berenang*), (*((banjir*) OR (badai) OR (bencana))*), (*(kecelakaan AND (kapal OR perkapalan OR layar OR pelayaran OR laut))*), (*(keselamatan AND (kapal OR perkapalan OR layar OR pelayaran OR laut OR maritim))*), (*penyelamatan air*), and (*penyelamatan perairan*).
3. Google Scholar: Searches used the *allintitle* filter to identify publications whose titles include terms such as (*drown OR drowns OR drowned OR drowning*), (*swim OR swims OR swimming*), (*hurricane OR hurricanes OR cyclone OR cyclones OR typhoon OR typhoons OR monsoon OR monsoons*), (*flood OR floods OR flooding*), (*disaster OR disasters*), (*boat OR boats OR boating OR ship OR ships OR shipping*), (*maritime safety*), and (*water rescue*), combined with *Indonesia*.
4. Google Cendekia (Google Scholar Indonesia): Searches used the *allintitle* filter to identify publications whose titles include terms such as (*tenggelam*), (*renang OR berenang*), (*((banjir OR badai OR bencana) tenggelam)*), (*((air OR perairan) penyelamatan)*), (*(kecelakaan (kapal OR perkapalan OR layar OR pelayaran OR laut))*), and (*(keselamatan (kapal OR perkapalan OR layar OR pelayaran OR laut OR maritim))*).
5. Government Sources: Searches were restricted to Indonesian websites (*site:.go.id*, *site:.org*) and concentrated on terms (*tenggelam*), (*renang OR berenang*), (*((banjir OR badai OR bencana) tenggelam)*), (*((air OR perairan) penyelamatan)*), (*(kecelakaan (kapal OR perkapalan OR layar OR pelayaran OR laut))*), and (*(keselamatan (kapal OR perkapalan OR layar OR pelayaran OR laut OR maritim))*), and (*water rescue*) to gather local government data and resources published in Indonesian.

A set of inclusion and exclusion criteria was used to narrow down the systematic search corresponding to the research objectives, as described in Table 2.1.

Table 2.1. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none"> • Literature published up until May 2023 • Original research articles • Comprehensive scientific reviews, meta-analyses, statements of clinical standards, case reports, opinion pieces • Grey literature, such as government or other authoritative reports, policy statements, issues papers, theses and dissertations, and conference papers/proceedings • Full-text available • Published in English or Indonesian language • Drowning deaths in humans • Drowning specifically taking place in Indonesia • Unintentional drowning deaths, including accidental, disaster-related and water-transport related drowning deaths • Drowning risk factors • Drowning prevention • Regulations on water safety, safe boating and shipping, maritime safety, and disaster risk management relevant to drowning prevention • Health promotion approaches on water safety and drowning prevention Water safety, safe boating, and shipping regulation 	<ul style="list-style-type: none"> • Tsunami-related drowning incidents • Intentional self-harm by drowning • Assault by drowning • Drowning in war operations • Drowning by undetermined intent

2.3.1.4. Review Strategy

Publications were screened for inclusion by title, abstract, and full text. Two Indonesian researchers independently reviewed search results at the stage of title, abstract, and full text review. The flow of the selection process of all identified records was as follows:

1. Title and abstract screening

The titles and abstracts of all records identified through the database searching were screened by the inclusion and exclusion criteria, to ensure the relevance of the studies included for the evidence-informed review.

2. Full-text screening

Full-text versions of identified articles were then appraised to examine the relevance of the finding of the studies to answer the research questions. The PRISMA-ScR flow diagram²²⁵ was utilised to summarise the selection process of this review.

2.3.1.5. Data Abstraction

The following data were abstracted from the original peer-reviewed publications: authors, year of study and publication, type of publication (original research article, comprehensive scientific review, meta-analysis, statement of clinical standards, case report, opinion piece, or grey literature), data source, study aim, study design, study sample and setting, scale of study (national or subnational), categories of drowning investigated, methods, relevant findings on the mortality, risk factors, and prevention of drowning, intervention type, and comparator. For grey literature, the following data were abstracted: authors (government agencies), year of publication, scale of study, categories of drowning investigated, and relevant findings.

2.3.1.6. Analysis

Mortality numbers, proportions, and rates were extracted or inferred from the identified studies as epidemiological measures of unintentional drowning, either at the subnational or national scale. For this review, the Health Promotion Framework¹⁶⁸, which comprises medical, behavioural, and socio-environmental approaches at the individual through to the population level, was used to map the socio-ecological dimension of drowning prevention and health promotion approaches that have been or are currently being used in Indonesia.

The calculation of drowning mortality rates involved determining the number of deaths attributed to drowning within a specified population (national or provincial), divided by the total number of this population, expressed per 100,000 population, for a given year, in a given country (Indonesia) or territory (province). The denominator was the size of the population at the midpoint of the time period.^{236,237}

The HPF framework (Figure 1.4) was used not only to assess current drowning prevention strategies available in Indonesia, but also to identify additional strategies that could be implemented to address the multifaceted nature of the drowning.¹⁶⁸

2.3.1.7. Ethical Consideration

Ethical approval has been obtained from the Human Research Ethics Committee (HREC) of the University of Mataram - Indonesia (Ethics Approval number 128/UN18.F8/ETIK/2023). The study did not collect personal, sensitive, or confidential information from participants, and only used publicly accessible documents as evidence.

2.3.2. Phase Two: Population-Based Retrospective Cohort Study

This study was conducted as a population-based retrospective cohort study, which falls under the category of analytical observational quantitative research. The scoping review phase of the study identified the absence of the following data recording systems in Indonesia: 1) a national drowning or injury surveillance system; 2) a coordinated national death registry at both national and subnational levels from which drowning data can be obtained; or 3) documentation on cause of deaths at both the national and provincial levels of health, civil, and bureau of statistics registers.⁶¹ Therefore, data on unintentional drowning deaths and incidences were sourced from the GBD 2019 Study by the IHME.⁶⁰ Given the nature and level of completeness of the available data, the population-based retrospective cohort study design was chosen.

A population-based cohort study is a longitudinal observational investigation that monitors a cohort of individuals over time to explore the incidence of particular outcomes or events and their associated risk factors.²³⁸⁻²⁴⁶ This study design facilitates the examination of disease progression or health-related occurrences within a population and enables the evaluation of the impact of various exposures or interventions on outcome development. These endeavours typically entail substantial sample sizes and extended follow-up durations. By recruiting participants from the general populace rather than from specific subsets, population-based cohort studies offer valuable insights into the broader distribution and determinants of health and disease. Therefore, this design was selected to adequately capture and analyse drowning occurrences in the extensive population of Indonesia, as well as allowing examination into drowning mortality trends, to generate evidence and inform the formulation of water safety policies and drowning prevention interventions.²³⁸⁻²⁴⁶

In a retrospective cohort study, participants are selected based on their exposure status (for instance, whether they have been exposed to specific risk factors for drowning).²³⁸⁻²⁴⁷ However, the outcome of interest, such as fatal drowning, has already occurred by the time the data is collected. This design allows researchers to assess existing data sources, such as medical records or historical surveys, to evaluate whether exposure affects the likelihood of the outcome by comparing incidence

rates between the exposed and unexposed groups. This methodology is particularly valuable for investigating the impact of exposures on health outcomes when conducting a prospective study is impractical or unethical, by relying on existing data sources—such as medical records, administrative databases, or historical records—or, as in this thesis, verbal autopsy surveys.²³⁸⁻²⁴⁷

In contrast to this design, a case-control study begins with participants who have already experienced the outcome (for instance, those who have drowned) and compares them to those who have not experienced the outcome.^{238,240,244,246} This design is useful for identifying potential risk factors associated with the outcome by comparing the history of exposure between cases (those who drowned) and controls (those who did not). However, since case-control studies start with participants based on their outcome status, researchers cannot determine the incidence of the outcome based on exposure, hence this design cannot directly measure risk. Therefore, opting for a retrospective cohort study over a case-control study was more appropriate for this study, as it facilitated a clearer understanding of how exposure status correlated with drowning-related mortality. Furthermore, this design enabled researchers to infer the likelihood or risk of fatal drowning associated with specific exposures, such as age, sex, and jurisdiction, providing valuable insights into the dynamics of drowning risk in Indonesia.^{238,240,244,246}

2.3.2.1. Research Aims

The quantitative study aimed to examine the incidence and mortality rates, years of life lost (YLLs), and risk factors for fatal unintentional drowning in Indonesia, and investigate overall drowning burden via years lived with disability (YLDs) and disability adjusted life years (DALYs), between 2005 and 2019 using the 2019 Global Burden of Disease (GBD) study estimates.

2.3.2.2. Research Questions

This study answered these following questions:

1. What are fatal unintentional drowning incidence and mortality rates in Indonesia between 2005 and 2019?
2. What are fatal unintentional drowning risk factors in Indonesia between 2005 and 2019?
3. What is unintentional drowning burden in Indonesia between 2005 and 2019, via YLDs and DALYs?

2.3.2.3. Data Collection

An analysis of quantitative, national and subnational data sourced from the GBD 2019 Study⁶⁰ database was performed to generate estimates of mortality rates, incidence, YLLs, YLDs, and DALYs for unintentional drowning at a national and sub-national level in Indonesia, including all 34 provinces. The study utilised the division of Indonesia into 34 provinces, as opposed to the current configuration of 38 provinces, as the additional 4 provinces were established after the observed study period, beginning in 2022.¹⁴⁴

The data acquired spanned the period of 2005 to 2019 and were collected using verbal autopsy survey instruments and modelling in coordination with the Indonesian Ministry of Health.⁶⁰ The year of 2005 was chosen as the starting year of investigation, as a global consensus on the standardised definition of drowning was issued by the WHO in 2005, which includes both fatal and non-fatal drowning cases and has since guided consistent global reporting and research.⁴³ The endpoint, 2019, represents the most recent year with complete data available through the GBD study at the time of analysis. The GBD 2019 Study data focused on unintentional drowning, as defined by the ICD-9 code of 'E910', and ICD-10 codes 'W65-W74' for accidental drowning.^{6,69,248} However, it is worth noting that these codes did not include unintentional drowning due to water transport and disaster, nor do they account for drownings with intentional or undetermined intent, or incidents involving other causes such as trauma, envenomation, or animal attacks in the water, hence potentially underestimated the actual drowning numbers.⁶³

In this study, "incidence" pertains specifically to the frequency of non-fatal drowning incidents within the Indonesian population throughout the study duration. This definition excludes drowning-related fatalities, which were treated distinctly as mortality events.

Information on DALYs, YLDs, and YLLs due to drowning were also inferred to assess the overall burden of drowning in Indonesia.²⁴⁹ The burden of disease refers to the overall impact of health conditions on individuals and populations, encompassing aspects such as mortality, morbidity, and disability. It involves quantifying the prevalence, severity, and duration of specific diseases or conditions within a given population over a specified period. It begins with collecting data on the prevalence, incidence, mortality rates, and disability weights associated with the health condition under consideration. Then, YLLs, which are the years of life lost due to premature mortality caused by the health condition, are determined by multiplying the number of deaths by a standard life expectancy at the age of death. One YLL denotes the loss of a single year of life. Next, the YLDs, or years lived with disability for

each health condition, can be determined by multiplying the prevalence of the condition by the disability weight (ranging between 0 and 1, with 0 indicating optimal health and 1 indicating mortality) and the average duration of the health condition in years. One YLD signifies the loss of a complete year of healthy life due to disability or ill health. Once YLLs and YLDs are determined, DALYs could be calculated by adding YLLs and YLDs. One DALY represents the loss of an equivalence of one year of life lived in full health.²⁴⁹

Data were downloaded using the IHME GBD results tool for the period 2005-2019 for Indonesia and the sub-national provinces.⁶⁰ This study complies with the Guidelines for Accurate and Transparent Health Estimates Reporting recommendations.²⁵⁰

2.3.2.4. Data Abstraction

The following data were extracted on unintentional drowning deaths and non-fatal submersion in Indonesia: incidence rates, mortality rates, YLLs, YLDs, and DALYs, based on year, gender, age group (under-5, 5-14 years, 15-49 years, 50-60 years and 70+ years), and province. The age classification used aligns with the WHO's age classification and demographic framework, where the 15-49 years age group represents the socially and economically active population.²⁵¹ This classification is particularly relevant in countries with an expansive population pyramid, such as Indonesia, where younger individuals comprise the largest proportion of the population.²⁵¹ In addition, this age categorisation has been applied in other studies assessing drowning burden and trends, including those utilising data from the GBD study, thereby facilitating comparability with findings across countries.^{6,39,252}

2.3.2.5. Analysis

Data were extracted from the GBD Study 2019 and entered into Microsoft Excel and IBM SPSS Statistics V.27. Trend analysis between the period of 2005 and 2019 was inferred with linear regression. Relative risk (RR) (with a 95% confidence interval [CI]) was calculated to measure the association between exposures of interest (sex, age group, jurisdiction/province) and unintentional drowning deaths. Where RR was calculated, the predictor group with the lowest annual mortality rate was used as the reference point (except for provinces, where the rate for Jakarta as the capital province of Indonesia was used as the reference point). In terms of age-related risk, the age group 15-49 years was selected as a comparison group based on analysis of drowning deaths across all age groups in Indonesia which consistently showed that this demographic had the lowest drowning mortality rates from 2005 to 2019.

RR served as a fundamental measure within epidemiology, offering insight into the association between a specific exposure and an outcome of interest.^{253,254} Relative risk is the ratio of the risk of developing the outcome in the exposed group compared to the unexposed group. It was computed by dividing the risk of the outcome in the exposed group ($a/(a + b)$) by the risk in the unexposed group ($c/(c + d)$):

$$RR = (a/(a+b))/(c/(c+d))$$

Where (a) is the number of individuals exposed who experienced the health outcome; (b) is the number of individuals exposed who did not experience the health outcome; (c) is the number of individuals unexposed who experienced the health outcome; and (d) is the number of individuals unexposed who did not experience the health outcome.^{253,254}

RR provides a ratio indicating the likelihood of the outcome occurring in the exposed group compared to the unexposed group, directly estimating the risk or probability of the outcome in each group, making it suitable for cohort studies.^{253,254} In contrast, the Odds Ratio (OR) is the ratio of the odds of developing the outcome in the exposed group to the odds of the outcome in the unexposed group. Unlike RR, OR does not directly estimate risk but rather the odds, which is the ratio of the probability of the event occurring to the probability of it not occurring.^{253,254} Hence, OR can serve as an approximation of RR when the outcome of interest is uncommon, as odds and probability become numerically similar in such cases. This phenomenon, often termed the "rare disease assumption", makes OR a suitable measure of association in rare outcomes or case-control studies. However, it may overestimate RR if the outcome is more frequent, such as in cohort studies.^{255,256} Therefore, for this current study, RR was selected as the measure of association for its direct estimation of risk and suitability with study design.^{253,254}

2.3.2.6. Strengths and Limitations

The utilisation of GBD 2019 Study data to analyse drowning mortality and burden in Indonesia has several limitations. First, although GBD data provides a standardised method for estimating global health metrics, it is modelled rather than directly observed, which may obscure short-term variations and anomalies, warranting cautious interpretation.²⁵⁷ In addition, certain categories of drowning relevant to Indonesia, such as water transport-related or disaster-related incidents, were not captured, potentially underestimating the drowning burden. The focus on unintentional drowning also excludes intentional cases, which can further undermine the overall drowning situation. Furthermore, reliance on

verbal autopsy instruments for collecting unintentional drowning data in Indonesia may introduce selection and information biases, although this issue could be mitigated by the vivid recall associated with sentinel events.²⁵⁸

The retrospective cohort study methodology may also introduce certain limitations.^{202,245,246} Since the data were collected after outcomes had occurred, establishing a definitive temporal relationship between exposure and outcome can be challenging. Moreover, controlling for confounding factors was also difficult, as exposures could not be manipulated, and participants could not be randomised.^{202,245,246} A more thorough discussion of the strengths and limitations of the use of GBD data as data source and the retrospective cohort design can be found in Chapter 9, Section 9.6. Research Strengths and Limitations.

2.3.2.7. Ethical Consideration

Ethics approval was granted by the University of Mataram of Indonesia (Ethics Approval number 128/UN18.F8/ETIK/2023). The study did not collect personal, sensitive, or confidential information from participants, and only used publicly accessible documents as evidence.

2.3.3. Phase Three: Exploratory Qualitative Study

This study was undertaken as an exploratory qualitative study, conducted in seven villages across rural sub-districts of West Nusa Tenggara (WNT) Province of Indonesia, involving focus group discussions with parents of young children and village community leaders. The exploratory qualitative design was deemed suitable to answer the research questions, which were designed to explain and further extend the findings of the quantitative arm of the study: 1) The highest average annual mortality rates in Indonesia were consistently identified among the under-five age-group, with Indonesian children aged less than 5 years old being 3.67 times (95% CI: 3.63 - 3.72) more likely to become victims of fatal drowning compared to individuals aged between 15 to 49 years; 2) Under-five children residing in eastern parts of Indonesia, such as in Papua, Maluku, and Nusa Tenggara regions, had a higher likelihood of suffering fatal drowning compared to the reference group of Indonesian capital province, Jakarta.²⁵⁹

The rationale for conducting the qualitative study stemmed from philosophical paradigms suggesting that participants' realities are subjective and unique, influenced by their specific social, historical, and cultural backgrounds.^{202,204-207} While this broader philosophical approach of interpretivism, which embraces a constructivist ontology, underpinned this study and may incorporate emic perspectives, it encompasses a wider range of methodologies and theoretical frameworks that

do not necessarily prioritise insider perspectives.²⁶⁰ As this study focused on the communities of WNT Province, an emic epistemological approach was a suitable perspective for this exploration, for this approach emphasises understanding knowledge and meaning from the perspectives of the community members themselves, capturing their insider viewpoints on how they interpret their reality, beliefs, and practices within a specific cultural context.²⁶⁰⁻²⁶²

This qualitative approach aimed to explore how individuals perceive risk factors associated with child drowning and how communities can take preventive action, recognising that understanding these factors requires an exploration of participants' subjective experiences and perspectives within their respective contexts.^{202,204-207} The qualitative study design was selected to complement the quantitative findings of the research project, providing in-depth insights into individuals' perspectives, experiences, and behaviours, which quantitative data alone may not be able to capture.^{202,214,263} The qualitative approach enabled exploration of the complex phenomenon of child drowning in their natural context, allowing for a deeper understanding of water safety behaviours and decision-making processes in Indonesian communities and households. Moreover, the qualitative method was valuable for generating hypotheses and refining research questions for subsequent investigations of drowning prevention in Indonesia.^{202,214,263}

The exploratory qualitative research design allowed an open exploration of the phenomenon of child drowning risk and prevention in Indonesia, which has minimal coverage in the existing literature, enabling study participants to contribute to the development of new knowledge in this area.^{202,214,263-266} An exploratory qualitative design is characterised by its open-ended nature and flexible approach to data collection and analysis, allowing researchers to explore relatively uncharted phenomena with little theoretical framework. Unlike other qualitative designs, such as descriptive designs which may have more defined research questions, exploratory qualitative studies aim to generate new insights, theories, or hypotheses through in-depth exploration of participants' perspectives and experiences to gather context-specific data, which are then analysed using techniques such as thematic analysis to identify emerging themes or patterns. Therefore, exploratory qualitative research is particularly useful in the early stages of inquiry when little is known about a research topic, such as about child drowning in communities in Indonesia in this study, allowing the researchers to gain a deeper understanding before proceeding to more structured or hypothesis-driven investigations.^{202,214,263-266}

2.3.3.1. Research Aims

The qualitative study aimed to investigate Indonesian parents' and community perceptions and practices regarding child drowning risk and prevention in and around home.

2.3.3.2. Research Questions

This study answered these following questions:

1. What are Indonesian parents' and village community leaders' perceptions regarding child drowning risk in and around home?
2. What are Indonesian parents' and village community leaders' practices to prevent children from drowning in and around home?

2.3.3.3. Study Site

Despite Kalimantan and Papua having the highest recorded drowning mortality rates among Indonesia's largest islands, the decision not to conduct the study in these regions was influenced by several significant factors. Firstly, the vastness of these areas presents considerable logistical challenges. Kalimantan spans five provinces across 544,150 km² and has a population of over 17.3 million, while Papua covers approximately 319,036 km² and has over 5.7 million people across six provinces, each characterised by rich cultural diversity.^{2,143} This extensive geography, population, and diversity would require substantial time and resources to adequately cover the regions and collect meaningful data. Secondly, time constraints were a critical consideration. Expanding the study to include Kalimantan and Papua would have stretched resources thin and potentially compromised the quality of the data collected. Lastly, travel restrictions imposed due to the COVID-19 pandemic further complicated the feasibility of conducting research in these regions. These limitations significantly hindered access, making it challenging to engage with participants and gather data effectively. Ultimately, these considerations led to the decision to focus the study on another region of Indonesia with high drowning mortality rates, allowing for a more manageable and thorough investigation of parental and community perceptions regarding child drowning risk and prevention.

The WNT Province of Indonesia, also known as 'Nusa Tenggara Barat' in Indonesian, was deliberately chosen as the study site because of its archipelagic and rural nature. These characteristics make it one of the most vulnerable regions in Indonesia to drowning, as indicated by the findings of the quantitative arm of this research project.²⁵⁹ In 2019, it

exhibited high under-five drowning mortality rates, reaching 12.6 per 100,000 for males and 6.1 per 100,000 for females, ranking among the highest nationwide.²⁵⁹ This province indeed represents one of the most drowning-prone settings in Indonesia, with its coastal areas and inland water bodies capturing a geographical variation of drowning events.² In addition, WNT was selected as the study site due to its status as one of the provinces with the poorest health performance, representing high-risk populations of economically disadvantaged children residing in rural areas with inadequate access to healthcare, education, and safe aquatic environments.^{1,2}

In 2023, WNT, comprising a chain of islands in eastern Indonesia, had a total population of 5.5 million, and ranked as the eighth province with the highest population density in Indonesia.^{2,267,268} Lombok Island, the second largest island of the province, accommodates over 3.9 million people, constituting 71% of WNT's population and making it one of the most densely populated islands in Indonesia.^{2,267,268} The high population density in WNT, especially on Lombok Island, heightens the risk of drowning by increasing human activity near bodies of water and enhancing exposure to such environments, as has previously reported in Algeria and United Kingdom.^{269,270}

WNT has more than 1.7 million children, representing 36% percent of its population.¹ Over the years, WNT has consistently exhibited concerning child health indicators, with persistently high prevalence of malnutrition among children, as well as elevated infant and under-5 mortality rates.²⁷¹⁻²⁷³ In 2022, WNT had an all-cause infant mortality rate of 25 deaths per 1,000 live births and an all-cause under-five mortality rate of 29 deaths per 1,000 live births, placing it among the highest rates across all Indonesian provinces.²⁷¹⁻²⁷³ However, there is a lack of information regarding the extent to which preventable drowning deaths contribute to these elevated child mortality rates, as identified in the scoping review phase of this research project.⁶¹

Furthermore, the WNT region stands out as one of Indonesia's disaster-prone regions, particularly for earthquakes, tsunamis, and flooding.^{3,4} This vulnerability is attributed to the province's composition of small islands and the presence of the Flores back-arc thrust along Lombok's northern coastline, which is part of the convergence between the Indo-Australian and Sunda tectonic plates.^{121,274} One instance of water-related disaster in the province is the 2018 small-scale tsunamis, approximately 1-2.5 meters in height, which struck Lombok's northern coast, after a fault ramp rupture occurred and triggered four major earthquakes ranging from magnitude 6.4 to 6.9.^{121,274} This highlighted the region's susceptibility to various

water-related disasters, including tsunamis, landslides, tropical cyclones, and floods, consequently increasing the risk of disaster-related drowning among its populations.

Economic disparities further compound the vulnerability to drowning in WNT. The province ranks with the second-lowest GDP per capita among all Indonesian provinces, with over 19% of its population living below the national poverty threshold, equating to less than USD 0.70 per day, with many families earning only slightly above this line, posing significant challenges in drowning prevention, as well as in disaster preparedness, response, and recovery efforts within local communities.^{1,271,272} Over 65% of children in the region experience deprivations in non-income dimensions of poverty, particularly in educational attainment, health status, and household amenities such as water and sanitation, with persistent disparities evident between urban and rural areas.¹ Only half of WNT's population have access to basic sanitation facilities at home, while a quarter engage in open defecation, including in water bodies, thereby increasing children's exposure to unsafe aquatic environments and heightening the risk of child drowning.¹ Therefore, to inform targeted drowning prevention efforts, it is crucial to gain a deeper understanding of how rural communities in WNT perceive the risk of child drowning within their communities and the preventive measures they employ.

Out of the 12 approached villages that met the inclusion criteria, seven villages spanning all districts (West Lombok, North Lombok, East Lombok, Central Lombok, and Mataram) of Lombok Island in the WNT province were selected as study sites (Figure 2.2). The seven villages were selected based on the feasibility of conducting data collection within the designated timeframe, as well as their responsiveness and readiness to engage with the study and the recruitment approach facilitated by village chiefs and community health workers. This indicated that community involvement and support were critical in the recruitment process, potentially enhancing the quality and reliability of the data collected.

In each selected village, one focus group discussion was conducted. These villages represent both coastal and inland areas to ensure comprehensive representation across diverse geographical settings and facilitate the examination and comparison of potential disparities among different population groups.

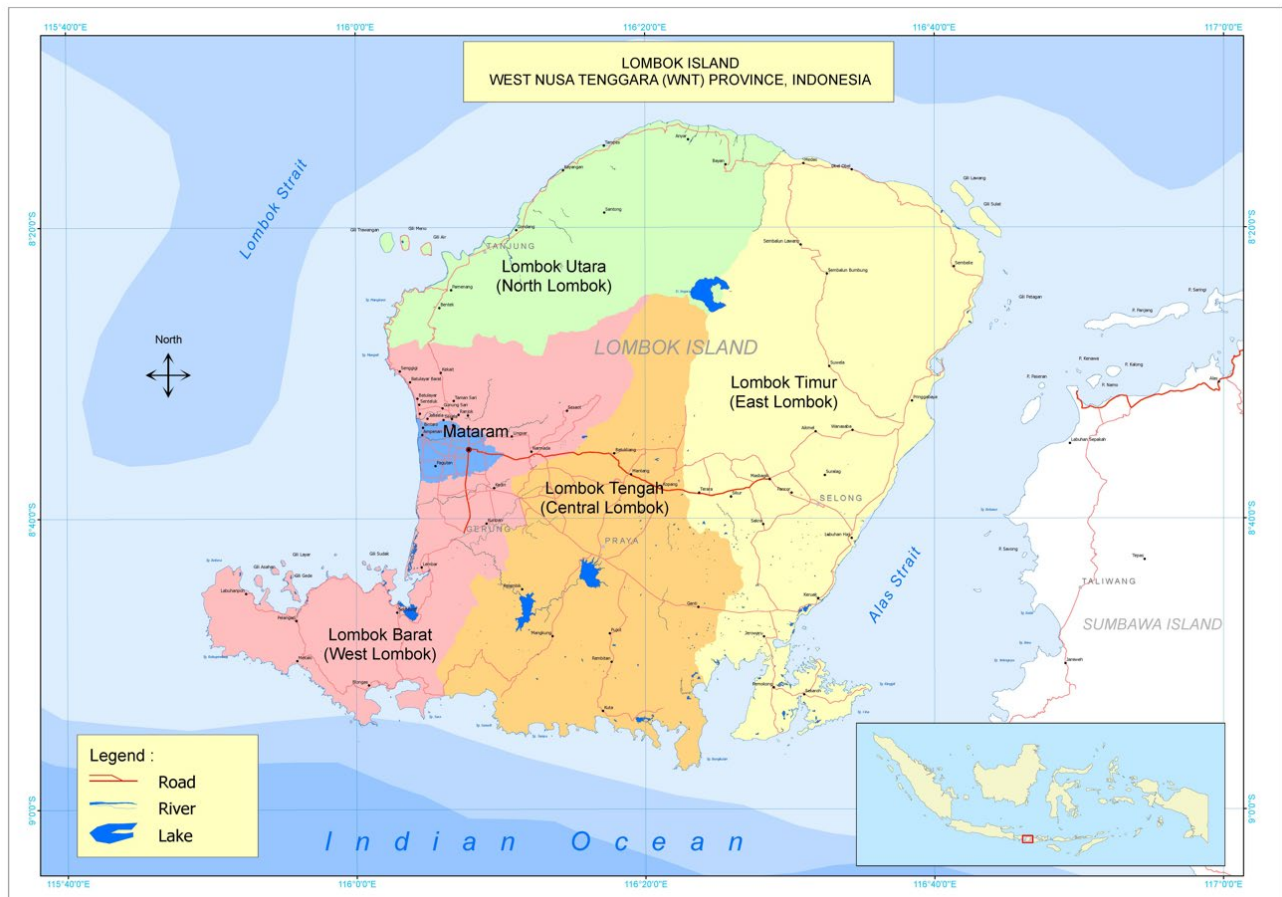


Figure 2.2. Map of Study Sites in West Nusa Tenggara, Indonesia

This map was created using data from the Environment and Forest Services of West Nusa Tenggara Province, which is in the [Public Domain](#). Original source: "Lombok Map" by [Environment and Forestry Services of West Nusa Tenggara Province](#), 2000.

2.3.3.4. Sample Selection and Recruitment

The study population consisted of parents of children under-five years and village community leaders residing in Lombok Island, WNT Province, Indonesia. Parents of children under-five years were selected for this phase based on findings from the retrospective cohort study in Chapter 4, which consistently identified this age group as having the highest drowning mortality rates across Indonesia, including in WNT Province.²⁵⁹ Parents were also chosen based on previous studies confirming parental supervisory behaviour as a significant protective factor in preventing drowning fatalities.^{157,275,276} Village community leaders were also selected as study participants due to their close interaction with local community members across various issues within the village, and hence are likely to provide valuable

group-level information on socio-cultural norms, attitudes, and community practices, which may offer richer data than that which can be gathered from individual parents.^{277,278}

Participants were eligible for inclusion if they were mothers and fathers of children aged 1-4 years, and/or identified socially as village community leaders, residing in villages of sub-districts located in coastal areas and or near inland water bodies of Lombok Island, WNT. Village chiefs, religious leaders, village elders, public service leaders, voluntary community health workers, community leaders, and other socially influential individuals in village communities were approached to join the focus groups. These criteria aimed to provide insights into socio-cultural beliefs and practices and decision-making processes at both individual and community levels regarding child drowning prevention. The recruited village community leaders were predominantly parents of children aged above five or grandparents of children under five themselves. This demographic composition ensured a clearer understanding of the community context surrounding child drowning.

Recruitment employed purposive sampling to select participants based on the inclusion criteria, ensuring focused representation of the population of interest.^{202,214,279-282} Purposive sampling is a non-probability sampling technique widely used in qualitative research to deliberately select participants based on specific criteria aligned with the research objectives. In this study, this sampling method was particularly valuable in including participants with unique perspectives or experiences relevant to the study's focus on child drowning risk and prevention in the community, facilitating the collection of rich and relevant data and enhancing the depth and breadth of the study findings. Furthermore, the purposive sampling approach ensured that the sample represented diverse viewpoints and insights across the geographic spread of Lombok Island.^{202,214,279-282}

Snowball sampling was utilised to leverage existing social networks within the community, enabling a deeper understanding of the inherent social networks and dynamics in the community.²⁸³⁻²⁸⁶ Snowball sampling is a non-probability sampling method widely used in qualitative research to recruit participants through referrals from other participants or key informants. This method is particularly useful to reach marginalised or difficult-to-access population groups, as it relies on social networks to access individuals who may not be easily identifiable. The process began with the researchers identifying initial participants — village chiefs and community health workers — who then facilitated the identification of key informants with substantial knowledge and experience related to child drowning and who met the study criteria. As the sampling process progresses, the sample size "snowballs",

growing larger as participants referred additional individuals. However, it is important to acknowledge potential biases inherent in this sampling method, such as overrepresentation of certain subgroups or the exclusion of individuals who are not connected to the initial participants.²⁸³⁻²⁸⁶

Face-to-face recruitment took place at communal village gatherings, where individuals who expressed interest in participating received detailed information sheets and consent forms in person. No participants dropped out of the study, ensuring a consistent sample for analysis. Data saturation determined the final sample size of 62 participants. Data saturation refers to the point at which no new information significantly contributes to the understanding of the research topic, indicating that a sufficient range of perspectives and experiences has been gathered to effectively address the research questions.²⁸⁷⁻²⁹⁰ Therefore, determining sample size in qualitative studies often revolves around reaching this saturation point rather than adhering to predetermined numerical criteria, as attained in this study.²⁸⁷⁻²⁹⁰ To achieve this point, in this study, the researchers continued data collection until redundancy in the information collected was reached, at which stage new themes or insights regarding the research questions ceased to emerge, thus confirming data saturation.

2.3.3.5. Data Collection

Seven focus group discussions (n=62) were conducted at various community locations. Focus group discussions (FGDs) were used to collect the data, consisting of individual narratives and personal accounts on experiences and perspectives of child drowning, as well as group level information on social cultural norms and attitudes, normative behaviours of what people are supposed to collectively do as a community, community practices, and group decision-making processes, a richer data set than what can be collected in a one-on-one interview.²⁹¹⁻²⁹⁵

In this study, participants from both groups (parents and village community leaders) were included together in the same FGD. FGDs were selected as data collection method as they offered several advantages. Firstly, they provided a platform for gathering diverse perspectives and insights from different community segments, of parents and community leaders, simultaneously.²⁹¹⁻²⁹⁵ Moreover, the interactive environment of FGDs not only enriched the data collected but also encouraged participants to build upon each other's ideas, leading to deeper discussions and nuanced understandings of the research topic. In addition, they enabled an exploration through group dynamics, facilitating the emergence

of shared experiences, disagreements, and consensus among participants. Furthermore, FGDs uncovered social norms, cultural values, and social dynamics that may not be readily apparent in one-on-one interviews, thereby enhancing the validity and comprehensiveness of the findings.²⁹¹⁻²⁹⁵

While including community leaders alongside parents in the same FGD could create a power imbalance, field notes indicated that the overall atmosphere of the discussions encouraged sharing and reflection. This setting facilitated the articulation of nuances and social dynamics related to water safety and childrearing practices, that might not have emerged as readily in separate groups. Furthermore, to mitigate potential discomfort, several efforts were made to create a supportive environment emphasising confidentiality and respect for diverse viewpoints. First, ground rules were established to ensure respectful dialogue and to maintain a sense of safety for sharing personal experiences. In addition, the facilitator actively promoted an inclusive atmosphere by encouraging all participants to share their opinions equally, which helped reduce the influence of dominant community leaders. Furthermore, member checking provided participants the opportunity to express any thoughts or experiences they felt uncomfortable sharing in the group context, further enriching the depth of the insights collected.

Data collection was guided by a moderator guide (Table 2.2), which was developed based on the constructs of HBM¹⁸⁷ and the findings of the scoping review phase⁶¹ of this research project on drowning patterns, risk factors, and prevention in Indonesia. Research team members with experience in both health promotion and injury prevention developed the moderator guide, consisting of a series of relevant prompts. The constructs of HBM, which were utilised as a framework to guide the focus group discussions, propose that for a behavioural change intervention to be efficacious, it needs to address an individual's specific perceptions about the susceptibility of children in their community to drown, the severity of child drowning consequences, benefits and barriers to adopt safe behaviours around aquatic environments, and their self-efficacy in preventing child drowning in their community. Hence, these constructs were used to guide the discussion, as outlined in Table 2.2.^{187,189} The HBM's role in shaping individual's health behaviour is illustrated in Figure 1.5.

Table 2.2. Focus Group Moderator Guide's Domains of Enquiry and Examples of Follow-Up Questions and Probes

Domains of enquiry and examples of follow up questions and probes	Constructs of Health Belief Model applied
<ul style="list-style-type: none"> • Q1. "Could you tell me some of the activities your family engaged with around water bodies?" - Family's relationship with water: <ul style="list-style-type: none"> • "Could you tell me about your family's and children's activities around water?" • "Could you tell me what water bodies exist in your community and in and around your home?" • "Could you tell me your use of watercrafts and flotation devices on board?" - Supervision for children: <ul style="list-style-type: none"> • "Could you tell me more about your family structure and the main caretaker in your household?" • "Could you tell me who in your family is responsible to supervise children while they are doing activities around water?" 	<ul style="list-style-type: none"> • Perceived susceptibility
<ul style="list-style-type: none"> • Q2. "What do you think are the greatest health concerns for your community?" - "How important do you think drowning is as a health issue in your community?" - "Where do you think drowning fits among these greatest health concerns in your community?" - "Have you ever experienced/witnessed/heard stories about drowning events in your community?" - "Are you aware of local beliefs and practices surrounding the issue of drowning in your community?" 	<ul style="list-style-type: none"> • Perceived susceptibility • Perceived severity • Cues to action
<ul style="list-style-type: none"> • Q3. "Who do you think is at most risk for drowning in your community?" • Q4. "What do you think of drowning as a cause of injury/death for children?" • Q5. "What do you think are the reasons that might cause a child to drown?" • Q6. "Can you tell me about aspects of the environment and community in which you live that could increase the risk of a child drowning?" 	<ul style="list-style-type: none"> • Perceived susceptibility • Perceived severity • Perceived barriers • Self-efficacy • Cues to action
<ul style="list-style-type: none"> • Q7. "What are some of the things that might make it hard to keep children safe from drowning?" • Q8. "Can you tell me about how and what have you taught your children about water dangers?" • Q9. "What would you like to see put in place to prevent children from drowning in your community?" - "Who do you think are responsible for preventing drowning?" - "Where do you get your information on drowning prevention from?" - "What are some of the things that might make it more difficult for you to apply this in your community?" 	<ul style="list-style-type: none"> • Perceived barriers • Perceived benefits • Self-efficacy • Cues to action

The moderator guide ensured the research objectives remained central, guaranteeing coverage of key topics while allowing for the exploration of unforeseen issues.^{292,296,297} In addition, a carefully designed guide promoted participant engagement through clear prompts and probes, encouraging varied perspectives and lively discussion. Moreover, it

ensured consistency in facilitation methods, facilitating comparison and generalisation of findings collected across multiple FGDs. The guide served as a beneficial resource to ensure adherence to ethical standards throughout the research process.^{292,296,297} Prior to the data collection process, the lead researcher (MC) conducted pilot focus group discussions with parents residing in a rural Lombok area to field test the moderator guide, to identify potential ambiguities or biases in the questions and enable refinement of the questions and prompts for optimal effectiveness in guiding subsequent focus groups.²⁹¹ The pilot informed minor adjustments to the prompts. The data from the pilot FGD were included in the analysis.

Focus group sessions were overseen by two female Indonesian team members fluent in Indonesian, the local Sasak language, and English (MC, PBF). Each group lasted 50 to 60 minutes and consisted of five to twelve participants. MC guided the discussions while PBF documented interactions and took field notes. Field notes were crucial in this study, providing a detailed record of observations, interactions, and contextual information from the research setting, enhancing the depth and trustworthiness of research findings and facilitating the researcher's immersion in the research context.²⁹⁸

Consent to audio-record the sessions was obtained from each participant prior to the focus group discussions. In addition, participants' relevant personal and social data on access to open water reservoirs, gender, age, occupation, and education level were also collected prior to focus groups by employing a short questionnaire. In accordance with ethical guidelines and to maintain confidentiality, only the participants and researchers were present during data collection sessions. This approach minimised potential distractions and safeguarded the integrity of the data, promoting an atmosphere conducive to open, honest responses. No repeat focus group discussions were conducted in this study; however, member-checking was undertaken to confirm the accuracy of the transcripts and the representativeness of the interpretations.

Audio records of focus group discussions were transcribed verbatim and translated to English by the lead researcher (MC). Verbatim transcription was crucial for capturing participants' language nuances and ensuring data accuracy.²⁹⁹ It allowed the researchers to closely analyse perspectives, meanings, and emotions expressed during focus groups, and identify subtle differences and patterns, enabling a deeper understanding of the research phenomenon. Verbatim transcription also enhanced research transparency and trustworthiness.²⁹⁹ The translated transcripts were later back-translated into Indonesian by

the other Indonesian team member (PBF), with English samples reviewed by senior researchers (SGD and RCF), to verify data accuracy.

2.3.3.6. Analysis

Translated transcripts, demographic data, and field notes were entered into NVivo Version 20. This study employed thematic analysis (TA), guided by Braun and Clarke's framework³⁰⁰, for its suitability in exploring child drowning in Indonesian communities, offering a flexible method to investigate the research questions in this under-explored area.

TA is a qualitative method used to identify, examine, and explain patterns or themes within data.^{263,301} This approach involves systematically coding and categorising data to uncover underlying themes or patterns relevant to the research inquiry. TA provided several advantages in exploring the complex phenomenon of child drowning in rural Indonesian communities. Firstly, it offered a flexible and adaptable framework, enabling researchers to address the wide range of research questions. Secondly, it facilitated a systematic analysis of qualitative data by breaking it down into manageable units, aiding in the identification of patterns and themes. Furthermore, TA supported in-depth exploration through iterative processes of data immersion, coding, theme development, and interpretation, yielding rich and nuanced insights.^{263,301} Importantly, this approach emphasises researcher reflexivity rather than strict objectivity or reliability, aligning with the principles of reflexive TA.^{300,302,303} This flexibility allowed for a comprehensive understanding of the complexities surrounding child drowning in these communities.

The TA analysis in this study began with a primarily deductive approach, utilising constructs from the Health Belief Model (HBM)¹⁸⁷, the Health Promotion Framework (HPF)¹⁶⁸, and the 2017 WHO implementation guide for drowning prevention⁵⁹ as guiding frameworks. These deductive elements are discussed in detail in Chapters 5, 6, and 8 of this thesis. Following this deductive process, the analysis also incorporated inductive elements, allowing new themes to emerge directly from the data in Chapters 5 through 8, but particularly in Chapter 7 where disaster-related themes were prominent. Therefore, while the theoretical frameworks provided structure, the analysis also favoured open and organic coding, emphasising iterative data immersion, reflection, and questioning. This approach underlined the subjective and interpretative nature of TA.^{263,301}

In Chapter 7, a fully inductive approach was applied, allowing for a flexible exploration of participants' experiences and perspectives concerning risks, preparedness, and responses to

water-related disasters, particularly in relevance to disaster-related drowning. The open-ended nature of this approach was particularly well-suited for uncovering insights into disaster-related drowning—a subject that remains under-examined in current literature—and enabled an unstructured analysis of participants' lived experiences. In contrast, Chapter 8 began with a predominantly deductive approach. The initial phase of the analysis was guided by constructs from the HBM¹⁸⁷ and the 2017 WHO implementation guide for drowning prevention⁵⁹, providing a structured framework for coding development. Following this deductive phase, the analysis transitioned to an inductive approach, allowing new themes not encompassed by these frameworks to emerge organically. These themes included issues such as financial constraints, rurality, and parental attitudes toward supervision and swimming, which were identified as barriers to the effective implementation of intervention programs.

Regarding the level of content analysis, a latent analysis was employed to identify underlying themes, concepts, and meanings, even though they were not directly stated by participants. This method enabled the exploration of wider social and psychological contexts within the data, revealing subtextual insights that a manifest analysis would not capture.³⁰⁴⁻³⁰⁶ Latent analysis of participants' fatalistic beliefs about drowning revealed that drowning was often viewed as an inevitable rather than a preventable event. This perspective stemmed from participants' beliefs that drowning deaths were predestined by divine forces or powers beyond human control, reflecting broader societal beliefs on the inevitability of drowning and injury-related incidents. Another example is the latent analysis examining sociocultural attitudes towards swimming and supervision. These attitudes were found to be influenced by traditional gender roles and expectations in childrearing and participation in swimming, societal norms around child safety, and cultural and religious perspectives on the appropriateness of swimming attire and physical interaction between genders during swimming training. These deeper insights highlighted how wider societal beliefs and attitudes shape individual perceptions and practices related to water safety and supervision.

In this study, the thematic analysis progressed through several stages.^{300,302} First, data immersion involved the researchers thoroughly familiarising themselves with the dataset by repeatedly reading focus group transcripts. Second, code development entailed generating initial codes across the dataset by systematically labelling segments of data representing meaningful concepts, ideas, and patterns. The researchers started with deductive coding based on the theoretical framework of the HBM to guide the initial stages of analysis.

However, as analysis progressed, new sights emerged organically beyond the original framework. This approach allowed for a nuanced exploration of both theoretical expectations and unexpected findings within the data, reflecting a balance between deductive and inductive approaches. The coding process was initially undertaken by MC, followed by collaborative work involving MC, RCF, and SGD. Thirdly, relevant codes were grouped together into potential themes. The next step was iterative organising, structuring, and refining of data to capture key concepts and phenomena within the data set. This was followed by clearly defining each theme, setting its scope and boundaries, developing its narrative, and giving it an informative name, ensuring that each theme was distinct and coherent. The researchers then moved beyond descriptive analysis to interpret the meaning and significance of the themes within the research context, exploring relationships between themes, considering how specific social, cultural, and historical contexts shaped meanings, identifying underlying assumptions or theoretical frameworks, and considering the broader implications of the findings. The findings were subsequently organised and presented in the thematic tables for Chapters 5 through 8 of this thesis. Each table provided detailed definitions and scopes of the themes, along with representative excerpts. The researchers then developed narratives for the identified themes, integrating the data and providing contextual basis, as presented in the Results sections of Chapters 5 through 8.^{300,302}

2.3.3.7. Rigor

Ensuring rigor in qualitative research involves various strategies to enhance credibility, dependability, confirmability, and transferability.³⁰⁷⁻³¹³ Credibility refers to the extent to which the study findings accurately reflect the participants' narratives and viewpoints. In the current study, credibility was achieved through prolonged engagement with the research setting and participants, allowing researchers to develop a more thorough understanding of the context under study. In addition, detailed and rich descriptions of the research context, participants, and findings, as well as inclusion of quotes, were also provided to enhance the credibility of this study.³⁰⁷⁻³¹³

Dependability pertains to the consistency of the research findings over time, over different focus groups, as well as across different researchers.³⁰⁷⁻³¹³ To ensure dependability of this study, audit trails, consisting of detailed records of data collection and analysis procedures, were kept, allowing for transparency and replication of the study. The study also employed member-checking and peer debriefing sessions to identify inconsistencies or alternative interpretations. Member checking entailed validating research findings through sharing

preliminary results and interpretations with participants, inviting their feedback, corrections, or additional insights, ensuring that their perspectives were accurately represented in the final analysis.³⁰⁷⁻³¹³

Confirmability focuses on the objectivity of the research findings, aiming to minimise the influence of researcher bias.³⁰⁷⁻³¹³ Reflexive notetaking, where researchers critically reflected on their own biases and assumptions, helped enhance confirmability in this study, by promoting self-awareness and reflexivity.³⁰⁷⁻³¹³

Lastly, transferability concerns the extent to which the findings of the study can be applied or generalised to other contexts or populations.³⁰⁷⁻³¹³ While qualitative research often prioritises in-depth exploration over generalisability, the utilisation of purposive sampling in this study enhanced transferability by intentionally selecting participants who possessed characteristics relevant to the research question (in this case, parents of young children and community leaders). This approach ensured that the findings were grounded in the specific context of the study. By selecting participants based on targeted criteria, purposive sampling facilitated the collection of detailed narratives and insights, which captured the diversity and complexity of community perspectives on child safety and drowning prevention. The rich, context-specific descriptions provided a basis for situating the findings within the broader social, cultural, and historical context, allowing readers to assess the applicability of the findings to their own contexts.³⁰⁷⁻³¹³

In summary, this study was guided by the principles of credibility, dependability, confirmability, and transferability through the undertaking of these measures: 1) Purposive sampling; 2) Prolonged engagement at research sites to build rapport with participants and to gain full understanding of participants' narratives, 3) Collection of participant demographics; 4) Continual reflection on assumptions and biases; 5) Member-checking, conducted both informally during each FGD to immediately verify findings, and formally through follow-up interviews after FGD transcriptions, to validate the interpretation of the data collected; 6) Back-translation to validate data accuracy; 7) Iterative cycles of coding, interpreting, and reflecting on data; 8) Consensus discussions on themes and theme definitions; 9) Inclusion of direct quotations as evidence; and 10) Establishment of an audit trail of data collection and analysis.^{303,308}

The consolidated criteria for reporting qualitative research (COREQ) checklist³¹⁴ was also used to guide study design and report on findings, as outlined in Table 2.3, enhancing the rigor and transparency of the research design and reporting.

Table 2.3. COREQ (Consolidated Criteria for Reporting Qualitative Research) Checklist

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
<i>Personal characteristics</i>			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	56
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	title page, 56, 64
Occupation	3	What was their occupation at the time of the study?	xxii, 64
Gender	4	Was the researcher male or female?	56, 64
Experience and training	5	What experience or training did the researcher have?	xxii, 64
<i>Relationship with participants</i>			
Relationship established	6	Was a relationship established prior to study commencement?	60, 65
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	371, 373-374
Interviewer characteristics	8	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	xxii, 64-65
Domain 2: Study design			
<i>Theoretical framework</i>			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	46-47
<i>Participant selection</i>			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	51-52
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	53
Sample size	12	How many participants were in the study?	53
Non-participation	13	How many people refused to participate or dropped out? Reasons?	53
<i>Setting</i>			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	53
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	56
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	159-160
<i>Data collection</i>			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	54-56
Repeat interviews	18	Were repeat interviews carried out? If yes, how many?	56
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	56

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Field notes	20	Were field notes made during and/or after the interview or focus group?	56
Duration	21	What was the duration of the interviews or focus group?	56
Data saturation	22	Was data saturation discussed?	53
Transcripts returned	23	Were transcripts returned to participants for comment and/or correction?	56, 59-60
Domain 3: analysis and findings			
<i>Data analysis</i>			
Number of data coders	24	How many data coders coded the data?	59
Description of the coding tree	25	Did authors provide a description of the coding tree?	58-59
Derivation of themes	26	Were themes identified in advance or derived from the data?	57-59
Software	27	What software, if applicable, was used to manage the data?	57
Participant checking	28	Did participants provide feedback on the findings?	59-60
<i>Reporting</i>			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	161-173, 184-190, 203-208, 219-227
Data and findings consistent	30	Was there consistency between the data presented and the findings?	174-176, 191-193, 209-211, 228-229
Clarity of major themes	31	Were major themes clearly presented in the findings?	160-173, 184-190, 202-208, 219-227
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	200

Note: Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist. Adapted from "Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups" by Tong A, Sainsbury P, and Craig J. Tong A, Sainsbury P, Craig J, 2007, *International Journal for Quality in Health Care*, p. 352. Copyright © 2007 by Oxford University Press. Reprinted with permission.

2.3.3.8. Ethical Considerations

Prior to commencing the focus group discussions, each participant was given a written informed consent form to assess their willingness to participate in the study, along with permission to be audio-recorded. Both the written and verbal aspects of consent provided detailed information to participants about the research's objectives, the methods of data collection, the measures implemented to ensure confidentiality, and the participants' entitlement to withdraw from the study at any point for any reason.

Focus group discussions were conducted face-to-face to gather data using a series of open questions. The questions were checked in advance to ensure they were culturally sensitive, and field trialled through pilot focus group discussions with parents residing in Lombok area. During the focus group discussions, if there were questions that the participants did not wish to answer, they were accommodated so that they did not feel pressured to answer the questions. Participation in the study posed minimal risks to the participants. There was no direct benefit in participating in the study; however, the findings of the study could contribute to the development of water safety and drowning prevention interventions in their region.

While maintaining complete confidentiality is challenging in focus group research due to the nature of group-based discussions, several steps were taken to enhance confidentiality. At the commencement of each focus group the importance of not sharing information outside the group was emphasised. All the information collected during interviews/focus group discussions were kept confidential and anonymised. Anonymised data were analysed and combined with all responses from all focus groups with all participants, hence reducing the possibility of identification or re-identification. Only anonymous and non-identifying direct quotes were used in the thesis, publications, and presentations and no identifying details were used in the thesis. Privacy protection, compliance with data management and storage, and data anonymisation were ensured by all research team members.

Ethical approval was obtained from the University of Mataram, Indonesia (Ethics Approval number 044/UN18.F8/ETIK/2024) and recognised by James Cook University's Human Research Ethics Committee (External HREC Approval Acknowledgement reference number H9088).

2.4. Ethical Aspects of the Research: Researcher Reflexivity on Positionality

In conducting research, researchers often face ethical dilemmas, necessitating the upholding of integrity and honesty, and consideration of the potential ethical impact of their work.^{202,204,206-212} Therefore, in addition to being grounded in the ethical principles of respect for human beings, beneficence, justice, merit and integrity, as outlined by the National Health and Medical Research Council (NHMRC)'s National Statement on Ethical Conduct in Human Research, researchers are required to engage in reflexive thinking, to critically assess their own positionality by examining their assumptions, values, and potential biases, and reflecting on how these factors may have impacted their research process and conclusions.^{202,204,206-212,315}

Positionality refers to the researcher's standpoint, shaped by their worldview and their role in the research context, including social and political aspects.^{202,204,206-212,316-319} It encompasses their beliefs, influenced by factors such as political views, gender, ethnicity, and social status. In this reflection, researchers need to critically examine their own positions, privileges, and motivations, and how these factors may shape their research questions, methodologies, and interpretations. This self-awareness demands sensitivity to the researcher's cultural and social context. Through reflexivity, researchers can recognise and address biases early, leading to more rigorous and transparent research.^{202,204,206-212,316-319}

In conducting this study, I acknowledge my position as a middle-class, well-educated female medical doctor of Javanese descent, belonging to the largest ethnic and religious group in Indonesia. I also acknowledge the duality of both my 'insider' and 'outsider' positionality concerning the population groups studied in the qualitative arm of this study, and how this duality provides valuable insights into the local context but also raises the possibility of inadvertently assuming expertise where none exists.³¹⁷⁻³¹⁹

As I grew up and reside in the culturally rich community of Lombok, WNT, this lived experience has provided me with a unique perspective and deep connection to the region and an understanding of the local customs, beliefs, and societal dynamics, which I believe enrich my approach to this study. However, I am mindful of the potential influence of my own background and experiences on the research process. Being of Javanese descent in a predominantly Sasak community may introduce certain biases or perceptions that I need to critically examine during data collection and analysis.

Conducting focus group discussions across diverse communities in Lombok presents an opportunity to navigate the complexities of my positionality. While my familiarity with the region enables me to establish rapport and trust with participants, I remain conscious of the need to

approach the discussions with openness and sensitivity to local perspectives and voices. Furthermore, as a medical doctor, my professional experience may influence my perceptions and understanding of research methodologies and the interpretation of the data I collect. Moreover, I acknowledge that my privileged socioeconomic position may create a power dynamic when collecting data from underserved, less educated populations.

To address these aspects, I engaged in reflexive practices throughout the research journey, and continuously assessed any biases or assumptions that may arise from my position, to ensure the credibility and conformability of the research findings. Furthermore, recognising the importance of centring the voices and experiences of these communities in the research process, I actively sought advice from community leaders to ensure inclusivity and representation of the diverse realities of the populations I study. Prolonged engagement at the study site also deepened my understanding of the research setting and participants, centring community voices and ensuring an authentic interpretation of participants' perspectives.

Throughout this research, I kept my positionality as a close consideration on the need to be informed by cultural sensitivity, ethical awareness, and methodological rigor. By embracing my positionality as a researcher with ties to the community, and acknowledging my privileged position, I strive to contribute meaningfully to the understanding and prevention of unintentional drowning in Indonesia while upholding principles of equity and social justice.^{209,316-319}

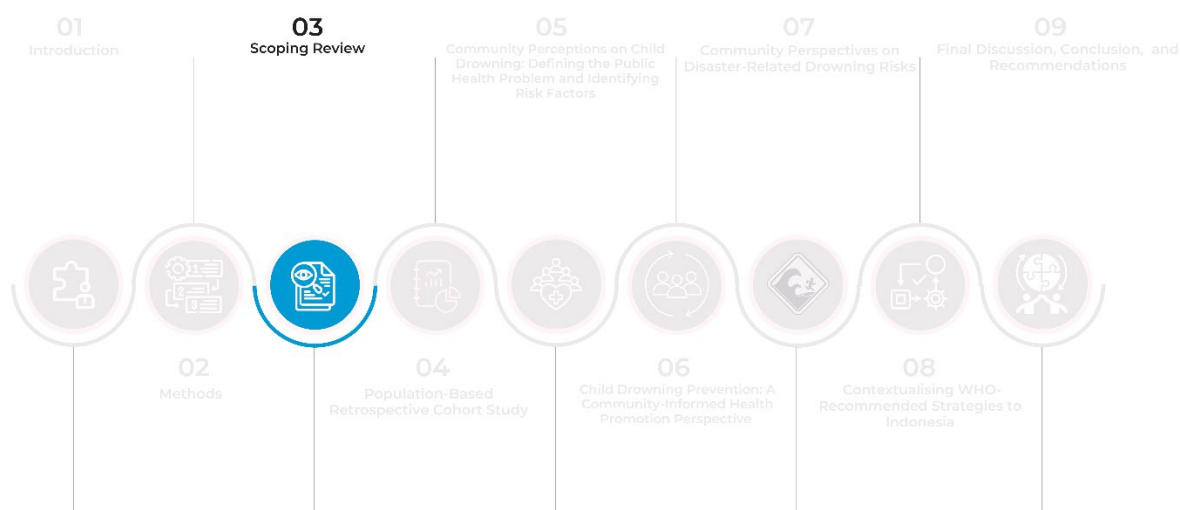
In addition to reflecting on and addressing biases introduced by my positionality, other ethical principles were also adhered to, helping to ensure the integrity and validity of the findings. These ethical considerations are summarised below, as well as outlined under the section 'Ethical Consideration' in this Chapter.

1. **Research Merit and Integrity:** This study demonstrates research merit by addressing an important and relevant topic of unintentional drowning burden, risk, and prevention in Indonesia. This study upholds integrity through rigorous methodology, and ensuring accurate, honest, and transparent documentation of procedures for data collection, analysis, and reporting throughout the research process.
2. **Respect for Human Beings:** This study respects the dignity, autonomy, and rights of all individuals involved, including participants, researchers, and community members. Informed consent was acquired prior to data collection to ensure that participants are fully informed about the research aims, procedures, risks, and benefits before agreeing to participate. The participants had the right to withdraw from the study at any juncture, for any reason of their

choosing. Confidentiality and privacy of participants are protected, and their identities are anonymised in reporting to prevent any potential harm or stigmatisation.

3. Justice: This study ensures fairness and equity in the treatment of participants and the distribution of research benefits and burdens. Efforts are made to include diverse perspectives and voices in the research process, including underserved populations who may be disproportionately affected by unintentional drowning incidents.
4. Beneficence: This research presented a low negligible risk in inflicting harm or foreseeable inconvenience. It is anticipated that Indonesian populations will benefit, albeit indirectly, from this research, through the advancement of knowledge, development of public health policies and interventions, and, ultimately, enhancement of the safety of Indonesian communities. Measures have been implemented to minimise potential harms or risks associated with participation. Specifically, arrangements have been made with the counselling unit at the local university to offer support to participants who may encounter difficulties for disclosing sensitive information related to child drowning incidents. Ethical considerations are integrated into the research design to ensure that the welfare and interests of participants and the broader community were prioritised throughout the research process.³¹⁵

Chapter 3 Scoping Review



3.1. Overview

Title: Fatal drowning in Indonesia: Understanding knowledge gaps through a scoping review.

This chapter is presented as a publication manuscript. The formatting of this chapter adheres to journal requirements; however, table and figure numbering, as well as referencing, have been aligned with the thesis format. The references for this chapter are included within the overall thesis' reference list.

The chapter has been published in the *Health Promotion International journal* (see Appendix 1) under a under a CC BY 4.0 license. Copyrights © 2023 by the authors. The citation for the publication is: Cenderadewi M, Devine SG, Sari DP, Franklin RC. Fatal drowning in Indonesia: Understanding knowledge gaps through a scoping review. *Health Promotion International*. 2023;38(5):daad130 (1-22). doi:10.1093/heapro/daad130.⁶¹

This chapter presents a scoping review analysing mortality rates and risk factors for unintentional drowning in Indonesia, alongside an examination of existing health promotion and drowning prevention methods within a socio-ecological health promotion framework. The review provided comprehensive data on unintentional drowning rates, risk factors, and prevention strategies in Indonesia, serving as a foundation for the subsequent chapters.

The authors' contributions are outlined as follows: i) M. Cenderadewi: Conceptualisation, data curation, formal analysis, funding acquisition, investigation, methodology, project administration,

resources, validation, visualisation, writing – original draft, writing – review & editing; ii) S. G. Devine: Conceptualisation, formal analysis, methodology, supervision, validation, visualisation, writing – review & editing; iii) D. P. Sari: Data curation, formal analysis, investigation, validation; and iv) R. C. Franklin: Conceptualisation, formal analysis, methodology, supervision, validation, visualisation, writing – review & editing.

The paper is presented below as the final published version.

3.2. Abstract

Little is known about unintentional drowning deaths in Indonesia, the world's fourth most populous and largest archipelagic country. This study aimed to describe the epidemiology and risk factors of unintentional drowning in Indonesia and explore existing health promotion and drowning prevention approaches in Indonesia within a socio-ecological health promotion framework. A scoping review, guided by PRISMA-ScR, was conducted to locate peer-reviewed studies and government reports/policy documents published until May 2023, in English or Indonesian language, using MEDLINE (Ovid), CINAHL, Informat, PsycINFO (ProQuest), Scopus, SafetyLit, BioMed Central, and Google Scholar, Indonesian journal databases (Sinta, Garuda) and government agencies websites around the terms: drown, swim, flood, hurricane, disaster, water rescue, and maritime/boat safety. This review identified 32 papers. However, a paucity of information on unintentional drowning rates, risk factors, and prevention in Indonesia was noted. The unavailability of a coordinated national drowning data collection system in Indonesia, from which national and subnational subcategory data can be collected, underlines the possibility of under-representation of drowning mortality. The association between various exposures and drowning incidents has not been fully investigated. An over-reliance on individual-focused, behaviour-based, preventive measures was observed. These findings highlight the need for: improving drowning surveillance to ensure the availability and reliability of drowning data; and strengthening research to understand the risk factors for drowning and delivery of drowning prevention programs. Further policy development and research focusing on health promotion approaches that reflect a socio-ecological approach to drowning prevention in Indonesia is imperative.

3.3. Contribution to Health Promotion

By upholding concepts of health promotion, this review may inform the international health promotion community on potential challenges of drowning prevention efforts in resource-limited settings.

- The over-reliance on educational interventions aimed at individuals and the limited availability of population-focused drowning prevention measures is observed in Indonesia.
- The research area of community participation in creating safe environment and evidence-informed water safety and drowning prevention-related policy development is relatively neglected in Indonesia.
- A demand for further research focused on policy formulation, implementation, and evaluation to prevent drowning across low- and middle-income countries is apparent.

3.4. Background

Drowning is the third leading cause of death by unintentional injury worldwide, after road injury and falls.^{6,7,191,320,321} Most drowning deaths worldwide (91%, or 337,240 drowning deaths) occurred in low and middle-income countries (LMIC), particularly in Southeast Asia (35%, or 130,149 drowning deaths), underlining the importance of providing reliable information on unintentional drowning deaths to inform the development, implementation, and evaluation of drowning prevention interventions and policy within countries in this region.⁷ However, understanding of unintentional drowning deaths in Indonesia, the world's largest archipelagic and fourth most populous country with high numbers of meteorological and hydrological events, is limited.⁴¹ To address the burden of global drowning, effective health promotion approaches which address drowning at all levels will be required, and comprehensive information on drowning incidents, including in Indonesia, is vital for the planning and implementation of relevant prevention approaches.

Indonesia is one of the world's most natural disaster-prone areas and is at risk from multiple hazards, including flooding, landslides, earthquakes, tsunamis, volcanoes, and tropical cyclones.¹³¹ Indonesia is also the largest archipelagic state worldwide, consisting of 16,056 islands, extending 5,150 kilometres between the Indian and Pacific Oceans.^{131,132,322,323} Understanding the potential contribution of water transport-related and disaster-related drowning deaths in Indonesia on top of the rate of unintentional drowning will be important, as they are often left out of studies on drowning worldwide.⁴⁰

The prevention of drowning encompasses a wide range of measures, ranging from individual-focused approaches, such as swimming training programmes, to community-based actions, such as community participation in controlling access to open water bodies, policy development on water safety regulations, and providing access to safe water.^{37,176,177,324} This emphasises the urgent need for cohesive approaches across the spectrum of upstream, midstream, and downstream drowning prevention.^{7,179-181,324}

Drowning prevention is closely linked to health and safety promotion.¹⁸² By connecting drowning prevention and health promotion, a broader understanding of drowning prevention can be achieved, which includes the process of empowering individuals and communities in taking control over their own health-related behaviours and practices.^{37,183,184,324} Talbot and Verrinder¹⁶⁸ illustrated the concepts of health promotion in the Health Promotion Framework (HPF), which comprises of: 1) medical approaches, focusing on individual risk assessment and health information; 2) behavioural approaches, focusing on health education, skills development, and social marketing; and 3) socio-environmental approaches, focusing on increasing cross-sector partnerships and community capacity, including community action, community participation, structural change, policy development and review, and economic and regulatory activities. This framework was used throughout this review to assess gaps in drowning prevention approaches in Indonesia.¹⁶⁸

3.5. Research Aims

This review aimed to describe the epidemiology and risk factors of unintentional drowning in Indonesia and explore health promotion and prevention approaches currently in place.

3.7. Research Questions

This study answered the following questions:

1. What information is available on fatal unintentional drowning mortality numbers and rates in Indonesia?
2. What is known about risk factors for unintentional drowning in Indonesia?
3. What prevention and health promotion approaches are currently being used in Indonesia to reduce unintentional drowning deaths?
4. How can the HPF¹⁶⁸ be applied to inform strategy development to prevent unintentional drowning Indonesia?

3.8. Methods

This review was conducted using a scoping review methodology guided by the Arksey and O'Malley methodological framework, Joanna Briggs Institute (JBI) guideline, and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR).²²²⁻²²⁶ Scoping review methodology was selected to explore characteristics of unintentional drowning in Indonesia, a little studied area of interest, and to map evidence from both research and non-research sources, providing a comprehensive overview on unintentional drowning in Indonesia and knowledge gaps for subsequent evidence syntheses.²²⁶

3.8.1. Search Strategy

A systematic search was conducted in between May 2021 and May 2023 to identify relevant literature for all categories of unintentional drowning published to this date. Eight databases were searched including MEDLINE (Ovid), CINAHL, Informit, PsycINFO (ProQuest), Scopus, SafetyLit, BioMed Central, and Google Scholar; along with two Indonesian journal databases (Sinta and Garuda); and websites of Indonesian government agencies identified in previous studies as the most important actors for documenting drowning events and undertaking drowning prevention in Indonesia, including for disaster- and water transport-related drowning: 1) Ministry of Health; 2) Ministry of Education, Culture, Research, and Technology; 3) Ministry of Marine Affairs and Fisheries; 4) Ministry of Transportation; 5) National Disaster Management Agency, and 6) National Search and Rescue Agency²²⁹⁻²³⁵. The searches were undertaken in English and Indonesian language, using the most relevant and exhaustive search terms, in accordance with each database utilised (for details on search terms, see Table 3.1).

Table 3.1. Search Strings Used for Each Database

Databases	Language of publications	Search strings
MEDLINE (Ovid)	English	(drown*) AND indonesia
		exp Drowning/ AND indonesia.mp.
		(swim*) AND indonesia
		swimming/ AND indonesia.mp
		maritime AND indonesia
		(flood*) AND indonesia
		exp Floods/ AND indonesia.mp
		((hurricane*) OR (cyclone*) OR (typhoon*) OR (monsoon*)) AND indonesia
		exp Cyclonic Storms/ and exp Indonesia/
		(disaster*) AND indonesia
		(exp Disasters/ or exp Natural Disasters/) AND exp Indonesia/
	(water rescue) AND indonesia	
	((boat*) OR (ship*)) AND indonesia	
	exp Ships/ and *Indonesia/	
Indonesian	tenggelam	
	renang OR berenang	
	banjir OR badai OR bencana	
	kecelakaan AND (kapal OR perkapalan OR layar OR pelayaran OR laut)	
	keselamatan AND (kapal OR perkapalan OR layar OR pelayaran OR laut)	
CINAHL	English	(drown*) AND indonesia
		TX drown* AND indonesia
		(MH "Drowning+") AND (MM "Indonesia")
		(swim*) AND indonesia
		(MM "Swimming") AND (MM "Indonesia")
		maritime AND indonesia
		(flood*) AND indonesia
		((hurricane*) OR (cyclone*) OR (typhoon*) OR (monsoon*)) AND indonesia
		(MM "Natural Disasters+") AND (MM "Indonesia")
		(MM "Water Rescue") AND (MM "Indonesia")
		((boat*) OR (ship*)) AND indonesia
	(MH "Ships+") AND (MH "Indonesia")	
	Indonesian	tenggelam
		renang OR berenang
banjir OR badai OR bencana		
penyelamatan AND (air OR perairan)		
kecelakaan AND (kapal OR perkapalan OR layar OR pelayaran OR laut)		
keselamatan AND (kapal OR perkapalan OR layar OR pelayaran OR laut)		
Informit	English	(drown*) AND indonesia
		(swim*) AND indonesia
		maritime AND indonesia
		(flood*) AND indonesia
		((hurricane*) OR (cyclone*) OR (typhoon*) OR (monsoon*)) AND indonesia
		(disaster*) AND indonesia
		(water rescue) AND indonesia
		((boat*) OR (ship*)) AND indonesia
	Indonesian	tenggelam
		renang OR berenang
		banjir OR badai OR bencana
		penyelamatan AND (air OR perairan)
		kecelakaan AND (kapal OR perkapalan OR layar OR pelayaran OR laut)
		keselamatan AND (kapal OR perkapalan OR layar OR pelayaran OR laut)

Databases	Language of publications	Search strings
		keselamatan AND (kapal OR perkapalan OR layar OR pelayaran OR laut)
PsycINFO (ProQuest)	English	(drown*) AND indonesia
		(swim*) AND indonesia
		maritime AND indonesia
		(flood*) AND indonesia
		((hurricane*) OR (cyclone*) OR (typhoon*) OR (monsoon*)) AND indonesia
		(disaster*) AND indonesia
		(water rescue) AND indonesia
	((boat*) OR (ship*)) AND indonesia	
	Indonesian	tenggelam
		renang OR berenang
banjir OR badai OR bencana		
kecelakaan AND (kapal OR perkapalan OR layar OR pelayaran OR laut)		
keselamatan AND (kapal OR perkapalan OR layar OR pelayaran OR laut)		
Scopus	English	(drown*) AND indonesia
		(swim*) AND indonesia
		(maritime safety) AND indonesia
		(flood*) AND indonesia
		((hurricane*) OR (cyclone*) OR (typhoon*) OR (monsoon*)) AND indonesia
		(disaster*) AND indonesia
		(water rescue) AND indonesia
	((boat*) OR (ship*)) AND indonesia	
	Indonesian	tenggelam
		renang OR berenang
banjir OR badai OR bencana		
penyelamatan AND (air OR perairan)		
kecelakaan AND (kapal OR perkapalan OR layar OR pelayaran OR laut)		
keselamatan AND (kapal OR perkapalan OR layar OR pelayaran OR laut)		
SafetyLit	English	(drown*) AND Indonesia
		(swim*) AND indonesia
		maritime AND indonesia
		(flood*) AND indonesia
		((hurricane*) OR (cyclone*) OR (typhoon*) OR (monsoon*)) AND indonesia
		(disaster*) AND indonesia
		(water rescue) AND indonesia
	((boat*) OR (ship*)) AND indonesia	
	Indonesian	tenggelam
		renang OR berenang
banjir OR badai OR bencana		
penyelamatan AND (air OR perairan)		
kecelakaan AND (kapal OR perkapalan OR layar OR pelayaran OR laut)		
keselamatan AND (kapal OR perkapalan OR layar OR pelayaran OR laut)		
BioMed Central	English	(drown*) AND Indonesia
		(swim*) AND indonesia
		(maritime safety) AND indonesia
		(flood*) AND indonesia
		((hurricane*) OR (cyclone*) OR (typhoon*) OR (monsoon*)) AND indonesia
		(disaster*) AND indonesia
		(water rescue) AND indonesia
	((boat*) OR (ship*)) AND indonesia	
	Indonesian	tenggelam
		renang OR berenang

Databases	Language of publications	Search strings
		banjir OR badai OR bencana
		kecelakaan AND (kapal OR perkapalan OR layar OR pelayaran OR laut)
		keselamatan AND (kapal OR perkapalan OR layar OR pelayaran OR laut OR maritim)
Google Scholar	English	allintitle: (drown OR drowns OR drowned OR drowning) indonesia
		allintitle: (swim OR swims OR swimming) indonesia
		allintitle: (maritime safety) indonesia
		allintitle: (flood OR floods OR flooding) indonesia
		allintitle: (hurricane OR hurricanes OR cyclone OR cyclones OR typhoon OR typhoons OR monsoon OR monsoons) indonesia
		allintitle: (disaster OR disasters) (drowning OR drowned OR drowns OR drown) indonesia
		allintitle: (water rescue) indonesia
	Indonesian	allintitle: tenggelam
		allintitle: renang OR berenang
		allintitle: (banjir OR badai OR bencana) tenggelam
		allintitle: (air OR perairan) penyelamatan
		allintitle: kecelakaan (kapal OR perkapalan OR layar OR pelayaran OR laut)
		allintitle: keselamatan (kapal OR perkapalan OR layar OR pelayaran OR laut OR maritim)
Sinta	Indonesian	tenggelam
		renang
		berenang
		banjir tenggelam
		badai tenggelam
		bencana tenggelam
		kecelakaan kapal
		kecelakaan layar
		kecelakaan pelayaran
		kecelakaan laut
		keselamatan kapal
		keselamatan perkapalan
		keselamatan layar
		keselamatan pelayaran
		keselamatan laut
		keselamatan maritim
		water rescue
		penyelamatan air
		penyelamatan perairan
Garuda	Indonesian	tenggelam
		renang
		berenang
		banjir tenggelam
		badai tenggelam
		bencana tenggelam
		kecelakaan kapal
		kecelakaan layar
		kecelakaan pelayaran
		kecelakaan laut
		keselamatan kapal
keselamatan perkapalan		

Databases	Language of publications	Search strings
		keselamatan layar
		keselamatan pelayaran
		keselamatan laut
		keselamatan maritim
		water rescue
		penyelamatan air
		penyelamatan perairan
Government websites (Google)	Indonesian	tenggelam site:.go.id
		tenggelam site:.org
		kematian tenggelam site:.go.id
		kematian tenggelam site:.org
		faktor resiko tenggelam site:.go.id
		faktor resiko tenggelam site:.org
		prevention tenggelam site:.go.id
		prevention tenggelam site:.org
		renang site:.go.id
		renang site:.org
		berenang site:.go.id
		berenang site:.org
		banjir OR badai OR bencana site:.go.id
		banjir OR badai OR bencana site:.org
		water rescue site:.go.id
		water rescue indonesia site:.org
		(air OR perairan) penyelamatan site:.go.id
		(air OR perairan) penyelamatan site:.gov
(kapal OR perkapalan OR layar OR pelayaran OR laut) kecelakaan site:.go.id		
(kapal OR perkapalan OR layar OR pelayaran OR laut) kecelakaan site:.org		
(kapal OR perkapalan OR layar OR pelayaran OR laut) keselamatan site:.go.id		
(kapal OR perkapalan OR layar OR pelayaran OR laut) keselamatan site:.org		

Inclusion and exclusion criteria were used to narrow down the systematic search corresponding to the research objectives. Inclusion criteria included: 1) literature published up until May 2023; 2) original research articles; 3) comprehensive scientific reviews, meta-analyses, statements of clinical standards, case reports, opinion pieces; 4) grey literature, such as government or other authoritative reports, policy statements, issues papers, theses and dissertations, and conference papers/proceedings; 5) full-text available; 6) published in English or Indonesian language; 7) drowning deaths in humans; 8) drowning specifically taking place in Indonesia; 9) unintentional drowning deaths, including accidental, disaster-related and water-transport related drowning deaths; 10) drowning risk factors; 11) drowning prevention; 12) regulations on water safety, safe boating and shipping, maritime safety, and disaster risk management relevant to drowning prevention; and 13) health promotion approaches on water safety and drowning prevention. The exclusion criteria excluded all publications on tsunami-related events, intentional drowning (intentional self-harm by drowning, assault by drowning, drowning by undetermined intent), and drowning in war operations.

Unintentional drowning deaths screened in this review included accidental drowning deaths, disaster-related drowning deaths, and water-transport related drowning deaths. This inclusion was based on the ICD 10 coding for non-intentional drowning, which includes accidental drowning (W65-W74), disaster-related drowning (X34-X39), and water transport-related drowning (V90.-, V92.-); while excluding intentional self-harm by drowning (X71), assault by drowning (X92), drowning by undetermined intent (Y21), and drowned in war operations NOS (Y36.4).⁶⁵ Studies on the epidemiology of unintentional drowning were included in this review if they reported the epidemiological measures of drowning mortality as a count, proportion, or rate. When calculable, mortality rates were inferred from drowning death counts reported in the reviewed studies. Drowning deaths involving a foreign national that occurred in Indonesia were also included. Conversely, instances where Indonesian citizens drowned abroad were excluded.

Despite being disaster-related, tsunami-related drowning deaths were excluded, due to its relatively rare occurrence (only 75 tsunami events, out of 41,470 disaster events, were documented in Indonesia between 1815 and 2023³²⁵), and the low chance of victim survival, even for good swimmers, due to the sheer force of tsunami vortices³²⁶, underlining the fact that risk factors and prevention of tsunami-related drowning are entirely distinct from those of other causes.^{327,328} Moreover, even though our database searches included papers on boating, shipping and maritime safety, and disaster risk management in Indonesia, all studies identified were on regulatory activities and community participation around maritime safety and flood mitigation not specifically linked nor relevant to the efforts of preventing drowning, hence they were excluded. However, it is acknowledged that disaster risk management, including tsunami risk assessment and preparedness, boating, shipping and maritime safety, and their link to drowning prevention, are an area of concern urgently needed to be further investigated in Indonesia.^{233,329-331}

3.8.2. Literature Update

The initial systematic search was conducted between 2021 and 2022³³², then expanded in May 2023 as suggested by journal reviewers. The systematic process was replicated with an expansion of search terms and truncations for each systematic search, based on gaps identified in the previous search and input from peer-reviewers. The same electronic databases were utilised. The inclusion and exclusion criteria, critical review of the articles, data extraction and analysis utilised in the initial search and review were applied again for the literature update. For this thesis, another search was conducted in May 2024 to identify all literature published up to that point, ensuring the inclusion of the most current literature.

3.8.3. Review Strategy

Peer-reviewed publications were screened for inclusion by title, abstract and full text. Two researchers (MC, DPS) independently reviewed search results at the stage of title, abstract and full text review. The flow of the selection process of all identified records was as follows:

1. Title and abstract screening

The titles and abstracts of all records identified through the database searching were screened by the inclusion and exclusion criteria, to ensure the relevance of the studies included for the evidence-informed review.

2. Full-text screening

Full-text versions of identified articles were then appraised to examine the relevance of the finding of the studies to answer the research questions. The PRISMA-ScR flow diagram summarised the review process, as presented in Figure 3.1.

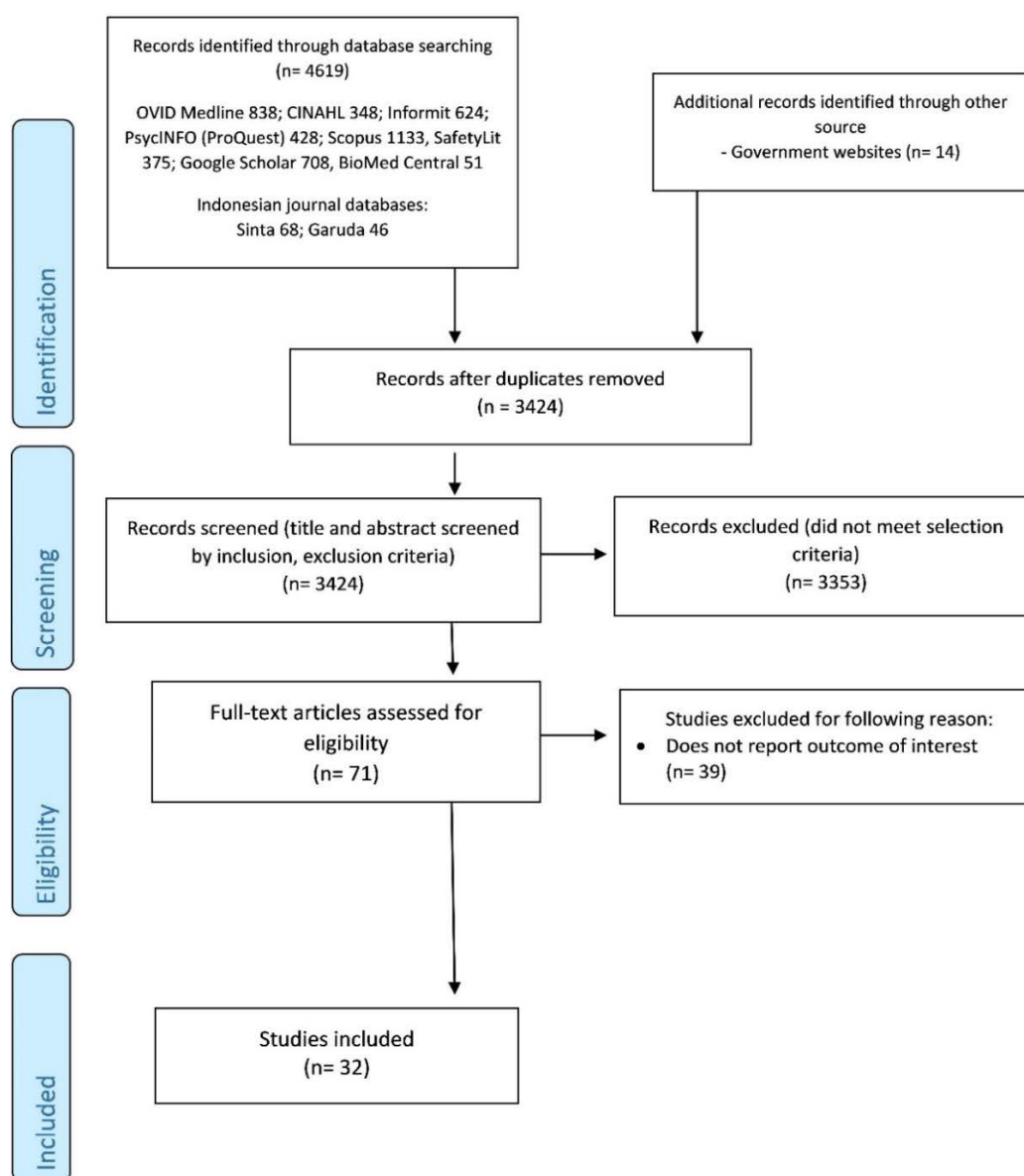


Figure 3.1. The PRISMA-ScR 2020 Flow Diagram for Scoping Review

3.8.4. Data Abstraction

The following data were abstracted from the original peer-reviewed publications: authors, year of study and publication, type of publication (original research article, comprehensive scientific review, meta-analysis, statement of clinical standards, case report, opinion piece, or grey literature), data source, study aim, study design, study sample and setting, scale of study (national or subnational), categories of drowning investigated, methods, relevant findings on the mortality rate, risk factors, and prevention of drowning, intervention type and comparator (if applicable). For grey literature, the following data were abstracted: authors (government agency), year of publication, scale of study, categories of drowning investigated, and relevant findings.

3.8.5. Synthesis/Analysis

Mortality numbers, proportions, and rates were extracted or inferred from the identified studies as epidemiological measures of unintentional drowning, either at the subnational or national scale. For this review, the HPF¹⁶⁸, which comprises medical, behavioural, and socio-environmental approaches at the individual through to the population level, was used to map the socio-ecological dimension of drowning prevention and health promotion approaches that have been or are currently being used in Indonesia.

3.8.6. Ethics Approval

Ethical approval has been obtained from the Human Research Ethics Committee (HREC) of the University of Mataram - Indonesia (Ethics Approval number 128/UN18.F8/ETIK/2023). The scoping review did not collect personal, sensitive, or confidential information from participants, and only used publicly accessible documents as evidence.

3.9. Results

From the 4619 potentially relevant records initially identified via database searching and government websites, 32 articles were included in this review, including 24 (75%) peer-reviewed publications^{126,333-356} and eight (25%) pieces of grey literature consisting of government issues papers, theses, and a conference proceeding^{235,325,344,357-361}. All but one reviewed articles were published in the Indonesian language. All but one peer-reviewed studies were published in local and national Indonesian journals in Indonesian language.

Of the 32 papers reviewed in this study, the information on the number of unintentional drowning deaths in Indonesia at the national and provincial level was only presented in eight (25%) studies, including three (9.4%) studies reporting accidental drowning deaths^{333,354,356}, two (6.3%) papers reporting disaster-related deaths^{126,325}, and three (9.4%) papers reporting water transport-related deaths^{347,352,359}. Risk factors were investigated in 11 (34.4%) studies, with seven (21.9%) studies discussing factors potentially contributing to accidental drowning events^{333,334,344,353,354,356,361}, three (9.4%) on contributing factors to water transport-related deaths^{347,352,359}, and one (2.1%) outlining risk factors to disaster-related deaths¹²⁶.

Twenty (62.5%) studies^{235,335-343,345,346,348-351,355,357,358,360} examined preventative aspects of unintentional drowning. Most of these studies (n= 19) described individual-focused approaches. Summary of studies reviewed is outlined in Supplementary Table 3.14.1.

3.9.1. Numbers and Rates of Unintentional Drowning Death in Indonesia

3.9.1.1. Accidental Drowning Deaths

Three descriptive observational studies^{333,354,356} reported accidental drowning deaths at the subnational level, all outlining the epidemiological measures of drowning mortality as a count. The only data source for drowning deaths identified in these studies was medico-legal/autopsy records. Two of these studies^{333,356} reported drowning mortality at the provincial scale of Bali and included drowning deaths involving Indonesians and foreign nationals. Both studies reported drowning deaths documented by Sanglah Provincial Hospital in the province of Bali, with a total of 209 drowning deaths documented between 2010-2014, from which an average annual drowning mortality rate of 1.73/100,000 between 2010-2014 can be inferred (noting that this is a referral hospital and may miss some incidents). Meanwhile, one study³⁵⁴ reported 15 drowning deaths documented by the Forensic Department of Prof. Dr. R. D. Kandou Provincial Hospital of North Sulawesi between 2007-2011, from which an average annual drowning mortality of 0.18/100,000 can be inferred for the provincial level of North Sulawesi between 2007-2011. However, it is important to note that all drowning data reported in these studies were collected from provincial referral hospitals and may miss some incidents.

3.9.1.2. Disaster-Related Drowning Deaths

Two papers^{126,325} in this review discussed disaster-related deaths. The Indonesian National Disaster Management Agency³²⁵ reported the frequency of disasters and disaster-related mortalities and missing cases in Indonesia between 1815 and 2023: 1) 13,927 flooding events, with 22,476 deaths and 8,195 missing victims; 2) 9,503 flooding and avalanche events, with 3,324 deaths and 379 missing victims; 3) 499 tidal wave-related disaster events, with 165 deaths and 49 missing victims; and 4) 11,225 cyclone events, with 479 deaths and 49 missing victims. These hydrometeorological disasters, excluding tsunami, contributed to 36.7% (N=100,434/259,407) of disaster-related deaths and 17% (N=8,672/51,037) of all disaster-related missing victims in Indonesia, from which disaster-related rate of 186 deaths per 100,000 disaster-affected populations can be inferred.

In a study using the Emergency Disasters Database (EM-DAT) and the Dartmouth Flood Observatory (DFO) data to analyse floods and flood-induced mortality across the globe between 1975 and 2016, Hu, Zhang, Shi, Chen and Fang¹²⁶ reported Indonesia amongst countries with the highest flood frequency and flood-induced mortality worldwide,

estimating 5,000 to 10,000 flood-induced deaths occurred in Indonesia between 1975 and 2016, with tropical cyclones contributing to 0-10% of these deaths, from which flood-induced rates of 1-3 deaths per 100,000 flood-affected populations can be inferred. However, it is important to note that the exact cause of the reported hydrometeorological disaster-related deaths, either by drowning or other causes, were not stated in these two studies, and that data for the period before 1990 may be severely underestimated. There was also no information available on data sources and how at-risk populations were estimated, hence the possibility of selection and measurement/information bias was identified in this study, resulting in the difficulty of inferring cause-specific or proportionate mortality rates.

3.9.1.3. Water Transport-Related Drowning Deaths

Three studies reported water transport-related deaths in Indonesia^{347,352,359}. The Indonesian National Disaster Management Agency³⁵⁹ reported that a total of 15 shipping/boating accidents occurred across Indonesia between 2014 and 2017, resulting in 121 deaths and 97 missing victims. Saputra³⁴⁷ reported on the completed investigations of 120 shipping accidents by the Indonesian National Transportation Safety Committee between 2003 and 2019, and found they contributed to 513 deaths and 701 missing victims across Indonesia. At the subnational level, Suwardjo, Haluan, Jaya and Soen'an³⁵² reported that 61 fishing vessel accidents occurred around the three subdistrict-level fishing ports of Central Java Province between 2006 and 2008, contributing to a total of 68 deaths, or an annual average of 32 dead/missing fishing crews, and an average fatality accident rate (FAR) for all three study sites of 115 deaths per 100,000 fishermen, with 26.5% (n=18/68) of victims falling off the ships into the water during shipping or fishing, and 45.6% (n=31/68) drowning due to the ship capsizing. However, it is important to note that the exact cause of the reported water transport-related deaths were not stated in these studies, and that these reports only included cases where the Indonesian Disaster Management Agency was involved in the rescue/evacuation process, or investigated by the Indonesian National Transportation Safety Committee, or reported by the authorities within the study site and period, hence it may miss some incidents and make inferring cause-specific or proportionate mortality rates difficult.

3.9.2. Risk Factors of Fatal Unintentional Drowning in Indonesia

Risk factors were investigated in 11 studies, with seven studies reporting factors potentially contributing to accidental drowning events^{333,334,344,353,354,356,361}, three discussing potential contributing factors to water transport-related drowning^{347,352,359}, and one outlining risk factors to disaster-related drowning deaths¹²⁶.

Several factors were identified as potential risk factors of for unintentional drowning in Indonesia: 1) sociodemographic characteristics, including age and sex (Indonesian males aged 18 and over disproportionately contributed to the majority of drowning death cases in Bali and North Sulawesi^{333,354,356}), nationality (foreign nationals and Indonesians made up for almost similar proportions of drowning deaths in Bali^{333,356}, noting the high population of foreign nationals in the major tourist destination Bali may differ from populations of other provinces), population density (population density had a significantly positive correlation with the number of flood-related deaths¹²⁶), and income level (flood-induced mortality increased with the decrease of per capita GDP¹²⁶); 2) environmental factors, including aquatic location of drowning deaths (most accidental and water transport-related drowning cases occurred in open seawater^{333,356,359}), seasonality (highest numbers of fishing vessel accidents were recorded during rainy seasons³⁵²), geographical and environmental conditions (a third of boating/shipping accidents occurred in Indonesia were weather-related³⁵⁹, and most flooding inundation and flood-induced deaths occurred in low-lying regions with dense river systems¹²⁶), and hydrometeorological disasters (the frequency of floods and flood-induced mortality were generally increasing, with a large proportion of flood-induced deaths attributed to tropical cyclone-induced flash floods¹²⁶); 3) risky behaviour (alcohol identified on a fifth of autopsied drowning victims, although there was no information on the blood alcohol content³⁵⁶); 4) low knowledge and skills on water safety and water rescue, particularly knowledge on first aid for drowning victims^{334,344,353,361}, and 5) low knowledge and compliance for boating, shipping, and maritime safety-related regulations, including poor maintenance of ships, lack of safety equipment on board, poor knowledge and compliance of safety regulations, and underqualified seafarers and poor ship crews' capacity in ensuring safe boating/maritime practice^{347,352,359}, as summarised in Table 3.2..

However, it is important to note that despite the importance of providing an understanding of risk factors for drowning across Indonesia, no RR/OR was reported across all studies reviewed, and no studies reported statistical correlations of risk factors of interest in association to fatal unintentional drowning incidents. All information on unintentional drowning risk factors was presented as proportions/counts of drowning deaths between categories of risk factors (Table 3.2).

Table 3.2. Studies on Risk Factors of Unintentional Drowning in Indonesia

Risk factors investigated		Study findings
Socio-demographic characteristic	Sex	<ul style="list-style-type: none"> • Male victims: 84.6% (n= 77/91), females: 15.4% (n=14/91) of drowning deaths recorded by the Forensic Department of Sanglah Provincial Hospital of Bali from 2012 to 2014 (Astreani and Alit, 2015). • Male victims: 84,5% (n= 60/71), females: 15,5% (n=11/71) of drowning deaths recorded by the Forensic Department of Sanglah Provincial Hospital of Bali between 2010 and 2012 (Usaputro and Yulianti, 2013). • Male victims: 80% (n= 12/15), females: 20% (n=3/15) of drowning deaths recorded by the Forensic Department of Prof. Dr. R. D. Kandou General Hospital of North Sulawesi Province between 2007 and 2011 (Wulur, 2013). • No measures of association were reported, and a possibility of selection bias was identified in all three studies above (Astreani and Alit, 2015; Usaputro and Yulianti, 2013; Wulur, 2013).
	Age	<ul style="list-style-type: none"> • Adults: 87.9% (n=80/91); children: 12.1% (n=11/91) of drowning deaths in Bali from 2012 to 2014. The definition of the term 'adult' and ' children' were not defined (Astreani and Alit, 2015). • Adults aged 21–30 years: 22.5% (n=16/71), >50 years: 19.7% (n=14/71), 31–40 years: 18.3% (n=13/71), and <20 years: 16.9% (n=12/71) of drowning deaths in Bali between 2010 and 2012 (Usaputro and Yulianti, 2013). • Adults aged ≥ 20 years: 86.7% (n=13/15), children aged 5-14 years: 6.67% (n=1/15) of drowning deaths in North Sulawesi Province between 2007 and 2011 (Wulur, 2013). • No measures of association were reported, and a possibility of selection and measurement/information bias was identified in all three studies above (Astreani and Alit, 2015; Usaputro and Yulianti, 2013; Wulur, 2013).
	Nationality	<ul style="list-style-type: none"> • Indonesians: 54.9% (n=50/91), foreign nationals: 45.1% (n=41/91) of drowning deaths in Bali between 2012 and 2014 (Astreani and Alit, 2015). • Foreign nationals: 49.3% (n=35/71), Indonesians: 40.8% (n=29/71) of drowning deaths in Bali between 2010 and 2012 (Usaputro and Yulianti, 2013). • No measures of association were reported, and a possibility of selection and measurement/information bias was identified in the two studies above (Astreani and Alit, 2015; Usaputro and Yulianti, 2013).
	Population density	<ul style="list-style-type: none"> • Significant positive correlation between population density and the number of flood-related deaths. A possibility of selection bias was identified (Hu et al., 2018).
	Income level	<ul style="list-style-type: none"> • The flood-affected population and flood-induced mortality increased with the decrease of per capita GDP. A possibility of selection bias was identified (Hu et al., 2018).
Environmental factor	Aquatic locations of drowning deaths	<ul style="list-style-type: none"> • Beaches: 69.2% (n= 63/91), swimming pools: 13.2% (n=12/91), river: 13.2% (n=12/91), bathroom and swamps: 4.4% (n=4/91) of drowning deaths in Bali between 2012 and 2014 (Astreani and Alit, 2015). • Open seawater: 53.5% (n= 38/71), freshwater bodies: 25.4% (n=18/71), unknown location: 21.1% (n=15/71) of drowning deaths in Bali between 2010 and 2012 (Usaputro and Yulianti, 2013). • Open seas: 60% (n=9/15), rivers (related to river crossings): 26.67% (n=4/15), lakes and during flooding events: 6.67% (n=1/15) of ship accidents between 2013 and 2017 (Indonesian National Disaster Management Agency, 2023).

Risk factors investigated		Study findings
		<ul style="list-style-type: none"> No measures of association were reported, and a possibility of selection and measurement/information bias was identified in all three studies (Astreani and Alit, 2015; Indonesian National Disaster Management Agency, 2023; Usaputro and Yulianti, 2013).
	Seasonality	<ul style="list-style-type: none"> Of 61 fishing vessel accidents reported to occur around three fishing ports of Central Java Province between 2006 and 2008, the highest numbers of fishing vessel accidents were recorded during rainy seasons (November to February). No measures of association were reported. A possibility of selection bias was identified (Suardjo et al., 2010).
	Geographical and environmental conditions	<ul style="list-style-type: none"> Weather-related: 33.33% (n=5/15) of ship accidents in Indonesia between 2014 to 2017. No measures of association were reported. A possibility of selection bias and measurement/information bias was identified (Indonesian National Disaster Management Agency, 2023). Floodings and flood-induced deaths most often occurred in low-lying regions with dense river systems. Plain areas with slope of <math><0.5^\circ</math>: 40% of flood events and 50% of flood-induced deaths worldwide; plain areas with slopes <math>0.5^\circ< (hu="" 2018).<="" 48%="" 60%="" a="" al.,="" and="" association="" bias="" deaths="" et="" events="" flood="" flood-induced="" identified="" li="" math>-<math>15^\circ<="" math>:="" measures="" no="" of="" possibility="" reported.="" selection="" was="" were="" worldwide.=""> </math>0.5^\circ<>
	Hydrometeorological disasters	<ul style="list-style-type: none"> Between 1975 and 2016, the frequency of floods and flood-induced mortality were generally increasing globally, including in Indonesia. The annual variation of mortality per flood event was highly related to floods with higher intensity, with the highest flood frequency and flood-induced mortality worldwide reported to occur in Asia, particularly in China, India, Indonesia, and the Philippines. A large proportion of flood-induced deaths and the highest flood-induced mortality rate worldwide can be attributed to tropical cyclone-induced flash floods. No measures of association were reported. A possibility of selection bias was identified in this study (Hu et al., 2018).
Risky behaviours	Alcohol consumption	<ul style="list-style-type: none"> Blood alcohol was identified in 20% (n=4/20) of autopsied drowning victims at Sanglah Provincial Hospital of Bali between 2010 and 2012. No information on the blood alcohol content. No measures of association were reported (Usaputro and Yulianti, 2013).
Biological factors	Underlying medical conditions	<ul style="list-style-type: none"> Comorbid conditions were recorded on 15% (n=3/20) of drowning victims underwent autopsy at Sanglah Provincial Hospital of Bali between 2010 and 2012. No information on comorbid conditions. No measures of association were reported (Usaputro and Yulianti, 2013).
Knowledge and skills on water safety and water rescue	Knowledge on first aid for drowning victims	<ul style="list-style-type: none"> Significant correlation between fishermen's knowledge on Basic Life Support (BLS) and attitude to BLS being given for drowning victims ($p<0.05$) (Elsi and Gusti, 2020). Coastal area residents with 'sufficient' knowledge on first aid for drowning victims: 4.26% (n=2/47), 'insufficient' level of knowledge: 87.23% (n=41/47). No measures of association were reported (Prasetyo, 2017). Coastal area residents with 'sufficient' level of knowledge on first aid for maritime accidents' victims: 55% (n=22/40), 'good' level of knowledge: 42.5% (n=17/40). No measures of association were reported (Welembuntu et al., 2021). Coastal area residents with 'sufficient' level of knowledge on first aid for drowning victims: 57.14% (n=20/35), 'good' level of knowledge: 31.4% (n=11/35), 'poor' level of

Risk factors investigated	Study findings
Water safety, safe boating and shipping, and maritime safety-related regulations	<p>knowledge: 11.4% (n=4/35). No measures of association were reported (Widyastuti and Rustini, 2017).</p> <ul style="list-style-type: none"> A possibility of selection bias and measurement bias was identified in all four studies above ((Elsi and Gusti, 2020; Prasetyo, 2017; Welembuntu et al., 2021; Widyastuti and Rustini, 2017).
Water safety, safe boating and shipping, and maritime safety-related regulations	<p>Types of boat/ship</p> <ul style="list-style-type: none"> Passenger boats: 86.67% (n/13/15), fishing boat: 6.67% (n=1/15), rescue boat: 6.67% (n=1/15) of ship accidents in Indonesia between 2014 to 2017 (Indonesian National Disaster Management Agency, 2023). Motorboats including cargo ships, bulk carriers, container ships, and passenger ships (ferries and Ro-Ro ferries): 89% (n=107/120) of ship accidents investigated by the Indonesian National Transportation Safety Committee between 2003 and 2019 (Saputra, 2021). No measures of association were reported, and a possibility of selection and measurement/information bias was identified in two studies above (Indonesian National Disaster Management Agency, 2023; Saputra, 2021).
Knowledge and compliance to regulations on water safety, safe boating and shipping, and maritime safety	<ul style="list-style-type: none"> Boat overloading: 33.33% (n=5/15), collisions: 13.33% (n=2/15) of ship accidents in Indonesia between 2014 to 2017 (Indonesian National Disaster Management Agency, 2023). Fire: 37% (n=44/120); submersion/sinking: 28% (n=34/120), collisions: 18% (n=22/120), other causes: 17% (n=20/120) of ship accidents investigated by the Indonesian National Transportation Safety Committee between 2003 and 2019. Contributing factors to shipping accidents identified were: 1) poor maintenance of ships; 2) unavailability/poor maintenance of safety equipment on board; 3) poor knowledge, awareness, and compliance of safety regulations; and 4) underqualified seafarers and poor ship crews' capacity in ensuring safe shipping/maritime practice (Saputra, 2021). Contributing factors to fishing vessel accidents in Central Java Province between 2006 and 2008: 1) underqualified shipping crews; 2) poor knowledge, awareness, and compliance of safety regulations; 3) unfulfillment of safety requirements.. Approximately 84.3% of skippers and ship crews did not go beyond primary level education, hence did not qualify to undertake Basic Safety Training for shipping crews. Seventy per cent (n=45/64) of all fishing vessels registered did not fulfil safety requirements due to insufficient number of life jackets and rescue buoys, unequipped with fire extinguishers and life rafts, and lacking in other safety equipment (Suwardjo et al., 2010). No measures of association were reported, and a possibility of selection and measurement/information bias was identified in all three studies above in all three studies above (Indonesian National Disaster Management Agency, 2023; Saputra, 2021; Suwardjo et al., 2010).

3.9.3. Drowning Prevention in Indonesia

Analysis of the application of the Health Promotion Framework across the 16 peer-reviewed papers^{335-343,345,346,348-351,355} and four grey literature sources^{235,357,358,360} on drowning prevention interventions revealed that most prevention approaches were midstream and downstream individual-focused, behaviour-based intervention, with a focus on education to build knowledge and skills, as outlined on Table 3.3. The interventions included providing health information/education on: 1) emergency first aid for drowning victims^{335-343,349-351,355,360}; 2) water rescue^{345,346,348,350}; and 3) drowning prevention awareness^{235,357}. These educational interventions were aimed at diverse populations, including local street stallholders in coastal areas, fishermen, youth groups, tourism awareness group members, and community health workers.

Only one grey literature source²³⁵ reported on regulatory activities and social marketing approaches for drowning prevention. Meanwhile, two studies^{336,345} outlined the potential of training local community groups to perform and assist on local water rescue efforts (Table 3.3)

Table 3.3. Analysis of Prevention Interventions Investigated in Indonesia using the Health Promotion Framework¹⁶⁸

Author	Type of publication	Population investigated	Study design	Intervention method investigated	Prevention aspect investigated in relation to Health Promotion Framework			Relevant findings
					Medical/ Individual approach	Behavioural approach	Socio-environmental approach	
Faradisi et al. (2021)	Original research article	Twenty-one street stallholders on Nyamplung Beach, Central Java Province	Pre-test, post-test study	Health education on Cardio-Pulmonary Resuscitation (CPR) on drowning victims	-	HE ¹	-	<ul style="list-style-type: none"> • Proportion of participants with good level of knowledge: post-intervention > pre-intervention. • No measures of association were reported. • A possibility of selection bias and measurement bias was identified.
Fernalia et al. (2022)	Original research article	Community members at Lingkar Barat Subdistrict, Bengkulu Province (data on the number of participants are not available)	Community service project	Health education on performing water rescue.	-	HE	CA	<ul style="list-style-type: none"> • Water rescue-trained local community group was formed. • No evaluation on participants' level of knowledge and skills on water rescue. • No measures of association were reported. • A possibility of selection bias and measurement bias was identified.
Gobel et al. (2014)	Original research article	Forty-seven fishermen from a coastal area of North Bolaang Mongondow Regency, North Sulawesi Province	Pre-test, post-test study	Health education on first aid for drowning victims	-	HE	-	<ul style="list-style-type: none"> • Significant increase on the mean level of knowledge after the intervention applied ($p < 0.05$). • No information on long-term knowledge retention. • A possibility of selection bias and measurement bias was identified.

¹ Abbreviations: CA: Community action; HE: Health education; HI: Health information; PD: Policy development; RA: Regulatory activity; SD: Skills development; SM: Social marketing

Author	Type of publication	Population investigated	Study design	Intervention method investigated	Prevention aspect investigated in relation to Health Promotion Framework			Relevant findings
					Medical/ Individual approach	Behavioural approach	Socio-environmental approach	
Hady et al. (2020)	Original research article	Fifty residents of a coastal area of Takalar Regency, South Sulawesi Province	Pre-test, post-test study	Health education and roleplay on first aid for drowning victims	-	HE	-	<ul style="list-style-type: none"> Significant increase on the mean level of knowledge after the intervention applied ($p < 0.05$). No information on long-term knowledge retention. A possibility of selection bias and measurement bias was identified.
Indonesian Ministry of Health (2020)	Grey literature (government report)	NA	NA	Development of the National Drowning Prevention Strategy and Coordinating Agency; Development of drowning prevention awareness campaign for school-age children	-	SM	PD, RA	<ul style="list-style-type: none"> The Directorate of Occupational and Sports Health (of the Indonesian Ministry of Health) will initiate four aspects of drowning prevention on national level: <ul style="list-style-type: none"> a) Development of the National Drowning Prevention Coordinating Agency b) Development of coordinated mechanisms of disseminating and monitoring health data c) Development of the National Drowning Prevention Strategy d) Development of drowning prevention awareness campaign targeting school-age children across Indonesia. Indonesian Ministry of Health will initiate a multisectoral coordination with the Indonesian Coordinating Ministry for Maritime and Investment Affairs; Ministry of Marine Affairs and Fisheries; Ministry of Youth and Sports Affairs; Ministry of Transportation; Ministry of Education and Culture; Ministry of Tourism; National Bureau of Statistics; Maritime Security Agency; Sea and Coast Guard; National Search and Rescue Agency; National Agency for Disaster Management; National Police, Seafarers Union; and Maritime Doctors Association.
Indonesian Ministry of Health (2017)	Grey literature (policy statement of clinical standard)	NA	NA	Health information on pre-hospital and intrahospital emergency care for trauma patients	HI	-	-	<ul style="list-style-type: none"> National clinical practice guideline for treatment of trauma cases, including for drowning victims. Targeting Indonesian medical doctors.
Indonesian Ministry of Health (2015)	Grey literature (policy statement)	NA	NA	Health information on preventing drowning in children	HI	-	-	<ul style="list-style-type: none"> Handbook on preventing drowning in children. Targeting health workers and trained community members.

Author	Type of publication	Population investigated	Study design	Intervention method investigated	Prevention aspect investigated in relation to Health Promotion Framework			Relevant findings
					Medical/ Individual approach	Behavioural approach	Socio-environmental approach	
Lesmana et al. (2018)	Original research article	Forty-six respondents living in a coastal area of Amal Beach, Tarakan City, North Kalimantan Province	Pre-test, post-test study	Health education on first aid for drowning victims	-	HE	-	<ul style="list-style-type: none"> Proportion of participants with good level of knowledge: post-intervention > pre-intervention. No measures of association were reported. A possibility of selection bias and measurement bias was identified.
Nadapdap (2021)	Grey literature (thesis)	Systematic search on 7 national journals and three international journals, using keywords "knowledge", "first aid", "drowning" and "basic life support"	Literature review	Health education on Basic Life Support (BLS) for drowning victims	-	HE	-	<ul style="list-style-type: none"> Review identified respondents' knowledge as 'good' after being given health education on BLS for drowning victims. A possibility of selection bias and measurement bias was identified.
Nugroho and Suryono (2020)	Original research article	Fifteen members of a local freshwater fishing community of Kediri Regency, East Java Province	Pre-test, post-test study	Health education on first aid for infant drowning victims	-	HE	-	<ul style="list-style-type: none"> Significant increase of the mean level of self-efficacy in emergency handling of toddler drowning victims after the intervention applied ($p < 0.05$). No information on long-term knowledge and self-efficacy retention. A possibility of selection bias and measurement bias was identified.
Ose et al. (2020)	Original research article	Thirty-two volunteer village health workers overseeing a coastal area of Amal Beach, Tarakan City, North Kalimantan Province	Pre-test, post-test study	Health education on performing CPR on drowning victims	-	HE	-	<ul style="list-style-type: none"> Significant increase of the mean level of knowledge after the intervention applied ($p < 0.05$). No information on long-term knowledge retention. A possibility of selection bias and measurement bias was identified.
Patimah (2019)	Original research article	Eighteen residents of a coastal area of Jayapura City, Papua Province	Pre-test, post-test study	Health education on BLS and evacuation for drowning victims	-	HE	-	<ul style="list-style-type: none"> Significant increase of the mean level of knowledge after the intervention applied ($p < 0.05$). No information on long-term knowledge retention. A possibility of selection bias and measurement bias was identified.
Patimah et al. (2019)	Original research article	Fifty-eight residents of a coastal area of Jayapura District, Papua	Pre-test, post-test study	Health education on first aid for drowning victims	-	HE	-	<ul style="list-style-type: none"> Proportion of participants with good level of knowledge: post-intervention > pre-intervention. No measures of association were reported. A possibility of selection bias and measurement bias was identified.
Pranoto et al. (2023)	Original research article	Sixty members of tourism awareness groups on Mentawai Islands, West Sumatra Province	Community service project	Health education on performing water rescue and CPR on drowning victims	-	HE	-	<ul style="list-style-type: none"> No evaluation on participants' level of knowledge and skills of on water rescue and CPR. No measures of association were reported.

Author	Type of publication	Population investigated	Study design	Intervention method investigated	Prevention aspect investigated in relation to Health Promotion Framework			Relevant findings
					Medical/ Individual approach	Behavioural approach	Socio-environmental approach	
								<ul style="list-style-type: none"> • A possibility of selection bias and measurement bias was identified.
Rosmi et al. (2020)	Original research article	Thirty-six members of youth organisations (Karang Taruna) on Gresik Regency, East Java Province	Community service project	Health education on the dangers of flooding and performing water rescue on flooding-related drowning victims	-	HE	CA	<ul style="list-style-type: none"> • Water rescue-trained local community group was formed. • No evaluation on participants' level of knowledge and skills on flooding-related water rescue. • No measures of association were reported. • A possibility of selection bias and measurement bias was identified.
Sadewa et al. (2023)	Original research article	Thirty-five participants consisting of lifeguards, pool attendants, swimming trainers, students, and swimming pool visitors at the Faculty of Sports and Health Sciences, Yogyakarta State University, Yogyakarta Province	Descriptive quantitative and qualitative approach	The development of modified water rescue tools (jerry cans lined with Styrofoam and equipped with ropes) for water rescue efforts, as an effective, cheap, easy to obtain substitute to water rescue equipment	HI	-	-	<ul style="list-style-type: none"> • The modified water rescue tool was deemed "very decent" by participants to be utilised on water rescue efforts. • No evaluation on the implementation and outcome of the intervention. • A possibility of selection bias and measurement bias was identified.
Sillehu and Kartika (2018)	Original research article	Thirty-five regency-level National Search and Rescue Agency staff members for Ambon City, Maluku Province	Analytical observational	Water rescue practice	HI	-	-	<ul style="list-style-type: none"> • Significant correlation between the performance by the National Search and Rescue Agency and the rescue of drowning victims ($p<0.05$). • A possibility of selection bias and measurement bias was identified.
Sugiantoro and Wahyudi (2021)	Original research article	Fifteen fishermen from Lempasing Regency, Lampung Province	Pre-test, post-test study	Health information on first aid for drowning victims	HI	-	-	<ul style="list-style-type: none"> • Significant increase of the mean level of knowledge and attitude after the intervention applied ($p<0.05$). • No information on long-term knowledge retention. • A possibility of selection bias and measurement bias was identified.

Author	Type of publication	Population investigated	Study design	Intervention method investigated	Prevention aspect investigated in relation to Health Promotion Framework			Relevant findings
					Medical/ Individual approach	Behavioural approach	Socio-environmental approach	
Sukarna et al. (2021)	Original research article	Thirty street stallholders on a coastal area on the province of Bangka Belitung Islands	Pre-test, post-test study	Health education on performing CPR and evacuation on drowning victims	-	HE	-	<ul style="list-style-type: none"> • Significant increase of the mean level of knowledge after the intervention applied ($p < 0.05$). • No information on long-term knowledge retention. • A possibility of selection bias and measurement bias was identified.
Suryono and Nugroho (2020)	Original research article	Fifteen members of a local freshwater fishing community of Kediri Regency, East Java Province	Pre-test, post-test study	Health education on first aid for infant drowning victims	-	HE	-	<ul style="list-style-type: none"> • Proportion of participants with sufficient level of knowledge: post-intervention > pre-intervention. • No measures of association were reported. • A possibility of selection bias and measurement bias was identified.

3.10. Discussion

This scoping review aimed to describe the epidemiology of and risk factors for unintentional drowning in Indonesia and explore existing health promotion and prevention approaches currently in place. Despite a dire need to provide better understanding on the magnitude of drowning as a health problem in Indonesia, limited literature reporting on drowning epidemiology, risk factors or prevention and health promotion approaches in Indonesia were identified.

3.10.1. Drowning Mortality Data across Indonesia: The Disparity on Data Availability

Comprehensive data are imperative for agenda setting.⁵⁹ However, this review outlined the limited availability of drowning data across Indonesia. The data sources for drowning deaths identified in this review were derived from medico-legal autopsy records, records of investigated shipping accidents and rescue reports, with no drowning data derived from health and demographic surveillance data, national death registry, integrated coronial information system, police department records, national health reports, or news reports. This is due to the unavailability of a coordinated national death registry in Indonesia, from which national and subnational data for all categories of unintentional drowning can be recorded.¹⁰ This unavailability underlines the possibility of underrepresentation of drowning data and a public health issue regarding the health system capacity on collecting, reporting, and utilising health data.

A similar reliance on medico-legal reports has been reported in other LMIC, such as in South Africa, where the dependence on hospital-based reports means that the surveillance system may miss drowning-related injuries which occur in and around homes, particularly in rural areas with inadequate access to healthcare facilities.³⁶²⁻³⁶⁴ The underreporting of drowning incidents can be linked to the nature of drowning deaths, where victims often suffer a quick death on location and never reach medical facilities or are reported to authorities, which may impede accurate data collection in countries with dependence on facility-based reporting systems, such as in Indonesia.^{7,179,181} These limitations underline the urgent need to strengthen public health system capacity; develop standardised, national health, death and coronial data reporting frameworks; enhance multi-sectoral collaboration; and advocate for political and financial investment, to develop a robust drowning data collection system in Indonesia.^{110,365,366}

3.10.2. Drowning Risk Factors in Indonesia: A Knowledge Gap

This review identified a lack of exploration on predictors for unintentional drowning fatalities, with no studies reporting RR/OR or statistical correlations of predictors of interest and fatal unintentional drowning incidents. This may hinder the development of prevention interventions

needed across different provinces of Indonesia, which may be different to prevention interventions which have been shown to be effective in high income countries.^{164,367-369}

Increasing supervision of children, raising community awareness and skills on water safety, and encouraging community participation have been identified as important protective factors for drowning in LMIC.^{41,75,370} Further scaling up of these interventions to other LMIC, including to Indonesia, should be considered, as part of the global effort to reduce the global burden of drowning, particularly among children.⁷⁵ Further research on contributing factors to disaster-related and water transport-related drowning deaths is also imperative to inform the development of drowning preventive strategies suitable for Indonesian context, given the high frequency of hydrometeorological disasters and water transport-related incidents and the nation's high vulnerability to the impacts of disasters and climate change^{126,233,325,329-331,347,352,359}

3.10.3. Understanding the Linkage between Drowning Prevention and Health Promotion

Using the HPF¹⁶⁸ to analyse the socio-ecological approaches utilised in the prevention of drowning in Indonesia, this review identified the under-exploration of the concept of the socio-ecological approach of health promotion related to drowning prevention in Indonesia, leaving the research area of community participation and development of evidence-informed policy around water safety relatively neglected. The limited availability of population-focused midstream and upstream drowning prevention interventions in Indonesia does not align with the underlying premise of the Health Promotion Framework, which supports the need for multisectoral, multi-strategic approaches including educational, behavioural, socio-environmental, and regulatory approaches to ensure effective individual and community-level injury prevention.^{37,183,184,371,372} A comprehensive approach to drowning prevention in Indonesia requires approaches that go across the downstream, midstream, upstream continuum and include strengthening individual and broader community level knowledge and skills, fostering coalitions and networks, changing organisational practices, and policy and legislation setting.¹⁶⁴

3.11. Implications for Policy, Practice, and Future Research

3.11.1. Policy

A national, evidence-informed regulatory framework for drowning prevention, guided by the WHO implementation guide on preventing drowning⁵⁹ and affirmed by the 2021 United Nations General Assembly Resolution on global drowning prevention¹⁰⁰, is required to reduce drowning fatalities in Indonesia. To inform this, a situational assessment must be performed in Indonesia, to: 1) review available data on drowning; 2) assess current efforts regarding drowning prevention including

existing policy and regulation; 3) identify key stakeholders who play a role in drowning prevention; and 4) assess required human and financial resources.⁵⁹ This approach is supported by the WHO, who also recommends advancing drowning prevention through robust data collection, to inform burden and risk factor identification, and agenda setting, as well as development and evaluation of regulatory frameworks and prevention interventions.⁵⁹

3.11.1.1. Contributing to Situational Assessment on Drowning Prevention in Indonesia

Several findings of this review may inform the situational assessment on drowning prevention in Indonesia. Furthermore, although not included in this study, several studies identified during the database searches may provide baseline information around disaster risk management and enforcement of maritime, shipping, and boating safety in Indonesia, informing the urgently needed multisectoral collaboration to develop coordinated national drowning prevention efforts:

1. The unavailability of coordinated national death registry in Indonesia, from which national and subnational subcategory drowning data can be collected, underlines the possibility of under-representation of drowning data. Developing a robust and consolidated drowning data collection system, which employs data triangulation methodology, combining data from national death and coronial registry, organisational reports, and media report monitoring, is imperative to inform the drowning prevention agenda in Indonesia.
2. The Indonesian Ministry of Health (2020) initiated the development of the National Drowning Prevention Strategy and Coordinating Agency, in conjunction with the strengthening of health data dissemination and monitoring, and development of social marketing approaches to increase community awareness on drowning prevention. This initiative was undertaken as a response to the WHO call for member nations to strengthen their national drowning data collection.¹⁰ Main actors for drowning prevention include the Indonesian Ministry of Health as the lead agency, in coordination with the Indonesian Coordinating Ministry for Maritime and Investment Affairs; Ministry of Marine Affairs and Fisheries; Ministry of Youth and Sports Affairs; Ministry of Transportation; Ministry of Education and Culture; Ministry of Tourism; National Bureau of Statistics; Maritime Security Agency; Sea and Coast Guard; National Search and Rescue Agency; National Agency for Disaster Management; National Police, Seafarers Union; and Maritime Doctors Association.²³⁵ Further research is needed to update the progress of

the initiative and evaluate the impact and outcome of interventions in reducing drowning against key indicators.

3. Main actors on disaster risk management include the National Disaster Management Agency as the lead agency; Meteorological, Climatological, and Geophysical Agency; Ministry of Public Works; Ministry of Environment and Forestry; Spatial Planning Agencies; river basin management authorities; National Search and Rescue Agency; Red Cross Society; and National Police and Military Forces. Limited budget (only 0.1-0.4% of national budgeting were allocated for disaster risk reduction efforts at the local level), low human resource capacity, non-integrated regulations, and unclear coordination mechanisms across government agencies were the apparent challenges.^{229-232,329}
4. Main actors on maritime and boating safety enforcement include the Ministry of Transportation as the lead agency, harbourmasters and Sea and Coast Guard. Low human resource capacity, low compliance to regulations, overlapping regulatory frameworks with unclear responsibilities and coordination mechanisms between agencies, and the geographic nature of Indonesia as a vast archipelagic nation were identified as challenges in enforcing maritime and boating safety nationwide.^{233,234}
5. A continuous effort to systemically integrate drowning prevention framework across regulatory activities enforcing water safety, adequate supply of safe water, maritime/boating safety, occupational health and safety, disaster risk management, and sustainable spatial and non-spatial development planning, emphasising the importance of disaster risk reduction and climate change adaptation to the efforts of reducing fatalities, with clear obligations, responsibilities, and coordination mechanisms between agencies, is required in Indonesia.

3.11.2. Practice

Increasing supervision of children, raising community awareness and skills on water safety, and encouraging community participation have been identified as important protective factors for drowning in LMIC.^{41,75,370} As advocated by the WHO, the effectiveness of community driven crèches in preventing child drowning for children aged 12-59 months, and swimming lessons in reducing the risk of drowning for children aged 6 and above, along with their cost effectiveness, have been widely reported in rural settings in Bangladesh.^{75,373-376} Further scaling up of these interventions to other LMIC, including to Indonesia, should be considered, as part of the global effort to reduce the global burden of drowning, particularly among children.⁷⁵ Further research is required to evaluate the process, impact and outcome of these interventions against key indicators in Indonesia; improving local capacity and understanding in preventing drowning in the country.³⁷⁷

3.11.3. Future Research

More research on drowning is needed in Indonesia across all domains, however several priorities for future research were noted, with a particular focus on developing and improving the performance of drowning surveillance to ensure the availability and reliability of drowning mortality and morbidity data across Indonesia. Studies investigating the measurement of association between accidental, disaster-, and water transport-related drowning risk factors, and the incidence of fatal and non-fatal unintentional drowning incidents are essential to inform the appropriate prevention measures for Indonesia. Further research on drowning cases related to disasters, disabilities, genders, older populations, and children is also vital to provide a better understanding of the at-risk populations in the country.³⁷⁸⁻³⁸²

In addition, further investigation on broader health promotion approaches that reflect a socio-ecological approach to drowning prevention is imperative for Indonesian context. It is particularly important to explore the potential vital link between unintentional drowning prevention and safe water provision, boating and maritime safety regulations and enforcement, occupational safety and health, rural development, disaster risk management, and efforts to bridge economic inequities and disparities in accessing healthcare across different populations, particularly impacting the socioeconomically disadvantaged populations of rural and remote areas of archipelagic Indonesia.^{126,233,325,329-331,347,352,359}

3.12. Strengths and Limitations

Several factors contributed to the strength of this review, including the inclusion of studies published in Indonesian language and the use of broad search terms to capture the extensive causes of drowning and the wide areas where drowning may occur. However, several limitations were also identified. Firstly, it is possible that not all studies exploring unintentional drowning in Indonesia were located. In addition, the lack of information on accidental, disaster-related and water transport-related drowning mortality numbers, cause of deaths, data sources and at-risk populations, along with the inconsistency in data collection and reporting between articles, may compromise the accuracy and quality of drowning data identified, limiting the generalisability and mortality rate inference from the findings, potentially resulting in the underestimation of the magnitude of unintentional drowning mortality across Indonesia.

3.13. Conclusion

Limited publications on drowning rates, risk factors, and prevention were observed within Indonesia. The unavailability of a coordinated national drowning data collection system in Indonesia underlines the possibility of under-representation of drowning mortality. The under-investigated measurement of association between various exposures and fatal drowning incidents was identified, potentially hindering the development of prevention interventions. The over-reliance on individual-focused prevention measures was observed in Indonesia, with an apparent under-development of socio-ecological health promotion approaches to drowning prevention. Several highlights for future research were noted, with a particular focus on improving the performance of drowning surveillance, to ensure the availability and reliability of drowning mortality and morbidity data across Indonesia. Broader health promotion approaches that reflect a socio-ecological approach to drowning prevention in Indonesia is also imperative in reducing drowning incidents and fatalities in Indonesia.

3.14. Supplementary Table

Supplementary Table 3.14.1. Summary of Studies Reviewed

No	Authors	Year of study	Type of publication	Study aims	Data source	Study design	Sample, setting	Scale of study		Types of unintentional drowning reported			Findings							
								National	Subnational	Accidental	Water-transport related	Disaster-related	Epidemiology	Risk factors				Prevention		
														Sex	Age group	Location	Others	Intervention type	Relevant outcomes	
1	Astreaeni and Alit (2015)	2012-2014	Original research article	To investigate cardinal signs of suspected drowning bodies	Medico-legal/autopsy records	Observational descriptive	Drowning deaths recorded by the Forensic Department of Sanglah Provincial Hospital, Bali from 2012 to 2014		v	v				A total of 112 drowning deaths was recorded by Sanglah Provincial Hospital of Bali between 2012-2014, with 91 cases included as samples on this study.	Male victims: 84.6% (n=77/91), females: 15.4% (n=14/91). No measures of association were reported.	Adults: 87.9% (n=80/91); children: 12.1% (n=11/91). The definition of the term 'adult' and 'children' were not defined. No measures of association were reported.	Beaches: 69.2% (n=63/91), swimming pools: 13.2% (n=12/91), river: 13.2% (n=12/91), bathroom and swamps: 4.4% (n=4/91). No measures of association were reported.	Indonesians: 54.9% (n=50/91), foreign nationals: 45.1% (n=41/91). No measures of association were reported.	NA	NA
2	Elsi and Gusti (2020)	2020	Original research article	To determine the fishermen's knowledge and attitude on Basic Life Support (BLS) for drowning victims.	Primary data	Cross sectional descriptive	Forty-one fishermen in Padang City, West Sumatra Province		v	v				NA	NA	NA	NA	Significant correlation between fishermen's knowledge on BLS and attitude to BLS being given for drowning victims (p<0.05).	NA	NA
3	Faradisi et al. (2021)	2020	Original research article	To provide education and training on first aid for cardiac arrest and respiratory arrest caused by drowning to street stallholders on coastal area	Primary data	Pre-test, post-test design	Twenty-one street stallholders on a coastal area of Nyamplung Beach, Pemalang Regency, Central Java Province		v	v				NA	NA	NA	NA	NA	Health education and roleplay on Cardio-Pulmonary Resuscitation (CPR) on drowning victims	Proportion of participants with good level of knowledge: post-intervention > pre-intervention. No measures of association were reported.
4	Fernalia et al. (2022)	2022	Original research article	To form a water rescue-trained community group to assist during flooding, boating/shipping accident, or other drowning events	Primary data	Community service project	Community members at Lingkar Barat Subdistrict, Bengkulu Province (data on the number of participants are not available)		v	v	v	v		NA	NA	NA	Na	NA	Health education on performing water rescue.	Water rescue-trained local community group was formed. No evaluation on participants' level of knowledge and skills on water rescue. No measures of association were reported.
5	Gobel et al. (2014)	2014	Original research article	To determine the effect of health education on fishermen's level of knowledge on first aid for drowning victims	Primary data	Pre-test, post-test design	Forty-seven fishermen from North Bolaang Mongondow Regency, North Sulawesi Province		v	v				NA	NA	NA	NA	NA	Health education on first aid for drowning victims	Significant increase on the mean level of knowledge after the intervention applied (p<0.05). No information on long-term knowledge retention.

No	Authors	Year of study	Type of publication	Study aims	Data source	Study design	Sample, setting	Scale of study		Types of unintentional drowning reported			Findings						
								National	Subnational	Accidental	Water-transport related	Disaster-related	Epidemiology	Risk factors				Prevention	Relevant outcomes
														Sex	Age group	Location	Others		
6	Hady et al. (2020)	Not stated	Original research article	To determine the effect of the roleplay method on the coastal area residents' level of knowledge and skills on performing first aid for drowning	Primary data	Pre-test, post-test design	Fifty people resided on a coastal area of Takalar Regency, South Sulawesi Province		v	v			NA	NA	NA	NA	NA	Health education and roleplay on first aid for drowning victims	There was a significance increase on the mean level of knowledge after the intervention applied (p<0.05)
7	Hu et al. (2018)	2016	Original research article	To investigate frequency and intensity of floods, flood-induced mortality, and flood-affected population between 1975 and 2016 across the globe.	Secondary data	Analytical observational	Data on flood events worldwide were collected from: 1) the Emergency Disasters Database (EM-DAT), which contains information about each individual flood event during 1900-current; and 2) the Dartmouth Flood Observatory (DFO) covering a period of 1985-present	v				v	1) Occurrence rate of floods, flood-induced mortality and flood-affected population were generally increasing globally; 2) The flood frequency and flood-induced mortality are the largest in Asia, specifically in China, India, Indonesia and the Philippines; 3) Flood-induced mortality rates for Indonesia between 1975 and 2016 were 1.0% to 3.0% of total flood-affected populations, with 5,000 to 10,000 flood-induced deaths reported for the study period. A possibility of selection and measurement/information bias was identified.	NA	NA	NA	1) The frequency of floods and flood-induced mortality were generally increasing globally, including in Indonesia; 2) Annual variation of mortality per flood event was highly related to floods with higher intensity, with the flood frequency and flood-induced mortality are the largest in Asia, including in Indonesia; 3) A large proportion of flood-induced deaths and the highest flood-induced mortality can be attributed to tropical cyclone-induced flash floods (no measures of association were reported); 4) Floodings and flood-induced deaths most often occurred in low-lying regions with dense river systems. Plain areas with slope of <0.5°: 40% of flood events and 50% of flood-induced deaths worldwide; plain areas with slopes 0.5°-15°: 60% of flood events and 48% of flood-induced deaths worldwide (no measures of association were reported); 5) Population density had a significantly positive correlation with the number of flood-related victims per unit area and number of deaths, while the flood-affected population and flood-induced mortality increased with the decrease of per capita GDP.	NA	NA

No	Authors	Year of study	Type of publication	Study aims	Data source	Study design	Sample, setting	Scale of study		Types of unintentional drowning reported			Findings						
								National	Subnational	Accidental	Water-transport related	Disaster-related	Epidemiology	Risk factors				Prevention	Relevant outcomes
														Sex	Age group	Location	Others	Intervention type	
8	Indonesian Ministry of Health (2020)	2015-2019	Grey literature (government report)	Accountability report: Directorate of Occupational and Sports Health, Indonesian Ministry of Health	NA	NA	NA	√		√	√	√	NA	NA	NA	NA	NA	<p>A national level, coordinated policy development, regulatory activities, and social marketing framework on drowning prevention</p> <p>The development of national drowning prevention framework is to be undertaken by the Directorate of Occupational and Sports Health (the Indonesian Ministry of Health), in coordination with the Indonesian Coordinating Ministry for Maritime and Investment Affairs; Ministry of Marine Affairs and Fisheries; Ministry of Youth and Sports Affairs; Ministry of Transportation; Ministry of Education and Culture; Ministry of Tourism; National Bureau of Statistics; Maritime Security Agency; Sea and Coast Guard; National Search and Rescue Agency; National Agency for Disaster Management; National Police, Seafarers Union; and Maritime Doctors Association.</p> <p>Four main aspects of national drowning prevention framework to be initiated: a) Development of the National Drowning Prevention Coordinating Agency; b) Development of coordinated mechanisms of disseminating and monitoring health data; c) Development of the National Drowning Prevention Strategy; d) Development of drowning prevention awareness campaign targeting school-age children across Indonesia.</p>	
9	Indonesian Ministry of Health (2017)	2011	Grey literature (policy statement of clinical standard)	National clinical practice guideline for treatment of trauma cases	NA	NA	NA	√		√	√	√	NA	NA	NA	NA	NA	<p>Health information on pre-hospital and intrahospital emergency care for trauma patients</p> <p>Mainly targeting Indonesian medical doctors</p>	
10	Indonesian Ministry of Health (2015)	2015	Grey literature (policy statement)	Handbook on preventing drowning in children	NA	NA	NA	√		√			NA	NA	NA	NA	NA	<p>Health information on risk factors and prevention of drowning in children</p> <p>Targeting health workers and community members that had been through health education programme on giving first aid for drowning victims.</p>	

No	Authors	Year of study	Type of publication	Study aims	Data source	Study design	Sample, setting	Scale of study		Types of unintentional drowning reported			Findings						
								National	Subnational	Accidental	Water-transport related	Disaster-related	Epidemiology	Risk factors				Prevention	
														Sex	Age group	Location	Others	Intervention type	Relevant outcomes
11	Indonesian National Disaster Management Agency (2023)	2014-2023	Grey literature (government report)	Disaster information data	NA	NA	Data on frequency, number of deaths, and number of missing victims of flooding, flooding and avalanche and cyclone events covering a period of 1815 to 2023	v			v	Between 1815 and 2023: 1) 13,927 flooding events with 22,476 deaths and 8,195 missing victims; 2) 9,503 flooding and avalanche events, with 3,324 deaths and 379 missing victims; 3) 499 tidal wave-related events, with 165 deaths and 49 missing victims; 4) 11,225 cyclone events, with 479 deaths and 49 missing victims. Excluding tsunami, these deaths contributed to 79.16% (N=100,434/126,875) of disaster-related deaths and 65.29% (N=8,672/13,283) of all disaster-related missing victims in Indonesia. No data on the cause of death. No information on data sources. A possibility of selection and measurement/information bias was identified.	NA	NA	NA	NA	NA	NA	
12	Indonesian National Disaster Management Agency (2023)	2013 - 2017	Grey literature (government report)	Information on shipping/boating accidents	NA	NA	Data on frequency, number of deaths, and number of missing victims of shipping/boating accidents reported by the Indonesian Disaster Management Agency between February 2013 to April 2017	v			v	Between 2014 to 2017, 15 shipping/boating accidents, with 121 deaths and 97 missing victims were reported. No information on the cause of deaths. A possibility of selection and measurement/information bias was identified.	NA	NA	Open seas: 60% (n=9/15), rivers: 26.67% (n=4/15), lakes and during flooding events: 6.67% (n=1/15). No measures of association were reported.	Passenger boats: 86.67% (n/13/15), fishing boat: 6.67% (n=1/15), rescue boat: 6.67% (n=1/15). Boat overloading: 33.33% (n=5/15), collisions: 13.33% (n=2/15). No measures of association were reported.	NA	NA	
13	Lesmana et al. (2018)	2018	Original research article	To investigate coastal residents' knowledge on first aid for drowning victims	Primary data	Pre-test, post-test design	Forty-six residents of a coastal area of Amal Beach, Tarakan City, North Kalimantan Province		v	v		NA	NA	NA	NA	Health education on first aid on drowning victims	Proportion of participants with good level of knowledge: post-intervention > pre-intervention. No measures of association were reported.		
14	Nadapdap (2021)	2021	Grey literature (thesis)	To examine public knowledge of first aid for drowning victims	Secondary data	Literature review	Systematic search on 7 national journals and three international journals, using keywords "knowledge", "first aid", "drowning"		v	v		NA	NA	NA	NA	Health education on BLS for drowning victims	Review identified respondents' knowledge as 'good' after being given health education on BLS for drowning victims. A possibility of selection bias and measurement bias was identified. No measures of association were reported.		

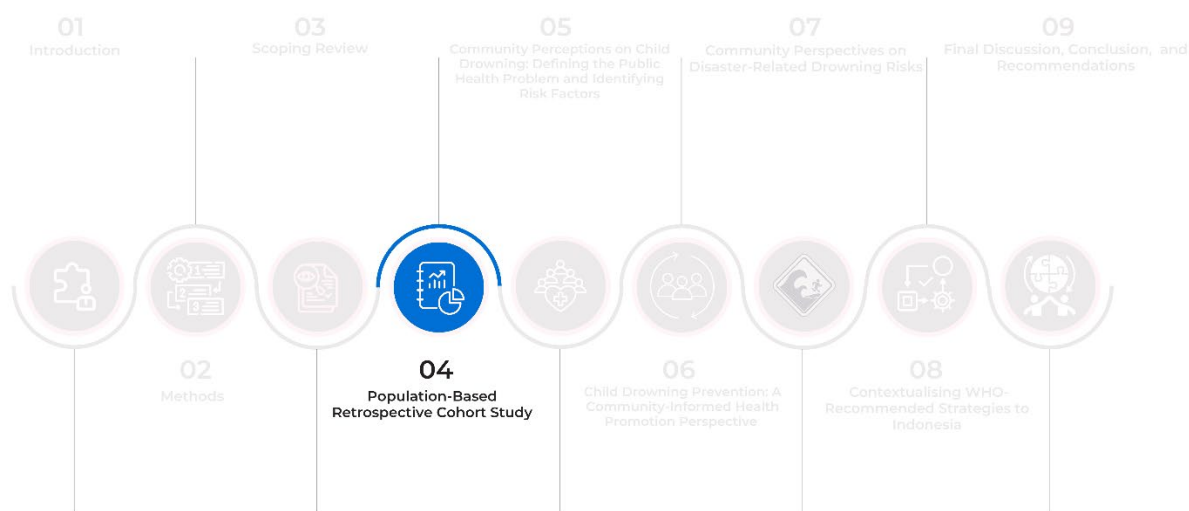
No	Authors	Year of study	Type of publication	Study aims	Data source	Study design	Sample, setting	Scale of study		Types of unintentional drowning reported			Findings						
								National	Subnational	Accidental	Water-transport related	Disaster-related	Epidemiology	Risk factors				Prevention	Relevant outcomes
														Sex	Age group	Location	Others	Intervention type	
15	Nugroho and Suryono (2020)	2019	Original research article	To analyse the self-efficacy in emergency handling of toddler drowning victims	Primary data	Pre-test, post-test design	Fifteen members of a local freshwater fishing community of Darungan Village, Kediri, East Java Province		v	v			NA	NA	NA	NA	NA	Health education on first aid for infant drowning victims	Significant increase of the mean level of self-efficacy in emergency handling of toddler drowning victims after the intervention applied (p<0.05). No information on long-term knowledge and self-efficacy retention.
16	Ose et al. (2020)	2018	Original research article	To determine the effect of health education on community health volunteers' level of knowledge on first aid for drowning victims and individuals with cardiac arrest	Primary data	Pre-test, post-test design	Thirty-two community health volunteers overseeing a coastal area of Amal Beach, Tarakan City, North Kalimantan Province		v	v			NA	NA	NA	NA	NA	Health education on performing CPR on drowning victims and individuals with cardiac arrest	Significant increase of the mean level of knowledge after the intervention applied (p<0.05). No information on long-term knowledge retention.
17	Patimah (2019)	Not stated	Original research article	To determine the effect of health education on level of knowledge on BLS for drowning victims	Primary data	Pre-test, post-test design	Eighteen residents of a coastal area of Hamadi Village, Jayapura City, Papua Province		v	v			NA	NA	NA	NA	NA	Health education on BLS and evacuation on drowning victims	Significant increase of the mean level of knowledge after the intervention applied (p<0.05). No information on long-term knowledge retention.
18	Patimah et al. (2019)	2019	Original research article	To determine community knowledge and attitudes on first aid for drowning victims	Primary data	Pre-test, post-test design	Fifty-eight residents of a coastal area of Hamadi Subdistrict, Jayapura City, Papua Province		v	v			NA	NA	NA	NA	NA	Health education on first aid on drowning victims	Proportion of participants with good level of knowledge: post-intervention > pre-intervention. No measures of association were reported.
19	Pranoto et al. (2023)	2022	Original research article	To increase knowledge on assisting water accident victims	Primary data	Community service project	Sixty members of local tourism awareness group in Tua Pejat Village, Mentawai Islands, West Sumatra Province		v	v			NA	NA	NA	NA	NA	Health education on performing water rescue and CPR on accidental drowning victims	No evaluation on participants' level of knowledge and skills on water rescue and CPR. No measures of association were reported.
20	Prasetyo (2017)	2017	Grey literature (thesis)	To investigate coastal area residents' level of knowledge on first aid for drowning victims	Primary data	Observational descriptive	Forty-seven residents living in a coastal area of Sulawesi Tenggara province		v	v			NA	NA	NA	'Sufficient' knowledge on first aid for drowning victims: 4.26% (n=2/47), 'insufficient' level of knowledge: 87.23% (n=41/47). No measures of association were reported.	NA	NA	NA
21	Rosmi et al. (2020)	2017	Original research article	To increase the knowledge on water rescue as an emergency response during flooding	Primary data	Community service project	Thirty-six members of youth organisations (Karang Taruna) in Benjeng Subdistrict, Gresik Regency, East Java Province		v			v	NA	NA	NA	NA	NA	Health education on the dangers of flooding and performing water rescue on flooding-related drowning victims	Water rescue-trained local community group was formed. No evaluation on participants' level of knowledge and skills on flooding-related water rescue. No measures of association were reported.

No	Authors	Year of study	Type of publication	Study aims	Data source	Study design	Sample, setting	Scale of study		Types of unintentional drowning reported			Findings							
								National	Subnational	Accidental	Water-transport related	Disaster-related	Epidemiology	Risk factors				Prevention	Relevant outcomes	
														Sex	Age group	Location	Others			Intervention type
22	Sadewa et al. (2023)	2022	Original research article	To determine the feasibility of the utilisation of a modified water rescue tool in water rescue efforts for drowning victims	Primary data	Descriptive quantitative and qualitative approach	Thirty-five participants consisting of lifeguards, pool attendants, swimming trainers, students, and swimming pool visitors at the Faculty of Sports and Health Sciences, Yogyakarta State University, Yogyakarta Province		v	v				NA	NA	NA	NA	NA	The development of modified water rescue tools (jerry cans lined with Styrofoam and equipped with ropes) for water rescue efforts, as an effective, cheap, easy to obtain substitute to water rescue equipment	On buoyancy, target accuracy, effectiveness and durability, the modified water rescue tool was deemed "very decent" by participants to be utilised on water rescue efforts. The definition of the term 'very decent' was not described. No evaluation on the implementation and outcome of the intervention.
23	Saputra (2021)	2003-2019	Original research article	To analyse completed ship accident investigations	Secondary data	Descriptive observational	One hundred and twenty ship accidents investigations completed by the Indonesian National Transportation Safety Committee from 2003 until 2019.	v			v			Over the period of 2003 to 2019, completed investigations of a total of 120 ship accidents by the Indonesian National Transportation Safety Committee reported 513 deaths, 726 injured victims, and 701 missing victims. No information on the cause of deaths.	NA	NA	NA	Types of ship: 89% (n=107/120) occurred in motorboats (cargo ships, bulk carriers, container ships, and passenger ships (ferries and Ro-Ro ferries). Fire: 37% (n=44/120); submersion/sinking: 28% (n=34/120), collisions: 18% (n=22/120), other causes: 17% (n=20/120). Contributing factors to shipping accidents: 1) poor maintenance of ships; 2) unavailability/ poor maintenance of safety equipment on board; 3) poor knowledge, awareness, and compliance of safety regulations; and 4) underqualified seafarers and poor ship crews' capacity in ensuring safe shipping/maritime practice. No measures of association were reported.	NA	NA
24	Sillehu and Kartika (2018)	2015	Original research article	To investigate the role of the Indonesian National Search and Rescue Agency in rescuing drowning victims in sea	Primary data	Analytical observational	Thirty-five regency-level National Search and Rescue Agency staff members for Ambon City, Maluku Province		v	v	v			NA	NA	NA	NA	No intervention	Significant correlation between the performance by the National Search and Rescue Agency and the rescue of drowning victims (p<0.05). A possibility of selection bias and measurement bias was identified	
25	Sugiantoro and Wahyudi (2021)	2020	Original research article	To examine the effect of health information on knowledge and attitude on first aid for drowning	Primary data	Pre-test, post-test design	Fifteen fishermen from Lemasing Regency of Lampung Province		v	v	v			NA	NA	NA	NA	Health information on first aid for drowning victims	Significant increase of the mean level of knowledge and attitude after the intervention applied (p<0.05). No information on long-term knowledge retention.	
26	Sukarna et al. (2021)	2020	Original research article	To determine the effect of health education on knowledge and skills on evacuating drowning victims	Primary data	Pre-test, post-test design	Thirty street stallholders on a coastal area of Sijuk, Belitung Regency, Bangka Belitung Islands Province		v	v				NA	NA	NA	NA	Health education on performing CPR and evacuation on drowning victims	Significant increase of the mean level of knowledge after the intervention applied (p<0.05). No information on long-term knowledge retention.	

No	Authors	Year of study	Type of publication	Study aims	Data source	Study design	Sample, setting	Scale of study		Types of unintentional drowning reported			Findings							
								National	Subnational	Accidental	Water-transport related	Disaster-related	Epidemiology	Risk factors				Prevention	Relevant outcomes	
														Sex	Age group	Location	Others			Intervention type
27	Suryono and Nugroho (2020)	Not stated	Original research article	To determine the effect of health education on knowledge and skills on performing first aid on infant drowning victims	Primary data	Pre-test, post-test design	Fifteen members of a local freshwater fishing community of Darungan Village, Kediri Regency, East Java Province		✓	✓				NA	NA	NA	NA	Health education on first aid for infant drowning victims	Proportion of participants with sufficient level of knowledge: post-intervention > pre-intervention. No measures of association were reported.	
28	Suwardjo et al. (2010)	2006-2008	Original research article	To assess fatality accident rate (FAR) of fishing vessel accidents around Tegalsari, Pekalongan and Cilacap Fishing Ports of Central Java Province	Primary and secondary data	Analytical observational	Data on 61 fishing vessel accidents collected from the harbourmasters of Tegalsari, Pekalongan and Cilacap Fishing Ports; the Indonesian Fishermen Association; the Indonesian Water Police Unit; and the Indonesian Department of Maritime Affairs and Fisheries between 2006 and 2008		✓		✓							NA	Contributing factors to fishing vessel accidents: 1) underqualified shipping crews; 2) poor knowledge, awareness, and compliance of safety regulations; 3) unfulfillment of safety requirements. Approximately 84.3% of skippers and ship crews did not go beyond primary level education, hence did not qualify to undertake Basic Safety Training for shipping crews. Seventy per cent (n=45/64) of all fishing vessels registered did not fulfil safety requirements due to insufficient number of life jackets and rescue buoys, unequipped with fire extinguishers and life rafts, and lacking in other safety equipment. The highest numbers of fishing vessel accidents were recorded during rainy seasons (November to February). No measures of association were reported.	NA
29	Usaputro and Yulianti (2013)	2010-2012	Original research article	To determine the characteristics and risk factors of drowning deaths	Medico-legal/autopsy records	Observational descriptive	Drowning deaths recorded by the Forensic Department of Sanglah Provincial Hospital of Bali between 2010 and 2012		✓	✓								NA	A total of 97 drowning deaths was recorded by Sanglah Provincial Hospital of Bali between 2010-2012, with 71 cases included as samples in this study. Male victims: 84.5% (n=60/71), females: 15.5% (n=11/71). No measures of association were reported. Aged 21-30 years: 22.5% (n=16/71), >50 years: 19.7% (n=14/71), 31-40 years: 18.3% (n=13/71), <20 years: 16.9% (n=12/71). No measures of association were reported. Open seawater: 53.5% (n=38/71), freshwater bodies: 25.4% (n=18/71), unknown location: 21.1% (n=15/71). No measures of association were reported. Foreign nationals: 49.3% (n=35/71), Indonesians: 40.8% (n=29/71). Blood alcohol was identified in 20% (n=4/20) (no information on the blood alcohol content), fatal traumas in 20% (n=4/20), and history of comorbid condition(s) in 15% (n=3/20) (no information on comorbid conditions) of autopsied drowning victims. No measures of association were reported.	NA
30	Welembuntu et al. (2021)	2021	Original research article	To investigate the residents' knowledge on first aid for maritime accidents' victims	Primary data	Observational descriptive	Forty residents of coastal Kulur II Village, Tabukan Tengah Subdistrict, Sangihe Islands Regency, North Sulawesi Province		✓		✓				NA	NA	NA	NA	'Sufficient' level of knowledge on first aid for maritime accident victims: 55% (n=22/40), 'good' level of knowledge: 42.5% (n=17/40). No measures of association were reported.	NA

No	Authors	Year of study	Type of publication	Study aims	Data source	Study design	Sample, setting	Scale of study		Types of unintentional drowning reported			Findings										
								National	Subnational	Accidental	Water-transport related	Disaster-related	Epidemiology	Risk factors				Prevention					
														Sex	Age group	Location	Others	Intervention type	Relevant outcomes				
31	Widyastuti and Rustini (2017)	2017	Grey literature (conference proceeding)	To investigate the coastal area community knowledge on first aid for drowning victims	Primary data	Observational descriptive	Thirty-five residents of a coastal area of Bulak Subdistrict, Surabaya City, East Java Province		v	v				NA	NA	NA	NA	NA	NA	'Sufficient' level of knowledge on first aid for drowning victims: 57.14% (n=20/35), 'good' level of knowledge: 31.4% (n=11/35), 'poor' level of knowledge: 11.4% (n=4/35). No measures of association were reported	NA	NA	
32	Wulur (2013)	2007-2011	Original research article	To examine autopsy findings in drowning cases at Prof. Dr. R. D. Kandou Provincial Hospital of North Sulawesi between January 2007 and December 2011	Primary data	Observational descriptive	Drowning deaths recorded by the Forensic Department of Prof. Dr. R. D. Kandou Provincial Hospital of North Sulawesi, between January 2007 and December 2011		v	v				A total of 15 drowning deaths was recorded by Prof. Dr. R. D. Kandou Provincial Hospital of North Sulawesi between 2007-2011. All cases identified were included as samples for this study.	Male victims: 80% (n=12/15), females: 20% (n=3/15). No measures of association were reported.	Adults aged ≥ 20 years: 86.7% (n=13/15), children aged 5-14 years: 6.67% (n=1/15). No measures of association were reported.	NA	NA	NA	NA	NA	NA	NA

Chapter 4 Population-Based Retrospective Cohort Study



4.1. Overview

Title: The burden of unintentional drowning in Indonesia: Insights from the Global Burden of Disease Study 2019

This chapter is presented as a publication manuscript. The formatting of this chapter adheres to journal requirements; however, table and figure numbering, as well as referencing, have been aligned with the thesis format. The references for this chapter are included within the overall thesis' reference list.

The chapter has been published in the *Injury Prevention* journal (see Appendix 2) under a CC BY 4.0 license. Copyrights © 2024 by the authors. The citation for the publication is: Cenderadewi M, Devine SG, Peden AE, Franklin RC. The burden of unintentional drowning in Indonesia: Insights from the Global Burden of Disease Study 2019. *Injury Prevention*. 2024;doi:10.1136/ip-2024-045274.²⁵⁹

This chapter presents a population-based retrospective cohort study analysing unintentional drowning data for Indonesia from the GBD 2019 Study, reporting incidence and mortality rates, years of life lost (YLLs), risk factors, and burden via years lived with disability (YLDs) and disability adjusted life years (DALYs), between 2005 and 2019. The findings underscore the significance of addressing drowning as a cause of premature mortality, particularly among young children, guiding the subsequent qualitative chapters.

The authors' contributions are outlined as follows: i) M. Cenderadewi: Conceptualisation, data curation, formal analysis, investigation, methodology, project administration, resources, validation, visualisation, writing – original draft, writing – review & editing; ii) S. G. Devine: Conceptualisation, formal analysis, methodology, supervision, validation, visualisation, writing – review & editing; iii) A. Peden: Formal analysis, visualisation, writing – review & editing; and iv) R. C. Franklin: Conceptualisation, formal analysis, methodology, project administration, resources, funding acquisition, supervision, validation, visualisation, writing – review & editing.

The paper is presented below as the final published version.

4.2. Abstract

Introduction A high burden of unintentional fatal drowning has been reported in low and middle-income countries. However, little is known about unintentional drowning in Indonesia.

Methods This population-based retrospective cohort study analysed unintentional drowning data for Indonesia sourced from The Global Burden of Disease study 2019. Estimates of trends, mortality rates, incidence rates, YLDs, and DALYs were generated.

Results A decline in unintentional drowning mortality rates was observed, with an average annual mortality rate of 2.58/100,000. Males were 1.81 (95% CI: 1.79 - 1.84) times more likely than females to unintentionally drown. Average annual mortality rates for drowning were highest among the under 5 age-group (9.67 per 100,000), individuals aged 70 and over (5.37 per 100,000), and children aged 5-14 years (3.04 per 100,000). Children under five years of age, individuals aged 70 years and older, and children aged 5-14 years were 3.67 (95% CI: 3.63 - 3.72), 2.5 (95% CI: 2.45 - 2.56), and 1.97 (95% CI: 1.94 – 2.00) times more likely to fatally drown, respectively, compared to those aged 15 to 49 years old. Distributions of drowning deaths vary depending on region with mortality rates higher in Papua, Kalimantan, Sulawesi, Maluku, Sumatra, and Nusa Tenggara regions.

Discussion While a decline in drowning mortality rates in Indonesia was identified between 2005 and 2019, mortality rates for unintentional drowning remained high among children under 5 years, the elderly population, and those residing in Papua, Kalimantan, Sulawesi, Maluku, Sumatra, and Nusa Tenggara, warranting further focused attention.

Conclusion A downward trend in the rate of unintentional drowning deaths in Indonesia is observed from 2005 onwards, with risk variation based on age, gender, and region. The findings highlight the importance of addressing drowning as a cause of premature mortality and health system

burden in Indonesia, including through enhancing drowning data collection systems and identifying drowning risk factors.

4.3. Key Messages

What is already known on this topic?

- Most drowning deaths worldwide occurred in low and middle-income countries (91%), particularly in Southeast Asia (35%).
- No publication on the national level of drowning rates in Indonesia has been identified.

What this study adds?

- Between 2005 and 2019, a decline in unintentional drowning mortality rates was observed, with an average annual mortality rate of 2.58/100,000.
- The unintentional drowning risk varies based on age, sex, and region in Indonesia. Being male, aged under 5, aged 70 years and above, and residing in provinces in Papua, Kalimantan, Sulawesi, Maluku, Sumatra, and Nusa Tenggara, were recognised as risk factors.

How might this study affect research, practice, or policy?

- The findings highlight the importance of continuing to enhance drowning data collection systems, as well as identifying drowning risk factors and developing contextualised drowning preventive strategies in Indonesia.

4.4. Introduction

Drowning represents a major challenge for global public health.⁷ In 2017 an estimated 295,210 deaths occurred globally due to unintentional drowning, with a global mortality rate of 4.0/100,000.⁶ Most drowning deaths worldwide occurred in low and middle-income countries (LMICs) (91%), particularly in Southeast Asia (35%).⁷ However, less is known about unintentional drowning deaths in Indonesia, the world's largest archipelagic state and the fourth most populated nation.¹¹

Located in the Southeast Asia region, Indonesia consists of 16,056 islands, with a population of over 270,200,000 and a density of 141 people per square kilometre.¹¹ Indonesia's vast area comprises 1,919,440 square kilometres of land area, including 93,000 square kilometres of inland seas, and 6,159,032 square kilometres of water area, exposing Indonesians to a high risk of drowning and submersion.^{131,132} Despite this, according to the 2021 Regional Status Report on Drowning in South-East Asia by the World Health Organization (WHO), Indonesia does not have a national coordination mechanism for drowning prevention and water safety, and no coordinated national death registry from which national and subnational drowning data can be collected.¹⁰

To further understand the magnitude of drowning as a public health problem in Indonesia, this research aims to examine mortality rates, incidence rates, years of life lost (YLLs), and risk factors of fatal unintentional drowning in Indonesia, and investigate overall drowning burden via years lived with disability (YLDs) and disability adjusted life years (DALYs), between 2005 and 2019 using the 2019 Global Burden of Disease (GBD) Study estimates.

4.5. Methods

This study was undertaken as a population-based retrospective cohort study. This study is part of a larger explanatory sequential mixed-methods study investigating unintentional drowning in Indonesia, which comprised three phases: 1) a scoping review⁶¹; 2) a retrospective cohort study reported here; and 3) a qualitative study aimed to expand the quantitative findings. The scoping review⁶¹ revealed the limited availability of drowning data in Indonesia, informing our decision to utilise the GBD Study 2019 data as the primary source for this investigation.

An analysis of quantitative, national data sourced from the GBD Study 2019⁶⁰ by The Institute for Health Metrics and Evaluation (IHME) database was performed to generate estimates of mortality rates, incidence rates, YLDs, YLL's and DALYs for unintentional drowning at a national and sub-national level in Indonesia, including all its 34 provinces. The data collected, spanned the period of 2005 to 2019 and in coordination with the Indonesian Ministry of Health, was collected using verbal autopsy

survey instruments and modelling.^{43,60} This current study focuses on unintentional drowning, as defined by the International Classification of Disease (ICD) 9 and ICD-10 codes. The GBD Study 2019 used the ICD-9 code, E910, and ICD-10 codes, W65-W74 for unintentional drowning.^{6,69,248} These codes do not include unintentional drowning due to water transport and disaster, nor drowning of intentional or undetermined intent and are considered an underestimation of drowning⁶³.

In this study, “incidence” pertains specifically to the frequency of non-fatal drowning incidents within the Indonesian population throughout the study duration. This definition excludes drowning-related fatalities, which were treated distinctly as mortality events. Information on DALYs, YLDs, and YLLs due to drowning were also inferred to assess the overall burden of drowning in Indonesia.²⁴⁹ One DALY represents the loss of an equivalence of one year of life with full health. DALYs for drowning are the sum of YLLs due to premature mortality caused by drowning and YLDs due to drowning and or submersion.²⁴⁹

Data were downloaded using the IHME GBD results tool between March 2021 until March 2022 for collecting drowning data for the period of 2005 to 2019 for Indonesia and the sub-national provinces.⁶⁰ The year of 2005 is chosen as the starting year of investigation, as a consensus on the establishment for a definition of drowning was issued by the WHO in 2005, which included both fatal and non-fatal drowning cases.⁴³

This study complies with the Guidelines for Accurate and Transparent Health Estimates Reporting recommendations.²⁵⁰

4.5.1. Data Abstraction

The following data was extracted on unintentional drowning deaths and non-fatal submersion in Indonesia: mortality rates, incidence rates, YLDs, YLLs, and DALYs²⁴⁹, based on year, gender, age group (under 5, 5-14 years, 15-49 years, 50-69 years and 70+ years), and province of Indonesia (Figure 4.1).



Figure 4.1. Thirty-Four Indonesian Provinces Investigated in the Study

["Indonesia, administrative divisions - mg - monochrome.svg"](#) by [Yug](#), adapted from an [original map by Yug](#), is shared under a [CC BY-SA 3.0](#) license via [Wikimedia Commons](#).

4.5.2. Analysis

Data were extracted from the GBD Study 2019 and entered into Microsoft Excel and IBM SPSS Statistics V.27. Trend analysis between the period of 2005 and 2019 was inferred with linear regression. Relative risk (RR) (with a 95% confidence interval [CI]) was calculated to measure the association between exposures of interest (sex, age group, jurisdiction/province) and unintentional drowning deaths. Where RR was calculated, the predictor group with the lowest annual mortality rate was used as the reference point (except for provinces, where the rate for Jakarta as the capital province of Indonesia was used as the reference point).

4.5.3. Ethics Approval

Ethics approval was granted by the University of Mataram of Indonesia (Ethics Approval number 128/UN18.F8/ETIK/2023).

4.5.4. Funding

GBD is supported by the Bill and Melinda Gates Foundation. The funders of the study had no role in the study design, data collection, data analysis, data interpretation, writing of the report, or the decision to submit the article for publication. All authors had full access to the data in the study and had final responsibility for the decision to submit for publication.

4.6. Results

In total, there were 94,035 (95% UI: 77,135.3-108,737.1) unintentional drowning deaths in Indonesia between 2005 and 2019, of which 69.0% were males.

4.6.1. Incidence and Mortality Rates

The average annual mortality rate in Indonesia between 2005 and 2019 was 2.58/100,000. Notably, there was a consistent decrease observed in the drowning mortality rate over this period, from 3.35/100,000 in 2005 to 1.93/100,000 in 2019 (Table 4.1). This trend is supported by a high R-squared value of 0.99 obtained from the regression model. The regression equation ($y = -0.10x + 209.53$) reinforces this pattern, with a negative coefficient indicating a declining trend. These results collectively suggest a significant decrease in drowning mortality rates throughout the years under analysis. While there is evidence suggesting a negative trend in non-fatal drowning incidence rates over the study period, the linear regression model fails to sufficiently explain the overall relationship between the variables ($y = -0.11x + 243.86$, $R^2 = 0.06$).

Table 4.1. Drowning Incidence, Mortality, YLLs, YLDs, and DALYs in Indonesia 2005-2019

Year	Number of non-fatal drowning cases	95% UI	Non-fatal drowning incidence rates (per 100,000)	95% UI	Number of drowning deaths	95% UI	Mortality rates (per 100,000)	95% UI	YLDs	95% UI	Rates of YLDs (per 100,000)	95% UI	YLLs	95% UI	Rates of YLLs (per 100,000)	95% UI	DALYs	95% UI	Rates of DALYs (per 100,000)	95% UI
2005	61352.42	45,075.22-84,026.33	26.98	19.82-36.95	7,616	6,202.70-8,749.59	3.35	2.73-3.85	2,513.69	1,738.77-3,462.23	1.11	0.76-1.52	542,077.91	412,084.15-637,426.50	238.35	181.20-280.28	544,591.60	414,998.38-639,848.26	239.46	182.48-281.34
2006	72759.46	52,774.19-101,862.47	31.61	22.93-44.26	7,379	5,965.72-8,428.78	3.21	2.59-3.66	2,530.15	1,733.73-3,489.02	1.10	0.75-1.52	521,409.01	393,000.54-610,907.60	226.53	170.74-265.42	523,939.16	395,322.40-613,833.36	227.63	171.75-266.69
2007	60359.17	43,904.17-83,543.14	25.92	18.85-35.87	7,087	5,857.66-8,333.34	3.04	2.52-3.53	2,536.56	1,749.95-3,504.65	1.09	0.75-1.50	498,411.02	385,079.04-592,487.36	214.02	165.36-254.42	500,947.59	388,154.70-594,943.98	215.11	166.68-255.47
2008	60170.82	43,364.20-84,069.45	25.55	18.41-35.69	7,051	5,832.69-8,129.72	2.99	2.48-3.45	2,537.32	1,743.10-3,486.62	1.08	0.74-1.48	495,280.81	381,643.60-584,417.20	210.27	162.02-248.11	497,818.13	384,129.77-586,737.39	211.34	163.08-249.09
2009	62136.06	45,240.77-86,850.32	26.09	19.00-36.47	6,946	5,579.32-8,011.40	2.92	2.34-3.36	2,536.73	1,747.54-3,514.79	1.07	0.73-1.48	486,051.92	363,375.60-574,788.41	204.09	152.58-241.34	488,588.65	365,705.73-577,232.66	205.15	153.55-242.37
2010	63051.52	45,705.06-88,193.95	26.19	18.99-36.64	6,717	5,490.60-7,778.91	2.79	2.28-3.23	2,536.61	1,754.11-3,498.70	1.05	0.73-1.45	466,659.98	352,554.59-551,696.60	193.87	146.47-229.20	469,196.59	354,600.35-554,989.94	194.92	147.32-230.57
2011	61247.35	44,072.92-86,333.37	25.19	18.12-35.50	6,520	5,257.99-7,435.72	2.68	2.16-3.06	2,525.79	1,737.92-3,467.77	1.04	0.71-1.43	450,282.95	330,262.55-525,410.36	185.16	135.81-216.06	452,808.74	333,408.30-527,808.40	186.2	137.10-217.04
2012	60870.65	43,637.47-85,781.12	24.79	17.77-34.93	6,301	5,139.79-7,239.70	2.57	2.09-2.95	2,495.40	1,722.69-3,448.42	1.02	0.70-1.40	432,036.69	329,442.74-508,156.66	175.93	134.16-206.93	434,532.08	331,671.73-510,854.33	176.95	153.06-208.03
2013	60870.50	43,636.90-85,568.21	24.53	17.61-34.52	6,102	4,984.85-7,046.51	2.46	2.01-2.84	2,460.63	1,692.25-3,390.81	0.99	0.68-1.37	415,522.00	312,695.14-490,432.54	167.64	126.16-197.87	417,982.62	315,094.29-491,253.52	168.64	127.13-198.60
2014	60759.66	43,583.90-85,404.61	24.30	17.43-34.16	5,878	4,845.57-6,807.30	2.35	1.94-2.72	2,437.33	1,687.56-3,363.28	0.97	0.67-1.35	396,972.31	302,305.79-471,771.23	158.76	120.90-188.67	399,409.64	304,534.71-474,405.89	159.73	121.79-189.73
2015	60851.40	43,576.42-85,456.30	24.13	17.28-33.89	5,630	4,621.39-6,562.34	2.23	1.83-2.60	2,440.46	1,673.68-3,373.42	0.97	0.66-1.34	377,641.95	293,571.22-450,819.91	149.78	116.44-178.80	380,082.41	295,685.12-453,071.62	150.75	117.27-179.70
2016	63769.57	45,682.88-89,662.94	25.10	17.98-35.28	5,393	4,492.61-6,231.97	2.12	1.77-2.45	2,602.20	1,799.32-3,593.91	1.02	0.72-1.41	356,334.33	279,104.49-423,869.44	140.23	109.83-166.80	358,936.53	281,762.31-426,339.69	141.25	110.88-167.68
2017	65971.37	47,182.44-93,070.90	25.77	18.43-36.36	5,251	4,365.57-6,158.09	2.05	1.71-2.41	2,795.01	1,928.99-3,847.61	1.09	0.75-1.50	343,360.19	263,368.63-410,262.08	134.13	102.88-160.27	346,155.20	266,125.58-412,660.11	135.22	103.96-161.20
2018	76593.68	55,309.66-107,131.58	29.72	21.46-41.56	5,153	4,396.00-6,089.18	2	1.67-2.36	2,866.57	1,975.54-3,940.32	1.1	0.77-1.53	334,335.24	264,447.55-401,656.57	129.71	102.59-155.83	337,201.81	266,977.83-404,131.29	130.82	103.58-156.79
2019	67737.79	48,714.70-95,161.42	26.11	18.77-36.68	5,011	4,192.79-5,845.54	1.93	1.62-2.25	2,925.14	2,026.13-4,049.23	1.13	1.44-2.74	321,737.24	256,585.39-381,494.75	124	98.8-147.03	324,662.37	258,835.12-384,151.12	125.13	99.76-148.05

Note: YLDs: Years of living with disability; YLLs: Years of life lost; DALYs: Disability-adjusted life years

4.6.1.1. Mortality Rates by Age Group and Gender

Between 2005 and 2019, drowning mortality rates for both males and females of all ages decreased in Indonesia (Figure 4.2 and Supplementary Table 4.10.2). The highest drowning mortality rate across the 15-year period was identified among under-5 males, with an average annual mortality rate of 9.67/100,000 between 2005 and 2019, contributing the largest proportion of deaths by unintentional drowning in Indonesia (34.74%) (Figure 4.2, Supplementary Table 4.10.1). Between 2005 and 2019, unintentional drowning mortality rates were higher for males than females across all age groups (Figure 4.2, Table 4.2, Supplementary Table 4.10.2).

Drowning mortality rates by age group and gender 2005-2019 in Indonesia

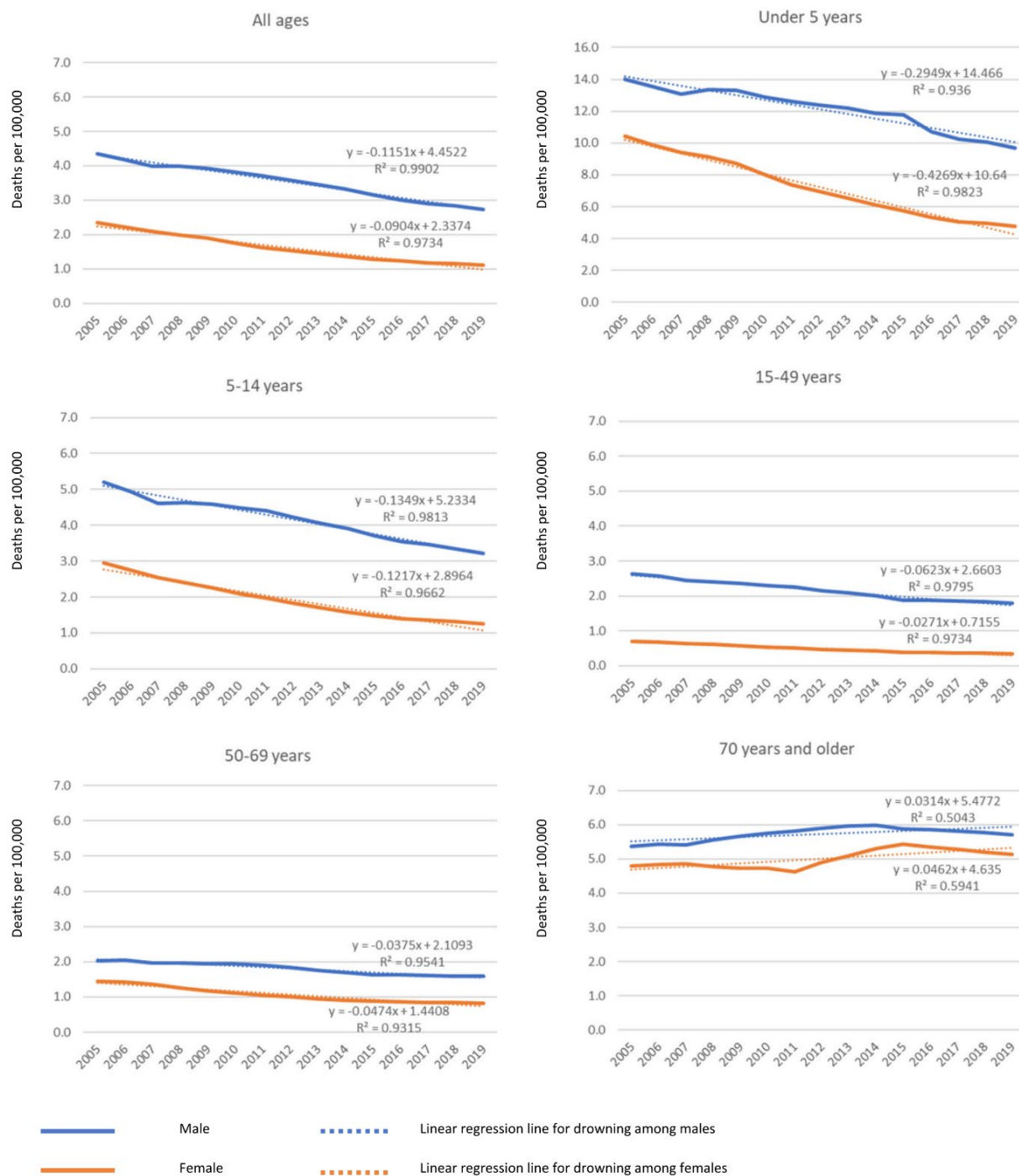


Figure 4.2. Unintentional Drowning Mortality Rates by Age Group and Gender in Indonesia 2005-2019

4.6.1.2. Mortality rates by province

Distributions of drowning deaths by sex vary depending on region. Of 34 provinces in Indonesia, the highest drowning death rates for all age groups in the year 2019 were observed in male populations in the province of North Kalimantan (10.95/100,000), Central Kalimantan (10.06/100,000), Papua (5.51/100,000 populations), and Gorontalo (5.21/100,000, which are located in the central and eastern part of Indonesia, in comparison with mortality rates from unintentional drowning in other provinces in the western part of Indonesia (Figure 4.3, Supplementary Table 4.10.1).

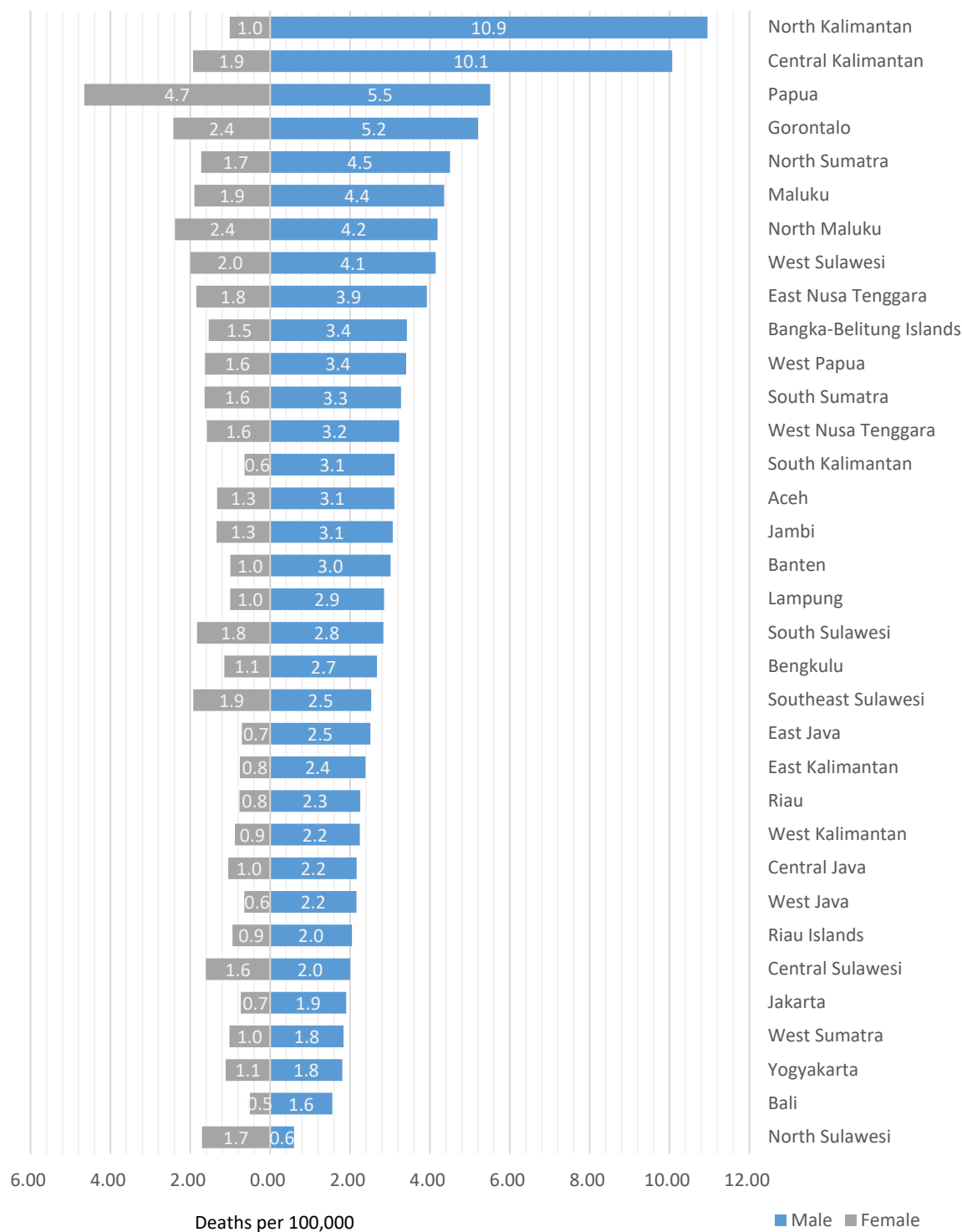


Figure 4.3. The 2019 Mortality Rates of Unintentional Drowning of All Ages by Sex and Province in Indonesia

High under 5 drowning mortality rates were observed in the provinces located in the eastern and central parts of Indonesia in 2019, including North Kalimantan (26.50/100,000), Papua (24.46/100,000), and West Sulawesi (18.38/100,000) (Figure 4.4, Supplementary Table 4.10.1). For female populations, the highest drowning death rates for the under 5 age group in the year 2019 were observed in the province of Papua (32.58/100,000), which was higher than in other provinces (Figure 4.4, Supplementary Table 4.10.1). Between 2005 and 2019, several provinces experienced the highest reductions in child drowning cases, including Maluku ($y = -1.44x + 30.51$, $R^2 = 0.97$), West Nusa Tenggara ($y = -0.99x + 23.35$, $R^2 = 0.98$), Papua ($y = -0.92x + 42.45$, $R^2 = 0.92$), West Sulawesi ($y = -0.97x + 27.19$, $R^2 = 0.98$), North Maluku ($y = -0.86x + 25.07$, $R^2 = 0.98$), South Sulawesi ($y = -0.85x + 18.42$, $R^2 = 0.98$), East Nusa Tenggara ($y = -0.83x + 21.37$, $R^2 = 0.96$), South Sumatra ($y = -0.81x + 22.90$, $R^2 = 0.98$), North Kalimantan ($y = -0.72x + 27.42$, $R^2 = 0.94$), and Riau ($y = -0.61x + 15.34$, $R^2 = 0.96$).

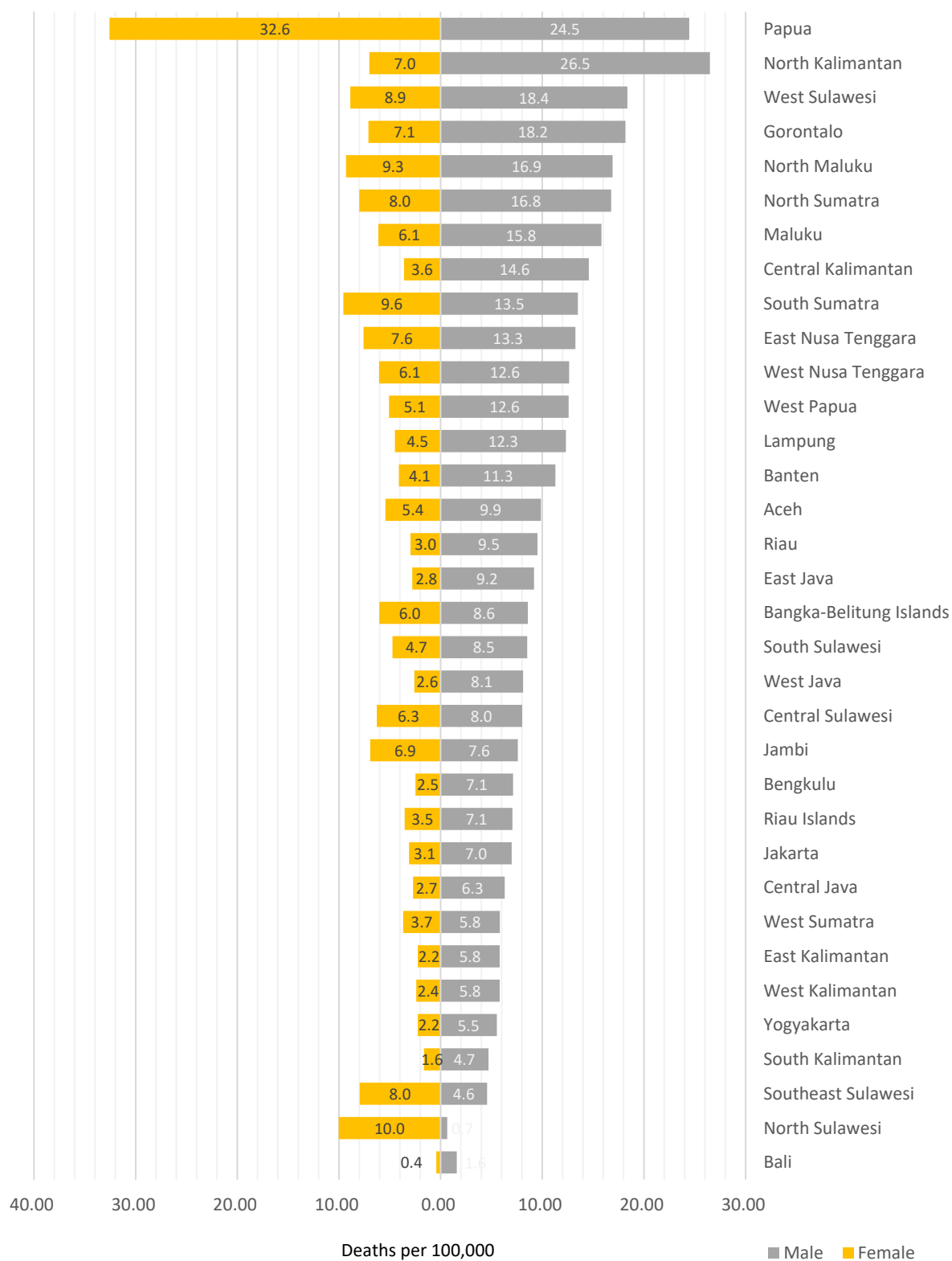


Figure 4.4. The 2019 Under-Five Unintentional Drowning Mortality Rates by Sex and Province in Indonesia

4.6.2. YLDs and DALYs

Unintentional drowning DALYs showed a decrease between 2005 and 2019 ($y = -8.26x + 243.95$, $R^2 = 0.99$), with rate of DALYs of 239.46 (95% UI: 182.48-281.34) in 2005 and 125.13 (95% UI: 99.76-148.05) in 2019 (Table 4.1).

4.6.3. Risk Factors

In Indonesia, males were 1.81 times (95% CI: 1.79-1.84) more likely than females to unintentionally drown (Table 4.2). Indonesian children aged less than 5 years old were 3.67 times (95% CI: 3.63 - 3.72) more likely to become victims of fatal drowning in comparison to individuals aged between 15 to 49 years (Table 4.2). Elderly populations were also an important contributor, with individuals aged 70 years and above 2.5 times (95% CI: 2.45 - 2.56) more likely to fatally drown in comparison to individuals aged 15-49 years (Table 4.2).

Table 4.2. Risk Factors of Fatal Unintentional Drowning in Indonesia

	Total deaths by unintentional drowning (N= 94035)	Average annual mortality rate per 100,000 (Between 2005 and 2019)	Relative Risk (RR)	95% Confidence Interval (CI)
Sex				
Male	64898	5.227	1.81	1.79 - 1.84
Female*	29137	3.142	1*	Ref
Age Group				
Under 5	32663	9.665	3.67	3.63 - 3.72
5-14 years	21222	3.038	1.97	1.94 - 2.00
15-49 years*	26892	1.331	1*	Ref
50-69 years	7149	1.436	0.87	0.85 - 0.89
70+ years	6109	5.367	2.50	2.45 - 2.56
Provinces				
Aceh	2082	2.998	1.63	1.54 - 1.73
Bali	868	1.464	0.84	0.78 - 0.91
Bangka-Belitung Islands	568	2.972	1.60	1.47 - 1.76
Banten	4576	2.790	1.49	1.42 - 1.56
Bengkulu	668	2.490	1.41	1.30 - 1.54
Central Java	10141	2.051	1.23	1.18 - 1.28
Central Kalimantan	2382	6.783	3.69	3.49 - 3.90
Central Sulawesi	874	2.133	1.20	1.12 - 1.30
East Java	11619	2.062	1.23	1.18 - 1.29
East Kalimantan	993	2.076	1.12	1.04 - 1.21
East Nusa Tenggara	3115	4.286	2.40	2.28 - 2.53
Gorontalo	804	4.899	2.81	2.60 - 3.04
Jakarta*	2510	1.755	1*	Ref
Jambi	1468	3.066	1.70	1.60 - 1.82
Lampung	2778	2.365	0.73	0.69 - 0.78
Maluku	1198	5.004	2.79	2.61 - 3.00
North Kalimantan	623	7.226	3.53	3.23 - 3.85
North Maluku	769	4.808	2.57	2.38 - 2.79
North Sulawesi	470	1.393	0.79	0.71 - 0.87
North Sumatra	8137	4.062	2.35	2.25 - 2.46
Papua	3203	6.918	3.98	3.781 - 4.20
Riau	2085	2.370	1.26	1.19 - 1.33
Riau Islands	529	2.050	1.02	0.93 - 1.12
South Kalimantan	1893	3.286	1.88	1.77 - 1.99
South Sulawesi	4511	3.666	2.14	2.04 - 2.25
South Sumatra	4249	3.701	2.11	2.01 - 2.22
Southeast Sulawesi	988	2.835	1.54	1.43 - 1.65
West Java	12442	1.857	1.06	1.02 - 1.11
West Kalimantan	1557	2.271	1.29	1.21 - 1.38
West Nusa Tenggara	2443	3.520	2.03	1.92 - 2.14
West Papua	397	3.350	1.74	1.57 - 1.93

	Total deaths by unintentional drowning (N= 94035)	Average annual mortality rate per 100,000 (Between 2005 and 2019)	Relative Risk (RR)	95% Confidence Interval (CI)
West Sulawesi	837	4.605	2.55	2.36 - 2.76
West Sumatra	1435	1.940	1.11	1.04 - 1.18
Yogyakarta	824	1.573	0.33	0.30 - 0.36

Note:

* Where RR was calculated, the group with the lowest annual mortality rate (except for jurisdictions, where the rate for Jakarta was used) for unintentional drowning deaths was used as the reference point

The top three highest average annual mortality rates for unintentional drowning were registered in the province of North Kalimantan (7.23/100,000), Papua (6.92/100,000) and Central Kalimantan (6.78/100,000), and individuals in Papua had the highest likelihood of dying from unintentional drowning (RR=3.98), compared to the reference group of metropolitan capital of Indonesia, Jakarta (Table 4.2).

4.7. Discussion

Unintentional drowning is a little studied public health issue in Indonesia. Overall, this study identifies a decline in drowning mortality rates in Indonesia between 2005 and 2019 ($R^2 = 0.99$, $y = -0.10x + 209.53$). During the 15-year study period, mortality rates for unintentional drowning were higher in males than females, and also higher among children aged under 5 years, elderly populations aged 70 years and above, and populations residing in the Papua, Kalimantan, Sulawesi, Maluku, Sumatra, and Nusa Tenggara regions. These findings underscore the need for further focused attention and interventions in these demographic groups and geographical areas.

4.7.1. The Rates and Trends of Unintentional Drowning in Indonesia

Overall, there was a decrease in drowning mortality rates, with an average annual mortality rate between 2005 and 2019 of 2.58/100,000. However, it is acknowledged that the GBD Study 2019 data for Indonesia was mostly sourced from verbal autopsy data, and only reported unintentional drowning, while excluding cases caused by water-transport related and disaster-related drowning incidents, thus potentially underrepresenting the actual magnitude of drowning in Indonesia. A previous study in Australia has reported how different ICD-10 coding combinations affected the capture of drowning deaths in the national register.⁶³ When specific ICD codes of W65-74 for accidental drowning and submersion were used, as in the GBD Study 2019, only 61% of unintentional drowning deaths were captured. However, inclusion of additional drowning-related codes for accidental drowning related to watercrafts, floodings, and undetermined intent increased the capture

rate to 78%, and when the drowning codes used were expanded to include intentional drowning events, with multiple causes of death considered, the capture rate raises to 92%.⁶³

DALYs attributed to unintentional drowning in Indonesia declined between 2005 and 2019 (Table 4.1, Supplementary Table 4.10.1). The observed decrease in incidents of drowning among children under the age of 5 in Indonesia during the study period ($y = -0.36x + 740.01$, $R^2 = 0.98$) likely contributes to the overall reduction in DALYs. In this study, the low YLDs correspond with findings from a previous study which reporting lower YLDs for children under 5 in LMICs, compared to high-income nations. This is attributed to the higher proportion of fatal drowning in LMICs.³⁸³

4.7.2. The Risk of Drowning among Males in Indonesia: Informing Preventive Measures

This study found that in Indonesia, males were 1.81 times (95% CI: 1.79-1.84) more likely than females to unintentionally drown. Among high-income nations, a common observation is the higher likelihood of males experiencing unintentional drowning, which has been linked to risky behaviours. This includes males tending to underestimate the risk of experiencing unintentional drowning and overestimate their knowledge and skill in water-related activities.³⁸⁴ Therefore, further research on the contributing factors and protective factors related to the risk of drowning is crucial. These factors may encompass behavioural and sociocultural aspects of drowning and are important in understanding drowning prevention suitable for the Indonesian context.

4.7.3. Unintentional Drowning as a Leading Cause of Injury Death for Indonesian Children

Indonesian children aged under 5 years were 3.67 times (95% CI: 3.63 - 3.72) more likely to die from unintentional drowning compared to populations aged 15-49 years. Under 5 drowning mortality rates in Indonesia vary across regions. For instance, in Papua, the under 5 mortality rates in 2019 was 32.6/100,000 for females and 25.4/100,000 for males, surpassing those of other provinces in the country. This finding corresponds to the 2014 WHO Global Report on Drowning which showed children aged under 5 years being disproportionately at risk for drowning.⁷ This underscores the urgent need of tailoring drowning prevention strategies in Indonesia to effectively address the heightened risk of drowning among children under the age of five, particularly across rural populations of eastern Indonesia.

There is limited understanding on contributing factors to the observed decline in child drowning rates in Indonesia.⁶¹ However, the advancement of socio-economic determinants of health, particularly the rise in GDP per capita, educational attainments, and healthcare expenditure, has been identified as an instrumental driver to the reduction of drowning prevalence, including in under 5 populations, worldwide.³⁹ This highlights the critical need for further investigation into how socio-

economic advancements and implemented interventions can effectively mitigate the burden of child drowning fatalities across Indonesia.

4.7.4. Fatal Unintentional Drowning among Elderly Indonesians

Individuals aged 70 years and above were 2.5 times more likely to fatally drown compared to individuals aged 15-49 years (Table 2). This finding corresponds to reported higher mortality rates among older populations in other countries, including in Japan, China, Australia, Canada and New Zealand.^{381,385} From 1950 to 2021, the average global life expectancy at birth has risen by 22.7 years³⁸⁶, and this prolonged lifespan may contribute to the concurrent increase in drowning-related fatalities among older age groups. However, efforts to reduce drowning among older populations has lagged behind that of young children.³⁸⁵ The findings of the current study should be a call to action to invest in drowning prevention among older people in Indonesia.

4.7.5. Jurisdiction as a Determinant for Unintentional Drowning in Indonesia

The distribution of drowning deaths across Indonesia exhibits regional disparities, with the highest mortality rates recorded in the provinces of North Kalimantan (7.23/100,000), Papua (6.92/100,000), and Central Kalimantan (6.78/100,000). This discrepancy underscores the crucial need to investigate how socio-economic determinants, infrastructure investments, and social and environmental changes influence drowning fatalities. Particularly notable are provinces in Kalimantan, Papua, Sulawesi, Maluku, and Nusa Tenggara regions, which present some of the nation's lowest GDP per capita, alongside the highest rates of drowning mortality and the highest reductions of child drowning mortalities throughout the 15-year study period.²⁶⁷ Therefore, it is imperative to evaluate the availability and effectiveness of water safety promotion strategies and drowning prevention interventions at both national and provincial levels in Indonesia and their impact on the varying mortality rates across provinces, particularly in provinces which have experienced the highest reductions in Maluku, Nusa Tenggara, Papua, Sulawesi, and Kalimantan.

4.7.6. Recommendations

4.7.6.1.1. Future Research

While this study has provided insight into the issue of unintentional drowning in Indonesia, several key areas for future research are noted: 1) Comprehensive examination of mortality and burden associated with all ICD-codes for drowning, encompassing unintentional drowning, water transport-related drowning, disaster-related drowning, drowning of undetermined intent, and intentional drowning; 2) Investigation of drowning risk factors specific to Indonesia and its individual provinces;

3) Exploration of the interconnectedness between drowning prevention efforts and initiatives aimed at improving social determinants of health; and 4) evaluation of the availability and effectiveness of water safety promotion and drowning prevention interventions.

4.7.6.1.2. Policy Development

The study underscores the urgent need to advance drowning prevention efforts through robust data collection to provide evidence for burden and risk factor identification, as well as agenda setting.⁵⁹ Immediate measures are required to strengthen the capabilities of the Indonesian public health system, establish standardised national reporting structures for health and mortality data, foster collaboration across multiple sectors, and secure political and financial investment to construct an integrated drowning data collection system in Indonesia. Additionally, the study emphasises the urgent need to tailor drowning prevention strategies in Indonesia to effectively address the heightened risk of drowning among children under 5 years of age, particularly in rural populations across eastern Indonesia.

4.7.6.1.3. Practice

The increased risk of drowning among children under 5 years of age emphasises the importance of adopting WHO-recommended prevention strategies aimed at reducing drowning fatalities in younger children, including enhancing supervision, establishing community-based childcare centres, and installing barriers to water bodies to limit children's access.^{59,179} However, effective implementation of these interventions requires tailoring to local contexts to ensure the effectiveness and sustainability of drowning prevention efforts in reducing child drowning fatalities in Indonesia.^{278,387,388}

4.8. Strengths and Limitations

This is the first study to explore the epidemiology of drowning in Indonesia. A key strength of this study is the mutually exclusive and exhaustively collected data available via the GBD Study, for both ICD9-coded and ICD10-coded cases for different time periods.^{6,248}

However, as in many cases of less optimal injury surveillance systems in developing nations, including in Indonesia, the data on drowning as a cause of death has been collected from verbal autopsy survey instruments, which may result in the underestimation of the actual number of unintentional drowning cases in Indonesia.^{69,248} Moreover, the GBD Study 2019 only reported

accidental drowning and submersion events (coded by ICD10 as W65-W74), excluding disaster-related and watercraft-related incidents, which may further limit understanding of the magnitude of drowning in Indonesia, where hydrometeorological disasters and transportation-related incidents frequently occur.

4.9. Conclusions

Between 2005-2019, there was a downward trend in the rate of drowning deaths in Indonesia. Being male, aged under 5 years, aged 70 years and above, and residing in provinces of Kalimantan, Papua, Sulawesi, Maluku, Sumatra, and Nusa Tenggara regions, were recognised as risk factors. The findings highlight the importance of continuing to enhance data collection systems, identifying risk factors, and developing contextualised preventive strategies for drowning in Indonesia.

4.10. Supplementary Tables

Supplementary Table 4.10.1. Mortality Rates of Unintentional Drowning by Sex, Age Group and Province in Indonesia between 2005 and 2019

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
2005	Aceh	16.039	13.927	6.034	3.189	2.832	0.545	1.811	1.032	6.937	6.007	5.136	2.830
	Bali	5.949	2.332	3.235	0.894	2.545	0.396	2.759	0.959	4.832	2.812	3.095	0.826
	Bangka-Belitung Islands	8.691	9.591	4.731	3.148	4.133	1.281	2.292	2.143	7.384	5.766	4.604	2.736
	Banten	18.781	9.981	7.012	2.930	2.652	0.595	1.577	1.019	6.301	6.610	5.275	2.242
	Bengkulu	12.311	6.607	5.120	2.708	2.850	1.055	1.711	1.392	5.224	6.522	4.348	2.183
	Central Java	7.055	6.787	3.043	3.211	2.168	0.797	2.387	2.142	4.214	5.516	2.896	2.158
	Central Kalimantan	19.038	8.008	14.214	3.874	11.198	1.425	12.530	3.323	23.715	14.111	12.989	3.024
	Central Sulawesi	3.103	13.571	0.778	4.707	1.092	1.328	1.109	2.157	1.873	4.833	1.282	3.660
	East Java	13.405	5.348	5.027	1.913	2.396	0.453	1.778	1.044	6.148	3.400	3.823	1.295
	East Kalimantan	10.416	5.794	4.162	1.484	2.739	0.551	1.826	1.282	5.811	6.740	3.849	1.495
	East Nusa Tenggara	23.750	19.566	10.421	6.083	3.649	0.975	2.342	1.588	5.537	4.796	8.035	4.721
	Gorontalo	21.765	13.266	12.564	7.181	3.627	2.194	2.758	3.308	4.317	6.124	7.543	4.647
	Jakarta	10.422	6.464	4.017	1.841	2.009	0.434	1.486	0.834	6.158	6.293	3.190	1.394
	Jambi	9.694	13.395	6.807	1.495	6.590	0.955	5.342	1.359	11.815	7.925	6.935	2.535
	Lampung	12.655	7.123	5.288	2.024	2.292	0.311	1.582	0.878	6.260	6.123	4.039	1.584
	Maluku	36.404	25.145	9.915	6.506	3.238	1.914	2.415	2.316	4.861	5.515	9.326	6.176
	North Kalimantan	40.665	15.850	10.632	2.042	10.568	0.314	17.242	0.513	35.387	2.547	15.150	2.757
North Maluku	25.003	25.703	9.514	7.056	3.203	2.289	2.088	3.148	4.835	6.709	7.440	6.509	
North Sulawesi	0.722	14.386	0.673	2.528	0.737	0.664	1.099	1.346	1.674	7.081	0.794	2.642	

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	North Sumatra	20.465	14.110	8.118	3.803	3.829	0.865	2.659	1.697	7.264	7.111	6.912	3.364
	Papua	30.656	55.952	8.876	4.900	3.322	0.976	2.157	1.583	6.593	7.550	8.336	9.628
	Riau	19.300	9.119	5.219	2.444	1.540	0.402	1.281	0.904	5.357	6.183	4.587	2.040
	Riau Islands	12.673	8.384	5.298	3.115	1.767	0.501	1.051	1.018	5.117	6.778	3.647	2.020
	South Kalimantan	21.368	2.888	12.110	1.043	9.807	0.352	3.514	0.252	15.282	0.957	10.959	0.749
	South Sulawesi	17.910	16.729	7.852	6.726	1.911	2.885	1.568	5.928	2.652	14.485	5.111	5.886
	South Sumatra	19.781	24.438	6.945	4.546	3.664	0.922	2.884	0.771	8.147	2.618	6.149	4.231
	Southeast Sulawesi	5.071	14.136	3.795	4.670	3.091	1.473	1.852	2.214	3.749	5.448	3.421	3.941
	West Java	11.360	5.926	3.247	1.833	1.877	0.387	1.492	0.581	4.361	2.224	3.176	1.319
	West Kalimantan	14.813	10.109	4.945	2.676	2.613	0.626	1.899	1.170	6.347	6.344	4.519	2.319
	West Nusa Tenggara	19.153	26.834	4.570	6.827	1.798	1.016	1.639	1.711	2.830	3.568	4.465	5.070
	West Papua	19.333	13.785	5.486	3.037	2.100	1.615	1.917	2.697	4.527	6.181	5.109	3.685
	West Sulawesi	31.432	22.496	9.799	5.060	2.895	0.904	1.988	1.674	6.056	7.770	8.466	4.872
	West Sumatra	9.074	11.454	2.697	1.707	1.353	0.610	1.244	0.832	2.171	1.795	2.584	2.106
	Yogyakarta	5.153	2.632	1.969	0.913	1.479	0.465	1.387	1.309	4.929	7.094	2.015	1.255
Indonesia	13.985	10.451	5.213	2.959	2.633	0.715	2.035	1.441	5.383	4.794	4.349	2.340	
2006	Aceh	15.324	12.875	5.717	2.914	2.763	0.532	1.844	1.065	7.028	6.181	4.928	2.639
	Bali	5.624	2.122	2.955	0.801	2.392	0.369	2.681	0.940	4.784	2.785	2.914	0.774
	Bangka-Belitung Islands	8.550	9.083	4.565	2.858	3.967	1.207	2.250	2.114	7.320	5.804	4.447	2.573
	Banten	17.909	9.302	6.547	2.667	2.585	0.564	1.611	1.011	6.441	6.778	5.026	2.089
	Bengkulu	11.855	6.128	4.817	2.480	2.773	1.020	1.722	1.384	5.296	6.615	4.176	2.055
	Central Java	6.945	6.495	2.922	3.028	2.141	0.774	2.425	2.143	4.329	5.618	2.853	2.091
	Central Kalimantan	18.330	7.487	13.312	3.516	10.841	1.357	12.735	3.236	24.121	14.153	12.533	2.841

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Central Sulawesi	3.030	12.537	0.733	4.314	1.054	1.261	1.096	2.123	1.893	4.851	1.240	3.401
	East Java	13.054	5.104	4.781	1.762	2.319	0.426	1.775	1.009	6.198	3.410	3.698	1.231
	East Kalimantan	9.770	5.274	3.972	1.381	2.761	0.538	1.815	1.258	5.722	6.705	3.747	1.403
	East Nusa Tenggara	22.299	17.973	9.743	5.608	3.465	0.929	2.319	1.587	5.593	4.925	7.557	4.378
	Gorontalo	21.121	12.518	11.914	6.795	3.542	2.145	2.775	3.310	4.384	6.200	7.248	4.449
	Jakarta	9.974	6.035	3.824	1.708	1.932	0.410	1.463	0.807	6.101	6.233	3.056	1.308
	Jambi	9.419	13.288	6.509	1.384	6.621	0.940	5.477	1.349	11.914	7.963	6.874	2.487
	Lampung	12.591	6.905	5.069	1.965	2.251	0.311	1.572	0.874	6.285	6.235	3.943	1.546
	Maluku	33.889	22.819	9.350	5.905	3.201	1.828	2.473	2.303	5.030	5.565	8.810	5.672
	North Kalimantan	37.673	14.293	10.013	1.888	10.295	0.297	17.387	0.504	35.671	2.556	14.489	2.485
	North Maluku	23.769	23.808	8.916	6.410	3.030	2.190	2.064	3.138	4.872	6.781	7.009	6.041
	North Sulawesi	0.704	13.519	0.647	2.432	0.706	0.643	1.078	1.339	1.663	7.111	0.770	2.518
	North Sumatra	19.820	13.308	7.685	3.458	3.718	0.807	2.647	1.645	7.305	7.107	6.640	3.139
	Papua	29.928	53.364	8.457	4.571	3.168	0.914	2.150	1.549	6.582	7.563	8.024	9.107
	Riau	18.638	8.583	4.918	2.226	1.497	0.380	1.283	0.882	5.395	6.180	4.398	1.909
	Riau Islands	11.969	7.796	5.015	2.880	1.694	0.494	1.060	1.051	5.192	6.981	3.488	1.915
	South Kalimantan	20.017	2.716	11.215	0.975	9.396	0.334	3.474	0.254	15.197	0.982	10.363	0.705
	South Sulawesi	17.486	15.629	7.345	6.093	1.838	2.715	1.577	5.767	2.707	14.228	4.876	5.510
	South Sumatra	19.165	22.998	6.657	4.388	3.558	0.892	2.849	0.776	8.067	2.677	5.932	4.002
	Southeast Sulawesi	4.984	13.442	3.618	4.332	2.978	1.397	1.843	2.182	3.725	5.484	3.303	3.723
	West Java	11.013	5.618	3.090	1.700	1.810	0.369	1.493	0.578	4.434	2.292	3.057	1.245
	West Kalimantan	13.776	9.204	4.568	2.419	2.499	0.594	1.891	1.164	6.357	6.395	4.241	2.134
	West Nusa Tenggara	18.206	24.340	4.276	6.244	1.738	0.960	1.627	1.669	2.850	3.590	4.234	4.620
	West Papua	19.686	13.677	5.996	3.540	2.603	1.817	1.952	2.777	4.490	6.236	5.523	3.897

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	West Sulawesi	30.291	21.200	9.224	4.762	2.779	0.894	1.957	1.694	5.995	7.848	8.055	4.606
	West Sumatra	8.672	10.612	2.496	1.537	1.315	0.578	1.249	0.826	2.199	1.809	2.460	1.949
	Yogyakarta	5.065	2.542	1.908	0.861	1.447	0.438	1.388	1.275	4.964	7.057	1.982	1.225
	Indonesia	13.518	9.855	4.937	2.741	2.559	0.682	2.042	1.418	5.443	4.834	4.191	2.212
2007	Aceh	14.755	11.927	5.406	2.665	2.727	0.520	1.888	1.094	7.162	6.375	4.760	2.469
	Bali	5.542	2.030	2.787	0.749	2.297	0.355	2.621	0.921	4.773	2.773	2.812	0.747
	Bangka-Belitung Islands	8.486	8.793	4.377	2.744	3.894	1.123	2.219	1.978	7.291	5.634	4.347	2.448
	Banten	17.302	8.806	6.093	2.411	2.507	0.531	1.636	0.998	6.607	6.968	4.806	1.958
	Bengkulu	11.469	5.751	4.545	2.287	2.707	0.981	1.727	1.371	5.393	6.744	4.026	1.945
	Central Java	6.844	6.426	2.682	2.783	1.796	0.628	2.061	1.782	3.852	5.000	2.535	1.877
	Central Kalimantan	17.724	6.741	12.495	3.132	10.575	1.537	12.892	4.091	24.346	15.148	12.154	2.868
	Central Sulawesi	2.779	11.707	0.688	3.974	0.992	1.145	1.060	1.955	1.848	4.698	1.158	3.133
	East Java	12.815	4.949	4.562	1.641	2.260	0.412	1.773	1.010	6.278	3.527	3.594	1.197
	East Kalimantan	9.227	4.855	3.839	1.307	2.811	0.530	1.808	1.236	5.642	6.761	3.683	1.334
	East Nusa Tenggara	21.449	16.929	9.209	5.299	3.392	0.904	2.285	1.555	5.596	4.957	7.242	4.145
	Gorontalo	20.861	12.027	11.413	6.480	3.490	2.092	2.790	3.281	4.455	6.265	7.039	4.284
	Jakarta	9.704	5.749	3.640	1.595	1.849	0.385	1.435	0.780	6.079	6.214	2.938	1.242
	Jambi	9.054	12.933	5.674	1.295	5.535	0.917	4.279	1.340	11.166	8.358	5.906	2.418
	Lampung	12.684	6.739	4.810	1.855	2.142	0.301	1.544	0.862	6.300	6.356	3.813	1.495
	Maluku	31.000	20.865	8.394	5.293	2.983	1.655	2.421	2.166	5.020	5.438	8.040	5.150
	North Kalimantan	36.436	13.081	9.929	1.730	10.225	0.267	17.462	0.468	35.891	2.478	14.257	2.247
North Maluku	22.206	22.064	8.018	5.795	2.745	1.998	1.951	2.945	4.731	6.613	6.394	5.528	
North Sulawesi	0.706	13.174	0.622	2.362	0.678	0.633	1.055	1.334	1.650	7.193	0.747	2.454	
North Sumatra	19.694	12.981	7.356	3.267	3.693	0.783	2.652	1.595	7.380	7.136	6.506	3.025	

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Papua	28.927	50.373	7.966	4.188	2.915	0.826	2.110	1.500	6.545	7.491	7.599	8.506
	Riau	18.179	8.209	4.553	2.028	1.445	0.357	1.280	0.855	5.460	6.199	4.214	1.801
	Riau Islands	11.333	7.237	4.723	2.631	1.590	0.473	1.056	1.072	5.244	7.154	3.316	1.802
	South Kalimantan	19.374	2.510	10.676	0.900	9.382	0.322	3.552	0.249	15.740	0.990	10.163	0.659
	South Sulawesi	16.060	14.855	6.219	5.600	1.705	2.807	1.548	6.206	2.680	16.748	4.351	5.507
	South Sumatra	19.082	22.034	6.736	4.262	3.695	0.862	3.054	0.736	9.094	2.568	6.033	3.822
	Southeast Sulawesi	4.942	12.785	3.456	4.022	2.893	1.273	1.828	2.040	3.724	5.353	3.209	3.477
	West Java	10.312	5.297	2.806	1.557	1.728	0.334	1.496	0.569	4.530	2.352	2.867	1.159
	West Kalimantan	12.886	8.362	4.195	2.171	2.388	0.554	1.867	1.141	6.380	6.440	3.980	1.954
	West Nusa Tenggara	16.756	22.142	3.794	5.688	1.608	0.867	1.586	1.578	2.814	3.458	3.864	4.183
	West Papua	18.336	12.390	5.323	3.109	2.291	1.629	1.840	2.620	4.237	6.015	4.986	3.501
	West Sulawesi	29.056	19.891	8.588	4.428	2.620	0.866	1.900	1.697	5.948	7.983	7.586	4.319
	West Sumatra	8.239	9.412	2.260	1.319	1.266	0.528	1.248	0.772	2.222	1.738	2.319	1.725
	Yogyakarta	5.297	2.636	1.905	0.863	1.447	0.429	1.404	1.244	5.081	7.111	2.006	1.232
	Indonesia	13.067	9.393	4.613	2.536	2.440	0.641	1.971	1.357	5.417	4.852	3.988	2.089
2008	Aceh	14.611	11.566	5.212	2.571	2.661	0.509	1.866	1.085	7.181	6.477	4.643	2.392
	Bali	5.685	2.030	2.712	0.718	2.271	0.345	2.593	0.902	4.775	2.759	2.788	0.734
	Bangka-Belitung Islands	8.498	8.613	4.248	2.533	3.750	1.033	2.190	1.907	7.274	5.830	4.225	2.326
	Banten	16.886	8.448	5.735	2.235	2.425	0.505	1.642	0.982	6.688	7.097	4.623	1.862
	Bengkulu	11.240	5.504	4.365	2.146	2.626	0.946	1.713	1.345	5.441	6.853	3.901	1.862
	Central Java	7.668	6.017	3.111	2.551	1.919	0.637	2.132	1.740	4.232	5.345	2.772	1.814
	Central Kalimantan	17.434	6.418	12.265	2.973	10.358	1.452	12.908	3.875	24.575	15.069	11.949	2.733
	Central Sulawesi	3.920	11.358	0.740	3.767	1.106	1.089	1.144	1.897	2.220	4.852	1.375	2.996
	East Java	12.753	4.872	4.442	1.563	2.264	0.361	1.763	0.786	6.385	2.982	3.557	1.088

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	East Kalimantan	8.762	4.496	3.698	1.224	2.744	0.503	1.781	1.204	5.605	6.811	3.555	1.257
	East Nusa Tenggara	20.673	15.838	8.689	4.873	3.195	0.839	2.256	1.515	5.758	4.998	6.881	3.854
	Gorontalo	21.247	12.026	11.101	6.298	3.463	2.042	2.808	3.227	4.535	6.305	6.946	4.191
	Jakarta	9.585	5.579	3.531	1.528	1.790	0.371	1.407	0.764	6.041	6.234	2.862	1.202
	Jambi	8.948	12.041	5.203	1.228	4.710	0.852	3.498	1.262	10.478	8.414	5.229	2.260
	Lampung	13.011	6.752	4.674	1.803	2.102	0.294	1.542	0.843	6.388	6.452	3.774	1.476
	Maluku	30.380	19.162	8.478	4.807	3.055	1.556	2.452	2.088	5.342	5.591	7.984	4.740
	North Kalimantan	34.976	12.577	9.496	1.661	9.951	0.251	17.351	0.455	35.805	2.580	13.789	2.131
	North Maluku	22.244	21.022	8.154	5.464	2.796	1.898	1.977	2.855	5.005	6.838	6.420	5.231
	North Sulawesi	0.700	12.824	0.606	2.306	0.659	0.608	1.018	1.305	1.633	7.160	0.730	2.374
	North Sumatra	19.599	12.737	7.079	3.103	3.605	0.749	2.607	1.536	7.395	7.157	6.346	2.920
	Papua	29.034	50.957	7.802	4.172	3.097	0.863	2.120	1.480	6.566	7.479	7.647	8.555
	Riau	17.755	7.905	4.291	1.875	1.411	0.344	1.281	0.833	5.509	6.219	4.064	1.716
	Riau Islands	10.662	6.670	4.415	2.398	1.509	0.441	1.062	1.053	5.318	7.169	3.151	1.679
	South Kalimantan	16.701	2.771	9.269	1.050	7.742	0.311	3.024	0.297	13.758	1.261	8.545	0.715
	South Sulawesi	16.193	14.271	6.273	5.096	1.942	2.313	1.766	4.905	3.307	14.142	4.507	4.816
	South Sumatra	18.734	20.922	5.941	4.012	3.267	0.880	2.743	0.953	9.208	3.536	5.535	3.681
	Southeast Sulawesi	4.961	12.583	3.346	3.849	2.845	1.200	1.818	1.974	3.725	5.529	3.154	3.357
	West Java	11.714	5.125	3.306	1.459	1.768	0.312	1.502	0.563	4.614	2.445	3.116	1.105
	West Kalimantan	12.137	7.719	3.909	1.998	2.311	0.532	1.846	1.127	6.381	6.476	3.775	1.823
	West Nusa Tenggara	18.619	20.810	4.352	5.163	1.817	0.993	1.718	1.783	3.270	4.285	4.313	4.028
	West Papua	18.273	11.642	5.426	2.945	2.353	1.541	1.831	2.516	4.358	6.087	5.010	3.301
	West Sulawesi	28.178	19.093	8.135	4.197	2.559	0.836	1.890	1.671	5.992	8.060	7.261	4.113
	West Sumatra	8.657	11.322	2.475	1.624	1.330	0.579	1.290	0.917	2.330	2.229	2.441	2.041

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Yogyakarta	5.557	2.749	1.915	0.865	1.442	0.416	1.407	1.210	5.158	7.174	2.026	1.237
	Indonesia	13.351	9.142	4.621	2.387	2.404	0.605	1.965	1.254	5.559	4.779	3.983	1.993
2009	Aceh	14.333	10.910	5.057	2.468	2.603	0.497	1.848	1.082	7.215	6.585	4.522	2.280
	Bali	5.442	1.905	2.570	0.669	2.255	0.336	2.556	0.879	4.735	2.713	2.722	0.706
	Bangka-Belitung Islands	8.457	8.261	4.133	2.281	3.564	0.940	2.156	1.834	7.256	5.930	4.076	2.174
	Banten	16.415	8.013	5.454	2.082	2.358	0.481	1.634	0.964	6.735	7.175	4.459	1.764
	Bengkulu	11.024	5.198	4.245	2.012	2.535	0.907	1.691	1.317	5.470	6.960	3.784	1.774
	Central Java	8.003	5.588	3.359	2.359	1.994	0.631	2.146	1.660	4.475	5.541	2.888	1.737
	Central Kalimantan	16.955	5.980	12.027	2.818	10.167	1.393	12.950	3.764	24.869	15.097	11.742	2.612
	Central Sulawesi	5.013	10.929	0.818	3.592	1.203	1.037	1.206	1.836	2.570	4.946	1.573	2.857
	East Java	12.648	4.717	4.337	1.499	2.255	0.328	1.753	0.647	6.464	2.634	3.507	1.005
	East Kalimantan	8.385	4.160	3.597	1.155	2.681	0.475	1.752	1.172	5.572	6.834	3.446	1.185
	East Nusa Tenggara	19.520	14.476	8.226	4.502	3.074	0.795	2.226	1.475	5.840	5.016	6.514	3.550
	Gorontalo	21.344	11.835	10.747	6.119	3.364	1.995	2.783	3.202	4.587	6.431	6.763	4.083
	Jakarta	9.313	5.301	3.421	1.464	1.737	0.356	1.379	0.748	5.989	6.235	2.774	1.153
	Jambi	8.728	10.525	4.822	1.171	4.026	0.793	2.923	1.201	9.794	8.484	4.658	2.046
	Lampung	13.179	6.617	4.550	1.720	2.037	0.281	1.532	0.824	6.460	6.549	3.704	1.431
	Maluku	28.663	17.512	8.303	4.534	3.054	1.492	2.471	2.060	5.571	5.799	7.673	4.409
	North Kalimantan	33.746	11.844	9.250	1.598	9.765	0.238	17.270	0.444	35.706	2.638	13.441	1.988
	North Maluku	21.631	19.609	8.016	5.078	2.712	1.775	1.962	2.759	5.149	6.960	6.218	4.860
	North Sulawesi	0.702	12.101	0.595	2.234	0.631	0.578	0.977	1.270	1.610	7.133	0.708	2.254
	North Sumatra	19.641	12.463	6.901	2.982	3.561	0.720	2.579	1.481	7.430	7.193	6.250	2.824
Papua	28.726	49.527	7.620	4.054	3.083	0.838	2.111	1.443	6.562	7.415	7.518	8.260	
Riau	17.294	7.505	4.122	1.770	1.389	0.334	1.276	0.814	5.556	6.259	3.933	1.631	

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Riau Islands	10.085	6.184	4.195	2.228	1.446	0.416	1.058	1.044	5.369	7.170	3.019	1.580
	South Kalimantan	14.336	2.823	8.223	1.142	6.564	0.305	2.735	0.349	12.339	1.570	7.337	0.743
	South Sulawesi	15.840	13.481	6.193	4.713	2.118	1.968	1.936	4.058	3.893	12.488	4.539	4.294
	South Sumatra	18.518	20.168	5.504	3.898	3.024	0.888	2.549	1.114	9.351	4.323	5.241	3.592
	Southeast Sulawesi	4.943	12.129	3.255	3.659	2.794	1.125	1.795	1.903	3.713	5.627	3.095	3.197
	West Java	12.130	4.769	3.594	1.363	1.780	0.296	1.506	0.553	4.678	2.506	3.202	1.035
	West Kalimantan	11.371	6.973	3.692	1.859	2.234	0.509	1.809	1.114	6.368	6.512	3.580	1.690
	West Nusa Tenggara	19.333	19.333	4.716	4.751	1.960	1.082	1.809	1.950	3.656	5.068	4.543	3.859
	West Papua	17.625	10.660	5.302	2.677	2.184	1.397	1.788	2.414	4.375	6.077	4.778	3.016
	West Sulawesi	26.746	17.577	7.715	3.929	2.472	0.798	1.856	1.642	6.014	8.156	6.852	3.805
	West Sumatra	8.474	11.743	2.550	1.812	1.353	0.603	1.302	1.012	2.404	2.656	2.435	2.147
	Yogyakarta	5.622	2.733	1.909	0.860	1.436	0.403	1.411	1.170	5.236	7.217	2.027	1.230
	Indonesia	13.293	8.718	4.590	2.258	2.365	0.575	1.953	1.176	5.662	4.743	3.930	1.890
2010	Aceh	13.615	9.944	4.862	2.329	2.532	0.483	1.830	1.077	7.268	6.709	4.335	2.126
	Bali	5.406	1.707	2.474	0.626	2.253	0.334	2.538	0.854	4.781	2.685	2.695	0.677
	Bangka-Belitung Islands	7.944	6.901	3.686	1.380	2.709	0.705	2.051	1.705	7.144	5.946	3.420	1.704
	Banten	15.659	7.385	5.182	1.942	2.291	0.460	1.635	0.946	6.767	7.230	4.267	1.649
	Bengkulu	10.296	4.608	4.033	1.826	2.399	0.858	1.662	1.281	5.491	7.058	3.567	1.638
	Central Java	8.033	5.080	3.484	2.180	2.038	0.623	2.157	1.600	4.677	5.722	2.935	1.658
	Central Kalimantan	16.115	5.350	11.581	2.614	9.678	1.302	12.855	3.647	25.090	15.098	11.269	2.442
	Central Sulawesi	5.990	9.971	0.859	3.186	1.201	0.915	1.247	1.745	2.932	5.017	1.688	2.566
	East Java	12.275	4.411	4.202	1.416	2.239	0.302	1.738	0.544	6.517	2.360	3.426	0.920
East Kalimantan	7.933	3.787	3.458	1.096	2.628	0.459	1.721	1.142	5.524	6.829	3.326	1.117	

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	East Nusa Tenggara	17.930	12.393	7.560	3.893	2.811	0.714	2.180	1.438	5.921	5.090	5.969	3.087
	Gorontalo	21.151	10.657	10.447	5.650	3.459	1.831	2.871	2.923	4.686	5.893	6.679	3.709
	Jakarta	8.912	4.888	3.299	1.385	1.677	0.342	1.346	0.734	5.925	6.238	2.667	1.089
	Jambi	8.490	9.168	4.513	1.106	3.515	0.743	2.527	1.148	9.235	8.580	4.215	1.855
	Lampung	13.080	6.267	4.393	1.628	1.997	0.275	1.525	0.808	6.526	6.665	3.614	1.368
	Maluku	26.359	15.059	7.871	3.983	2.848	1.343	2.423	1.988	5.737	5.931	7.112	3.862
	North Kalimantan	32.702	11.101	9.047	1.537	9.546	0.226	17.073	0.433	35.547	2.697	13.095	1.847
	North Maluku	20.758	17.834	7.716	4.719	2.618	1.692	1.928	2.683	5.249	7.105	5.938	4.478
	North Sulawesi	0.699	11.777	0.581	2.194	0.616	0.560	0.946	1.240	1.596	7.142	0.694	2.183
	North Sumatra	19.413	11.844	6.719	2.846	3.508	0.693	2.556	1.432	7.465	7.229	6.111	2.684
	Papua	27.349	44.939	7.326	3.748	2.791	0.730	2.043	1.361	6.476	7.267	7.057	7.437
	Riau	16.477	6.876	3.934	1.652	1.362	0.324	1.270	0.795	5.618	6.322	3.750	1.515
	Riau Islands	9.460	5.500	3.998	2.063	1.362	0.385	1.056	1.031	5.404	7.147	2.866	1.449
	South Kalimantan	11.945	2.693	7.170	1.168	5.541	0.297	2.532	0.406	11.170	1.937	6.237	0.742
	South Sulawesi	15.225	12.319	6.025	4.333	2.248	1.665	2.086	3.402	4.489	11.147	4.499	3.793
	South Sumatra	17.979	18.825	5.133	3.712	2.828	0.895	2.398	1.252	9.465	5.053	4.955	3.423
	Southeast Sulawesi	4.845	11.370	3.146	3.443	2.730	1.061	1.786	1.842	3.729	5.755	3.017	3.000
	West Java	11.959	4.268	3.738	1.248	1.766	0.279	1.513	0.541	4.735	2.542	3.183	0.947
	West Kalimantan	10.427	6.020	3.459	1.711	2.153	0.485	1.773	1.098	6.340	6.545	3.362	1.533
	West Nusa Tenggara	18.947	17.244	4.882	4.305	2.056	1.155	1.871	2.111	3.999	5.868	4.572	3.619
	West Papua	14.943	8.274	4.308	1.805	1.347	0.995	1.587	2.193	4.272	5.978	3.714	2.258
	West Sulawesi	25.163	15.854	7.295	3.675	2.394	0.768	1.827	1.609	6.025	8.273	6.432	3.484
	West Sumatra	8.012	11.314	2.542	1.921	1.370	0.616	1.318	1.089	2.468	3.071	2.377	2.138
	Yogyakarta	5.634	2.650	1.897	0.846	1.431	0.390	1.412	1.132	5.307	7.274	2.021	1.217

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Indonesia	12.882	7.997	4.486	2.096	2.303	0.543	1.941	1.114	5.751	4.729	3.813	1.754
2011	Aceh	12.957	8.622	4.610	2.052	2.293	0.439	1.776	1.058	7.233	6.721	4.044	1.884
	Bali	5.174	1.599	2.191	0.570	2.134	0.321	2.394	0.835	4.677	2.780	2.530	0.655
	Bangka-Belitung Islands	8.113	7.194	3.891	2.106	3.420	0.863	2.092	1.725	7.189	6.059	3.879	1.962
	Banten	15.080	6.765	4.934	1.799	2.220	0.439	1.616	0.922	6.772	7.210	4.093	1.534
	Bengkulu	9.659	4.005	3.796	1.583	2.164	0.782	1.598	1.228	5.442	7.058	3.294	1.472
	Central Java	7.983	4.510	3.481	1.943	1.999	0.572	2.066	1.448	4.812	5.618	2.888	1.514
	Central Kalimantan	15.484	4.727	11.180	2.446	9.552	1.266	12.821	3.576	25.372	15.078	11.051	2.318
	Central Sulawesi	6.960	9.570	1.031	3.227	1.368	0.944	1.301	1.717	3.299	5.106	1.918	2.525
	East Java	12.016	4.049	4.082	1.326	2.207	0.276	1.713	0.452	6.570	2.029	3.346	0.829
	East Kalimantan	7.464	3.346	3.310	1.005	2.523	0.430	1.677	1.104	5.471	6.767	3.170	1.026
	East Nusa Tenggara	16.939	11.394	7.206	3.703	2.853	0.718	2.210	1.430	5.991	5.097	5.735	2.901
	Gorontalo	21.250	9.631	9.817	5.080	3.376	1.642	2.905	2.670	4.822	5.472	6.449	3.324
	Jakarta	8.555	4.504	3.169	1.312	1.613	0.327	1.312	0.719	5.894	6.201	2.560	1.028
	Jambi	8.244	9.125	4.278	1.051	3.245	0.721	2.287	1.111	8.776	8.625	3.943	1.814
	Lampung	13.091	5.890	4.271	1.536	1.948	0.266	1.510	0.790	6.612	6.739	3.536	1.301
	Maluku	25.071	13.423	7.519	3.778	2.859	1.327	2.381	1.953	5.858	6.033	6.809	3.573
	North Kalimantan	31.867	10.468	8.860	1.499	9.328	0.219	16.897	0.422	35.365	2.718	12.785	1.729
	North Maluku	20.764	16.772	7.577	4.595	2.695	1.679	1.894	2.629	5.290	7.210	5.887	4.275
	North Sulawesi	0.693	11.105	0.566	2.121	0.586	0.538	0.904	1.211	1.573	7.103	0.668	2.073
	North Sumatra	19.241	11.098	6.578	2.698	3.437	0.660	2.523	1.374	7.406	7.104	5.975	2.520
Papua	26.476	41.727	7.031	3.525	2.639	0.673	1.995	1.304	6.397	7.091	6.737	6.847	
Riau	15.793	6.269	3.749	1.535	1.324	0.311	1.249	0.773	5.650	6.328	3.577	1.400	

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Riau Islands	8.897	4.860	3.803	1.911	1.280	0.355	1.035	1.012	5.365	7.001	2.715	1.323
	South Kalimantan	10.017	2.490	6.288	1.165	4.731	0.290	2.359	0.463	10.183	2.337	5.354	0.731
	South Sulawesi	14.912	11.384	5.950	4.068	2.394	1.443	2.252	2.888	5.083	9.923	4.525	3.403
	South Sumatra	17.895	17.872	4.896	3.618	2.654	0.905	2.277	1.397	9.513	5.796	4.756	3.318
	Southeast Sulawesi	4.773	10.759	3.048	3.276	2.686	1.010	1.765	1.781	3.725	5.820	2.953	2.838
	West Java	11.868	3.815	3.901	1.152	1.757	0.264	1.514	0.520	4.748	2.467	3.177	0.865
	West Kalimantan	9.533	4.868	3.218	1.495	1.998	0.444	1.709	1.073	6.291	6.499	3.106	1.332
	West Nusa Tenggara	18.074	15.506	4.922	3.957	2.124	1.251	1.904	2.312	4.266	6.755	4.499	3.458
	West Papua	15.686	8.446	4.844	2.219	1.850	1.189	1.624	2.237	4.284	6.014	4.187	2.480
	West Sulawesi	24.007	14.390	6.847	3.431	2.313	0.740	1.788	1.581	6.008	8.341	6.059	3.202
	West Sumatra	7.312	10.527	2.474	1.989	1.355	0.623	1.309	1.160	2.486	3.469	2.261	2.081
	Yogyakarta	5.611	2.533	1.877	0.829	1.414	0.377	1.403	1.093	5.342	7.264	2.004	1.198
	Indonesia	12.588	7.373	4.398	1.965	2.252	0.516	1.908	1.045	5.808	4.616	3.714	1.633
2012	Aceh	12.925	8.533	4.601	2.145	2.399	0.461	1.761	1.064	7.305	6.845	4.069	1.895
	Bali	4.951	1.450	1.949	0.508	2.016	0.312	2.210	0.814	4.605	2.916	2.369	0.633
	Bangka-Belitung Islands	8.393	7.026	3.906	2.279	3.564	0.845	2.084	1.658	7.258	6.442	3.978	1.961
	Banten	14.877	6.326	4.789	1.699	2.168	0.421	1.609	0.907	6.802	7.230	3.989	1.448
	Bengkulu	9.740	3.941	3.721	1.674	2.278	0.803	1.603	1.237	5.417	7.180	3.334	1.495
	Central Java	7.900	4.109	3.299	1.735	1.904	0.514	1.929	1.325	4.929	5.750	2.765	1.402
	Central Kalimantan	14.824	4.206	10.721	2.284	9.434	1.223	12.759	3.496	25.692	15.092	10.820	2.204
	Central Sulawesi	7.900	8.605	1.134	2.791	1.353	0.799	1.312	1.616	3.638	5.387	2.021	2.222
	East Java	12.140	4.068	4.021	1.269	2.139	0.271	1.672	0.487	6.591	2.561	3.279	0.847
East Kalimantan	7.170	3.088	3.197	0.959	2.484	0.420	1.648	1.076	5.462	6.773	3.079	0.976	

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	East Nusa Tenggara	17.455	11.809	6.945	3.717	2.846	0.734	2.073	1.377	6.127	5.434	5.669	2.936
	Gorontalo	21.704	9.463	9.625	4.940	3.294	1.585	2.880	2.667	4.856	5.610	6.340	3.226
	Jakarta	8.439	4.262	3.083	1.257	1.561	0.315	1.281	0.708	5.862	6.224	2.490	0.987
	Jambi	8.258	8.009	4.094	0.997	2.901	0.670	2.055	1.064	8.344	8.698	3.663	1.650
	Lampung	13.224	5.578	4.169	1.461	1.901	0.256	1.501	0.771	6.745	6.850	3.473	1.243
	Maluku	23.945	11.710	7.075	3.360	2.766	1.197	2.283	1.886	6.140	6.487	6.447	3.175
	North Kalimantan	31.536	9.659	8.746	1.388	9.128	0.198	16.687	0.400	35.277	2.886	12.553	1.571
	North Maluku	20.438	15.045	7.149	4.070	2.506	1.490	1.795	2.522	5.494	7.639	5.580	3.811
	North Sulawesi	0.708	11.074	0.552	2.098	0.569	0.521	0.875	1.183	1.557	7.113	0.655	2.031
	North Sumatra	18.754	10.989	6.163	2.560	3.322	0.619	2.398	1.336	7.734	7.775	5.711	2.449
	Papua	26.531	39.441	6.922	3.338	2.502	0.613	1.965	1.255	6.348	6.974	6.583	6.382
	Riau	15.266	5.764	3.614	1.437	1.296	0.299	1.235	0.754	5.694	6.381	3.437	1.303
	Riau Islands	8.541	4.667	3.665	1.837	1.288	0.357	1.031	1.003	5.366	6.919	2.651	1.284
	South Kalimantan	8.655	2.370	5.608	1.177	4.124	0.290	2.251	0.525	9.422	2.787	4.699	0.737
	South Sulawesi	13.810	9.739	5.396	3.500	2.277	1.264	2.129	2.548	5.383	9.682	4.185	2.971
	South Sumatra	17.034	15.802	4.477	3.099	2.422	0.766	2.082	1.245	9.859	5.710	4.405	2.881
	Southeast Sulawesi	4.802	10.026	2.983	2.984	2.644	0.901	1.757	1.689	3.744	6.131	2.911	2.606
	West Java	11.445	3.831	3.731	1.127	1.660	0.257	1.434	0.539	4.906	2.925	3.017	0.867
	West Kalimantan	8.961	4.348	3.044	1.407	1.939	0.430	1.671	1.062	6.285	6.542	2.956	1.246
	West Nusa Tenggara	17.237	12.384	4.732	3.198	2.068	1.039	1.850	2.061	4.552	6.670	4.305	2.836
	West Papua	15.353	7.624	4.599	1.968	1.741	1.067	1.548	2.162	4.401	6.264	4.001	2.239
	West Sulawesi	23.565	13.494	6.585	3.253	2.243	0.706	1.749	1.553	6.008	8.470	5.822	3.003
	West Sumatra	7.670	8.806	2.471	1.790	1.341	0.558	1.298	1.079	2.669	3.588	2.276	1.811
	Yogyakarta	5.722	2.470	1.882	0.817	1.401	0.362	1.410	1.057	5.448	7.335	2.006	1.186

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Indonesia	12.365	6.930	4.213	1.826	2.165	0.479	1.833	1.002	5.910	4.897	3.577	1.540
2013	Aceh	12.368	8.014	4.485	2.083	2.313	0.455	1.721	1.048	7.156	6.891	3.899	1.808
	Bali	4.575	1.274	1.710	0.446	1.905	0.303	2.038	0.790	4.523	3.083	2.202	0.611
	Bangka-Belitung Islands	8.889	6.842	4.017	2.221	3.428	0.785	2.054	1.571	7.165	6.663	3.944	1.882
	Banten	14.776	5.995	4.632	1.604	2.104	0.405	1.589	0.886	6.770	7.174	3.882	1.374
	Bengkulu	9.780	3.766	3.727	1.714	2.366	0.806	1.586	1.217	5.688	7.245	3.372	1.482
	Central Java	7.983	3.833	3.160	1.545	1.829	0.461	1.818	1.203	5.052	5.834	2.678	1.303
	Central Kalimantan	15.056	3.987	10.474	2.186	9.417	1.202	12.685	3.400	25.876	14.981	10.777	2.144
	Central Sulawesi	8.796	8.102	1.429	2.772	1.554	0.802	1.357	1.548	3.964	5.557	2.276	2.144
	East Java	12.173	3.984	3.918	1.213	2.052	0.265	1.620	0.505	6.573	3.032	3.182	0.853
	East Kalimantan	6.896	2.847	3.070	0.911	2.411	0.406	1.616	1.046	5.448	6.741	2.966	0.927
	East Nusa Tenggara	16.698	10.665	6.308	3.215	2.559	0.649	1.913	1.297	6.176	5.680	5.210	2.615
	Gorontalo	22.132	9.228	9.766	4.929	3.425	1.573	2.888	2.627	4.840	5.606	6.418	3.168
	Jakarta	8.193	3.974	2.959	1.179	1.509	0.301	1.252	0.686	5.805	6.159	2.400	0.933
	Jambi	8.183	9.168	3.993	0.965	2.817	0.680	1.958	1.042	8.024	8.763	3.554	1.745
	Lampung	13.167	5.464	4.086	1.391	1.817	0.250	1.467	0.755	6.554	6.917	3.363	1.207
	Maluku	22.574	10.076	6.718	3.059	2.707	1.105	2.201	1.804	6.264	6.752	6.091	2.833
	North Kalimantan	31.927	9.088	8.665	1.307	8.955	0.182	16.469	0.380	34.975	2.967	12.414	1.451
	North Maluku	20.122	13.507	6.887	3.737	2.424	1.354	1.731	2.389	5.591	7.857	5.370	3.442
	North Sulawesi	0.711	11.526	0.539	2.109	0.563	0.518	0.851	1.155	1.531	7.081	0.646	2.036
North Sumatra	18.791	9.929	5.912	2.435	3.164	0.571	2.268	1.218	7.657	7.614	5.512	2.240	
Papua	27.953	40.567	7.005	3.473	2.736	0.665	1.946	1.251	6.284	6.891	6.844	6.491	
Riau	15.033	5.425	3.486	1.353	1.272	0.291	1.220	0.736	5.717	6.396	3.332	1.230	

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Riau Islands	8.362	4.407	3.568	1.753	1.259	0.339	1.014	0.980	5.364	6.796	2.586	1.219
	South Kalimantan	7.560	2.240	5.029	1.176	3.649	0.294	2.146	0.585	8.724	3.253	4.171	0.744
	South Sulawesi	12.951	8.404	4.950	3.033	2.186	1.084	2.043	2.212	5.687	9.223	3.918	2.586
	South Sumatra	16.780	14.002	4.238	2.645	2.228	0.652	1.959	1.129	10.643	5.751	4.188	2.511
	Southeast Sulawesi	4.834	9.345	2.939	2.796	2.586	0.827	1.711	1.591	3.708	6.286	2.860	2.419
	West Java	11.003	3.713	3.590	1.080	1.578	0.249	1.367	0.551	4.995	3.311	2.870	0.850
	West Kalimantan	8.520	3.987	2.891	1.354	1.938	0.427	1.659	1.047	6.294	6.521	2.860	1.189
	West Nusa Tenggara	16.877	10.301	4.691	2.705	2.061	0.899	1.805	1.857	4.818	6.658	4.219	2.422
	West Papua	15.292	7.106	4.682	2.015	2.054	1.102	1.544	2.099	4.495	6.385	4.162	2.191
	West Sulawesi	22.875	12.483	6.402	3.095	2.203	0.680	1.711	1.516	5.970	8.514	5.591	2.801
	West Sumatra	7.835	7.296	2.464	1.618	1.345	0.513	1.298	1.030	2.870	3.796	2.279	1.592
	Yogyakarta	5.739	2.367	1.871	0.800	1.370	0.348	1.391	1.024	5.485	7.395	1.980	1.171
	Indonesia	12.210	6.519	4.060	1.699	2.087	0.449	1.765	0.952	5.968	5.091	3.456	1.452
2014	Aceh	12.067	7.583	4.318	2.005	2.221	0.419	1.691	1.032	7.077	6.944	3.746	1.726
	Bali	4.234	1.141	1.499	0.397	1.793	0.289	1.871	0.764	4.459	3.284	2.045	0.598
	Bangka-Belitung Islands	9.513	6.885	4.176	2.164	3.292	0.681	2.028	1.490	7.077	6.875	3.928	1.827
	Banten	14.741	5.841	4.584	1.567	2.073	0.368	1.569	0.864	6.756	7.102	3.820	1.331
	Bengkulu	9.231	3.396	3.601	1.614	2.334	0.740	1.565	1.185	5.895	7.281	3.255	1.398
	Central Java	7.772	3.627	3.063	1.395	1.776	0.378	1.707	1.083	5.212	5.938	2.587	1.221
	Central Kalimantan	16.726	4.192	10.839	2.230	9.283	1.157	12.501	3.288	25.906	14.912	10.906	2.155
	Central Sulawesi	9.381	7.419	1.704	2.527	1.638	0.687	1.377	1.466	4.313	5.735	2.426	1.964
	East Java	12.107	4.018	3.854	1.166	2.003	0.242	1.577	0.520	6.540	3.574	3.105	0.872
	East Kalimantan	6.287	2.511	2.915	0.836	2.363	0.373	1.580	1.010	5.393	6.667	2.828	0.859

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	East Nusa Tenggara	15.519	9.574	5.680	2.737	2.326	0.582	1.784	1.219	6.255	6.011	4.736	2.317
	Gorontalo	22.205	8.960	9.622	4.776	3.392	1.455	2.853	2.568	4.840	5.602	6.307	3.051
	Jakarta	7.716	3.652	2.830	1.106	1.472	0.265	1.231	0.666	5.773	6.052	2.298	0.877
	Jambi	8.808	8.851	3.852	0.934	2.617	0.628	1.819	1.007	7.658	8.779	3.427	1.676
	Lampung	13.579	5.451	4.043	1.345	1.751	0.236	1.408	0.735	6.362	6.934	3.306	1.182
	Maluku	21.053	8.775	6.288	2.701	2.585	0.939	2.109	1.721	6.317	7.051	5.668	2.515
	North Kalimantan	32.547	8.879	8.731	1.248	8.822	0.158	16.204	0.360	34.517	3.046	12.342	1.379
	North Maluku	19.606	12.282	6.615	3.404	2.355	1.152	1.672	2.279	5.634	8.106	5.141	3.132
	North Sulawesi	0.725	11.644	0.532	2.078	0.552	0.496	0.830	1.126	1.519	7.073	0.638	2.001
	North Sumatra	18.459	9.230	5.684	2.250	3.008	0.498	2.149	1.114	7.628	7.552	5.277	2.068
	Papua	28.109	39.024	6.991	3.363	2.633	0.618	1.886	1.200	6.194	6.698	6.719	6.131
	Riau	14.863	5.143	3.406	1.286	1.254	0.272	1.205	0.717	5.719	6.432	3.245	1.168
	Riau Islands	8.232	4.218	3.444	1.602	1.214	0.325	1.002	0.962	5.366	6.698	2.508	1.160
	South Kalimantan	6.690	2.111	4.566	1.168	3.232	0.302	2.060	0.641	8.157	3.719	3.729	0.750
	South Sulawesi	11.690	7.054	4.549	2.589	2.130	0.890	1.974	1.856	6.069	8.668	3.649	2.200
	South Sumatra	15.788	12.075	4.025	2.245	2.098	0.469	1.834	1.028	9.558	5.845	3.901	2.160
	Southeast Sulawesi	5.001	9.148	2.970	2.692	2.543	0.718	1.673	1.503	3.681	6.486	2.849	2.317
	West Java	10.393	3.613	3.384	1.052	1.492	0.227	1.298	0.557	5.061	3.707	2.694	0.837
	West Kalimantan	7.754	3.413	2.701	1.244	1.893	0.394	1.626	1.025	6.258	6.446	2.699	1.092
	West Nusa Tenggara	15.858	8.353	4.578	2.223	2.039	0.666	1.749	1.654	5.089	6.612	4.040	2.030
	West Papua	14.673	6.401	4.534	1.825	1.934	0.976	1.465	1.970	4.483	6.445	3.950	1.977
	West Sulawesi	22.030	11.782	5.976	2.946	2.151	0.620	1.684	1.482	5.988	8.615	5.283	2.640
	West Sumatra	7.725	5.881	2.448	1.444	1.342	0.424	1.294	0.985	3.101	4.040	2.248	1.388
	Yogyakarta	5.548	2.221	1.817	0.767	1.346	0.322	1.371	0.998	5.499	7.416	1.935	1.150

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Indonesia	11.878	6.110	3.916	1.574	2.012	0.392	1.697	0.901	5.984	5.307	3.320	1.365
2015	Aceh	11.802	6.865	4.146	1.857	2.064	1.032	1.634	1.005	6.884	7.047	3.554	1.594
	Bali	3.592	0.951	1.239	0.341	1.678	0.764	1.674	0.739	4.322	3.535	1.849	0.585
	Bangka-Belitung Islands	9.712	6.934	4.131	2.101	3.186	1.490	1.987	1.435	7.121	7.047	3.849	1.775
	Banten	14.987	5.461	4.366	1.460	1.902	0.864	1.516	0.840	6.564	7.080	3.660	1.246
	Bengkulu	8.530	3.074	3.391	1.542	2.252	1.185	1.543	1.163	5.811	7.278	3.075	1.330
	Central Java	7.774	3.344	2.859	1.269	1.658	1.083	1.631	1.028	5.179	6.040	2.458	1.155
	Central Kalimantan	16.483	4.151	10.781	2.194	9.149	3.288	12.298	3.204	25.733	14.798	10.762	2.123
	Central Sulawesi	9.578	6.961	1.669	2.326	1.586	1.466	1.348	1.417	4.278	5.877	2.380	1.829
	East Java	12.043	3.711	3.605	1.068	1.805	0.520	1.506	0.518	6.414	3.820	2.908	0.837
	East Kalimantan	6.409	2.446	2.800	0.822	2.133	1.010	1.513	0.978	5.246	6.646	2.662	0.836
	East Nusa Tenggara	15.202	8.933	5.215	2.634	2.215	1.219	1.723	1.208	6.254	5.869	4.472	2.198
	Gorontalo	21.418	8.456	9.366	4.589	3.349	2.568	2.829	2.510	4.835	5.581	6.095	2.905
	Jakarta	7.869	3.481	2.663	1.031	1.345	0.666	1.183	0.648	5.606	6.097	2.186	0.835
	Jambi	8.356	8.118	3.760	0.880	2.606	1.007	1.814	0.981	7.708	8.772	3.343	1.568
	Lampung	14.150	5.299	3.918	1.280	1.629	0.735	1.354	0.716	6.210	6.872	3.214	1.141
	Maluku	20.143	7.740	5.884	2.454	2.465	1.721	2.043	1.674	6.244	7.271	5.329	2.289
	North Kalimantan	31.734	8.451	8.637	1.179	8.666	0.360	15.946	0.348	34.168	3.084	12.089	1.284
	North Maluku	19.476	11.159	6.261	3.088	2.232	2.279	1.626	2.208	5.585	8.315	4.905	2.855
	North Sulawesi	0.726	11.477	0.523	2.050	0.534	1.126	0.804	1.113	1.497	7.230	0.623	1.961
North Sumatra	18.689	8.996	5.396	2.136	2.800	1.114	2.058	1.063	7.514	7.513	5.063	1.975	
Papua	29.347	39.663	6.909	3.409	2.508	1.200	1.826	1.172	5.993	6.599	6.684	6.095	
Riau	13.655	4.496	3.221	1.183	1.223	0.717	1.186	0.700	5.694	6.415	3.017	1.057	

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Riau Islands	7.923	4.000	3.223	1.560	1.103	0.962	0.961	0.934	5.176	6.553	2.342	1.107
	South Kalimantan	5.611	2.339	4.081	1.185	2.889	0.641	1.990	0.701	7.642	4.308	3.315	0.798
	South Sulawesi	10.918	6.395	4.135	2.454	1.966	1.856	1.859	1.887	5.980	8.744	3.354	2.113
	South Sumatra	15.338	10.536	3.808	1.909	1.966	1.028	1.761	0.937	9.091	5.944	3.685	1.872
	Southeast Sulawesi	4.905	8.737	2.905	2.530	2.461	1.503	1.630	1.443	3.648	6.620	2.764	2.182
	West Java	10.201	3.386	3.124	0.974	1.369	0.557	1.244	0.550	4.973	3.896	2.523	0.794
	West Kalimantan	7.288	3.109	2.568	1.172	1.841	1.025	1.589	1.008	6.226	6.370	2.577	1.033
	West Nusa Tenggara	16.062	7.275	4.412	1.948	1.921	1.654	1.688	1.516	5.156	6.754	3.918	1.801
	West Papua	14.646	5.973	4.408	1.756	1.989	1.970	1.436	1.927	4.441	6.575	3.916	1.893
	West Sulawesi	22.423	10.607	5.747	2.717	1.996	1.482	1.625	1.460	5.854	8.644	5.100	2.414
	West Sumatra	7.769	4.944	2.484	1.320	1.382	0.985	1.307	0.951	3.443	4.406	2.271	1.259
	Yogyakarta	5.433	2.189	1.807	0.766	1.314	0.998	1.336	0.962	5.445	7.397	1.890	1.133
	Indonesia	11.776	5.756	3.698	1.469	1.879	0.901	1.632	0.875	5.894	5.445	3.157	1.294
2016	Aceh	10.783	6.309	4.030	1.784	2.074	0.411	1.637	0.989	6.930	7.061	3.404	1.506
	Bali	1.995	0.525	0.850	0.249	1.698	0.287	1.603	0.691	3.912	3.331	1.653	0.527
	Bangka-Belitung Islands	9.518	6.913	4.112	2.106	3.101	0.668	1.969	1.411	7.070	6.877	3.755	1.744
	Banten	13.510	4.940	4.205	1.381	1.882	0.357	1.501	0.819	6.554	7.022	3.444	1.162
	Bengkulu	7.687	2.721	3.225	1.438	2.193	0.705	1.523	1.134	5.755	7.225	2.908	1.251
	Central Java	6.975	3.029	2.679	1.204	1.641	0.372	1.643	1.033	5.136	5.939	2.347	1.116
	Central Kalimantan	15.350	3.854	10.361	2.073	9.019	1.122	12.148	3.121	25.607	14.625	10.482	2.045
	Central Sulawesi	8.946	6.808	1.572	2.308	1.544	0.678	1.310	1.391	4.164	5.781	2.248	1.783
	East Java	10.431	3.205	3.414	0.993	1.804	0.235	1.497	0.505	6.398	3.683	2.746	0.778
	East Kalimantan	6.997	2.733	3.011	0.867	2.018	0.347	1.513	0.951	5.340	6.641	2.683	0.854

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	East Nusa Tenggara	13.556	7.869	4.971	2.417	2.209	0.558	1.728	1.185	6.280	5.879	4.181	1.998
	Gorontalo	19.411	7.669	8.870	4.280	3.287	1.386	2.799	2.459	4.829	5.575	5.726	2.712
	Jakarta	7.314	3.277	2.584	0.990	1.325	0.256	1.162	0.631	5.557	5.989	2.096	0.801
	Jambi	7.638	7.449	3.598	0.835	2.599	0.606	1.817	0.965	7.764	8.744	3.230	1.474
	Lampung	13.306	5.056	3.872	1.245	1.634	0.230	1.357	0.699	6.207	6.859	3.102	1.100
	Maluku	17.837	6.871	5.525	2.286	2.428	0.901	2.029	1.658	6.181	7.178	4.902	2.110
	North Kalimantan	29.055	7.741	8.386	1.134	8.469	0.155	15.614	0.339	33.734	3.022	11.612	1.174
	North Maluku	17.810	10.226	5.959	2.907	2.208	1.119	1.615	2.173	5.521	8.187	4.589	2.665
	North Sulawesi	0.668	10.494	0.507	1.928	0.529	0.479	0.804	1.094	1.501	7.251	0.615	1.839
	North Sumatra	18.331	8.909	5.376	2.124	2.798	0.494	2.050	1.057	7.470	7.495	4.967	1.940
	Papua	27.556	37.840	6.731	3.316	2.580	0.626	1.801	1.149	5.895	6.505	6.379	5.731
	Riau	10.532	3.314	2.834	0.997	1.185	0.251	1.176	0.683	5.707	6.324	2.552	0.870
	Riau Islands	7.473	3.774	3.143	1.504	1.100	0.314	0.958	0.912	5.184	6.451	2.255	1.052
	South Kalimantan	5.296	2.034	4.030	1.096	2.932	0.286	1.968	0.655	7.750	4.085	3.293	0.733
	South Sulawesi	9.555	5.444	3.894	2.253	1.945	0.864	1.844	1.881	5.897	8.755	3.137	1.978
	South Sumatra	14.808	10.532	3.755	1.911	1.963	0.471	1.775	0.937	9.165	5.852	3.594	1.847
	Southeast Sulawesi	4.584	8.188	2.800	2.433	2.415	0.699	1.598	1.413	3.613	6.529	2.667	2.067
	West Java	9.033	2.980	3.002	0.908	1.368	0.219	1.249	0.534	4.936	3.753	2.378	0.732
	West Kalimantan	6.725	2.807	2.459	1.110	1.828	0.386	1.575	0.990	6.216	6.322	2.480	0.982
	West Nusa Tenggara	15.087	7.166	4.329	1.989	1.910	0.675	1.676	1.522	5.076	6.686	3.755	1.793
	West Papua	12.964	5.308	4.153	1.600	1.837	0.894	1.399	1.868	4.368	6.459	3.548	1.718
	West Sulawesi	20.737	9.940	5.541	2.595	1.976	0.594	1.603	1.426	5.843	8.690	4.785	2.274
	West Sumatra	6.469	4.181	2.262	1.212	1.346	0.414	1.277	0.938	3.294	4.217	2.056	1.146
	Yogyakarta	5.481	2.257	1.876	0.797	1.294	0.314	1.337	0.950	5.521	7.520	1.891	1.146

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Indonesia	10.698	5.322	3.553	1.396	1.868	0.383	1.627	0.862	5.861	5.350	3.004	1.225
2017	Aceh	10.255	5.882	3.946	1.722	2.043	0.400	1.614	0.968	6.902	7.022	3.286	1.430
	Bali	1.146	0.295	0.615	0.192	1.668	0.279	1.541	0.663	3.620	3.258	1.521	0.496
	Bangka-Belitung Islands	9.856	7.068	4.188	2.117	3.022	0.650	1.940	1.386	7.025	6.781	3.722	1.728
	Banten	12.820	4.684	4.130	1.334	1.876	0.348	1.493	0.803	6.518	6.957	3.329	1.112
	Bengkulu	7.324	2.553	3.139	1.388	2.142	0.680	1.512	1.113	5.723	7.172	2.810	1.206
	Central Java	6.592	2.855	2.559	1.152	1.625	0.365	1.639	1.027	5.087	5.870	2.276	1.089
	Central Kalimantan	15.005	3.752	10.236	2.015	8.944	1.099	11.971	3.062	25.514	14.507	10.359	2.008
	Central Sulawesi	8.733	6.708	1.532	2.303	1.517	0.665	1.286	1.367	4.100	5.717	2.181	1.744
	East Java	9.847	2.992	3.299	0.950	1.790	0.230	1.480	0.497	6.351	3.617	2.657	0.748
	East Kalimantan	7.180	2.843	3.048	0.911	2.014	0.351	1.505	0.943	5.344	6.603	2.688	0.872
	East Nusa Tenggara	12.992	7.520	4.833	2.320	2.213	0.552	1.736	1.175	6.310	5.902	4.046	1.916
	Gorontalo	18.573	7.262	8.619	4.131	3.237	1.332	2.757	2.408	4.825	5.534	5.518	2.592
	Jakarta	7.460	3.332	2.591	0.988	1.315	0.252	1.147	0.618	5.489	5.950	2.087	0.798
	Jambi	7.369	6.941	3.506	0.806	2.563	0.583	1.801	0.945	7.767	8.686	3.151	1.397
	Lampung	13.472	5.034	3.897	1.234	1.633	0.226	1.351	0.689	6.173	6.830	3.081	1.084
	Maluku	16.535	6.335	5.310	2.206	2.427	0.884	2.008	1.632	6.115	7.095	4.648	2.003
	North Kalimantan	28.273	7.434	8.309	1.110	8.374	0.152	15.398	0.333	33.447	2.954	11.428	1.112
	North Maluku	17.712	9.989	5.995	2.915	2.171	1.088	1.604	2.137	5.483	8.110	4.501	2.592
	North Sulawesi	0.680	10.630	0.512	1.931	0.528	0.472	0.798	1.071	1.495	7.188	0.618	1.821
	North Sumatra	18.273	8.791	5.324	2.080	2.764	0.482	2.023	1.042	7.404	7.427	4.876	1.889
Papua	26.055	35.247	6.569	3.183	2.474	0.588	1.753	1.111	5.783	6.351	6.017	5.249	
Riau	9.659	2.981	2.654	0.917	1.156	0.241	1.152	0.667	5.638	6.190	2.378	0.803	
Riau Islands	7.412	3.741	3.102	1.481	1.097	0.307	0.949	0.893	5.164	6.375	2.214	1.026	
South Kalimantan	5.261	1.945	4.047	1.066	2.933	0.277	1.934	0.629	7.762	3.997	3.278	0.707	

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	South Sulawesi	8.471	4.720	3.623	2.067	1.920	0.837	1.821	1.869	5.808	8.666	2.943	1.863
	South Sumatra	14.502	10.301	3.689	1.876	1.947	0.464	1.773	0.927	9.150	5.786	3.509	1.789
	Southeast Sulawesi	4.578	8.118	2.808	2.443	2.396	0.691	1.571	1.386	3.603	6.490	2.645	2.032
	West Java	8.371	2.715	2.889	0.856	1.355	0.213	1.239	0.523	4.889	3.658	2.272	0.688
	West Kalimantan	6.202	2.549	2.332	1.034	1.792	0.372	1.542	0.967	6.153	6.206	2.368	0.929
	West Nusa Tenggara	14.264	6.789	4.183	1.931	1.873	0.661	1.655	1.501	5.049	6.631	3.583	1.727
	West Papua	12.594	5.101	4.130	1.602	1.910	0.901	1.403	1.848	4.369	6.438	3.511	1.688
	West Sulawesi	19.698	9.382	5.387	2.523	1.953	0.577	1.582	1.396	5.846	8.685	4.558	2.164
	West Sumatra	5.741	3.669	2.101	1.121	1.312	0.402	1.242	0.919	3.206	4.081	1.916	1.062
	Yogyakarta	6.042	2.498	1.994	0.857	1.272	0.307	1.337	0.941	5.620	7.689	1.929	1.177
	Indonesia	10.230	5.063	3.456	1.347	1.849	0.374	1.612	0.849	5.816	5.286	2.909	1.178
2018	Aceh	10.181	5.686	3.852	1.689	2.015	0.388	1.601	0.953	6.860	7.003	3.214	1.384
	Bali	1.576	0.415	0.685	0.215	1.665	0.275	1.544	0.651	3.662	3.202	1.569	0.507
	Bangka-Belitung Islands	9.096	6.431	3.938	2.008	2.983	0.632	1.898	1.356	6.845	6.623	3.561	1.621
	Banten	12.156	4.424	3.954	1.272	1.837	0.334	1.475	0.790	6.458	6.868	3.180	1.057
	Bengkulu	7.375	2.566	3.045	1.364	2.118	0.659	1.499	1.096	5.670	7.103	2.764	1.186
	Central Java	6.529	2.832	2.431	1.119	1.595	0.356	1.642	1.026	5.056	5.788	2.223	1.073
	Central Kalimantan	14.880	3.696	9.940	1.966	8.856	1.069	11.805	3.003	25.369	14.340	10.217	1.973
	Central Sulawesi	8.407	6.523	1.444	2.224	1.484	0.646	1.266	1.339	4.040	5.655	2.094	1.681
	East Java	9.616	2.933	3.190	0.925	1.774	0.224	1.470	0.491	6.300	3.552	2.594	0.730
	East Kalimantan	6.326	2.465	2.786	0.826	1.970	0.337	1.466	0.916	5.189	6.415	2.510	0.803
	East Nusa Tenggara	13.440	7.718	4.751	2.313	2.211	0.541	1.744	1.163	6.344	5.912	4.032	1.906
	Gorontalo	18.667	7.322	8.348	4.028	3.197	1.285	2.745	2.368	4.813	5.495	5.399	2.527
	Jakarta	7.241	3.216	2.381	0.924	1.271	0.239	1.133	0.612	5.439	5.816	1.993	0.766

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Jambi	7.701	7.111	3.447	0.801	2.537	0.562	1.800	0.934	7.758	8.631	3.136	1.385
	Lampung	12.792	4.726	3.757	1.179	1.616	0.219	1.346	0.678	6.136	6.809	2.956	1.036
	Maluku	16.498	6.368	5.135	2.198	2.421	0.873	1.999	1.611	6.046	6.986	4.545	1.976
	North Kalimantan	27.511	7.305	8.142	1.096	8.199	0.147	14.992	0.326	32.772	2.898	11.161	1.070
	North Maluku	17.420	9.676	5.777	2.818	2.168	1.063	1.590	2.102	5.413	8.000	4.360	2.495
	North Sulawesi	0.675	10.365	0.495	1.872	0.521	0.459	0.792	1.054	1.495	7.148	0.612	1.765
	North Sumatra	17.348	8.306	5.124	2.002	2.722	0.467	1.993	1.030	7.324	7.360	4.665	1.797
	Papua	25.578	34.288	6.350	3.103	2.460	0.580	1.728	1.094	5.683	6.266	5.816	4.999
	Riau	9.852	3.054	2.612	0.912	1.143	0.235	1.139	0.655	5.546	6.146	2.351	0.798
	Riau Islands	7.319	3.683	2.950	1.427	1.086	0.299	0.949	0.873	5.109	6.245	2.140	0.990
	South Kalimantan	4.978	1.783	3.899	1.005	2.883	0.264	1.908	0.607	7.749	3.915	3.185	0.670
	South Sulawesi	8.745	4.879	3.586	2.067	1.898	0.828	1.797	1.853	5.711	8.643	2.921	1.867
	South Sumatra	14.000	9.903	3.555	1.822	1.921	0.452	1.771	0.916	9.087	5.720	3.390	1.712
	Southeast Sulawesi	4.634	8.119	2.737	2.403	2.348	0.673	1.545	1.356	3.586	6.466	2.595	1.988
	West Java	8.458	2.724	2.830	0.844	1.343	0.206	1.235	0.513	4.847	3.573	2.240	0.675
	West Kalimantan	6.108	2.527	2.243	1.004	1.781	0.365	1.528	0.955	6.098	6.132	2.322	0.913
	West Nusa Tenggara	13.358	6.368	3.956	1.838	1.832	0.641	1.646	1.482	5.030	6.590	3.392	1.649
	West Papua	12.970	5.243	4.061	1.609	1.954	0.897	1.393	1.816	4.328	6.398	3.526	1.692
	West Sulawesi	19.234	9.267	5.132	2.438	1.911	0.554	1.566	1.370	5.837	8.686	4.366	2.095
	West Sumatra	6.043	3.850	2.054	1.121	1.298	0.392	1.230	0.904	3.153	4.007	1.909	1.060
	Yogyakarta	5.742	2.345	1.850	0.798	1.260	0.297	1.311	0.921	5.488	7.472	1.862	1.136
	Indonesia	10.064	4.968	3.343	1.313	1.827	0.364	1.602	0.839	5.770	5.213	2.836	1.147
2019	Aceh	9.880	5.427	3.732	1.623	1.979	0.377	1.575	0.938	6.812	6.977	3.112	1.328
	Bali	1.592	0.424	0.662	0.210	1.646	0.269	1.526	0.638	3.622	3.159	1.558	0.506

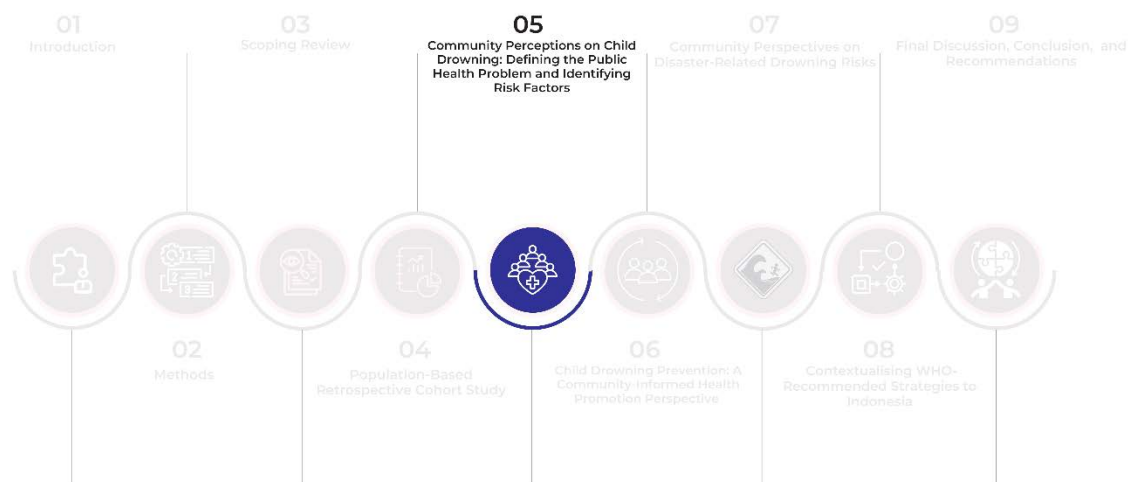
Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Bangka-Belitung Islands	8.587	6.032	3.754	1.905	2.918	0.609	1.856	1.329	6.728	6.492	3.424	1.537
	Banten	11.294	4.098	3.772	1.199	1.800	0.320	1.453	0.778	6.377	6.770	3.017	0.997
	Bengkulu	7.125	2.469	2.909	1.304	2.078	0.636	1.474	1.078	5.601	7.018	2.675	1.147
	Central Java	6.309	2.709	2.314	1.069	1.574	0.347	1.632	1.025	4.996	5.688	2.165	1.049
	Central Kalimantan	14.585	3.602	9.635	1.891	8.758	1.038	11.705	2.951	25.186	14.152	10.065	1.931
	Central Sulawesi	8.024	6.273	1.367	2.129	1.448	0.625	1.238	1.313	3.984	5.598	2.006	1.610
	East Java	9.194	2.782	3.058	0.887	1.747	0.218	1.443	0.486	6.236	3.501	2.510	0.708
	East Kalimantan	5.817	2.241	2.628	0.776	1.919	0.325	1.430	0.895	5.115	6.289	2.385	0.759
	East Nusa Tenggara	13.265	7.581	4.579	2.227	2.189	0.525	1.736	1.151	6.345	5.899	3.923	1.845
	Gorontalo	18.189	7.095	7.940	3.824	3.144	1.236	2.713	2.328	4.782	5.449	5.205	2.422
	Jakarta	6.993	3.107	2.198	0.855	1.234	0.228	1.108	0.604	5.361	5.688	1.904	0.736
	Jambi	7.592	6.920	3.333	0.770	2.507	0.542	1.789	0.921	7.746	8.571	3.071	1.340
	Lampung	12.328	4.498	3.647	1.125	1.586	0.211	1.340	0.672	6.119	6.801	2.852	0.998
	Maluku	15.819	6.132	4.891	2.101	2.399	0.847	1.971	1.583	5.974	6.873	4.355	1.896
	North Kalimantan	26.497	7.008	7.966	1.064	8.089	0.143	14.798	0.321	32.433	2.859	10.950	1.014
	North Maluku	16.924	9.296	5.538	2.681	2.146	1.030	1.567	2.063	5.345	7.872	4.191	2.382
	North Sulawesi	0.652	10.024	0.480	1.802	0.508	0.446	0.777	1.036	1.479	7.092	0.600	1.707
	North Sumatra	16.775	7.994	4.970	1.919	2.673	0.454	1.961	1.017	7.233	7.277	4.502	1.725
	Papua	24.459	32.579	6.057	2.940	2.401	0.559	1.685	1.071	5.559	6.135	5.511	4.654
	Riau	9.532	2.966	2.511	0.870	1.122	0.228	1.118	0.644	5.476	6.065	2.258	0.769
	Riau Islands	7.069	3.533	2.799	1.364	1.071	0.290	0.940	0.854	5.078	6.137	2.048	0.943
	South Kalimantan	4.709	1.642	3.770	0.951	2.863	0.256	1.872	0.591	7.694	3.862	3.114	0.640
	South Sulawesi	8.518	4.732	3.465	1.991	1.868	0.813	1.768	1.838	5.627	8.572	2.837	1.830
	South Sumatra	13.504	9.565	3.432	1.755	1.891	0.439	1.763	0.908	9.086	5.665	3.278	1.642

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Southeast Sulawesi	4.572	7.965	2.661	2.327	2.298	0.654	1.510	1.330	3.555	6.439	2.531	1.924
	West Java	8.110	2.591	2.725	0.807	1.326	0.200	1.219	0.504	4.784	3.484	2.162	0.647
	West Kalimantan	5.812	2.393	2.145	0.950	1.752	0.356	1.499	0.940	6.031	6.059	2.245	0.882
	West Nusa Tenggara	12.643	6.050	3.762	1.744	1.797	0.620	1.624	1.461	4.999	6.547	3.232	1.583
	West Papua	12.596	5.071	3.901	1.547	1.933	0.871	1.376	1.777	4.293	6.336	3.406	1.633
	West Sulawesi	18.378	8.881	4.880	2.316	1.869	0.532	1.535	1.342	5.798	8.667	4.144	1.997
	West Sumatra	5.826	3.685	1.954	1.066	1.270	0.381	1.203	0.888	3.094	3.922	1.838	1.019
	Yogyakarta	5.529	2.245	1.769	0.763	1.233	0.287	1.286	0.905	5.415	7.401	1.807	1.113
	Indonesia	9.687	4.771	3.213	1.256	1.799	0.354	1.581	0.829	5.711	5.141	2.742	1.106

Supplementary Table 4.10.2. The Trend of Unintentional Drowning Mortality Rates by Sex and Age Group in Indonesia between 2005 and 2019

Age Group		Mortality rates (per 100,000)															Linear Trend Model	R-squared
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019		
Under 5	Male	13.99	13.52	13.07	13.35	13.29	12.88	12.59	12.36	12.21	11.88	11.78	10.70	10.23	10.06	9.69	$y = -0.30x + 14.45$	$R^2 = 0.94$
	Female	10.45	9.86	9.39	9.14	8.72	8.00	7.37	6.93	6.52	6.11	5.76	5.32	5.06	4.97	4.77	$y = -0.43x + 10.64$	$R^2 = 0.98$
5-14 years	Male	5.21	4.94	4.61	4.62	4.59	4.49	4.40	4.21	4.06	3.92	3.70	3.55	3.46	3.34	3.21	$y = -0.14x + 5.23$	$R^2 = 0.98$
	Female	2.96	2.74	2.54	2.39	2.26	2.10	1.96	1.83	1.70	1.57	1.47	1.40	1.35	1.31	1.26	$y = -0.12x + 2.90$	$R^2 = 0.97$
15-49 years	Male	2.63	2.56	2.44	2.40	2.36	2.30	2.25	2.16	2.09	2.01	1.88	1.87	1.85	1.83	1.80	$y = -0.06x + 2.66$	$R^2 = 0.98$
	Female	0.71	0.68	0.64	0.61	0.58	0.54	0.52	0.48	0.45	0.42	0.39	0.38	0.37	0.36	0.35	$y = -0.03x + 0.72$	$R^2 = 0.97$
50-69 years	Male	2.03	2.04	1.97	1.96	1.95	1.94	1.91	1.83	1.76	1.70	1.63	1.63	1.61	1.60	1.58	$y = -0.04x + 2.12$	$R^2 = 0.95$
	Female	1.44	1.42	1.36	1.25	1.18	1.11	1.05	1.00	0.95	0.90	0.88	0.86	0.85	0.84	0.83	$y = -0.05x + 1.44$	$R^2 = 0.93$
70+ years	Male	5.38	5.44	5.42	5.56	5.66	5.75	5.81	5.91	5.97	5.98	5.89	5.86	5.82	5.77	5.71	$y = 0.03x + 5.48$	$R^2 = 0.50$
	Female	4.79	4.83	4.85	4.78	4.74	4.73	4.62	4.90	5.09	5.31	5.44	5.35	5.29	5.21	5.14	$y = 0.05x + 4.64$	$R^2 = 0.59$
All Ages	Male	4.35	4.19	3.99	3.98	3.93	3.81	3.71	3.58	3.46	3.32	3.16	3.00	2.91	2.84	2.74	$y = -0.12x + 4.45$	$R^2 = 0.99$
	Female	2.34	2.21	2.09	1.99	1.89	1.75	1.63	1.54	1.45	1.36	1.29	1.23	1.18	1.15	1.11	$y = -0.09 + 2.34$	$R^2 = 0.97$

Chapter 5 Community Perceptions on Child Drowning: Defining the Public Health Problem and Identifying Risk Factors



5.1. Overview

Title: Child drowning in Indonesia: Insights from parental and community perspectives and practices

This chapter is presented as a publication manuscript. The formatting of this chapter adheres to journal requirements; however, table and figure numbering, as well as referencing, have been aligned with the thesis format. The references for this chapter are included within the overall thesis' reference list.

The manuscript has been accepted for publication in the *Health Promotion International* journal and is currently in press. The paper will be published under a CC BY 4.0 license. Copyrights © 2024 by the authors. The citation for the publication is: Cenderadewi M, Franklin RC, Fathana PB, Devine SG. Child drowning in Indonesia: Insights from parental and community perspectives and practices. *Health Promotion International*. 2024;doi:10.1093/heapro/daae113.³⁸⁹

This qualitative chapter was designed to complement the quantitative study in the previous chapter, which revealed high mortality rates among children under five, especially in eastern Indonesia, including West Nusa Tenggara. This qualitative study aimed to investigate parental and community perceptions of child drowning as a public health concern in Indonesian communities, along with their perceptions and practices regarding the risk factors of child drowning. The findings underscored the pressing need to further investigate local contexts and social determinants of drowning to inform

development of effective water safety promotion and drowning prevention strategies in Indonesia, thus guiding the exploration in subsequent chapters.

The authors' contributions are outlined as follows: i) M. Cenderadewi: Conceptualisation, data curation, formal analysis, investigation, methodology, project administration, resources, validation, visualization, writing – original draft, writing – review & editing; ii) R. C. Franklin: Conceptualisation, formal analysis, methodology, resources, funding acquisition, supervision, validation, visualization, writing – review & editing; iii) P. B. Fathana: Data curation, investigation, validation; iv) S. G. Devine: Conceptualisation, data curation, formal analysis, methodology, resources, funding acquisition, supervision, validation, visualization, writing – review & editing.

The paper is presented below as the final accepted version for publication.

5.2. Abstract

Child drowning is a significant public health issue in Indonesia, however there is insufficient understanding of the issue and its associated risk factors within communities. This qualitative study aimed to explore parental and community perceptions and practices related to child drowning in Indonesian communities, and the perceived causes and risk factors. Seven focus group discussions (n=62) were conducted with parents of children aged under-five years and village community leaders in seven villages across all districts of Lombok Island, West Nusa Tenggara Province of Indonesia. Participants were recruited using purposive and snowball sampling. The thematic analysis, guided by Braun and Clarke's framework, used both deductive approaches, utilising Health Belief Model's constructs, and inductive approaches. Most participants were unaware of the susceptibility of their children and others in their community to drowning and of the potential severe outcomes of drowning such as injury, disability, and death. Participants generally associated drowning with beaches or open seas. Unprotected wells, tubs, and buckets were identified as notable risk factors for child drowning in and around home, shaped by some experience of child drowning incidents in the community. Supervision was identified as protective factor however mothers were often unavailable to supervise children, and supervision responsibility was often delegated to other family and community members. This study highlights the urgent need to enhance public awareness regarding children's susceptibility to drowning. Further exploration of local contexts and social determinants of drowning in Indonesian communities is crucial for ensuring effective water safety promotion and drowning prevention strategies.

5.3. Contribution to Health Promotion

- This review informs contextualisation of drowning prevention and water safety strategies in resource-limited settings of low- and middle-income countries (LMIC).
- This study identified limited community understanding of child drowning preventability, vulnerability, and risk factors. Applying the Health Belief Model (HBM), the study revealed a pervasive lack of awareness regarding the susceptibility of children and others in the community to drowning and potential severe consequences of drowning, including injury, disability, and death.
- Further investigation of the local contexts and social determinants of drowning, using a health promotion approach, is crucial for effective and sustainable water safety promotion and drowning prevention strategies in Indonesia and other LMIC.

5.4. Introduction

Despite considerable progress in reducing child mortality from various causes, child drowning persists as a significant yet preventable public health issue worldwide, especially in low- and middle-income countries (LMIC) in the South-East Asia Region, where over 33% of drowning deaths occur.^{6,10,70} Indonesia, with its vast archipelago of 17,500 islands and population of over 270,000,000, faces particularly high risk, especially among children under five years of age.²⁵⁹

Between 2005 and 2019, the under-five population in Indonesia consistently had the highest drowning mortality rates, averaging 9.67/100,000 population annually.²⁵⁹ Children under five were 3.67 times (95% CI: 3.63 - 3.72) more likely to fatally drown than individuals aged 15 to 49 years, with particularly high risks in Papua, Kalimantan, Sulawesi, Maluku, and Nusa Tenggara regions.²⁵⁹ Indonesia's vulnerability to natural disasters such as floods, cyclones, earthquakes, and tsunamis, as well as climate change-induced sea level rise, further compounds the risk.^{4,11,124} Despite this heightened risk, there is a lack of understanding about child drowning prevention in Indonesia.⁶¹ Hence, it is crucial to develop a clear understanding of parental and community perceptions regarding child drowning vulnerability and the associated risk and protective factors to inform drowning prevention and water safety promotion.

The Public Health Model (PHM) is a useful framework that can be used to understand and respond to public health issues, including drowning prevention.^{164,165} The PHM offers a systematic approach, progressing from issue identification to the development, implementation, and evaluation of interventions. It emphasises active community engagement and collaboration with stakeholders to

bridge the gap between injury prevention research and health promotion, and its first two stages, of defining the public health problem and risk factor identification, forms the foundation of this study (Figure 1.3).¹⁶⁶

There is also a growing recognition of the value of incorporating behavioural science theories into health promotion and injury prevention efforts.¹⁸⁵ Given the multifaceted nature of drowning, including its behavioural, natural, physical, and social aspects, integrating theories such as the Health Belief Model (HBM) can be beneficial in developing a deeper understanding of perceptions, behaviours and motivations relevant to drowning.^{186,187} The HBM suggests that individuals' motivation for health-promoting behaviours is influenced by their perceptions of susceptibility and severity of an issue, the perceived benefits and barriers to action, and cues to action and perceptions of self-efficacy that influence the adoption of health-promoting behaviour (Figure 1.5).^{186,187} By integrating these constructs, this study seeks to deepen the understanding of community perceptions of child drowning in Indonesia, to inform the development of effective health promotion interventions tailored to local contexts, empowering individuals and communities to adopt water safety-promoting behaviours more effectively.

5.4.1. Research Aims

This qualitative study aimed to explore parental and community perceptions and practices related to perceived causes and risk factors for child drowning in Indonesian communities.

5.4.2. Research Questions

This study answered the following questions:

1. What are Indonesian parental and community perceptions on child drowning as a public health issue in their community?
2. What are Indonesian parental and community perceptions and practices related to causes and risk factors of drowning?

5.5. Methods

5.5.1. Study Design

This qualitative study is part of a larger mixed-methods study investigating fatal unintentional drowning in Indonesia. The overall study comprised three phases: 1) a scoping review investigating the epidemiology, risk factors, and prevention strategies of unintentional drowning in Indonesia⁶¹, 2) a population-based retrospective cohort quantitative study examining mortality rates, incidence rates, risk factors, and burden of unintentional drowning in Indonesia between 2005 and 2019²⁵⁹, and 3) the qualitative study reported here. The exploratory qualitative design was chosen to expand and explain

the findings of the quantitative study, which highlighted high mortality rates among children under five, particularly in eastern Indonesia.²⁵⁹ The qualitative inquiry was grounded in constructivist ontology and interpretivist epistemology, which perceive reality as socially constructed and subjective, acknowledging that participants' realities are shaped by their social, historical, and cultural contexts, emphasising the uniqueness and subjectivity of their experiences and perceptions.^{202,204} This exploratory qualitative approach was selected for its potential to provide rich insights into participants' perceptions and experiences of drowning and perceived risk factors for child drowning in their communities, an area with limited exploration in existing literature.^{202,264}

5.5.2. Research Setting

This study was conducted in seven villages in all districts (West Lombok, North Lombok, East Lombok, Central Lombok, and Mataram districts) of Lombok Island, West Nusa Tenggara Province of Indonesia, representing coastal and inland communities, and child exposures to beaches, oceans, rivers, and other hazards around the household. West Nusa Tenggara was chosen as the study site due to its high under five drowning rates of 12.6/100,000 for males and 6.1/100,000 for females in 2019²⁵⁹ and its predominantly rural character and status as one of Indonesia's poorest health-performing provinces^{2,390-392}. The province is characterised by a blend of rural villages, agricultural areas, and growing urban centres, with the province's economy largely reliant on agriculture and fisheries³⁹⁰⁻³⁹². While West Nusa Tenggara hosts urban centres with some degree of urbanisation and economic activity, a substantial proportion of the province's population resides in its 1,021 rural villages (called 'desa' in Indonesia's administrative hierarchy), in contrast to 141 urban sub-districts (known as 'kelurahan', the urban administrative equivalent of 'desa').^{390,391}

In 2023, 19% of its population lived below the national poverty threshold, and many barely above it, with key health indicators, such as infant mortality (25 per 1,000 live births) and under-five mortality (29 per 1,000 live births), remaining among the nation's highest in 2022.²⁷¹⁻²⁷³ Economic disparities persist, and as reported by the United Nations International Children Emergency Funds (UNICEF)¹, only half the population has access to basic sanitation at home, heightening the risk of child drowning near open water bodies. UNICEF also reported that only 20% of 3-year-olds and 40% of 4-year-olds in West Nusa Tenggara are in preschool, whereas preschool attendance is higher in more developed provinces.¹ For instance, in East Java, where the per capita GDP is nearly 2.5 times that of West Nusa Tenggara, 40% of 3-year-olds and 80% of 4-year-olds attend preschool.^{1,267,393} This limited access to early childhood care and education does not align with the World Health Organization's (WHO) recommendation to promote daycare as a child drowning preventive measure for high-risk under-5 populations.^{7,59,70,99}

5.5.3. Sample Selection and Recruitment

Participants were eligible for inclusion if they were parents of children under the age of five or village community leaders, residing in villages of densely populated sub-districts located in coastal areas and/or near the inland water bodies of Lombok Island, West Nusa Tenggara Province of Indonesia. Parents were selected due to prior research highlighting their supervisory role as pivotal in preventing child drowning in LMIC.^{41,157} Village community leaders, such as village chiefs, elders, religious figures, and voluntary community health workers, were chosen for their deep community connections and understanding of local community norms and practices.²⁷⁷

Recruitment employed purposive and snowball sampling, facilitated by village chiefs and community health workers to identify critical informants with substantial insights into the subject. Face-to-face recruitment occurred during social village meetings and activities. Interested individuals were provided with a detailed information sheet and a consent form. Data saturation determined the final sample size of 62 participants.

5.5.4. Data Collection

Between October 2023 and March 2024, seven focus group discussions (FGDs) (n=62) were conducted at various community locations in the local language. This methodology facilitated in-depth data collection, capturing individual narratives and personal experiences regarding child drowning, as well as group-level insights into community norms, practices, and decision-making processes related to child drowning prevention. Participants from both groups (parents and village community leaders) were included together in the same FGD. This approach can facilitate discussions where different perspectives interact simultaneously, potentially leading to deeper insights into shared concerns or differing viewpoints. It also allows for the articulation of nuances of the issue and dimensions of social dynamics that might not emerge as readily in separate groups.²⁹²

Written consent to participate in the study, as well as permission to be audio-recorded, was obtained from each participant. Characteristics such as age, gender, education, occupation, number and ages of children, and details about the home environment, including nearby water bodies in participant's community and dwelling, were collected via a household demographic questionnaire at the start of each focus group (Appendix 7).

A moderator guide was developed by the research team members and informed by the HBM and the findings of the previous scoping review.^{61,187} The moderator guide was then translated into Indonesian language. Prior to the implementation, the lead researcher (MC) pilot tested the moderator guide for face validity, resulting in minor modifications of the prompts (Table 5.1).

Table 5.1. Focus Group Moderator Guide's Domains of Enquiry and Examples of Follow-Up Questions

Domains of enquiry and examples of follow up questions and probes	Constructs of Health Belief Model applied
<ul style="list-style-type: none"> • Q1. "Could you tell me some of the activities your family engaged with around water bodies?" <ul style="list-style-type: none"> - Family's relationship with water: <ul style="list-style-type: none"> • "Could you tell me about your family's and children's activities around water?" • "Could you tell me what water bodies exist in your community and in and around your home?" • "Could you tell me your use of watercrafts and flotation devices on board?" - Supervision for children: <ul style="list-style-type: none"> • "Could you tell me who in your family is responsible to supervise children while they are doing activities around water?" • "Could you tell me more about your family structure and the main caretaker in your household?" 	<ul style="list-style-type: none"> • Perceived susceptibility
<ul style="list-style-type: none"> • Q2. "What do you think are the greatest health concerns for your community?" <ul style="list-style-type: none"> - "How important do you think drowning is as a health issue in your community?" - "Where do you think drowning fits among these greatest health concerns in your community?" - "Have you ever experienced/witnessed/heard stories about drowning events in your community?" - "Are you aware of local beliefs and practices surrounding the issue of drowning in your community?" 	<ul style="list-style-type: none"> • Perceived susceptibility • Perceived severity • Cues to action
<ul style="list-style-type: none"> • Q3. "Who do you think is at most risk for drowning in your community?" • Q4. "What do you think of drowning as a cause of injury/death for children?" • Q5. "What do you think are the reasons that might cause a child to drown?" • Q6. "Can you tell me about aspects of the environment and community in which you live that could increase the risk of a child drowning?" 	<ul style="list-style-type: none"> • Perceived susceptibility • Perceived severity • Perceived barriers • Self-efficacy • Cues to action
<ul style="list-style-type: none"> • Q7. "What are some of the things that might make it hard to keep children safe from drowning?" • Q8. "Can you tell me about how and what have you taught your children about water dangers?" • Q9. "What would you like to see put in place to prevent children from drowning in your community?" <ul style="list-style-type: none"> - "Who do you think are responsible for preventing drowning?" - "Where do you get your information on drowning prevention from?" 	<ul style="list-style-type: none"> • Perceived barriers • Perceived benefits • Self-efficacy • Cues to action

Two Indonesian researchers (MC, PBF) facilitated the focus groups, with one (MC) facilitating discussions and the other (PBF) taking notes. Both were fluent in Indonesian, Sasak, and English. Discussions were primarily in Indonesian, but participants could also use the local Sasak language. Each group lasted 50 to 60 minutes and consisted of five to twelve participants.

Discussions were audiotaped and transcribed verbatim. The Indonesian transcripts were translated into English by the lead researcher (MC) and then back into Indonesian by another team member (PBF) to ensure accuracy. Senior researchers (SGD and RCF) reviewed a subset of translated transcripts to verify data accuracy.

5.5.5. Analysis

Translated transcripts, demographic data, and field notes were entered into NVivo Version 20. This study employed thematic analysis (TA), guided by Braun and Clarke's framework³⁰⁰, for its suitability in exploring child drowning in Indonesia, offering a flexible method to investigate a range of research questions in this under-explored area. While this study acknowledged the theoretical grounding provided by the HBM¹⁸⁷ and integrated it into a deductive approach to analysis, the analysis favoured open and organic coding. Themes emerged through iterative data immersion, reflection, and questioning, underscoring the subjective and interpretative nature of TA. Thus, researcher reflexivity is crucial, rather than emphasising objectivity, reliability, or coding accuracy, aligning with reflexive TA principles which allow for flexibility and adaptability.^{300,302,303} This approach allowed for in-depth exploration and interpretation, uncovering rich insights into the complexity of child drowning in Indonesian communities.

The TA progressed through several stages.^{300,302} First, data immersion involved the researchers thoroughly familiarising themselves with the dataset by repeatedly reading focus group transcripts. Second, code development entailed generating initial codes across the dataset by systematically labelling segments of data representing meaningful concepts, ideas, and patterns. The researchers started with deductive coding based on the theoretical framework of the HBM to guide the initial stages of analysis. However, as analysis progressed, new sights emerged organically beyond the original framework. This approach allowed for a nuanced exploration of both theoretical expectations and unexpected findings within the data, reflecting a balance between deductive and inductive approaches. Thirdly, relevant codes were grouped together into potential themes. The next step was iterative organising, structuring, and refining of data to capture key concepts and phenomena within the data set. This was followed by clearly defining each theme, setting its scope and boundaries, developing its narrative, and giving it an informative name, ensuring that each theme was distinct and coherent. The researchers then moved beyond descriptive analysis to interpret the meaning and significance of the themes within the research context, exploring relationships between themes, considering how specific social, cultural, and historical contexts shaped meanings, identifying underlying assumptions or theoretical frameworks, and considering the broader implications of the findings. The findings were subsequently organised and presented in a thematic table (Table 5.3), which provided detailed theme definitions and scopes and representative excerpts of each theme. The researchers then developed narratives for the four identified themes, integrating the data and providing the contextual basis, as presented in the Results section of this publication.^{300,302}

5.5.6. Researcher reflexivity on positionality

This study acknowledges the positionality of two Indonesian researchers (MC, PBF) as middle-class, well-educated medical doctors, alongside the senior researchers' (RCF, SGD) non-Indonesian backgrounds. Both Indonesian researchers are from Lombok, fluent in Sasak and Indonesian, offering a unique connection to the region. Throughout the analysis, the researchers consistently reflected on and critically examined how their socioeconomic positions, privileges, and assumptions, as well as the power dynamics with the underserved populations studied, might introduce biases, and they explored strategies to mitigate them. Advice from community leaders and prolonged engagement at the study site deepened the researchers' understanding of the research setting and participants, centring community voices and ensuring an authentic representation of participants' perspectives.

5.5.7. Rigor

To ensure the dependability, credibility, conformability, and transferability of the study, several measures were taken: 1) Purposive sampling; 2) Prolonged engagement at research sites to build rapport with participants and to gain full understanding of participants' narratives, 3) Collection of participant demographics; 4) Continual reflection on assumptions and biases; 5) Member-checking, conducted both informally during each FGD to immediately verify findings, and formally through follow-up interviews after FGD transcriptions, to validate the interpretation of the data collected; 6) Back-translation to validate data accuracy; 7) Iterative cycles of coding, interpreting, and reflecting on data; 8) Consensus discussions on themes and theme definitions; 9) Inclusion of direct quotations as evidence; and 10) Establishment of an audit trail of data collection and analysis.^{303,308}

5.5.8. Ethics Approval

Ethical approval was granted by the University of Mataram - Indonesia (Ethics Approval number 044/UN18.F8/ETIK/2024) and acknowledged by James Cook University's Human Research Ethics Committee (External HREC Approval Acknowledgement reference number H9088).

5.6. Results

Sixty-two parents of children under five years of age and village community leaders participated in the focus groups. The majority were female (n=47, 75.8%), aged between 25-44 (n=32, 51.6%), and had not completed primary education (n=36, 58.1%). Most participants recruited were mothers of children under the age of five (n=33, 53.2%), followed by village community leaders (n=23, 37.1%) and fathers (n=6, 9.7%) (Table 5.2). The village community leaders were predominantly parents of children aged over five years or grandparents of children under five. This demographic composition provided a deeper understanding of the community context surrounding child drowning.

Table 5.2. Focus Group Participants' Characteristics and Home Environment

Focus group participants' characteristics and home environment (n=62)			
		n	%
Gender	Female	47	75.8
	Male	15	24.2
Age group	18-24 years	6	9.7
	25-34 years	16	25.8
	35-45 years	16	25.8
	44-54 years	11	17.7
	55 and above	13	21.0
Education level	Did not complete primary education	36	58.1
	Completed primary education	14	22.6
	Completed high school	12	19.4
Occupation	Homemaker	34	54.8
	Daily labourer	7	11.3
	Farmer	4	6.5
	Fisherman	2	3.2
	Others	15	24.2
Number of children	0	1	1.6
	1	10	16.1
	2	11	17.7
	3	16	25.8
	4	12	19.4
	5 and over	12	19.4
Number of children under the age of five	0	23	37.1
	1	28	45.2
	2	11	17.7
Water bodies exist within 500 metres from participant's home	Wells	62	100.0
	Ditches	46	74.2
	Creeks	46	74.2
	Rivers/larger streams	13	21.0
	Beaches	12	19.4
	Ponds	1	1.6
Water bodies exist in and around participant's home	Wells	60	96.8
	Bathtubs (serves as water containers)	50	80.7
	Bucket	55	88.7

Data analysis revealed four key themes: a) Concepts of drowning as an issue; (b) Perceived preventability of child drowning; (c) Drowning risk factors; and (d) Implications of cultural norms and collectivism in childrearing practice on drowning risk. Results are presented below under each theme heading and summarised in Table 5.3, which includes further illustrative participant quotes.

5.6.1. Theme 1 – Concepts of Drowning as an Issue

Most participants across all age groups, particularly village community leaders aged 55 years and above, did not perceive drowning as a risk in their community. Those who did view drowning as a possibility, mostly saw it as an issue for those who lived near a beach. Only a few participants acknowledged drowning as a health concern in the community, mostly those who had personal experience of a non-fatal child drowning incidents in their home or community.

"There is no such thing [as children drowning]. Maybe it's them who live by the beach. Perhaps they are the ones who should pay more attention and supervise their children. It (drowning in children) seems like too far away of an idea."

Group 3, female, participant ID number: G3F1

"Actually, at times we are worried about it [drowning], especially when the kids are playing in the streams. That is why we look for them when they've been gone playing for too long."

Group 2, female, participant ID number: G2F4

Overwhelmingly, participants had considered drowning as a risk for adults working on the open seas. However, they had not considered the susceptibility of children drowning and showed limited awareness of the possibility of children drowning in and around the home environment.

"I think maybe it [drowning] is for people who work at the sea. Boaters, fishermen go to the sea every day. Drowning depends on the location, really. If it's in and around the home, where would these children drown?"

Group 2, male, participant ID number: G2M2

While some participants recognised that drowning could be serious and cause death, many, particularly those who appeared to be in older age groups, downplayed its severity. Most participants cited other illnesses such as fever, respiratory tract symptoms, and diarrhea as the primary health concerns for children in their community, with little consideration of drowning.

"No, not death [by drowning]. No. Maybe [drowning causes] like regular runny nose, from inhaling the water."

Group 1, female, participant ID number: G1F3

"The most important health problems here are usually related to children's illnesses. Fever, coughs, shortness of breath. But these kinds of illnesses are common in this village."

Group 5, female, participant ID number: G5F2

Some participants who appeared to be in younger age groups were more likely to recognise the severe consequences and potential fatality of drowning. Many of these participants cited acquiring awareness of the fatal consequences of drowning, including in children, from various media outlets, including news broadcasts on television and social media, emphasising the importance of preventive measures, particularly parental supervision of children.

“Drowning is important, and it is fatal because it can cause death from lack of oxygen. Children can pass out from it. It is a serious matter. 50:50 chance of survival, between life or death.”

Group 6, male, participant ID number: G6M1

“There are more news reports on drowning deaths these days, including those involving celebrities. If any celebrity or their children drown, we become more aware. The news report becomes a lesson for us that we need to be more cautious. We need to be careful not to trust other people too easily, including in letting our children be supervised by others.”

Group 6, female, participant ID number: G6F1

Interestingly, none of the participants mentioned how non-fatal drowning can cause injuries or disabilities. While some participants acknowledged the consequences of non-fatal drowning, they primarily referred to it as an 'illness' resulting from drowning, with no mention of injuries or disabilities caused by drowning.

“Drowning can cause illness from wrongly inhaling the water.”

Group 1, female, participant ID number: G1F2

“Not only can drowning cause an illness in children, but drowning can also cause children to die.”

Group 4, female, participant ID number: G4F1

Some participants reported that witnessing non-fatal child drowning incidents in their home and community changed their perception of children's susceptibility to drowning and the potential severity of its consequences. These incidents also heightened their awareness of the importance of providing constant supervision for children.

“My child almost drowned. My youngest child. Four and a half years old... My child almost didn't have the strength to survive, because he is still very young. I was the one who was being careless. I asked my son's friend to watch over him, but he didn't pay attention. I left both of them to play, thinking they would be fine. I went inside. The water level was very shallow, so I didn't think my son could drown in it, but apparently, children can still drown in shallow waters. It [the experience] must have changed my opinion [on child drowning risk]. Accidents could happen and cause deaths.”

Group 6, female, participant ID number: G6F3

5.6.2. Theme 2 – Perceived Preventability of Child Drowning

Many participants viewed child drowning as “accidents”. They perceived drowning incidents as unexpected and inevitable occurrences rather than preventable events that can be mitigated through appropriate measures. Some participants also described drowning as unintentional events.

“I think drowning is similar to road traffic accidents. It is an accident caused by carelessness.”

Group 6, male, participant ID number: G6M1

“Children drown if they slip. Slip and fall into the water.”

Group 1, female, participant ID number: G1F2

Participants' perception of the inevitability of child drowning incidents is influenced by deeply rooted cultural and religious-based fatalistic beliefs surrounding drowning. Many participants cited local cultural and religious beliefs, attributing drowning to destiny or supernatural causes such as 'spirits'.

“In our culture, in Sasak culture, death is our destiny, the end of life. It is a promise already made by God, determining how our lives will end. If drowning is our destiny, we must accept it.”

Group 4, female, participant ID number: G4F1

“Well, there are local beliefs. It's, I don't know how to explain it because these things cannot be seen with our eyes, but the water spirits are believed to drag people in. Logically, perhaps, if we would like to rationalise, there could be a whirlpool in the water that drags people in. But people still believe in such things. There are sacred places and sacred waterways believed to cause people to drown.”

Group 6, male, participant ID number: G6M1

However, some participants, despite believing drowning is inevitable due to destiny, still recognised the importance of taking preventive measures, especially for their children. They outlined specific safety skills children need to be equipped with, particularly swimming ability, and safety approaches parents would adopt to reduce the risk of their children drowning, such as providing supervision and attempting to access lifejackets on public boats, even though lifejackets are often not provided to passengers.

“If the boat goes down, you're going to drown. That's it. If I'm on my own, yes, I can say it [drowning] is my destiny, I can accept that. But if I'm with my kids, I don't think I can accept that [drowning] that easily, that I'm going to drown with my children. That's why I'm looking

for a safer spot on the ferry ... if the winds were strong, we told our children to sit under the lifejackets, near where the lifejackets were hanged, as if we could quickly grab them [lifejackets].”

Group 4, female, participant ID number: G4F3

“Child drowning happens because no children here know how to swim.”

Group 5, female, participant ID number: G5F6

5.6.3. Theme 3 – Drowning Risk Factors

Participants identified a range of risk factors that make children vulnerable to drowning including age and gender of the child, behavioural practices, and exposure to water hazards in the wider home, community, and natural environments.

Age of children was discussed as a risk for drowning with younger children being perceived as being particularly vulnerable. Some participants reported incidents of younger children drowning in public aquatic environments such as beaches. Several others recognised that children are prone to drowning but believe that such incidents will occur outside of their community.

“There [on the beach], we often heard people drowned, especially little children.”

Group 4, female, participant ID number: G4F1

“Young kids are prone to drown. Kids from other villages. Not here.”

Group 1, female, participant ID number: G1F7

Others viewed adolescents or young adults to be at particular risk, basing their views on past incidents observed in their communities and reported on the news, including on social media. Some participants attributed the heightened risk in adolescents to the difficulty of supervising them, their newfound independence, and their tendency to engage in unsafe water environments influenced by peers.

“There were drowning cases in Bima, I heard. There were several cases of drowning there, where young men drowned in the streams. Drowning is also commonly heard where I’m from, in my village. Also, many drowning cases here in Lombok. I heard it some time ago on tv and on social media, of a young man drowned and being carried by the stream up to Ampenan [a coastal sub-district in Mataram, Lombok Island].”

Group 5, female, participant ID number: G5F6

“When our children were younger, they only played around the house. But once they grew bigger, it’s a different level of delinquency, isn’t it? They can travel outside of the village by themselves. They can go to the bathing ponds by themselves”

Group 2, female, participant ID number: G2F1

Participants had differing views regarding whether gender was a risk factor for drowning. Some suggested boys were more prone to being “naughty” and disobey parents' advice to stay away from open or unsafe water bodies, hence more likely to drown, while others saw no difference in drowning risk between boys and girls and perceived that drowning could result from “naughty” behaviour in both.

“I think boys and girls these days are the same regarding the risk of drowning. Both can be naughty.”

Group 4, female, participant ID number: G4F1

Participants discussed various environments posing drowning risks for children, including natural, built, and home settings. Most cited natural aquatic locations, emphasising beaches and open seas as the main locations of concern, while some also mentioned larger rivers and lakes.

“In general, everyone has the risk to drown on the beach, with big waves, and people who cannot swim. I once helped rescue a female who was drowning on the beach ... I helped drag her out of the water.”

Group 6, male, participant ID number: G6M1

Participants recognised bathing pools/ponds as potential drowning sites. Participants described that bathing pools/ponds can be either man-made structures resembling swimming pools, albeit shallower and smaller, or modified natural water sources with embankments and coping built around them (Figure 5.1). Locals, especially in rural areas, often lack swimming skills, hence referring these facilities as 'bathing pools' or 'bathing ponds' for dipping and cooling off rather than swimming.



Description of images from top left to right, to bottom: Image A: man-made bathing pool in study site, with the water drained. Dimensions: 12 x 3 x 1 metre; Image B: Modified, natural bathing ponds in study site; Image C: 1) An open well in participant's home, with pulley system. 2) a cement tub serves as a water container, 3) a covered bucket, serves as a water container, with a water scoop on top

Figure 5.1. Examples of Water Bodies in Participants' Community and Home

Many participants noted children often went to bathing pools without parental or lifeguard supervision, heightened their risk of drowning. Some mentioned that the low entrance fees of privately owned bathing pools make them accessible to children. Participants also noted that these pools do not require parental attendance or impose minimum age limits for children.

“The children went there [to public bathing pools] with their friends. So, I think they could drown without the parents knowing. We call it “Kolam dua ribu” [in English: in English: ten US dollar cents bathing pool, referring to the entrance fee, referring to the entrance fee]. Some of the pools are quite deep, and these kids can plunge into the deeper pool, and nobody will know.”

Group 2, female, participant ID number: G2F5

“Children can enter these bathing ponds without parents, any time they wish.”

Group 4, female, participant ID number: G4F3

Several participants, particularly those who appeared to be younger parents, recognised the risk of child drowning at home. They identified 'tubs' or 'bathtubs', common as water containers inside Indonesian bathrooms, along with buckets and uncovered wells (example provided in Figure 1), as potential drowning sites in and around home. Incidents of non-fatal drowning in these household water sources were also cited by some participants. They mentioned that the drownings occurred when they were not supervising their children while playing around water in and around their homes.

“My son was also once played in the bathtub and almost drowned! I wasn't aware of that because he was playing in the bathroom. People here don't close their doors, their bathroom doors, so children can walk in and out ... I heard the sound; “Gulp. Gulp.” It was my son! I wasn't aware of him drowning. I thought, where is my child? The next thing I saw was his head was in the tub! He was still little at that time. Five years old.”

Group 5, female, participant ID number: G5F1

Unprotected wells and ditches in communities were also perceived as environmental risk factors of child drowning. Some participants mentioned that they had covered their wells to prevent children from falling in. However, they noted that some community members still maintain open wells in their houses.

“Yes, kids were curious about the uncovered well and what was inside, so they got closer to it and peeked in. We were worried about the possibility of children falling into the well, so most of us have covered our wells.”

Group 2, female, participant ID number: G2F1

"But no one worries about the possibility of falling into wells. If there are any children playing around the well, we just need to yell at them to stop playing around the well."

Group 2, male, participant ID number: G2M1, owns an open well in his house

Participants identified various weather conditions as environmental risk factors for drowning, particularly during the rainy season. They also highlighted the dangers posed by powerful waves, high tides, and strong offshore winds, which increase the risk of drowning both in natural water bodies and during water transport-related incidents.

"I tell them [the children] not to go around water during the rainy season, because the water will rise, and we might get carried away by the water flow."

Group 7, female, participant ID number: G7F1

In addition to rainy season flooding, most participants, whether coastal or inland residents, voiced their concerns about earthquakes and the risk of tsunamis. They referenced the 2018 series of 6.9 magnitude earthquakes in northern Lombok, which triggered small-scale tsunamis on the northern coast of the island, as a significant event that heightened their awareness of their susceptibility to tsunamis and the associated risk of disaster-related drowning.

"We were afraid of the seawater! Nowhere felt safe! ... We're not afraid of floodings, but we're very afraid of tsunamis!"

Group 2, female, participant ID number: G2F4

While several participants viewed lifejackets as an important safety device, most stated that lifejackets were rarely available or used on public boats. This lack of access to lifejackets was seen as a factor contributing to their vulnerability to drowning in watercraft-related incidents.

"No one on board of boats use lifejackets. Never. The boat crews never let people know that we must use lifejackets and where the lifejackets are stored. And I have took a few boat and ferry rides, to Bali and to Java, but no such information on lifejackets. Sometimes there were lifejackets around, sometimes no lifejackets can be seen around. But no there were no information on that, especially on smaller boats."

Group 2, male, participant ID number: G2M1

Many participants identified children's behaviours as drowning risks. Some perceived children's behaviours as "naughty" which led them to being in risky situations. Meanwhile, some participants who appeared to be younger parents, attributed the risky behaviour to children being naturally curious and active as part of their developmental phase.

"Mostly, it depends on the child's bravery. Even though the parents have watched their children, but children can be stubborn."

Group 5, female, participant ID number: G5F3

"Especially children around the age of 5 years old. That's why we need to supervise them closely. They're very active around this age. We need to watch them, what are they playing, how they are playing."

Group 6, male, participant ID number: G6M1

5.6.4. Theme 4 – Implications of Cultural Norms and Collectivism in Childrearing Practice on Drowning Risk

Participants highlighted the crucial role of supervision in preventing child drowning and discussed cultural norms and practices related to childrearing. Predominantly, participants across different age groups and both genders noted the cultural significance of mothers in childrearing. Participants described traditional gender roles in childcare and household duties, where mothers were primarily responsible for child safety alongside household chores, while fathers were seen as providers. Many mothers expressed challenges in balancing these responsibilities.

"The younger kids are usually with the mothers. While we hand-wash the clothes, with the water from the well in the buckets, our kids also play around the well and buckets. They're with us. We tell them not to play far near the streams or ditches. We're afraid that they may slip and fall into the water."

Group 2, female, participant ID number: G2F2

"As a stay-at-home mother, who must do everything by myself, yes, it is particularly difficult to balance between completing house tasks and taking care of my children. But it's different for men. It seems as if men only need to earn money and that's it. Meanwhile, women must wash, cook, clean the house, care for the children, some also work—everything."

Group 5, female, participant ID number: G5F6

Most participants also highlighted the cultural tradition of involving extended family, including in-laws, grandmothers, and older children, and neighbours in caring for young children. Mothers are often unable to provide constant supervision for their children, leading them to rely on their older children or children in the neighbourhood to supervise their children while playing, including around water bodies. These practices could either protect children from drowning or heighten their vulnerability.

“Children can be watched by in-laws. Or helped by their grandmothers, usually. Many members in this community play an important role in caretaking children. The grandparents, aunts, neighbours. We could watch each other’s children.”

Group 6, female, participant ID number: G6F1

“The children will watch themselves. It is common here in the village. They’ll take care of each other.”

Group 7, female, participant ID number: G7F1

Table 5.3. Definitions of Themes and Illustrative Quotes Supporting Interpretations of Themes

Themes	Definition and inclusions	Sub-themes	Representative excerpts
Concepts of drowning as an issue	Participants' views and concepts of drowning as a public health problem in their community, and of the severity of drowning consequences	Perceptions of drowning susceptibility	<p><i>"We never worried about drowning. We don't have people drown around here. Where would they drown? We don't have big rivers or lakes. Maybe for those closer by the beach."</i> (Group 2, female, participant ID number: G2F1)</p> <p><i>"Maybe it's fishermen who are more at risk for drowning. People who go to the sea every day."</i> (Group 7, female, participant ID number: G7F2)</p>
		Perceptions of severity of drowning consequences	<p><i>"I never thought about drowning like that (as a cause of injury/death in children)."</i> (Group 1, male, participant ID number: G1M1)</p> <p><i>"Children could be ill or die from drowning."</i> (Group 2, female, participant ID number: G2F5)</p> <p><i>"Yes, death by drowning in children is possible. They could die from swallowing too much water."</i> (Group 3, female, participant ID number: G3F5)</p>
		<ul style="list-style-type: none"> Personal experiences shaped perceptions on children's susceptibility to drown 	<p><i>"I entered the bathroom, just by pure coincidence, then I saw the child was already in the bathtub, flailing. The child was not conscious. He was limp. I was so scared. Especially for children around the age of 5 years old. That's why we need to supervise them closely. They are very active around this age."</i> (Group 6, male, participant ID number: G6M1, rescued his nephew from drowning)</p> <p><i>"[Name redacted]'s child was once almost drowned. In the bathtub. He put his head into the water in the tub. Yes, it could happen around us, especially with young children. And particularly when the tub is large, and the child is little. Especially in the bathroom, and with children as young as around 5 years old. You need to accompany your children when they are in the bathroom. ... Experience is a lesson."</i> (Group 6, female, participant ID number: G6F1, witnessed a non-fatal drowning incident of her neighbour's son)</p>
Perceived preventability of child drowning	Participants' views that child drowning is an inevitable accidental event, including underlying local cultural and religious beliefs that drowning is destined by God or caused by the presence of spirits	Drowning is an inevitable event	<p><i>"Drowning is destiny. It is a tragedy, an accident."</i> (Group 1, 5th female participant, age group: 25-34 years)</p> <p><i>"Drowning happens because the child slips and falls into the water."</i> (Group 3, female, participant ID number: G3F2)</p> <p><i>"Drowning is a matter of death. Death comes from God. Death from drowning is usual. It's destiny. When death by drowning is destined for them, it's their fate, as promised by God."</i> (Group 1, male, participant ID number: G1M1)</p> <p><i>"This person, an adult, as old as me perhaps, drowned in a waterfall ... The person drowned within minutes and cannot be found in those minutes. Perhaps the water has spirits, spirits that wait on it."</i> (Group 5, female, participant ID number: G5F3)</p>
		Drowning is a preventable event	<p><i>"(Child drowning happens) because children are curious. Even if they're in the swimming pools with their parents, for example, pools have different level of depths, and children can just run and plunge into the deeper pool. So as parents you need to tell them what to do beforehand."</i> (Group 4, female, participant ID number: G4F3)</p> <p><i>"Drowning happens because children will go with many friends, but they're all children. If anyone drowns, they will help one another and they will drown, since none of them can swim."</i> (Group 2, female, participant ID number: G2F1)</p>
Drowning risk factors	Demographic, behavioural, cultural, and environmental characteristics that participants associated with a	Age <ul style="list-style-type: none"> Young children 	<p><i>"Children are the most prone to drown."</i> (Group 5, female, participant ID number: G5F2)</p> <p><i>"That's why we are concerned about children going out by themselves, such as to the beach, for we have small children."</i> (Group 4, female, participant ID number: G4F3)</p>

Themes	Definition and inclusions	Sub-themes	Representative excerpts
	higher likelihood of drowning event taking place.	<ul style="list-style-type: none"> Adolescent and young adults 	<p><i>"Teenagers, three teenagers died from drowning."</i> (Group 6, female, participant ID number: G6F1)</p> <p><i>"... in East Lombok here, some time ago, university students, while undertaking a community project, had their legs pulled in by the water. Three university students. They all died."</i> (Group 5, female, participant ID number: G5F6)</p>
		Gender	<p><i>"Especially for boys (prone to drowning). It is very difficult to tell boys what to do. They tend not to listen to you."</i> (Group 2, female, participant ID number: G2F4)</p> <p><i>"Oh no, boys are not more at risk to drown. My granddaughters are much braver than the boys. They are very brave in playing with waves on the beach."</i> (Group 3, female, participant ID number: G3F5)</p>
		Locations <ul style="list-style-type: none"> Natural environments 	<p><i>"We heard many (drowning) cases these days from the news, especially on the beach."</i> (Group 6, female, participant ID number: G6F1)</p> <p><i>"We don't have people drown around here. Where would they drown? We don't have big rivers or lakes."</i> (Group 2, female, participant ID number: G2F1)</p>
		<ul style="list-style-type: none"> Man-modified bathing pools/ponds 	<p><i>"I tell my kids not to go the public bathing ponds. I tell them you might drown."</i> (Group 2, female, participant ID number: G2F1)</p> <p><i>"Perhaps there will be drowning in places like Narmada [a subdistrict in West Lombok, known for housing water springs and public swimming pools and bathing ponds which serve as popular tourist destinations], where there are plenty of water-related tourist destinations. Such as in Narmada, in bathing pools and ponds there."</i> (Group 5, female, participant ID number: G5F4)</p>
		<ul style="list-style-type: none"> Home environments 	<p><i>"Drowning can happen in buckets. People these days have big, tall buckets. So, it's dangerous, when bathtubs and buckets are not covered. But the thing is, because we often use the tubs and the buckets, that, even if they are covered, we will uncover and cover them back and forth because we take water from them multiple times a day. And children can open them themselves too ... The bathtubs here are big sometimes, so children can fit in easily. My child can plunge all into it!"</i> (Group 5, female, participant ID number: G5F1)</p> <p><i>"Perhaps children could drown when wells are not covered."</i> (Group 5, female, participant ID number: G5F2)</p>
		Environmental factors <ul style="list-style-type: none"> Lack of barriers to water bodies 	<p><i>"We truly stress it to them to avoid playing around uncovered wells, to avoid them falling over the edge of the wells."</i> (Group 2, female, participant ID number: G2F1)</p> <p><i>"The ditches in this village are not covered. Ditches perhaps can be covered (to reduce the risk of drowning)."</i> (Group 3, female, participant ID number: G3F2)</p>
		<ul style="list-style-type: none"> Weather conditions 	<p><i>"I told my children that when the volume of water on the stream is high, it's better for you not to go there. I often scare them, telling them that you could drown and there will be no one to save you, so that they will not play there. Especially during rainy season."</i> (Group 2, female, participant ID number: G2F4)</p> <p><i>"On ferries, lifejackets are being stored in one area. I observe the weather, usually. If the weather looks bad, I will sit near where lifejackets are stored ... Everyone can drown, depending on the situation. It depends on the weather."</i> (Group 6, male, participant ID number: G6M1)</p>
		<ul style="list-style-type: none"> Disasters 	<p><i>"No drowning in this community. We don't have floodings around here, maybe on the coast, near the sea ... No drowning. It's drier these days. It never floods in this area."</i> (Group 1, male, participant ID number: G1M1)</p> <p><i>"Never heard of drowning, but we have experienced earthquakes, when they said there will be tsunami."</i> (Group 2, female, participant ID number: G2F1)</p>

Themes	Definition and inclusions	Sub-themes	Representative excerpts
		Behavioural factors <ul style="list-style-type: none"> • Lifejackets use 	<p><i>“No lifejackets (on board public boats), which irked me, especially because the tides were so strong. There were lifejackets on the top deck, but we were not given them to wear. No one gave instructions or warned the passengers to wear lifejackets ... I observe the weather, usually. If the weather looks bad, I’ll sit near where lifejackets are stored.”</i> (Group 6, male, participant ID number: G6M1)</p> <p><i>“No, the boat crews never do that (letting people know that lifejackets must be used and where the lifejackets are stored). We took public boat sometimes, going out from the island, with kids. No one use lifejackets. I don’t know if it’s available.”</i> (Group 2, male, participant ID number: G2M2)</p>
		<ul style="list-style-type: none"> • Children’s behaviours 	<p><i>“Drowning happens if the children are naughty. Some of the kids are too naughty. They know that the pond is deep, but they are still willing to take the risk.”</i> (Group 2, female, participant ID number: G2F2)</p> <p><i>“There are always advises that we give them, not to play when the water rises. But kids are stubborn. They will always go on their own way with their friends.”</i> (Group 5, female, participant ID number: G5F2)</p> <p><i>“Maybe children being playful with each other causes drowning. Their friends being playful while playing. Young children probably don’t understand anything about the danger in water.”</i> (Group 5, female, participant ID number: G5F1)</p>
Implications of cultural norms and collectivism in childrearing practice on drowning risk	Participants’ views and practices on childrearing, including the influence of local cultural and gender norms, as well as the involvement of family and community members in childrearing and supervision practices.	Childrearing practices in the local community	<p><i>“It’s different with fathers. Fathers leave for work every day, while the responsibility to keep children safe at home is with the mothers.”</i> (Group 2, female, participant ID number: G2F1)</p> <p><i>“For me, as a homemaker, it is difficult for me to keep an eye on my children. Here, in this community, usually parents have, like, a spare parent, the grandmother, who often act as a caretaker, the second caretaker of the children.”</i> (Group 7, female, participant ID number: G7F2)</p> <p><i>“There are always many community members doing their activities around, so they can look after the children from any harm.”</i> (Group 2, female, participant ID number: G2F4)</p> <p><i>“I told my older children, to take care of their younger siblings, so they will not drown. And to not take their younger siblings to the beach, for fear of them being dragged away by the waves.”</i> (Group 1, female, participant ID number: G1F2)</p>
		Supervision while children play around water bodies	<p><i>“Yes, it’s common here, mothers letting their kids playing on their own. Children often play around streams too. And many older children go play further from here, to ponds around here. ... Many children are not accompanied by their parents while playing around water.”</i> (Group 4, female, participant ID number: G4F1)</p> <p><i>“Yes, it’s common for children here to play unsupervised. Mothers often let children play among themselves, because the mothers are probably busy at home as well.”</i> (Group 4, female, participant ID number: G4F3)</p>

5.7. Discussion

Child drowning is a significant public health issue in Indonesia. As highlighted in the first and second stage of the PHM, it is important to understand current parental and community perceptions and practices related to child drowning, to better comprehend how child drowning is perceived as a public health problem in the community as well as its perceived causes and risk factors, to inform future health promotion approaches to address the issue.^{165,166} This study has yielded valuable insights into the community's views on drowning as a cause of childhood mortality and injury, as well as identifying contextual factors that put children at risk of drowning in Indonesia.

Despite evidence of child drowning as a leading cause of death among Indonesian children²⁵⁹, the study identified a limited understanding regarding children's vulnerability to drowning, its preventability, and associated risk factors. Utilising constructs from the HBM, this study identified that most participants were unaware of the susceptibility of their children and others in the community to drowning, and the severe outcomes that can result such as injury, disability, and death, highlighting the urgent need to enhance public awareness about drowning. The study explored HBM constructs to identify perceived risk factors contributing to drowning, including being younger children, adolescent, and young adult males, behavioural practices such as inadequate supervision and non-usage of life jackets, and broader environmental factors within homes, communities, and natural settings. The HBM has been widely recognised and applied in various studies to better understand individual attitudes and behaviours towards drowning risks and related preventive behaviours.^{190,394-397} For instance, research by Denehy, Leavy, Jancey, Nimmo and Crawford¹⁹⁰ applied the HBM to assess parental and caretakers' perceptions regarding a mass media messaging campaign on child drowning risk. Their study highlighted how the model serves to identify the campaign's effectiveness in communicating children's susceptibility to drowning and the presence of water hazards in and around the home.¹⁹⁰ Another study by Abercromby, Leavy, Tohotoa, Della Bona, Nimmo and Crawford³⁹⁴ utilised the HBM to explore young adults' beliefs and practices related to alcohol consumption and water safety, revealing the role of sociocultural influences and values in their decision-making regarding alcohol consumption during activities around water through the exploration of HBM constructs.

Participants generally associated drowning with beaches or open seas, despite evidence indicating that child drowning incidents often occur in smaller water bodies such as unprotected wells, canals, ponds, and streams, similar to those that exist in participants' communities.^{398,399} Direct exposure to child drowning incidents prompted some awareness on the likelihood of such

occurrences in and around homes, with participants identifying open wells, tubs, and buckets as notable risk factors in and around homes, consistent with previous research in other LMIC.^{363,398-400} Participants highlighted that they acquired awareness of child drowning risks and consequences through media, particularly social media. This underscores the need for enhanced strategic communication, aligning with WHO recommendations, via media outlets, including social media, with parents being a key target audience, to bolster public awareness on child drowning risks and prevention, and to support effective implementation of prevention strategies.⁵⁹

Due to most participants not having previously considered child drowning as a significant issue or one that potentially has serious consequences, there was little discussion about intent to change behaviour or practices to prevent drowning.¹⁸⁵ While direct exposure to drowning incidents prompted some awareness of the issue, most participants were in early stages of behavioural change regarding protective strategies.⁴⁰¹ Although supervision was acknowledged as crucial to prevent child drowning, Indonesian mothers found it challenging to supervise their children constantly and often delegated supervision to other family and community members, despite previous research suggesting that this practice may be inadequate to prevent child drowning.^{160,196,402} The failure to perceive children being susceptible to drowning and lack of acknowledgement of the potential severe consequences of a drowning incident could stem from cultural norms accepting drowning occurrences as inherently inevitable and part of destiny. This perception of drowning as predestined by fate is similar to what has been reported in Bangladesh¹⁹⁶ and India²⁷⁸. This view of inevitability of drowning is further compounded by inadequate resources and infrastructure in both the home and community level. Therefore, further exploration of the local context and social determinants of drowning across Indonesian communities is essential to ensure proposed health promotion approaches are effective and feasible.

The study also highlighted a gap in understanding awareness and attitudes towards child drowning risks among various community segments, emphasising the necessity for separate investigations into parents and community leaders. These studies would inform targeted strategies tailored to each group. To develop effective strategies aligned with local contexts, beliefs, and practices, a collaborative co-design approach involving researchers, stakeholders, and community members is recommended.⁴⁰³⁻⁴⁰⁵ Previous research, such as in Australia, has demonstrated that co-design effectively customises drowning prevention interventions to meet local needs, bolstering community support and ensuring their long-term sustainability.⁴⁰³ Further

investigation is needed to assess its applicability in designing culturally sensitive and context-specific interventions suitable for different community segments in Indonesia.

While this study provides useful information that enhances our understanding of how parents and community members feel about child drowning as an issue and what they see as risk factors, further research into comprehensive health promotion strategies, grounded in a socio-ecological approach, is imperative to achieve effective and sustainable drowning prevention efforts in Indonesia. This involves examining the interconnectedness of drowning prevention with initiatives such as provision of safe aquatic environments, infrastructure investments, affordable childcare and early childhood education, equitable education, rural development, enforcement of boating and maritime safety regulations, disaster risk management, and efforts to alleviate socioeconomic disparities. This investigation is particularly crucial for socioeconomically disadvantaged populations in rural and remote regions across Indonesia's archipelago.

5.8. Strengths and Limitations

A strength of this study was the utilisation of the HBM to gain a deep understanding of community perspectives on child drowning and its seriousness within their communities. This, coupled with insights into risk factors, some of which are specific to the Indonesian context, is an important starting point for further research into contextually relevant health promotion approaches to address child drowning.

There are however some limitations that need to be acknowledged. This study was conducted on just one Indonesian island, although the sampling approach ensured a diverse geographical representation. Indonesia's vast diversity necessitates further research across the country to gauge if perceptions of drowning and risk factors align consistently. In addition, participants self-selected into the study, which may bias the sample toward those with a particular interest in or experience in drowning. This could result in findings that do not fully represent the broader community's views. Furthermore, parents and village community leaders were grouped in the same focus groups, hence it was not always possible to distinguish between their perspectives. This potential overlap in perspectives due to the composition of the focus group may have influenced the interpretation of findings, limiting the ability to compare perspectives distinctly between parents and village community leaders.

5.9. Conclusion

This qualitative study identified limited community understanding of the preventability, vulnerability, and risk factors of child drowning. Utilising constructs from the HBM, this study revealed that most participants were unaware of the susceptibility of their children and others in the community to drowning, and of the potential severe outcomes of drowning such as injury, disability, and death. This highlights the urgent need to enhance public awareness about the susceptibility of children to drowning and the severe consequences it can entail. While direct exposure to drowning incidents prompted some awareness of the issue, most participants were in early stages of behavioural change regarding protective strategies. Further exploration of local contexts and social determinants of drowning in Indonesian communities is imperative for ensuring effective and sustainable water safety promotion and drowning prevention strategies.

Chapter 6 Child Drowning Prevention: A Community-Informed Health Promotion Perspective



6.1. Overview

Title: Preventing child drowning in Indonesia: A community-informed health promotion perspective

This chapter is presented as a publication manuscript. The formatting of this chapter adheres to journal requirements; however, table and figure numbering, as well as referencing, have been aligned with the thesis format. The references for this chapter are included within the overall thesis' reference list.

The manuscript has been submitted for consideration for publication in the *Health Education and Behavior* journal. The citation for the publication is: Cenderadewi M, Franklin RC, Fathana PB, Devine SG. Preventing child drowning in Indonesia: A community-informed health promotion perspective. [Manuscript submitted for publication]. 2024.⁴⁰⁶

Building on Chapter 5, this chapter delves into current and proposed measures by parents and communities to prevent child drowning. The study findings underscored a predominant emphasis on individual-based behavioural interventions, such as swimming lessons for school-age children and educational programs on life-saving skills for parents and community members. Moreover, it underlined the importance of exploring contextually relevant water safety promotion strategies and fostering cross-sector partnerships for effective and sustainable drowning prevention in Indonesia. Consequently, the study findings informed the subsequent chapters.

The authors' contributions are outlined as follows: i) M. Cenderadewi: Conceptualisation, data curation, formal analysis, investigation, methodology, project administration, resources, validation, visualization, writing – original draft, writing – review & editing; ii) R. C. Franklin: Conceptualisation, formal analysis, methodology, resources, funding acquisition, supervision, validation, visualization, writing – review & editing; iii) P. B. Fathana: Data curation, investigation, validation; iv) S. G. Devine: Conceptualisation, data curation, formal analysis, methodology, resources, funding acquisition, supervision, validation, visualization, writing – review & editing.

The paper is presented below as the version submitted to the journal.

6.2. Abstract

Child drowning is a significant public health issue in Indonesia, however, there remains a lack of understanding within communities of the risks and how to prevent it. This qualitative study aimed to explore existing and suggested actions undertaken by parents and communities to prevent child drowning. Seven focus group discussions were conducted, comprising 62 participants, with parents of children under five years and village community leaders from seven villages on Lombok Island, West Nusa Tenggara Province, Indonesia. Participants were recruited with purposive and snowball sampling methods. The thematic analysis used both deductive, applying constructs of the Health Belief Model and the Health Promotion Framework, and inductive approaches. The results highlighted the focus that participants placed on individual-focused, behavioural midstream interventions for drowning prevention, particularly through initiatives such as swimming lessons for school-age children and educational programs on essential life-saving skills to respond to drowning incidents for parents and community members. Participants acknowledged the importance of population-focused midstream interventions, including implementing safety measures around water bodies and establishing community-based safe places for children, as well as upstream interventions, involving advocacy for policies, regulations, and intergovernmental agency collaboration. However, there was limited understanding on the roles of the education and health departments in preventing child drowning. Further research into the formal integration of swimming training into school curricula, the development of contextually relevant water safety promotion approaches, and the alignment of cross-sector partnerships is imperative to ensure effective and sustainable drowning prevention efforts in Indonesia.

6.3. Introduction

Child drowning is a significant global public health issue, particularly across low- and middle-income countries (LMIC), including in Indonesia.^{6,10,70} Between 2005 and 2019, Indonesia consistently witnessed high drowning mortality fatalities among children under five years of age, averaging 2178 deaths and a rate of 9.67/100,000 annually.²⁵⁹ Children under five years of age residing in the eastern part of Indonesia, including in Papua, Kalimantan, Sulawesi, Maluku, and Nusa Tenggara, recorded the highest fatalities from drowning.²⁵⁹

Located in the Southeast Asia region, Indonesia has the world's fourth largest population of over 270,200,000 people.¹¹ It is the world's largest archipelagic state consisting of 17,500 islands, where high numbers of hydrometeorological disasters occur annually, further exposing Indonesian children to a higher risk of drowning and submersion.¹¹ Unfortunately, there is a dearth of information outlining the local context and community perceptions and practices regarding child drowning prevention in Indonesia.⁶¹ To inform contextualised water safety promotion and drowning prevention strategies, it is crucial to firstly develop a clear understanding of parental and community perceptions and practices regarding child drowning prevention, and to understand current practices that might put children at risk or reduce the risk of drowning.

Childhood drowning is a complex issue with numerous behavioural, environmental, health and social underpinnings, thus requiring a comprehensive and multi-strategic approach to address it effectively.^{41,407-409} This approach should integrate strategies that go across a downstream, midstream, upstream continuum, and application of a framework, such as the Health Promotion Framework (HPF) can assist in systematically mapping current approaches being used to address childhood drowning, as well as identifying other strategies recommended by communities that may not yet be implemented.¹⁶⁸ The HPF is grounded in the reality of inter-related socio-ecological determinants of health, highlighting the multidimensional nature of health promotion. It encompasses: (i) biomedical approaches for individual risk assessment (downstream approaches); (ii) behavioural approaches to develop awareness and skills through health information and social marketing, health education, and skills development (midstream approaches), and (iii) socio-ecological approaches for community action and policy development to foster healthier environments (upstream approaches).¹⁶⁸ This framework was used in our study to holistically assess current strategies being used by parents and communities to prevent childhood drowning, as well as identifying perceived gaps and areas for improvement and alternative strategies that could be implemented to address the multifaceted nature of the issue.

Increasing evidence supports the benefit of integrating behavioural science theories to increase the effectiveness of health promotion and injury prevention.¹⁸⁵ This study applies behavioural science theories by utilising the Health Belief Model (HBM).^{186,187} The HBM suggests that an individual's motivation to adopt health-promoting behaviours is shaped by their perceptions of susceptibility and severity of the issue, along with the perceived benefits and barriers to action, and their confidence in their ability to perform the action (self-efficacy).^{186,187} By leveraging these constructs of the HBM, this study seeks to gain insights into the underlying beliefs, attitudes, and motivations influencing behaviours towards water safety, informing the development of targeted interventions in Indonesia.

6.3.1. Research Aims

This qualitative study aimed to explore the existing and suggested actions undertaken by parents and communities to prevent child drowning.

6.3.2. Research Questions

This study answered the following questions:

1. What are the current practices among Indonesian parents and communities for preventing child drowning in their community?
2. What strategies do Indonesian parents and communities recommend for preventing child drowning in their community?

6.4. Methods

6.4.1. Study Design

This qualitative study is a component of a larger mixed-methods inquiry into fatal unintentional drowning in Indonesia, comprising three phases: 1) a scoping review⁶¹, 2) a population-based retrospective cohort study²⁵⁹, and 3) the qualitative investigation reported here. The selection of a qualitative design aimed to expand on the findings of the quantitative study, which identified high mortality rates among children aged under five years, particularly in eastern Indonesia including in Nusa Tenggara.²⁵⁹ The exploratory qualitative approach^{202,264} enabled exploration into participants' perceptions and experiences in identifying and mitigating child drowning risks within Indonesian communities, an area underexplored in existing literature.

6.4.2. Research Setting

This study was conducted in seven villages across all districts (West Lombok, North Lombok, East Lombok, Central Lombok, and Mataram) of Lombok Island, situated in the West Nusa Tenggara province of Indonesia. The selection of West Nusa Tenggara as the study location was based on its high

under-five drowning rates of 12.6/100,000 for males and 6.1/100,000 for females in 2019, one of the highest across all Indonesian provinces.²⁵⁹ West Nusa Tenggara's rural characteristics and status as one of Indonesia's poorest health-performing provinces, underscored by its high under-five mortality rate of 29 deaths per 1,000 live births in 2022, highlighted the significance of investigating the region, as it represents the high-risk populations of economically disadvantaged children living in rural areas of Indonesia.²⁷¹⁻²⁷³

6.4.3. Sample Selection and Recruitment

Participants in this study were parents of children under five years of age and community leaders from villages of Lombok Island, West Nusa Tenggara Province of Indonesia. This age group is particularly vulnerable to drowning, making parents valuable sources of information on preventive measures. Community leaders, including village chiefs, elders, religious figures, and community health workers, were selected for their knowledge of community norms and actions related to drowning prevention. By involving both parents and leaders, diverse perspectives were gathered, enriching the understanding of prevention strategies at both household and community levels.

Recruitment utilised purposive sampling to deliberately select participants who possessed the knowledge and experiences relevant to the study aims.²⁷⁹ Further to this approach, a snowball sampling process was also used with village chiefs and community health workers identifying key informants who they thought would provide insight into the topic being explored.²⁸³ Face-to-face recruitment occurred during social village gatherings. Interested individuals contacted research team members to receive detailed information sheets and consent forms.

6.4.4. Data Collection

Seven focus group discussions (n=62) were conducted at various community locations between October 2023 and March 2024. This methodology captured individual stories and community practices related to child drowning prevention, fostering deeper insights and understanding through iterative discussions and participant interactions.^{291,410} Written consent was obtained from participants prior to the focus groups commencing. Participant characteristics were collected using a household demographic questionnaire before each focus group. The moderator guide, guided by the HBM¹⁸⁷ and findings of a previous scoping review⁶¹, was tested for face validity prior to implementation, resulting in minor modifications of the prompts (Table 5.1).

Focus group discussions, lasting 50-60 minutes, were facilitated by two female Indonesian research team members who are fluent in Indonesian, local Sasak language, and English (research team members de-identified for review). The lead researcher facilitated discussions and the second Indonesian research team member took notes including observations of interactions during the group

discussions. All focus groups were audiotaped with permission and then transcribed verbatim and translated into English by the lead researcher. The translated transcripts then translated back into Indonesian by the other Indonesian team member and samples in English reviewed by two senior researchers to verify data accuracy.

6.4.5. Analysis

Translated transcripts, demographic information, and field notes were entered into NVivo Version 20. The thematic analysis²⁶³ used both deductive analysis using constructs of HBM¹⁸⁷ and HPF¹⁶⁸, and inductive approaches, to identify and report meaningful patterns within the data. After becoming familiar with the entire data set by reviewing the interview transcripts multiple times, the lead researcher independently coded the data. Coding and excerpts were then reviewed by senior members of the research team. Lead researcher and senior researchers continuously reviewed collated excerpts for each theme to confirm accurate reflection of the data.

To ensure the dependability, conformability, transferability and authenticity of the study, several measures were undertaken: (i) Purposive sampling; (ii) Extended engagement at research locations to foster rapport and acquire a thorough understanding of participants' narratives, (iii) Gathering of participant demographics; (iv) Reflective note-taking and recording of observations; (v) Verification of data through member-checking; (vi) Validation of data accuracy through translation processes; (vii) Examination of references, codes, and themes by multiple researchers to ensure data accuracy and consistency; (viii) Consensus discussions on code definitions, coding of references, and themes; (ix) Incorporation of verbatim quotations; and x) Creation of an audit trail detailing data collection and analysis.

6.4.6. Ethics approval

Ethical approval has been obtained from the Human Research Ethics Committee (HREC) of a university in Indonesia and acknowledged by an HREC of a university in Australia (institutions de-identified for review).

6.5. Results

Sixty-two participants, comprising mothers (53.2%, n=33) and fathers (9.7%, n=6) of children under-five and village community leaders (37.1%, n=23), were involved in the focus groups. Predominantly female (75.8%, n=47), the participants were primarily aged between 25 and 34 (25.8%, n=16) or 35 to 44 years (25.8%, n=16), with the majority not completing primary education (58.1%, n=36) and identifying as homemakers (54.8%, n=34) (Table 5.2).

Data analysis revealed five key thematic areas related to the current strategies that were being undertaken to prevent drowning and potential prevention strategies suggested by participants: (i) Stakeholders in drowning prevention responsibility; (ii) Health information and communication agents; (iii) Community education and skills development; (iv) Community action; (v) Policy development and enforcement. Findings are detailed below under respective theme headings and synthesised in Table 6.1, which also features additional participant quotations for clarity.

6.5.1. Theme 1 – Stakeholders in Drowning Prevention Responsibility

Participants shared their perspectives on the stakeholders they felt were responsible for preventing drowning. Across all age groups, most participants viewed parents as the main actors responsible for preventing drowning in children.

“Parents would be responsible [to prevent drowning]. It’s impossible to rely on the government for everything. It’s too far-fetched.”

Group 4, female, participant ID number: G4F3

Participants highlighted the shared responsibility of government sectors in preventing drowning. They emphasised the involvement of child protection services, rescue agencies, environmental departments, the fire department, and the tourism department as key actors in child drowning prevention. Non-governmental stakeholders were not mentioned.

“There must be socialisation, information, education session[s], provided by the local government, from relevant government stakeholders, such as the ones dealing with the environment and with child protection. ... from child protection agency, SAR [Search and Rescue] team, firefighters. Those involve in rescue efforts.”

Group 6, male, participant ID number: G6M1

Meanwhile, only one participant cited the education department's responsibility in drowning prevention, stressing the need to include swimming lessons in school curriculum. No mention was made of the education department's involvement in other prevention aspects or of the health department's role in child drowning prevention.

“I think the government is also responsible [for drowning prevention]. I think swimming lessons could be a part of the school’s curriculum. ... it doesn’t need to be a total revision of the curriculum. This could be just as a supplementary.”

Group 7, female, participant ID number: G7F1

6.5.2. Theme 2 – Health Information and Communication Agents

Participants discussed various health communication strategies focusing on fostering attitudes, beliefs, and behaviours to prevent drowning. These included family-focused approaches and government-led initiatives.

Most participants emphasised the need for government-supported health information on child drowning prevention. Some stressed the value of in-person sessions to reach communities with limited media access.

“People need to be told what to do by the government, to be informed. Not all of us watch tv or get hold of handphone. If we meet like this [face-to-face], it is better for the mothers, to let the mothers know what they should do.”

Group 7, female, participant ID number: G7F1

Many participants shared their practices of teaching children about water safety, emphasising avoiding natural water bodies in the rainy season and deeper pools/ponds. They also emphasised the importance of parental supervision to prevent children from entering water bodies unsupervised.

“I tell them [the children] not to around water bodies during the rainy season, because the water will rise, and we might be carried away by the water flow. I also don’t allow them to go the beach with their friends alone. If they want to go to water bodies, they must go with us, their parents.”

Group 7, female, participant ID number: G7F1

Many participants noted that news reports, including those on social media, about drowning incidents, prompted action to improve parental supervision of children around water.

“Yes, the news from news broadcast and social media [influence my level of awareness on drowning]. These days, we get more cautious about taking our children to swim. I’m also very worried about having my children being supervised by anyone else. Especially children around the age of 5 years old.”

Group 6, male, participant ID number: G6M1

6.5.3. Theme 3 – Community Education and Skills Development

Participants discussed the need for specific skills training to prevent child drowning, emphasising the importance of children learning to swim. All stated that public schools, where their children attended, provided swimming lessons as part of the Sports/Physical Education class. However,

there was variation in the provision of lessons, with some children only receiving them in junior high school and others in both primary and junior high school. Participants then commented that the infrequency of these school-provided lessons hindered their children's ability to swim proficiently. Participants reported that only a single swimming lesson at a public pool was conducted once every school semester, equating to one lesson every six months. Consequently, participants felt parents could not rely solely on these lessons and needed to teach their children themselves. However, many noted that most parents in the community could not swim, making it challenging to teach their children.

“Swimming lessons are only provided by the school once per semester. That is why there’s no way the children can swim, except if their own parents frequently can take them to the swimming pool. ... [But] the parents themselves here don’t know how to swim. [For the school-provided lessons] we need to pay for the swimming pool [entrance fee] and the transport [cost] and the pocket money. Around 50 thousand rupiahs [AUD 5] every time they go swimming, so it’s a lot. The swimming lessons are for primary school and junior high school students.”

Group 6, female, participant ID number: G6F1

Many participants noted financial challenges related to transportation and pool entrance fees. Some proposed government-funded swimming lessons and local pool facilities to alleviate travel and cost burdens.

“If the government makes a swimming pool, around here, and have the children to learn to swim, that would be good.”

Group 1, male, participant ID number: G1M1

Some participants suggested government-provided first aid training for parents, particularly mothers and community members, to respond to child drowning incidents.

“The local government, relevant government departments should provide education for us, on how to rescue children. Parents need to be informed that if their children are already in the water and have drowned, their lives could actually be saved. ... So, first aid training, we need the education.”

Group 6, male, participant ID number: G6M1

6.5.4. Theme 4 – Community Action

Participants shared their perspectives and experiences on community actions to enhance child safety, suggesting measures such as covering water bodies and creating safe areas for children away from water.

Some participants mentioned the need for community playgrounds, noting that children often play near water due to limited safe open spaces. However, participants did not mention the need for playgrounds to supervised or fenced.

"I think [the community needs] a playground. A playground for the children, because we don't have open space here, so children tend to play in the creeks or ditches."

Group 1, male, participant ID number: G1M3

Some participants emphasised the need of establishing daycare and preschool centres in the community to mitigate child drowning risk. Participants suggested that childcare centres could provide supervision for primary school-age children, while older children were seen as capable of self-care. No participants mentioned the need for pre-school children to be supervised in childcare centres.

"Yes, younger children could be supervised in daycare here, around the age of primary school. Junior high students can take care of themselves already. We're worried about those of primary school age. They only care about the fun in playing in the water."

Group 2, female, participant ID number: G2F1

Participants stressed the importance of installing barriers around wells, ditches, streams, and ponds in the community to limit children's access to these water bodies. Some mentioned proactively covering wells to prevent accidents and noted incidents of people falling into wells, particularly children drawn by curiosity, as cues for action.

"Ditches and streams can perhaps be covered [to reduce the risk of drowning]. ... Such as with fences from bamboo, so that kids can't climb over it."

Group 3, female, participant ID number: G3F2

6.5.5. Theme 5 – Policy Development and Enforcement

Participants discussed the need for community-level policies and regulations promoting water safety. The importance of various policies was highlighted, including restricting unaccompanied children's access to public bathing pools, monitoring water levels to inform residents about flood risks, and enforcing safe boating regulations and safety features including lifeguard presence on public

waters. Some believed the government's limited capacity hindered effective enforcement. While participants recognised multisectoral responsibilities, most showed limited understanding on specific sectoral responsibilities for prevention.

“Streams or ponds, they need to have safety features. ... The water level needs to be monitored, not to be over their capacity and flood. ... In public places such as swimming pools, beaches, lifeguards must be present. These days, it is very rare for us to see lifeguards. No lifeguards, in fact. Perhaps the government has limited funding. Perhaps the SAR [Search and Rescue] team could help. But they [Search and Rescue team] only arrive once a drowning event has taken place.”

Group 6, male, participant ID number: G6M1

Table 6.1. Definitions of Themes and Illustrative Quotes Supporting Interpretations of Themes

Themes	Definition and inclusions	Sub-themes	Representative excerpts
Stakeholders in drowning prevention responsibility	Participants' views on stakeholders responsible for preventing drowning.	Multisectoral responsibilities	<p><i>"I think the most important thing is that the local government needs to reach the people with knowledge, the professionals, to provide education, information sessions for each community. ... Things we need to pay attention to, regarding the danger of drowning."</i> (Group 7, female, participant ID number: G7F1)</p> <p><i>"Maybe the Department of Tourism [part of the local and national government] could come here to inform us [on drowning prevention]."</i> (Group 7, female, participant ID number: G7F3)</p> <p><i>"BASARNAS [the Indonesian National Search and Rescue Agency], yes, they are responsible [to prevent drowning]. If there are people drown on the beach, BASARNAS will search for them, right."</i> (Group 3, female, participant ID number: G3F2)</p>
		Parents	<p><i>"Parents would be responsible [to prevent drowning]. It's impossible to rely on the government for everything. It's too far-fetched."</i> (Group 4, female, participant ID number: G4F3)</p> <p><i>"It's the parents that are responsible [to prevent drowning]. Both parents. Some children fear their mother more, but some fear their father more. It should be the responsibility of both parents."</i> (Group 5, female, participant ID number: G5F2)</p>
Health information and communication agents	Participants' views and practices on prevention strategies which promote attitudes, beliefs, and behaviours that prevent drowning. This includes parenting or family-focused prevention strategies to promote water safety-promoting norms and behaviours in the family.	Government	<p><i>"There must be socialisation, information, education session, provided by the local government. ... For us, new parents, for example, it is confusing if we are to experience it [child drowning]. We need to be educated on how to respond when things like drowning happen to our children. That is the most important thing for us. First, education needs to be provided."</i> (Group 6, male, participant ID number: G6M1)</p> <p><i>"Even on the tsunami, no one came to explain things to us. We only had our information from social media. Social media helps, but I think we still need instructions on this [preventing drowning] by the village apparatus, because not everyone is using social media."</i> (Group 5, female, participant ID number: G5F6)</p>
		Parents	<p><i>"We tell them [children] that when it rains, don't play at the ditches."</i> (Group 1, male, participant ID number: G1M3)</p> <p><i>"Children are curious. Even if they're in the swimming pools with their parents, for example, pools have different level of depths, and children can just run and plunge into the deeper pool. So as parents you need to tell them what to do beforehand. You need to explain things to them. Otherwise, they'll just jump into any water."</i> (Group 4, female, participant ID number: G4F3)</p>
		Media	<p><i>"There are more news reports on drowning these days, including from celebrities. Like, if any celebrity or their children drown, we then become more aware. The news becomes a lesson for us, that we need to be more cautious. We need to be careful, to not too easily trusting other people, including to let our children being supervised by other people."</i> (Group 6, female, participant ID number: G6F1)</p> <p><i>"Yes, we heard recent news on drowning cases on mass media, that is why we need to be more cautious. We need to supervise better, especially on children. During the rainy season, especially."</i> (Group 5, male, participant ID number: G5M1)</p>
Community education and skills development	Participants' views and experience on specific skills training needed to empower individuals with the knowledge and abilities necessary to	Swimming lessons for school-age children	<p><i>"No children here have swimming lessons. They learn to swim by themselves. Sometimes the father could take them to the beach. I live near the beach, so the kids' father takes my kids to the beach. There are swimming lessons provided by the school since primary school. Once every semester. As long as the child attends this, this grade taking for sport education, they will receive a grade. They will be marked, just by attending the session. We have to prepare their transport fee, and entrance fee for the swimming pool. So, the school usually will arrange a bemo [a small van used for public transport] and we pay for the cost."</i> (Group 3, female, participant ID number: G3F5)</p> <p><i>"There are swimming lessons provided by the school, but only for junior high school. About twice a year. Once every semester. They call it grading, grading the swimming ability and that's it. But it is far to swim. My kids are in junior high school, but I still need to drop my kids at the"</i></p>

Themes	Definition and inclusions	Sub-themes	Representative excerpts
	safely navigate aquatic environments and to assist others in distress.		<i>swimming pool, because they cannot ride motorbike. Even the cost of having them go for swimming [lessons arranged by the school] twice a year is already difficult for me, let alone more often than twice a year. If it's, say, once a month, oh no. No. If there is a pool around here to swim, the children would love it very much. They probably won't leave the pool ever! As long as it has swimming instructors."</i> (Group 2, male, participant ID number: G2M2)
		First aid training	<i>"We don't know how to do that, providing first aid for drowning. We actually need that education. We could only scream for help. We don't know how to help with drowning."</i> (Group 6, female, participant ID number: G6F3) <i>"For us, for instance, we perhaps have only watched in on tv, how to save people who are drowned. But we don't know how to do it. We need to be taught."</i> (Group 6, female, participant ID number: G6F1)
Community action	Participants' views and practices on community action for social and environmental changes to create safer environment for children.	Providing unsupervised safe places	<i>"Having a playground for the children perhaps can be done [to prevent child drowning]. A place where young kids could be gathered in one place. Especially for younger children. If we could not find our children at home, we only need to look there."</i> (Group 2, male, participant ID number: G2M2) <i>"We don't have any space for children to play around here. If there is a playground, a space to play around here, perhaps children will not go as far to play. There is no open space these days. It will be great if a playground can be provided for the children."</i> (Group 3, female, participant ID number: G3F2)
		Providing supervised safe places	<i>"Actually, people here are willing to look after one another, to watch each other's children. People in the village are mostly helpful to one another. If there is a facility, a childcare, in this village, to have the children being watched, that would be helpful to stop the children from playing in streams."</i> (Group 6, female, participant ID number: G6F1) <i>"Such as having a preschool [in the community]. That would be a good idea to prevent child drowning."</i> (Group 4, female, participant ID number: G4F3)
		Barriers	<i>"Yes, kids were curious about it [the uncovered well], what was in there, so they got closer to well, they peeked over the well. We were worried about the possibility of children taking a plunge into the well. So, most of us have covered our wells."</i> (Group 2, female, participant ID number: G2F1) <i>"No ponds or streams are not being fenced. Never. The ditches now often are covered by concrete, like concrete slabs. Actually, not really [ditches being covered]. It is [covered] in front of people's houses only, so it depends on the owner of the house."</i> (Group 1, female, participant ID number: G1F5)
Policy development and enforcement	Participants' views that look at policies and regulations that help create a climate in which water safety is encouraged or inhibited.		<i>"Bathing pools are not regulated. It should be regulated, that only children that come with their parents can enter, but it's not regulated. So, any children can enter bathing pools any time they wish."</i> (Group 4, female, participant ID number: G4F3) <i>"No one on board of boats use lifejackets. Never. The boat crews never let people know that we must use lifejackets and where the lifejackets are stored. And I have took a few boat and ferry rides, to Bali and to Java. But no such information on lifejackets. There should be lifejackets being prepared, as it should. Sometimes there were lifejackets around, sometimes no lifejackets can be seen around. But no there were no information on that. Especially on smaller boats. No one tells you what to do."</i> (Group 2, male, participant ID number: G2M1)

6.6. Discussion

Child drowning is a leading cause of death among Indonesian children, especially in eastern provinces like West Nusa Tenggara²⁵⁹; however, child drowning prevention remain insufficiently understood in Indonesia.⁶¹ This study provides insights into community perspectives and practices on current protective strategies used to reduce child drowning risk and necessary preventive measures within the local context.

This study revealed a consensus among participants on the importance of individual-focused interventions for preventing child drowning in Indonesia. Analysing community perspectives and actions using the HPF¹⁶⁸, it was revealed that participants sought interventions including swimming lessons for school-age children and educational programs to enhance parents' and community members' knowledge and skills on water safety and resuscitation. Although participants showed less clarity regarding the distinction between safe rescue and first aid skills, there was a clear recognition of the importance of personal life-saving skills, particularly for mothers. This aligns with WHO recommendations to equip parents and community leaders with safe rescue and resuscitation skills to prevent drowning fatalities.^{7,59,99} Drowning incidents often lead to fatal consequences, with submersion duration and timely access to cardio-pulmonary resuscitation reported as critical predictors for survival.⁴¹¹⁻⁴¹³ Further research is needed to determine effective methods of equipping Indonesian parents and community members with safe water rescue and resuscitation skills to intervene in emergencies without risking drowning themselves.⁵⁷

Participants also acknowledged the importance of both population-focused midstream and upstream interventions for drowning prevention. Recognised midstream interventions included implementing safety measures around water bodies and establishing community-based safe places for children. Upstream interventions included advocating for policies to limit access to water bodies, ensuring compliance with safety standards, identifying and addressing potential disaster hazards, and promoting interdisciplinary collaboration across government sectors. This recognition of midstream and upstream drowning prevention interventions aligns with the tenets of the HPF, which advocate for a continuum of multisectoral approaches, encompassing educational, behavioural, socio-environmental, and regulatory measures to ensure effective prevention at both individual and community levels.^{37,82,110,163} This resonates with the WHO's recommendation on drowning prevention, which outlines the importance of cross-sector partnerships for sustainable nationwide efforts.^{59,99}

Although many participants acknowledged the importance of interagency collaboration for effective drowning prevention, most had limited understanding of different government departments' responsibilities and objectives. Specifically, there was an awareness gap on the crucial roles of the education and health departments in child drowning prevention, despite being recognised as key actors in many countries' multi-strategic approaches to drowning.^{37,110,178,198,414} In this study, only one participant explicitly mentioned the education sector's responsibility to formally integrate swimming lessons into school curriculum. Although participants reported some level of swimming lessons were available in schools, implementation was inconsistent, and formal integration into the curriculum was lacking.

Participants lacked an understanding about how responsibilities are coordinated or divided between national and local government levels, highlighting the need for improved understanding and clarity regarding how different government levels collaborate to address water safety. Given Indonesia's archipelagic nature and large population and the multifaceted dimension of drowning, there is a pressing demand for systematic integration of drowning prevention frameworks across regulatory activities, spanning water safety enforcement, child protection, childcare, education, health services, safety infrastructure, boating regulation, disaster management, and addressing economic disparities.⁶¹ Clear delineation of responsibilities and coordination mechanisms among agencies is crucial for cohesive national prevention efforts.⁶¹

Participants demonstrated limited awareness of non-governmental stakeholders' relevance to drowning prevention, despite past research highlighting their global contributions.^{36,105,110} A previous review indicated non-health sectors often lead drowning prevention efforts in many countries, with increasing non-governmental organisations (NGOs) involvement in policy, implementation, and research, offering opportunities for aligning child drowning prevention with broader health and development goals.¹¹⁰ As recommended by the WHO, fostering multisectoral collaboration should begin by identifying and connecting with all relevant collaborators, including industry, academia, civil society, NGOs, international bodies, and local communities.⁵⁹ Further research is crucial to engage these stakeholders effectively in Indonesia's prevention efforts at all levels.

Participants recognised the importance of both face-to-face and media communication, including social platforms, to raise awareness about drowning risks and prevention. This aligns with WHO's recommendation to improve public awareness through strategic communication.^{7,59,70} Understanding Indonesia's local context is crucial for targeted

dissemination of child drowning prevention information, facilitating awareness and behaviour modification campaigns. These campaigns advocate for political commitment, policy support, and behaviour change, aiming to create supportive environments that empower individuals and communities to make safer choices, which ultimately reduces the risk of child drowning. As recommended by the WHO, these initiatives should be integrated into a strategic drowning prevention plan.^{7,59,70}

While this study provides valuable insights into how parents and community members perceived child drowning prevention, further research is imperative for developing contextually relevant water safety promotion approaches and the alignment of cross-sector partnerships in Indonesia. Investigating social determinants of drowning within the Indonesian context, is vital to ensure the effective and sustainable adoption of life-saving practices within underserved and culturally diverse communities across Indonesia.

6.7. Strengths and Limitations

This is the first study to our knowledge that explores parental and community perceptions around drowning prevention in Indonesia. While the sampling method ensured geographical diversity between coastal areas and areas around inland water bodies, the study focused solely on one specific region of Indonesia. Considering Indonesia's extensive geographical and cultural diversity, further research is needed nationwide to determine whether perceptions and actions related to child drowning prevention are consistent. Additionally, participants were self-selected and might diverge from the broader community's perspectives.

6.8. Conclusion

This study highlighted parents and community members' focus on individual-focused, interventions for drowning prevention, particularly on educational programs on swimming skills for school-age children and life-saving skills for parents and community members. There was limited understanding of the roles of education and health departments in child drowning prevention efforts. Although participants reported some level of swimming lessons were available in schools, implementation was inconsistent, and formal integration into the curriculum was lacking. Further research into formally integrating swimming training into school curricula and assessing its impact on reducing child drowning rates, developing contextually relevant water safety promotion approaches, and fostering cross-sector partnerships are crucial steps to ensure effective and sustainable drowning prevention efforts in Indonesia.

Chapter 7 Community Perspectives on Disaster-Related Drowning Risks



7.1. Overview

Title: “The seawater is rising!”: Community perspectives on water-related disaster and drowning risks in Lombok, Indonesia

This chapter is presented as a publication manuscript. The formatting of this chapter adheres to journal requirements; however, table and figure numbering, as well as referencing, have been aligned with the thesis format. The references for this chapter are included within the overall thesis' reference list.

The manuscript has been submitted for consideration for publication in the *International Journal of Disaster Risk Reduction*. The citation for the publication is: Cenderadewi M, Devine SG, Fathana PB, Franklin RC. “The seawater is rising!”: Community perspectives on water-related disaster and drowning risks in Lombok, Indonesia. [*Manuscript submitted for publication*]. 2024.⁴¹⁵

During the qualitative research, a key theme emerged on the community's concerns and experiences on disaster-related drowning risks in their communities. Therefore, this chapter explores community perceptions and experiences of disaster-related drowning risks in Indonesia. This study underlines the need for resilience building in disaster-prone communities and systematic integration of disaster risk reduction strategies into drowning prevention measures and policies. The study findings have relevance to the subsequent chapter on WHO-recommended drowning prevention interventions and informed the discussion on the final chapter.

The authors' contributions are outlined as follows: i) M. Cenderadewi: Conceptualisation, data curation, formal analysis, investigation, methodology, project administration, resources, validation, visualization, writing – original draft, writing – review & editing; ii) S. G. Devine: Conceptualisation, formal analysis, methodology, resources, funding acquisition, supervision, validation, visualization, writing – review & editing; iii) P. B. Fathana: Data curation, investigation, validation; iv) R. C. Franklin: Conceptualisation, data curation, formal analysis, methodology, resources, funding acquisition, supervision, validation, visualization, writing – review & editing.

The paper is presented below as the version submitted to the journal.

7.2. Abstract

Disaster-related drowning incidents are a critical concern across low- and middle-income countries (LMICs), including Indonesia, presenting unique challenges that require targeted interventions. Despite Indonesia's vulnerability to various water-related disasters, research into disaster-related drowning events is often overlooked in studies focusing on both drowning prevention and disaster mitigation globally and in Indonesia. This qualitative study explored community perceptions and experiences on disaster-related drowning risks in Lombok, Indonesia. Seven focus group discussions were conducted, comprising 62 participants, including village community leaders and community members from seven villages on disaster-prone Lombok Island, West Nusa Tenggara Province, Indonesia. The thematic analysis used inductive approach. This study identified the community's concerns regarding water-related disasters as relevant drowning risk factors in Indonesia as part of a wider study exploring drowning prevention. Participants attributed their vulnerability to the geological characteristics (not climatic) of Lombok, past tsunami events in Indonesia—specifically, the 2004 disaster in Aceh Province—and their perceived inadequacy in preparedness measures. To prevent disaster related drowning several areas need strengthening (and further investigation) in Indonesia: risk identification and targeted prevention for disaster-related drowning; resilience building in disaster-prone communities; enhancing self-efficacy through educational interventions including evacuation simulations; enhancing disaster risk communication through leveraging existing local resources and informal social networks; and systematic integration of disaster risk reduction strategies into drowning prevention measures and policies. The study underlined opportunities to integrate drowning prevention into broader disaster studies and disaster risk reduction (DRR) frameworks, including the Sendai Framework for DRR 2015-2030.

7.3. Research in Context

7.3.1. Evidence before this study

Despite numerous studies emphasising the significant impact of drowning and water-related disasters independently, the exploration of their interconnection within disaster risk reduction research and policy frameworks remains insufficient worldwide. Both drowning and water-related disasters are recognised as critical global public health issues, particularly affecting vulnerable populations in low- and middle-income countries. Despite sharing a conceptual framework that integrates hazard exposure, vulnerability, and preparedness/response capacity, the integration of these fields remains limited, including in Indonesia.

7.3.2. Added value of this study

This study identified community concerns regarding water-related disasters as relevant drowning risk factors in Indonesia. The study also highlighted community awareness of the importance of disaster preparedness and challenges in risk communication. Several aspects need to be further investigated and strengthened in Indonesia: i) risk identification and targeted prevention for disaster-related drowning; ii) resilience building in disaster-prone communities; iii) enhancing risk communication through leveraging existing local social networks; and iv) systematic integration of drowning prevention into broader disaster risk management strategies for comprehensive preparedness

7.3.3. Implications of all the available evidence

The study underlined opportunities to integrate drowning prevention into broader disaster studies and disaster risk reduction (DRR) frameworks, including the Sendai Framework for DRR 2015-2030. This integration enables researchers and practitioners to utilise existing expertise and resources in both DRR and water safety, promoting a more holistic approach to mitigating disaster-related drowning risk through enhancing interoperability, prompt mobilisation of resources, improving inter-agency communication, and fostering community resilience building and preparedness efforts.

7.4. Introduction

Disaster-related drowning incidents stand out as a critical concern across low- and middle-income countries (LMICs), presenting unique challenges that require targeted interventions.^{7,40,61,158,416} The frequency and severity of water-related disasters, such as floods, cyclones, landslides, and tsunamis, are often exacerbated by the progression of climate change, trigger sudden and widespread inundation of water, leaving vulnerable communities of LMICs, including Indonesia, at increased risk of drowning due to disaster-related exposures.^{40,42,156,417,418} Despite this vulnerability, research into disaster-related

drowning events is often overlooked in global studies that focus on drowning prevention and disaster mitigation, including within Indonesia.^{40,42,61,418}

The under-exploration of disaster-related drowning persists despite numerous studies highlighting the significant impact of drowning and water-related disasters separately, with both being recognised as global public health concerns that disproportionately affect vulnerable populations of LMICs, particularly those with low socioeconomic status.^{6,7,39,126,419-421} A study by Le Dé⁴² highlighted the near absence of drowning research within disaster studies, and the lack of drowning in policies focused on disaster risk reduction (DRR). This is despite both fields sharing a common conceptual framework that integrates hazard exposure—such as how severe weather events affect conditions in aquatic bodies, consequently, increasing drowning risks—and factors of vulnerability shaped by sociocultural, economic, and physical elements, alongside limited capacities such as insufficient knowledge and skills in disaster preparedness and water safety. The understudied connection between drowning risk and climate change also remains, despite the increasingly apparent influence of climate change on drowning risk. This is particularly concerning in LMICs, where infrastructure for warnings, evacuations, and shelters may be insufficient, as outlined by Sindall, et al.⁴⁰.

Peden, et al.⁴¹⁸ also highlighted that despite drowning being the primary cause of death during floods and cyclones, and despite the emphasis put forward by the United Nations (UN) General Assembly Resolution on drowning prevention to integrate drowning prevention efforts into existing DRR programs, there is a notable absence of specific mentions of drowning in the field of DRR, including in the Sendai Framework for Disaster Risk Reduction 2015-2030 and UN guidance on DRR. The Sendai Framework for Disaster Risk Reduction 2015-2030 guides comprehensive disaster risk management by prioritising four key actions: improving understanding of disaster risks to inform effective preparedness and response; strengthening governance to allow effective risk management and sustainable development; increasing investment to enhance economic, sociocultural and health resilience; and enhancing preparedness to facilitate effective response and recovery, to achieve substantial reductions in disaster mortality and affected populations worldwide, as well as minimising disaster-related losses.⁴²² The framework promotes a holistic approach to resilience building through collaboration and coordination across sectors and governance levels, integrating risk reduction into policies and regulations, offering social protection mechanisms to reduce the financial impact of disasters, and enhancing preparedness through community empowerment.^{422,423} Therefore, it is crucial to explore how drowning prevention can be further integrated into the broader field of disaster studies and DRR frameworks, including the Sendai Framework. This integration would enable researchers, practitioners, and stakeholders in both DRR and drowning prevention to leverage existing understanding in disaster

response and water safety, promoting a more comprehensive approach to mitigating the risks of disaster-related drowning in Indonesia.

Indonesia ranks among the world's most disaster-prone nations.^{4,124,126} Its distinctive geographic position, at the meeting point of the Indian and Pacific oceans and between Asian and Australian continents, compounded by its extensive coastline spanning 91,363.65 kilometres, the second longest globally, underscores the nation's vulnerability to a wide range of disasters, including earthquakes, tsunamis, landslides, tropical cyclones, and floodings.^{117-120,125} Between 1815 and 2023, water-related disasters, including tsunamis (and associated earthquakes), floods, tropical cyclones, landslides, and tidal waves, constituted 63% (164,037 deaths) of all disaster-related fatalities and 97% (49,512 cases) of all missing victims associated with disaster events in Indonesia, with tsunami fatalities surpassed those caused by other types of disasters.⁴ However, it is essential to acknowledge that the national disaster data lacked documentation on the specific causes of death, particularly regarding the extent to which drowning contributed to the overall fatalities, further complicating the accurate estimation of the burden of disaster-related drowning in Indonesia.⁴

It is also crucial to consider the projected increase in frequency and severity of weather events and related disasters, as well as rising sea levels in Indonesia linked to climate change. These factors have a significant potential impact on the livelihood and health of Indonesia's population, particularly in small, low-lying islands and coastal areas across the Indonesian archipelago, as noted in previous research.^{126,424-427} Several studies also highlight that rising sea levels can significantly change tsunami risks and complicate earthquake and tsunami predictions.⁴²⁸ Climate change-driven sea-level rise could worsen tsunami intensity by influencing how powerful tsunamis can be, particularly in low-lying coastal areas such as found in Indonesian islands.⁴²⁹ Climate change can also indirectly trigger earthquakes, volcanic eruptions, tsunamis, and landslides by melting ice, which reduces the weight on the Earth's crust, causing the land to rise and reactivate faults, as well as decrease pressure on magma chambers that supply volcanoes, potentially increasing seismic activity.^{428,430} Therefore, it is essential to gain a comprehensive understanding of how disaster-related drownings, including those influenced by climate change, contribute to the overall drowning burden in Indonesia. This involves incorporating community perspectives to identify risk factors, and to tailor effective drowning prevention strategies across the country.

The Indonesian archipelago sits at the junction of three of Earth's largest tectonic plates—the Eurasian, the Indo-Australian, and the Pacific Plates—contributing to its susceptibility to earthquakes and, consequently, tsunamis.¹²⁰⁻¹²³ Between 2000 and 2021, Indonesia experienced 18 significant earthquakes, some surpassing a magnitude of 8.0, potential precursors for tsunamis.¹²⁰ The 2004 Indian

Ocean Earthquake and Tsunami, also known locally among Indonesian populations as “the 2004 Aceh Earthquake/Tsunami”, triggered by magnitude 9.1 to 9.3 earthquakes which occurred along the boundary at the junction of the Indo-Australian and Eurasian tectonic plates, resulted in the deadliest natural disaster event of the 21st century, with the tsunami causing over 227,000 fatalities, with 165,000 of them occurring in Indonesia.^{120,123} Despite scientific advancements in understanding tsunami hazards, effectively communicating disaster risks to vulnerable communities remains a global challenge.^{120,121,123,431-433} This underscores the crucial role of disaster risk communication, necessitating a thorough and nuanced examination of the factors that can either facilitate or impede its efficacy.^{120,432} Developing a deeper understanding of Indonesian community perceptions on water-related disasters, including tsunamis, risk and preparedness, is important to inform effective risk communication, disaster mitigation, and drowning prevention strategies.

This study focused on Lombok Island, of West Nusa Tenggara (WNT) Province of Indonesia, for several reasons. Firstly, Lombok Island, where 71% of WNT's population resides, stands out as one of Indonesia's disaster-prone regions, particularly for earthquake, tsunami, tropical cyclones, coastal flooding, and urban flooding.^{3,434} This vulnerability is attributed to the presence of the Flores back-arc thrust, part of the Indo-Australian and Sunda plates convergence, along its northern coastline.^{121,274} Over the period of July to August 2018, Lombok experienced small-scale tsunamis of approximately 1-2.5 meters in height along its northern coast, triggered by fault ramp rupture resulting in four major earthquakes ranging from magnitude 6.4 to 6.9 and a series of over 800 lesser earthquakes.^{121,274} Secondly, Lombok was selected as study site due to its archipelagic and rural characteristics, making it one of Indonesia's most vulnerable areas to drowning, with high under-five years of age drowning mortality rates of 12.6/100,000 for males and 6.1/100,000 for females in 2019, among the highest nationwide.²⁵⁹ Economic disparities further exacerbate the vulnerability, with over 19% of the population living below the national poverty threshold, resulting in significant challenges in disaster preparedness, response, and recovery efforts among local communities.²⁷¹⁻²⁷³ Understanding how Lombok communities perceive water-related disasters as environmental risk factors of disaster-related drowning can provide valuable insights into risk communication dynamics and drowning prevention measures, informing targeted drowning and disaster mitigation and risk communication efforts.⁴³⁵ Therefore, this paper explored community perceptions and experiences related to drowning risks, with a focus on disaster-related incidents, in Lombok, Indonesia.

7.5. Methods

7.5.1. Study Design

This paper is part of an exploratory qualitative study that initially aimed to investigate parental and community perceptions of child drowning risk and prevention in Indonesia.^{389,406,436} It was built on findings from a previous scoping review⁶¹ and a population-based retrospective cohort study²⁵⁹ conducted in Indonesia, which identified high drowning mortality rates among children under five, particularly in eastern Indonesia, including in West Nusa Tenggara. The exploratory qualitative research design was chosen to facilitate an open exploration of the issue²¹⁴ of drowning risk and prevention in Indonesia, which has minimal coverage in the existing literature⁶¹.

While the study initially focused on drowning risk among children under five, an organic expansion of the focus group discussions occurred during the data collection, as the participants began to discuss broader concerns related to water-related disasters as the environmental risk factors contributing to drowning incidents among both adults and children. Inductive analysis revealed community members' significant concern about the impact of water-related disasters on their overall safety and well-being, and how their lived experiences shaped their understanding of risk, emphasising both immediate dangers—such as the perception of unavoidable fatalities due to tsunami forces—and broader issues that exacerbate disaster vulnerabilities, such as insufficient community preparedness.

7.5.2. Research Setting

The research was conducted in seven villages across all districts (West Lombok, North Lombok, East Lombok, Central Lombok, and Mataram) of Lombok Island, West Nusa Tenggara Province, Indonesia, including coastal and inland areas. This diverse geographical representation aimed to ensure a comprehensive understanding of potential disparities in perceptions on drowning risks among different population groups.

7.5.3. Sample Selection and Recruitment

Participants were considered eligible if they were identified as village community leaders or village community members residing in villages situated along the coastline and/or near inland water bodies in Lombok Island, West Nusa Tenggara Province, Indonesia. This selection criteria aimed to provide insights into beliefs, attitudes, practices, and experiences related to drowning risks and prevention at both individual and community levels.

Recruitment employed purposive sampling to select participants based on the inclusion criteria, ensuring focused representation of the population of interest across the geographic spread of Lombok Island.²⁷⁹ Furthermore, snowball sampling was utilised to leverage existing social networks

within the community, enabling a deeper understanding of the inherent social networks and dynamics in the community.²⁸³ Village chiefs and community health workers facilitated the identification of key informants who possessed significant insights into drowning risks in the community. Face-to-face recruitment took place at communal village gatherings, where individuals who expressed interest in participating received information sheets and consent forms in person.

7.5.4. Data Collection

Seven focus group discussions (participants=62) were conducted at various community locations between October 2023 and March 2024, until data saturation was achieved. This method enabled collection of diverse perspectives from different community segments including parents and community leaders, as well as fostering elaboration of ideas through discussion and interactions, enriching the qualitative data collected. Moreover, by corroborating information across multiple sources, these focus group discussions helped facilitate consistency in identified themes.^{291,410} Participant characteristics were collected prior to each focus group using a short participant questionnaire.

Focus group sessions were overseen by two Indonesian team members fluent in Indonesian and the local Sasak language (MC, PBF). MC guided the discussions while PBF documented interactions and took field notes. Consent was obtained from each participant prior to the focus group discussions to audio-record the sessions, which were then transcribed verbatim and translated to English by the primary researcher. These translations were later back translated into Indonesian by the other Indonesia team member (PBF), with English samples reviewed by senior researchers (SGD and RCF), to verify data accuracy.

7.5.5. Data Analysis

Translated transcripts, demographic information, and field notes were entered into NVivo Version 20. Using an inductive approach, this study applied thematic analysis (TA), guided by Braun and Clarke's framework³⁰⁰, to allow a flexible and adaptable exploration on participants' experiences and perspectives concerning risk, preparedness, and response to water-related disasters and disaster-related drowning—an under-explored area in the literature. The identified themes around disasters emerged organically through repeated processes of data immersion, reflection, and questioning, highlighting the interpretative and iterative nature of TA.^{300,302,303}

To provide a more thorough context for this emerging concern, all participant narratives related to disasters were systematically reviewed and labelled, identifying meaningful concepts, ideas, and patterns around disaster events. These codes were then grouped into potential themes, which were refined through iterative reorganisation and restructuring. Researchers then further defined each

theme, specifying its scope and boundaries. Moving beyond descriptive analysis, researchers interpreted the identified themes within the research context and explored relationships between themes, considering the theoretical implications and link of disaster preparedness and response and drowning prevention. The findings were synthesised into a thematic table (Table 1), providing detailed theme definitions and representative excerpts. Contextual narratives developed for each theme are presented in the Results section.^{300,302,303}

Various measures were implemented to ensure methodological rigour. These include: extended time spent in research sites for rapport building and to deepen researchers' understanding of participants' narratives, as well as the complexities of the research setting, participants' living conditions, and social networks in the community; continual reflections on researchers' biases and assumptions; establishing an audit trail to record the process of data collection and analysis; member-checking with participants to validate data; Use of verbatim quotes from participants; undertaking back-translation; iterative processes of data immersion and reflection; and consensus discussion on themes and theme definitions to ensure authentic data interpretations.⁴³⁷

7.5.6. Ethics Approval

Ethical clearance was obtained from the University of Mataram, Indonesia (Ethics Approval number 044/UN18.F8/ETIK/2024) and registered to James Cook University's Human Research Ethics Committee (External HREC Approval Acknowledgement reference number H9088).

7.6. Results

Sixty-two people participated in the focus groups. The majority were female (n=47, 75.8%), aged between 25-44 (n=32, 51.6%), and had not completed primary education (n=36, 58.1%). All participants recruited were community members, with over a third of them (n=23, 37.1%) identified as village community leaders.^{389,406,436}

Data analysis revealed three key themes: a) Perceptions of vulnerability; b) Sense of powerlessness and fear during a disaster event; c) Factors influencing the decision to evacuate. Results are presented below under each theme heading and summarised in Table 7.1, which includes further illustrative participant quotes.

7.6.1. Theme 1 – Perceptions of Vulnerability

Participants mentioned water-related disasters as key environmental risks for drowning in their community. Interestingly, while participants overwhelmingly acknowledged vulnerability to tsunamis, none recognised their susceptibility to flooding. Some participants who appeared to be in the

older age groups attributed their lack of susceptibility to flooding to their perceptions of the dry climate of the region. Furthermore, no other water-related disasters, such as landslides and tropical cyclones, were mentioned.

“No, we don’t have it [drowning incident] here. No drowning in this community. We don’t have floodings around here. It’s drier these days. It never floods in this area.”

Group 1, male, participant ID number: G1M1

“We’re not afraid of floodings, but we’re very afraid of tsunamis!”

Group 2, female, participant ID number: G2F4

Most participants, regardless of whether they lived in coastal or inland areas, expressed their primary concern about earthquakes and the ensuing risk of tsunamis. Most participants, across different age groups, attributed this concern for tsunamis to Lombok’s characteristic of being an earthquake-prone region. Many participants shared their experiences during the significant earthquake of 2018 and how it heightened their awareness and fear of potential tsunamis. Many participants also discussed the enduring impact of the 2018 tsunami threat on their mental health.

“In this area, we’re always worried about disasters, especially earthquakes. Especially related to the earthquake disaster we had on 2018, because big earthquakes lead to tsunami. We’ve been experiencing long-lasting trauma about the possibility of earthquakes and tsunamis. Until this day.”

Group 6, male, participant ID number: G6M1

“We’re still afraid of it [tsunami]. Even if no earthquakes happen, we are already anxious and afraid of tsunami. Even until today. Let alone when there were earthquakes, people were scared!”

Group 3, female, participant ID number: G3F3

Many participants noted the influence of past tsunami disasters, particularly the 2004 Aceh Province Tsunami, also known as the 2004 Indian Ocean Tsunami, on their perception of susceptibility to and the severe impacts of tsunamis. Moreover, many participants revealed feeling vulnerable because they lacked knowledge about what actions to take during tsunami events, with most relying on information from the media which mostly provided advise to evacuate to higher ground.

“That [2004] Aceh Tsunami what is what on our mind. We have an extreme fear that something like that will happen here. We heard about tsunami from the tv, that you need to

go to a higher place when tsunami hits. But we never had any education or information about it [responding to tsunami]. Nothing from other sources. I won't know what to do."

Group 3, female, participant ID number: G3F2

7.6.2. Theme 2 – Sense of Powerlessness and Fear during Disaster Event

Following the magnitude 6.9 earthquakes in 2018, most participants described experiencing intense feelings of powerlessness, fear, panic, and confusion. Moreover, numerous participants conveyed how the media portrayal of the 2004 tsunami catastrophe in Aceh Province deeply impacted their perception of the impending doom of tsunami and the seemingly insurmountable odds of survival, which intensified their feelings of fear and helplessness, amplifying their urgent need for evacuating. This was further compounded by their lack of knowledge on how to respond to tsunami threats.

"I had so many different feelings [during the threat of tsunami in 2018]. Everything was so out of hand. I felt my knees gave out. Everything was so out of hand. Sudden rolls of waves, we imagined it like that. There is no way you can run from it. Just rolls of waves of water, like massive amount of water being poured from the sea."

Group 3, female, participant ID number: G3F5

"People were screaming: "The seawater is rising! The seawater is rising!" How can we not be panicking? We have seen images of how big a tsunami can be, how massive the earthquakes can be, such as from Aceh!"

Group 3, female, participant ID number: G3F1

"We imagined something like the [2004] Aceh Disaster was happening. How the cars were being dragged down by the water. Everything being dragged by water! I know nothing on evacuating from tsunami! Tsunami will come suddenly, right? How do you suppose to save yourself when something like that comes so suddenly? You can't survive it!"

Group 3, female, participant ID number: G3F1

Many participants also described how these overwhelming feelings hindered their ability to respond efficiently, including leading to traffic congestion on evacuation routes.

"The road was filled with people, on their motorbikes, three to four people on one motorcycle. They were hollering, "The seawater is up! The seawater is up!" You can't move any further! The road was just full of people, on their motorbikes! Some abandoned their vehicles on the street and went running on foot! Even though the south part of the island, where they

ran to, was also in danger from tsunami, as we have water all around us in the island, but nobody had the mental capacity to think of that. People were so scared! The most important thing was we ran as far as we could!"

Group 1, female, participant ID number: G1F5

7.6.3. Theme 3 – Factors Influencing the Decision to Evacuate

Participants discussed their evacuation decisions during the 2018 tsunami threat in Lombok, citing various prompts for evacuating. Most stated that they heard about the threat of tsunami from informal channels of word-of-mouth within the community. Participants noted that unclear information circulated among community members, leading to heightened feelings of fear, confusion, and urgency to evacuate.

"I don't know! From friends, from people. From people around here. They said: "The seawater is coming! The seawater is coming! Run! Run!" Everyone said so! So, we just ran!"

Group 1, female, participant ID number: G1F6

"We just followed what other people were doing [on evacuating]. People ran this way, so we ran this way too. I didn't know where to go, just following the masses of people running."

Group 3, female, age group: participant ID number: G3F5

Only a few participants mentioned receiving warning about the potential tsunami threat from the mobile application of the Indonesian Meteorological, Climatological, and Geophysical Agency. However, those who did receive this warning observed a delay in receiving the information, and there were challenges in reaching local communities due to the urgency of community members to evacuate, intense fear of the tsunami, and technical difficulties such as electricity blackouts. These issues hindered the dissemination of official authoritative information, causing community members to rely on informal word-of-mouth sources for mobilising evacuation.

"Because people were screaming "The seawater is up! The sea water is up!", so the village chief yelled on top of his lungs "Run! Run! The seawater is up!" The electricity was off at that time, so the entire village just ran through the village's alleyways, running for their lives! I don't know where I heard everything from. From one person to the next. Word of mouth."

Group 1, female, participant ID number: G1F5

“Not yet! BMKG [the Indonesian Meteorological, Climatological, and Geophysical Agency] had not come out with any news at that time!”

Group 1, female, participant ID number: G1F7

“We actually heard from BMKG [the Indonesian Meteorological, Climatological, and Geophysical Agency]. Because of the magnitude of the earthquake, 7M, so a tsunami could be triggered, but the warning was redacted after 30 minutes, less than 30 minutes, when there was no longer a threat for tsunami. But it was too late as the word of mouth was already spreading. People had already evacuated away from here.”

Group 6, male, participant ID number: G6M1

Predominantly, participants evacuated to higher ground in the hills or spaces, such as schools, and other buildings, to save themselves from the tsunami.

“During that time [2018 tsunami threat], we were so afraid that the tsunami was coming! So, we climbed up the building, the first floor of the school near here. We got down after the earthquake stopped. But then more aftershocks happened, so we kept going up the building and going down, then up again! We kept running and running! We were confused, do we go up again if an aftershock happens. You didn't know what to do because it was like one or two months of aftershocks, right. So, each time there was an earthquake, we ran!”

Group 1, female, participant ID number: G1F1

Participants also noted that many community members evacuated from coastal areas to inland regions. Meanwhile, other community members sought refuge in open spaces, such as fields, school yards, cemeteries, and beaches, possibly stemmed from confusion between finding clear spaces to avoid collapsing buildings during earthquakes and the necessity to flee from tsunamis, as well as the lack of designated evacuation areas.

“Some people who live near the beach said that the seawater was rising, then we climbed up the hills to a higher place. Some people even went to the beach. People were just confused. We all, one entire village, ran and evacuated away from the village. Some ran away from buildings to seek open space, and some ran to a higher place. Many evacuated even further away to Narmada [about 40kms away]. They said the water was rising!”

Group 2, female, participant ID number: G2F1

Some participants residing in the northern part of the island voiced confusion about where to find safety during evacuations. This was due to their proximity to Rinjani, an active volcano prone to seismic activities, as well as to nearby coastal areas vulnerable to tsunamis. Many participants evacuated for an extended period, primarily fearing that their homes would collapse from aftershocks, rather than from tsunamis.

“The thing is, if things like this happen, we live near volcanic area, so if we climb up to higher areas, the sway from the earthquakes will be felt bigger than in lower region. But if we stay in the lower region near the coast, we are afraid of the seawater! Nowhere felt safe! We all evacuated in the field for a long time. We built tents away from home, with everyone else, because the aftershocks may bring our house down into rubble.”

Group 2, female, participant ID number: G2F4

Table 7.1. Definitions of Themes and Illustrative Quotes Supporting Interpretations of Themes

Themes	Definitions and inclusions	<i>Representative excerpts</i>
Perceptions of vulnerability	Participants' perceptions of their vulnerability to water-related disaster risks, as influenced by several factors, including geological features of the study site, past experiences with disaster threats, media coverage of past disaster events, and low levels of preparedness.	<p><i>"We don't have floodings here, if God is willing."</i> (Group 3, female, participant ID number: G3F5)</p> <p><i>"Yes, we are at risk for tsunamis because we have a lot of earthquakes. We were scared each time there were earthquakes. People bumped into one another in sheer panic. We were scared."</i> (Group 1, female, participant ID number: G1F5)</p> <p><i>"We keep thinking of that, that something like [the 2005 tsunami in] Aceh will happen to us. We all will be washed away by water."</i> (Group 3, female, participant ID number: G3F5)</p>
Sense of powerlessness and fear during disaster event	Participants' description of feeling powerless, scared, panic, and confused during an event of tsunami threat following M6.9 earthquakes, and how these feelings could impact their ability to react efficiently.	<p><i>"We were absolutely terrified of tsunami. We panicked. Absolutely terrified."</i> (Group 7, female, participant ID number: G7F3)</p> <p><i>"It was just overwhelming and confusing! I didn't know what to do!"</i> (Group 2, female, participant ID number: G2F5)</p> <p><i>"Everyone was very scared! We didn't know where to go. People were running around. People took off on their motorbikes. The entire road was full of people! No-one can move, everyone poured onto the road, running away from here."</i> (Group 7, female, participant ID number: G7F1)</p> <p><i>"We were thinking about where we should go, where we should evacuate to. We imagined a massive flow of water was coming. That was all I can think of, where should I go, with my children with me. My husband was at the mosque for the Maghrib prayer [after sunset]. It was just me who were responsible for my kids and I didn't know where to go. We imagine a massive flow of water was coming. How would you survive that? I just can't think at that time!"</i> (Group 3, female, participant ID number: G3F2)</p>
Factors influencing the decision to evacuate	Participants' perceptions and experiences regarding the decisions made by individuals and communities to evacuate. This encompassed various prompts to evacuate, such as word of mouth, influence by actions of others, and receiving advisories from authorities, and evacuation locations.	<p><i>"We heard [the warning about tsunami threat] from BMKG [the Indonesian Meteorological, Climatological, and Geophysical Agency]. But also, from word of mouth."</i> (Group 3, female, participant ID number: G3F4)</p> <p><i>"Everyone tried to climb into a higher spot! "The water was coming! The water was coming!" they said."</i> (Group 6, female, participant ID number: G6F1)</p> <p><i>"At first many people evacuated to the cemetery, because it's an open space. We don't have other open areas without houses. You just look for a clear area to run to."</i> (Group 1, female, participant ID number: G1F5)</p>

7.7. Discussion

Despite frequent water-related disasters and high drowning mortality rates in Indonesia, particularly in West Nusa Tenggara (WNT), the link between these disasters and drowning remains underexplored.^{4,61} This study provides insights into community perceptions and experiences regarding their susceptibility, preparedness, and response to water-related disasters, particularly tsunamis, as environmental risk factors contributing to disaster-related drowning. The insights revealed gaps in disaster preparedness, risk communication, and resilience, which are essential for improving drowning prevention and DRR strategies.

Participants emphasised disasters as key environmental risk factors contributing to drowning incidents in their community, particularly highlighting vulnerability to tsunamis over other water-related disasters. Participants in this study linked their vulnerability to disaster-related drowning in Lombok to the region's geological characteristics. Previous studies have reported how Lombok's topography, ranging from gently sloping shorelines that offer less protection against tsunami waves, to steep cliffs prone to erosion and instability during severe weather events, significantly amplify the risk of water-related disasters.^{121,274,438-440} However, given this study's focus on Lombok Island, West Nusa Tenggara Province, further research is needed to examine disaster and disaster-related drowning risks in other regions with varying geographic and sociocultural contexts. This would help validate and adapt mitigation strategies to fit the unique needs of different areas across Indonesia.

The susceptibility of Indonesian populations to disasters underlines the imperative to integrate drowning prevention more effectively within the broader field of disaster studies. Integrating drowning prevention into DRR offers mutual benefits. It allows drowning researchers to leverage DRR resources, such as early warning systems and community resilience programs, while DRR practitioners can utilise drowning prevention networks and water safety protocols to facilitate swift resource mobilisation, interoperability, and community resilience and preparedness.⁴² One exemplary practice of this integration is the implementation of the Surf Emergency Response System (SERS) by Surf Life Saving Australia (SLSA), to mobilise lifesaving services during disaster events in Australia, negating the complex emergency service systems.⁴⁴¹ In addition, the participation of lifesaver communities in DRR efforts in Australia has played a crucial role in providing evacuation assistance during flooding events.⁴⁴² However, Indonesia lacks similarly integrated approaches to address these overlapping areas, underlining the need for cohesive policies to protect vulnerable populations.^{42,61}

The study also highlights the need to enhance community resilience and self-efficacy through educational interventions, including embedded evacuation simulations, to promote continuous adoption of preparedness behaviours at the community, organisation, family, and individual levels, such as familiarising oneself with evacuation routes, stockpiling water and food, and assembling a grab-and-go evacuation bag, which frequently fail to materialise despite public awareness initiatives.^{120,121,443-448} Expanding educational approaches to water safety, by integrating swimming and safety training with disaster preparedness, could further strengthen community resilience.

Moreover, this study examined how individuals process information cues in response to disaster threats. Participants reported reliance on second-hand information and delays in official warnings during the 2018 earthquakes, a common challenge in near-field tsunami events, particularly in remote and underserved areas of Indonesia.^{121,432,449-453} Previous studies in Indonesia, Italy, Chile, and Turkey have also reported how tsunami warning dissemination is often complicated by the urgent need for prompt evacuation among local communities.^{432,454,455} A study in Padang, another part of Indonesia, highlighted how using informal networks, such as mosque communities and speakers, improved evacuation response times.⁴⁵⁶ Thus, empowering local communities and leveraging social networks may enhance disaster response across Indonesia, where geographic and sociocultural diversity necessitate tailored, locally relevant solutions.

Given Indonesia's geographic and sociocultural diversity, it is essential to further explore and tailor resilience-building and disaster-related drowning mitigation strategies that account for region-specific factors. This study identifies the following priority areas for disaster preparedness and drowning prevention strategies in Lombok, offering preliminary insights of research and practice gaps in the area and possibly in other regions with similar contexts:

1. Risk Identification and Targeted Prevention: Developing nuanced risk profiles to inform targeted prevention measures that address diverse regional vulnerabilities to disaster-related drowning.
2. Enhancing Preparedness: Enhancing self-efficacy in disaster readiness through educational interventions, embedding regular evacuation simulations, and refining risk communication strategies to effectively reach the public
3. Community Resilience Building: Strengthening local capacities through community co-designed resilience programs, focusing on education, social cohesion, and access to preparedness and water safety resources.

4. Improving Disaster Risk Communication: Leveraging local resources and networks to ensure timely and accessible risk information, particularly in remote areas.
5. Integration of Drowning Prevention into Broader Disaster Management: Incorporating drowning prevention into DRR strategies to create a unified approach to preparedness and response.^{422,457-466}

These priorities highlight the importance of context-specific interventions across Indonesia's varied regions and emphasise the need for adaptable, locally relevant approaches aligned with the Sendai Framework for Disaster Risk Reduction.^{42,61,418}

7.8. Strengths and Limitations

This study offers a unique perspective on the importance of water-related disasters as risk factors for drowning in Indonesia, a country characterised by its susceptibility to disasters and high drowning mortality rates. It serves as a crucial starting point for discussions pertaining to the systematic integration of disaster risk reduction initiatives into the framework for drowning prevention in disaster-prone countries and communities.

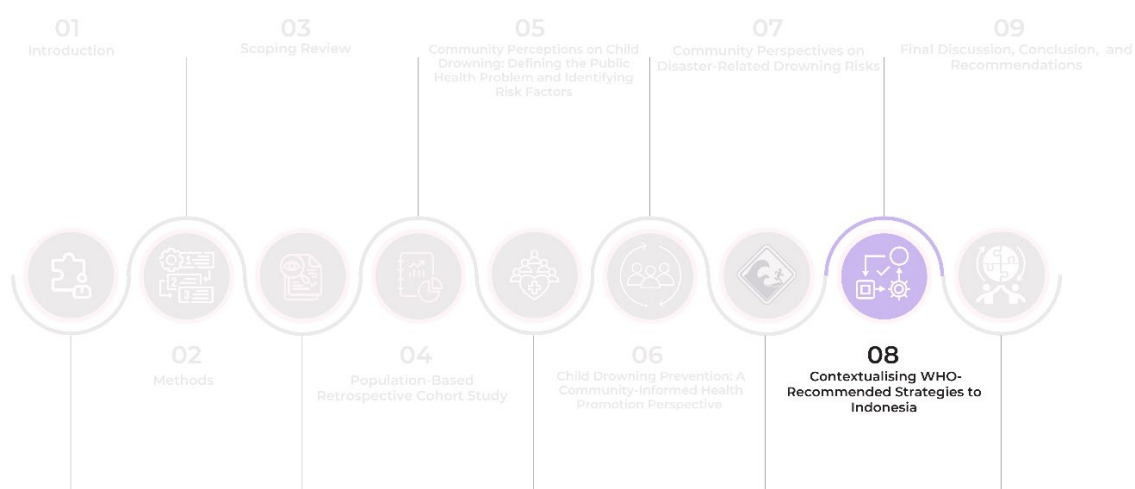
However, certain limitations must be acknowledged. Firstly, the study did not originally intend to explore disaster risk perceptions and DRR. Rather, discussions and acknowledgments regarding the significance of disasters as risk factors for drowning emerged spontaneously during the focus group discussions. Therefore, further research is warranted to specifically investigate how disaster risk perceptions influence drowning risk mitigation strategies and how DRR initiatives can be effectively integrated into drowning prevention efforts. Secondly, the study was conducted solely on one Indonesian island, albeit with a sampling approach designed to ensure a targeted yet diverse representation across both coastal and inland regions of Lombok. Given Indonesia's vast diversity, extensive geography, and large population size, further research across the country is necessary to ascertain whether perceptions and experiences of disaster-related drowning and disaster preparedness and response align consistently. Additionally, participants self-selected into the study, potentially biasing the sample towards individuals with a particular interest or experience in drowning prevention. Consequently, the findings may not fully reflect the perspectives of the broader community.

7.9. Conclusion

The community is concerned about water-related disasters as relevant drowning risk factors in Indonesia. While the study identified the critical importance of disaster preparedness

and risk communication in mitigating disaster impact, vulnerability during disasters is shaped by multiple factors, emphasising the importance of multi-strategic approaches to DRR and drowning prevention. Hence, several aspects need further investigation and strengthening in Indonesia: risk identification and targeted prevention for disaster-related drowning; enhancing self-efficacy in preparedness through educational interventions including evacuation simulations; resilience building in disaster-prone communities; enhancing disaster risk communication through leveraging existing local resources and social networks; and systematic integration of disaster risk reduction strategies into drowning prevention measures and policies.

Chapter 8 Contextualising WHO-Recommended Strategies to Indonesia



8.1. Overview

Title: Identifying enablers and barriers for implementing WHO-recommended drowning prevention strategies for children: Lessons from Indonesia for LMICs

This chapter is presented as a publication manuscript. The formatting of this chapter adheres to journal requirements; however, table and figure numbering, as well as referencing, have been aligned with the thesis format. The references for this chapter are included within the overall thesis' reference list.

The manuscript has been submitted for consideration for publication in the *Journal of Safety Research*. The citation for the publication is: Cenderadewi M, Franklin RC, Fathana PB, Devine SG. Identifying enablers and barriers for implementing WHO-recommended drowning prevention strategies for children: Lessons from Indonesia for LMICs. [*Manuscript submitted for publication*]. 2024.⁴³⁶

Building on Chapter 5, 6, and 7, this chapter explores examine the acceptability, enablers, and barriers for implementing WHO-recommended drowning prevention strategies in Indonesia. This study identified community support for WHO-recommended drowning prevention measures. The study findings emphasised the immediate need for low-cost, culturally appropriate, community-based interventions to reduce the risk of child drowning, particularly in rural areas of Indonesia, informing the discussion in the subsequent chapter.

The authors' contributions are outlined as follows: i) M. Cenderadewi: Conceptualisation, data curation, formal analysis, investigation, methodology, project administration, resources, validation, visualization, writing – original draft, writing – review & editing; ii) R. C. Franklin: Conceptualisation, formal analysis, methodology, resources, funding acquisition, supervision, validation, visualization, writing – review & editing; iii) P. B. Fathana: Data curation, investigation, validation; iv) S. G. Devine: Conceptualisation, data curation, formal analysis, methodology, resources, funding acquisition, supervision, validation, visualization, writing – review & editing.

The paper is presented below as the version submitted to the journal.

8.2. Abstract

Aims

Child drowning is a major cause of death among children in low- and middle-income countries (LMICs), despite global initiatives to reduce it. There remains a significant gap in effective community prevention strategies in LMICs, including Indonesia. This study aimed to explore the acceptance, facilitators, and barriers to implementing World Health Organization (WHO)-recommended drowning prevention strategies in Indonesia.

Methods

Seven focus group discussions with 62 participants, including parents of under-five children and village community leaders, were conducted across all districts of Lombok Island, West Nusa Tenggara, Indonesia. Thematic analysis utilised deductive approaches based on the Health Belief Model and the WHO's 2017 implementation guide for drowning prevention, along with inductive approaches.

Results

The study identified community support for WHO-recommended prevention measures, emphasising children's need for community-based swimming lessons and childcare facilities. Participants valued multisectoral collaboration, media communication, financial support, and collective childrearing practices as supportive factors in implementing interventions. However, financial constraints, rurality, and sociocultural norms, including gender dynamics around swimming, emerged as barriers and considerations for adopting the interventions.

Conclusion

The study findings provide valuable insights for refining drowning prevention strategies in both Indonesia and other LMICs by highlighting the importance of community engagement and addressing local barriers and facilitators in the design and implementation of interventions.

Practical applications

This study highlights the urgent need for affordable, culturally relevant, and safe community swimming lessons and childcare facilities to mitigate child drowning risks, especially in Indonesia's rural areas. Employing a co-design approach and exploring contextual socio-ecological determinants are crucial for tailoring effective interventions.

Keywords: Drowning, drowning prevention, water safety, community safety promotion, health promotion, social determinants of health, health behaviour, low- and middle-income countries

8.3. Introduction

There is a need to increase global initiatives to prevent drowning, especially for children under 5 years who are disproportionately impacted.⁸ With over half of drowning incidents occurring in low- and middle-income countries (LMICs), there is a need for cost-effective initiatives, especially in the Western Pacific and South-East Asia, including Indonesia who are currently underserved from a drowning prevention perspective.^{6,8,10,41,61}

Indonesia's vast geography of over 17,000 islands and frequent hydrometeorological disasters place it at high risk for drowning.¹¹ Despite a decrease in drowning rates from 2005 to 2019, the mortality rate for children under five in Indonesia remains high at 9.67/100,000 annually, surpassing global rates (5.5/100,000 in 2019) and rates in high-income countries such as Australia (1.06/100,000 in 2022/23⁴⁶⁷) and the United States (3.1/100,000 in 2022⁴⁶⁸). In Indonesia, elevated risks were observed among children in the regions of Papua, Kalimantan, Sulawesi, Maluku, and Nusa Tenggara.²⁵⁹ Therefore, there is an urgent need for tailored drowning prevention strategies for this high-risk population. However understanding of effective measures in Indonesia remains limited.⁶¹

The World Health Organization (WHO) has recommended multi-faceted prevention strategies to address the global burden of drowning.^{7,59,99} These include: (i) supervised safe places for young children; (ii) barrier installation; (iii) swimming lessons for school-age children; (iv) resilience building and flood risk management; (v) training in rescue and resuscitation; and (vi) enforcing maritime safety regulations. Supportive strategies involve multisectoral collaboration, strategic communications, national water safety plans, and advancing research.⁵⁹ However, there is limited understanding

regarding these strategies' social acceptability, effectiveness, and sustainability in Indonesia, which currently lacks a national strategy.⁶¹ Thus, gaining insights into enablers and barriers will be crucial for effective implementation within Indonesian communities and other LMICs with similar contexts.

To improve this understanding, this study applied the Health Belief Model (HBM).¹⁸⁷ By examining perceived susceptibility, severity, benefits, and barriers, the HBM identifies key motivators and deterrents for adopting water safety measures, as well as the role of cues to action and self-efficacy in prompting and sustaining preventive behaviours.¹⁸⁷ This approach allows for tailored drowning prevention strategies that address specific beliefs and concerns within Indonesian communities and can inform similar efforts in other LMICs with comparable contexts.

8.3.1. Research Aims

This qualitative study aimed to examine the acceptability, enablers, and barriers for implementing WHO-recommended drowning prevention strategies in Indonesia.

8.3.2. Research Questions

This study answered the following questions:

1. What are Indonesian parental and community perceptions on the social acceptability of WHO-recommended drowning prevention strategies within the context of their community?
2. What are Indonesian parental and community perceptions on enablers to participate in WHO-recommended drowning prevention strategies?
3. What are Indonesian parental and community perceptions on barriers for implementing WHO-recommended drowning prevention strategies?

8.4. Methods

8.4.1. Study Design

This qualitative study is a part of a broader mixed-methods inquiry into fatal unintentional drowning in Indonesia, and followed a scoping review⁶¹ and a population-based retrospective cohort study²⁵⁹. Employing an exploratory qualitative approach, the study was designed to further explain high drowning mortality rates among children under five in eastern Indonesia including in West Nusa Tenggara (WNT)²⁵⁹, by exploring community attitudes, beliefs, and practices on child drowning prevention, addressing a gap in the existing literature.^{202,264}

8.4.2. Research Setting

The research was conducted across seven villages in all districts (West Lombok, North Lombok, East Lombok, Central Lombok, and Mataram) of Lombok Island, WNT Province, covering diverse coastal and inland areas to explore drowning incidents in various settings and population groups.

WNT was selected as study sites due to its high under-five drowning mortality rates (12.6/100,000 for males and 6.1/100,000 for females in 2019)²⁵⁹ and high all-cause under-five mortality rate (29/1,000 live births in 2022)^{271,273}, both being one of the highest nationwide. The province's predominantly rural nature, high population density, and significant economic inequalities, with over 19% of its 5 million residents living below the national poverty threshold of less than USD 0.7 per day, also influenced the selection.^{2,267,268,272} Lombok Island, the second largest in the province, accommodates 71% (3.9 million) of WNT's population, making it one of Indonesia's most densely populated islands.^{2,143,267,268} Lombok is culturally diverse and predominantly Sasak speaking, with Indonesian as the formal language.¹⁴³

8.4.3. Sample Selection and Recruitment

Participants were eligible if they were parents of children under five or community leaders in densely populated coastal or inland water areas of Lombok Island, WNT. These criteria aimed to gather insights into socio-cultural beliefs, practices, and decision-making processes on child drowning prevention in the community. Recruited community leaders included village chiefs, elders, religious figures, and community health workers, most of whom were also parents or grandparents of children under-five.

Purposive and snowball sampling methods were utilised to ensure focused representation based on the inclusion criteria.^{279,283} Village chiefs and community health workers facilitated the identification of key informants who could provide insights into child drowning in the community. Face-to-face recruitment took place during communal village events, where interested individuals received detailed information and consent forms.

8.4.4. Data Collection

Seven focus group discussions (n=62) were held at various community locations from October 2023 to March 2024, until data saturation was achieved. This approach allowed for an in-depth exploration of participants' perspectives, as well as sociocultural norms and community dynamics that might not emerge in individual interviews.^{291,410} Participant characteristics were collected at the start of each focus group using a questionnaire. The moderator guide, informed by the HBM¹⁸⁷ and a previous scoping review⁶¹, was pilot tested with a small sample of parents in the study area. Feedback from

research team members and participants on the guide's relevance and clarity led to minor adjustments (Table 5.1).

Focus group discussions, lasting 50-60 minutes, were led by two female Indonesian team members proficient in Indonesian and local Sasak language (MC, PBF). MC facilitated the discussions, and PBF documented interactions and made field notes. All sessions were audio-recorded with consent, transcribed verbatim, and translated into English by the primary researcher (MC). Translations were then back translated into Indonesian by the other Indonesian team member (PBF) and English samples were reviewed by senior researchers (SGD and RCF) to ensure data accuracy.

8.4.5. Data Analysis

Translated transcripts, demographic data, and field notes were entered into NVivo Version 20. Thematic analysis (TA), guided by Braun and Clarke's framework³⁰⁰, combined deductive and inductive approaches. Using the constructs of the HBM¹⁸⁷ and the 2017 WHO implementation guide for drowning prevention⁵⁹, deductive analysis was conducted alongside an inductive method to systematically identify patterns of meaning, while also allowing organic emergence of themes through iterative data immersion and reflection, emphasising the interpretative nature of TA.^{300,302,303}

To ensure the dependability, conformability, transferability, and authenticity of the study, various measures were implemented: 1) Purposive sampling; 2) Extended involvement in research sites; 3) Gathering participant demographic information; 4) Continuous reflection on potential biases; 5) Member-checking; 6) Employing back-translation; 7) Continuous process of data immersion and reflection; 8) Consensus discussions on themes and theme definitions; 9) Incorporating direct quotations; and 10) Establishing an audit trail of data collection and analysis.⁴³⁷

8.4.6. Ethics approval

Ethical clearance was obtained from the University of Mataram, Indonesia (Ethics Approval number 044/UN18.F8/ETIK/2024) and registered to James Cook University's Human Research Ethics Committee (External HREC Approval Acknowledgement reference number H9088).

8.5. Results

Sixty-two participants, including parents of children under five and village community leaders, joined the focus groups. The majority were female (75.8%, n=47), aged between 25 and 44 (51.6%, n=32) and did not complete primary education (58.1%, n=36). Most were mothers of children under five (53.2%, n=33), followed by village community leaders (37.1%, n=23) (Table 5.2).

Data analysis was organised around four themes: a) Perceptions of acceptability towards WHO-recommended interventions; b) Barriers of drowning intervention implementation; c) Sociocultural considerations of implementing interventions; d) Enablers that facilitate participation in interventions. Results are presented below under each theme heading and summarised in Table 8.1.

8.5.1. Theme 1 – Perceptions of acceptability towards WHO-recommended interventions

Overall, participants endorsed all WHO-recommended strategies, including providing swimming lessons for school-age children, establishing community childcare centres, providing first aid training, installing barriers, managing flood risks, and enforcing boating safety regulations.

Predominantly, participants emphasised the importance of swimming lessons for reducing drowning risk among school-age children. While all mentioned their children attended swimming lessons as part of school's Physical Education class, participants highlighted inconsistencies and infrequency in lesson provision. Some children only received lessons in junior high school, while others had access to the lessons in primary and junior high school. Concerns were raised about the infrequent schedule—typically one lesson every six months—which hindered children's proficiency in swimming. Consequently, they would like to see government-supported community swimming programs which enhance children's swimming skills and encourage broader participation.

“I think it's good if the kids can have swimming lessons provided by the government, but only if we can afford it, most importantly, and in areas around here so that we don't have to travel far.”

Group 2, female, participant ID number: G2F4

Some participants supported establishing supervised safe places such as childcare and early childcare education centres in their community, to prevent children from playing near water bodies. While they emphasised supervising school-aged children in these centres, there was less emphasis on the need for supervision for preschool-aged children or younger.

“If there is a childcare facility in this village, to have the children being watched, that would be helpful to stop the children from playing in streams.”

Group 6, female, participant ID number: G6F1

Some participants stressed the need for government-provided first aid training for parents, especially mothers, and community members to respond to child drowning incidents in the community.

“We don’t know how to provide first aid for drowning. We actually need that education.”

Group 6, female, participant ID number: G6F3

Participants strongly supported installing barriers, such as covers for wells and fences for ditches, streams, and ponds, to restrict children's access to water bodies. Many have taken proactive measures to cover their wells as a safety precaution. However, there was no mention of installing door barriers or playpens to create safe play areas at home or childcare centres.

“We wish for the people to have their wells covered. At least with removable lids, to cover the wells when they are not used.”

Group 2, male, participant ID number: G2M2

Some participants emphasised the necessity of government-provided pre-event education to raise community awareness of flooding and tsunami and prepare residents to respond for potential risks effectively.

“Yes, we wish to be alerted about tsunami. In case of earthquakes, what we should do.”

Group 1, female, participant ID number: G1F6

Some participants mentioned the importance of enforcing boating and maritime safety regulations, noting that lifejackets were seldom available or utilised.

“No lifejackets [on board public boats] ... There were lifejackets on the top deck, but we were not given them to wear. No one gave instructions.”

Group 6, male, participant ID number: G6M1

8.5.2. Theme 2 – Barriers of Drowning Intervention Implementation

Participants discussed barriers to effective drowning prevention, including sociocultural norms and financial factors. Financial constraints were overwhelmingly cited as the main barrier to enrolling children in swimming courses and childcare centres. Participants noted that besides direct costs, expenses such as transportation and entrance fees imposed additional burdens on parents.

“Paying for it [swimming lessons] is difficult because you need to pay for everything, their transport cost, pool’s entrance fee, pocket money. And I have twins, so I need to pay around 100 thousand rupiahs [USD 6] every time they go swimming. It is difficult.”

Group 7, female, participant ID number: G7F2

The distance to swimming and childcare facilities added financial strain for many parents in rural communities, especially those without vehicles.

“The location of the swimming facility is very important. If it is far, if we don't have motorbike, then we cannot take the children.”

Group 5, female, participant ID number: G5F1

Regarding childcare centres, some participants expressed reluctance to entrust child supervision to other caregivers.

“Even if it is amongst us, to be recruited to caretake these children [in the childcare centre], it is still difficult. ... To delegate the responsibility, to trust other people with our children, it is difficult.”

Group 5, female, participant ID number: G5F6

In addition, some participants doubted community members' ability to participate as caretakers and organisers in community-based childcare centres due to their own domestic and caregiving duties, possibly affecting the program's long-term sustainability.

“I don't think it [community childcare centre] will work. ... Mothers here have their own responsibilities at home. They can't participate as caretakers.”

Group 7, female, participant ID number: G7F1

Some participants also noted insufficient space, including within community members' homes, as a barrier to establishing childcare centres in their community.

“The only thing is, we have no space for that many children to be kept together in one place.”

Group 4, female, participant ID number: G4F3

In addition, some participants doubted the practicality of installing barriers around water bodies at home and in the community.

“My family share a well with several households, and it is not covered because we still collect water from it using a pulley every day. We don't have a water pump.”

Group 4, female, participant ID number: G4F3

8.5.3. Theme 3 – Sociocultural Considerations of Implementing Interventions

Participants discussed sociocultural factors affecting the introduction of swimming training in their community, such as parental perceptions on the minimum age for swimming and cultural norms regarding swimwear and instructors' gender dynamics, informing the development of culturally sensitive program.

“If the government makes a pool around here, and have the children learning to swim, that would be good enough. However, it would be preferable, for instance, for girls to be taught by female swimming instructors. That is perhaps our suggestion for the government, if we may give suggestions to whomever is responsible to make such program.”

Group 1, male, participant ID number: G1M1

There were varying opinions on the minimum age for swimming lessons, with some willing to enrol their children as young as five, while others preferred waiting until the junior high school-age of 12-15 years.

“It’s a no from me if the child is too young. If the child is older than 12 years old, maybe during junior high school, I will let them join [the swimming lessons].”

Group 2, female, participant ID number: G2F1

In addition, many parents emphasised the importance of supervising their children during swimming lessons to ensure their safety from drowning in deeper pools and to protect them from “unwanted things”, referring to gender-based misconduct and assault.

“I think that the parents should be present, to accompany the child during the swimming lessons. You can’t just trust the instructor with our children.”

Group 5, female, participant ID number: G5F6

Participants discussed sociocultural and religious norms around gender in swimming lessons. While not a concern for younger girls, some participants worried that adolescent girls might feel uncomfortable in swimwear. Some suggested wearing everyday clothes as a modest alternative to facilitate appropriateness.

“If the girls are older, adolescent, they will probably have a concern or discomfort with wearing swimwear. If the girls are still little, it should be alright.”

Group 2, female, participant ID number: G2F1

“Children here usually wear their daily-wear t-shirts and shorts for swimming, especially for older girls around junior high school-age [12-15 years].”

Group 3, female, participant ID number: G3F5

Participants held diverse opinions on the gender of swimming instructors. Some preferred instructors of the same gender or requested parental presence during lessons with instructors of a different gender, while others prioritised instructor availability over gender.

“I’m not too comfortable with male [swimming] instructors. Just to be on the safe side. If the instructor is male, then I would like to accompany them [children] during the lessons. If the instructor is female, they can go on their own.”

Group 4, female, participant ID number: G4F1

8.5.4. Theme 4 – Enablers that Facilitate Participation in Interventions

Participants discussed factors that would facilitate the introduction of WHO-recommended drowning interventions in their community, including multisectoral collaboration, media’s role in enhancing awareness, subsidies, and collectivism.

Many participants emphasised the importance of cross-government agency collaboration in preventive efforts, with local government highlighted as primarily responsible for child drowning prevention. BASARNAS (the Indonesian National Search and Rescue Agency) was cited by many as a key agency, with no mention of non-governmental stakeholders.

“Information, education is the most important thing to be provided, by child protection agency, SAR [Search and Rescue] team, firefighters. Those involve in rescue efforts.”

Group 6, male, participant ID number: G6F1

Many participants discussed that they acquired awareness of child drowning risks through media, particularly social media.

“These days, we have social media. We have seen videos of people drowning, so we became more aware of its dangers.”

Group 5, female, participant ID number: G5F6

Participants predominantly emphasised the need for financial subsidies to fund swimming lessons and community childcare centre caretaker salaries, citing limited financial capacity as a barrier to participation.

"If the government paid for the swimming lessons, it would be very helpful. Private swimming lessons are very expensive—380 thousand rupiahs [USD 22] for four sessions. We cannot afford it."

Group 7, female, participant ID number: G7F2

Many participants acknowledged the value of collectivism in childrearing, where family and community members, such as grandparents, aunts, and neighbours, assist in caregiving while mothers attend to other duties. Some suggested community members serve as caretakers in community childcare centres.

"I'm willing to participate in supervising children. It's for our own community anyway. We're used to having our children being watched by others in this community. I would feel much better if there is a space for children to be supervised, so that they don't go playing too far."

Group 4, female, participant ID number: G4F1

Table 8.1. Definitions and illustrative quotes supporting interpretations of themes

Themes	Definition and inclusions	Sub-themes	Representative excerpts
Perceptions of acceptability towards WHO-recommended interventions	Participants' perceptions on the extent to which WHO-recommended interventions will be embraced and supported by community.	Swimming lessons for school-age children	<p><i>"Many parents would be so glad for that, having their children have swimming lessons, especially if provided by the government."</i> (Group 4, female, participant ID number G4F4)</p> <p><i>"Yes, we are very much open to the idea of swimming lessons for children in local water bodies here. If there is a facility around here provided by the government, a location to learn to swim, and it is clean, that should be enough."</i> (Group 1, female, participant ID number: G1F5)</p>
		Supervised safe places for children	<p><i>"People will welcome a childcare centre in the community to prevent drowning, especially as mothers would be busy cooking and doing other things."</i> (Group 4, female, participant ID number: G4F4)</p> <p><i>"Such as having an early childhood education centre in the community. That would be a good idea to prevent child drowning."</i> (Group 4, female, participant ID number: G4F3)</p>
		Training parents and community members in first aid	<p><i>"I think the local government, relevant government departments should provide education for us, on how to rescue children. The most important thing is education. Parents need to be informed, for those whose children are already drowned, already in the water, their lives could be saved, actually. But you need to know how to do it. So, first aid training, we need the education. We can't perform rescue on people if we don't have the knowledge. So perhaps a training session, with mannequins. These mothers have great memory, great mind. They could learn fast. But when it comes to your own children drowning, you will panic and forget things, so you need to train them."</i> (Group 6, male, participant ID number: G6M1)</p> <p><i>"For us, for instance, we perhaps have only watched in on tv, how to save people who are drowned. But we don't know how to do it."</i> (Group 6, female, participant ID number: G6F1)</p>
		Installing barriers to limit access to water bodies	<p><i>"We used to have an open well here in the house, but someone fell into it. So, we covered the well. We covered it with bamboo, after someone tripped and fell into it."</i> (Group 4, female, participant ID number: G4F5)</p> <p><i>"Maybe you can put fences around the streams. Perhaps not covering it but fencing it, such as with fences from bamboo. So that the kids can't climb over it."</i> (Group 3, female, participant ID number: G3F2)</p>
		Enforcement of boating and maritime safety regulations	<p><i>"No one on board of boats use lifejackets. Never. The boat crews never let people know that we must use lifejackets and where the lifejackets are stored. And I have took a few boat and ferry rides, to Bali and to Java. But no such information on lifejackets. There should be lifejackets being prepared, as it should. Sometimes there were lifejackets around, sometimes no lifejackets can be seen around. But no there were no information on that. Especially on smaller boats. No one tells you what to do."</i> (Group 2, male, participant ID number: G2M1)</p> <p><i>"No, we didn't wear lifejackets on boat. There were no lifejackets. There was no safety equipment whatsoever."</i> (Group 3, female, participant ID number: G3F4)</p>
		Managing risks of flood and tsunami	<p><i>"The water level needs to be monitored, not to be over their capacity and flood."</i> (Group 6, male, participant ID number: G6M1)</p> <p><i>"Maybe of the government, our hope is to be informed better on the threat of tsunami."</i> (Group 1, female, participant ID number: G1F5)</p>
		Barriers of drowning intervention implementation	Participants' perspectives on factors that may pose challenges to the

Themes	Definition and inclusions	Sub-themes	Representative excerpts
	effectiveness and sustainability of drowning prevention strategies to be implemented in the community.	Distance to facility	<p><i>"If the swimming lesson is being held far away, it's almost as good as none. The transport fee will be expensive for us to afford. We can't afford it if it's far away."</i> (Group 3, female, participant ID number: G3F4)</p> <p><i>"The distance matters a lot. No one will be able to take the children if it's too far."</i> (Group 4, female, participant ID number: G4F4)</p>
		Reluctance to delegate child supervision duties	<p><i>"Whether insiders or outsiders [of the community] are hired to supervise the children in the community-based childcare centre, I think it will still be difficult to delegate supervision. It's not easy to trust others with the care of your children."</i> (Group 5, female, participant ID number: G5F1)</p> <p><i>"Yes, having the children being supervised by someone else is a consideration. That's parents' main consideration."</i> (Group 6, female, participant ID number: G6F3)</p>
		Doubts about community member participation	<p><i>"I think having a community-based childcare centre in the community will be too difficult. There is no one to be the caretakers. Let us say, even for myself, who am I going to watch other people's children, when I can't even properly watch my own children?"</i> (Group 6, male, participant ID number: G6M1)</p> <p><i>"If the caretakers in the childcare centre are recruited from mothers here, it is difficult. They have their own responsibilities and busy schedule with their activities. Mothers have a busy day."</i> (Group 6, female, participant ID number: G6F2)</p>
		Availability of appropriate space	<p><i>"The space is the barrier [in realising a community-run childcare centre]. We don't have the space and place to do it."</i> (Group 1, female, participant ID number: G1F5)</p> <p><i>"There is no space for it, the location to gather that number of children."</i> (Group 6, male, participant ID number: G6M1)</p>
		Barrier installation practicality	<p><i>"But some wells in this community are not covered, because many people use the wells, drawing water from the wells, using a pulley. So, we can't cover it."</i> (Group 7, female, participant ID number: G7F3)</p> <p><i>"With ditches, for instance, you can't really cover all of them, because of the risk of flooding. When there is flooding, if the ditches are all covered, it will be difficult for the water to flow."</i> (Group 6, female, participant ID number: G6F1)</p>
		Sociocultural considerations of implementing interventions	Participants' perspectives on sociocultural factors that may influence the adoption and acceptance of the prevention strategies. These factors were not perceived as barriers in implementing prevention strategies. Instead, these factors informed the development of culturally sensitive interventions and were viewed as preferable by participants.
Parental presence during swimming lessons	<p><i>"Yes, we would still like to watch our own children during swimming lessons. It doesn't matter if they are girls or boys, kids need to be supervised from unwanted things."</i> (Group 2, female, participant ID number: G2F4)</p> <p><i>"I would still like to supervise my own children when they have their swimming lessons. If there is anything happen, I need to be able to know it firsthand."</i> (Group 2, female, participant ID number: G2F3)</p>		
Gender dynamics around swimming lessons	<p><i>" Maybe there will be concern with teenage girls wearing swimming suits. Maybe they will prefer to wear their own clothes, to be not as tight."</i> (Group 3, female, participant ID number: G3F2)</p> <p><i>"These days, there are modest swimsuits that will be suitable for Muslims. So, for girls to wear swimwear, it should be fine."</i> (Group 2, female, participant ID number: G2F6)</p> <p><i>"You can't really choose between having female or male [swimming] instructors. I think most swimming instructors would be male. It's not a problem for me. And children are still too young. They have not gone through puberty yet. Unless the children are older teenagers, then probably there will be a concern about that. But nevertheless, it's not a problem. It depends on the availability of swimming instructors. Swimming lessons are always taken in open public space, so I don't think that's a problem."</i> (Group 4, female, participant ID number: G4F3)</p>		

Themes	Definition and inclusions	Sub-themes	Representative excerpts
Enablers that facilitate participation in interventions	Participants' perspectives on factors that support the successful adoption and implementation of recommended drowning interventions in the community.	Multisectoral commitment	<p><i>"BASARNAS [the Indonesian National Search and Rescue Agency], they are responsible [to prevent drowning]. If there are people drown on the beach, BASARNAS will search for them, right."</i> (Group 3, female, participant ID number: G3F2)</p> <p><i>"Maybe the Department of Tourism could come here to inform us [on drowning prevention]."</i> (Group 7, female, participant ID number: G7F3)</p>
		News media's role in enhancing awareness	<p><i>"There are more news reports on drowning these days, including from celebrities. Like, if any celebrity or their children drown, we then become more aware. The news becomes a lesson for us, that we need to be more cautious. We need to be careful, to not too easily trusting other people, including to let our children being supervised by other people."</i> (Group 6, female, participant ID number: G6F1)</p> <p><i>"We heard information from the media, that higher locations are safer from the waves [during a tsunami event]. We also watched videos on the Aceh Tsunami, in 2004. From that moment on, we knew that following massive earthquakes, there are potential for tsunami to follow suit. So, we became more aware of that, of tsunami. ... Media didn't exist back then, but now we have social media, we have mobile phones to look for information on drowning."</i> (Group 6, male, participant ID number: G6M1)</p>
		Financial subsidies	<p><i>"If the government is willing to provide the location to swim, and have the swimming lessons for free, then it would help the community a lot. That is perhaps our suggestion for the government."</i> (Group 1, male, participant ID number: G1M1)</p> <p><i>"Mothers who don't work, would be willing to help in supervising children [in childcare centre], if they are being empowered financially by the government."</i> (Group 1, female, participant ID number: G1F5)</p>
		Leveraging collectivism	<p><i>"I think people here are used to helping each other to look after each other's children while they have something else to do. Like your neighbours or other family members, you can ask to drop your kids at their home if you need to go somewhere. So, I think if there is a childcare centre here, for free, I think people will be willing to help each other taking care of children in the community."</i> (Group 1, female, participant ID number: G1F2)</p> <p><i>"I think the women here would be happy to help, to participate [in supervising children in the childcare centre]. In terms of time availability, people here will be willing to participate in taking turn to supervise children in the community-based childcare centre. We're used to it."</i> (Group 1, female, participant ID number: G1F5)</p>

8.6. Discussion

Child drowning is a major cause of deaths in WNT, as in other regions in Indonesia.²⁵⁹ While there is support for WHO-recommended drowning prevention strategies, barriers such as cost, sociocultural issues, and parental attitudes need to be addressed for effective implementation. This study offers insights into community perspectives on the acceptability of these strategies and highlights contextual factors that affect their implementation, offering valuable lessons for Indonesia and other LMICs facing similar challenges.

Participants supported WHO-recommended drowning prevention efforts, emphasising the importance of swimming lessons for school-age children and establishing community childcare centres. Participants also highlighted the importance of multisectoral collaboration; and media, including social media, in raising awareness about child drowning risks and the need for supervision; aligning with WHO recommendations.⁵⁹ However, financial constraints, rurality, parental attitudes around child supervision, and sociocultural issues emerged as barriers. This emphasises the immediate need for low-cost, community-based swimming and childcare facilities that are subsidised, culturally appropriate, and safe, to effectively reduce the risk of child drowning, particularly in rural areas. Furthermore, there is a need for trained male and female instructors capable of delivering culturally appropriate swimming training in Indonesian communities. As recommended by the WHO, these instructors should be native speakers, trained and certified in swim teaching, water rescue, first aid, and CPR, and equipped to effectively teach groups of children.^{7,70,99,183} There is also a need to enhance trust in community childcare centres by training caregivers and equipping them with skills and knowledge in constant supervision for children, child safety risk identification and management, safety protocols, emergency response, communication with children and parents, behaviour management, child development, and cultural sensitivity, to ensure caregivers can be relied upon to provide safe and nurturing environments for children.^{70,99,402,409}

In addition, participants noted sociocultural factors, such as gender-related cultural and religious norms, influencing the adoption of swimming lessons in their community. This aligns with research in Australia and Canada, emphasising the importance of culturally sensitive interventions in drowning prevention programs,^{90,469-471} and underscores the need for a co-design approach involving community leaders, cultural and religious advisors, and other stakeholders, to incorporate local knowledge and perspectives into intervention design. This ensures relevance, acceptance, community ownership, and sustainability, as seen in studies in Australia.^{90,403,405,471}

The study highlighted how socio-ecological determinants, such as socioeconomic status, rurality, physical environment, social support networks, early childhood care, education, and gender norms can influence drowning interventions in Indonesia. As summarised in Figure 8.1, by utilising the socio-ecological health model, future research should explore the interconnected relationship between drowning prevention and socio-ecological determinants of drowning across four levels of influence: individual, interpersonal, community, and societal.^{86,472} This approach can promote water safety culture and reduce child drowning risks in Indonesia, and offer insights for other LMICs with similar contexts.

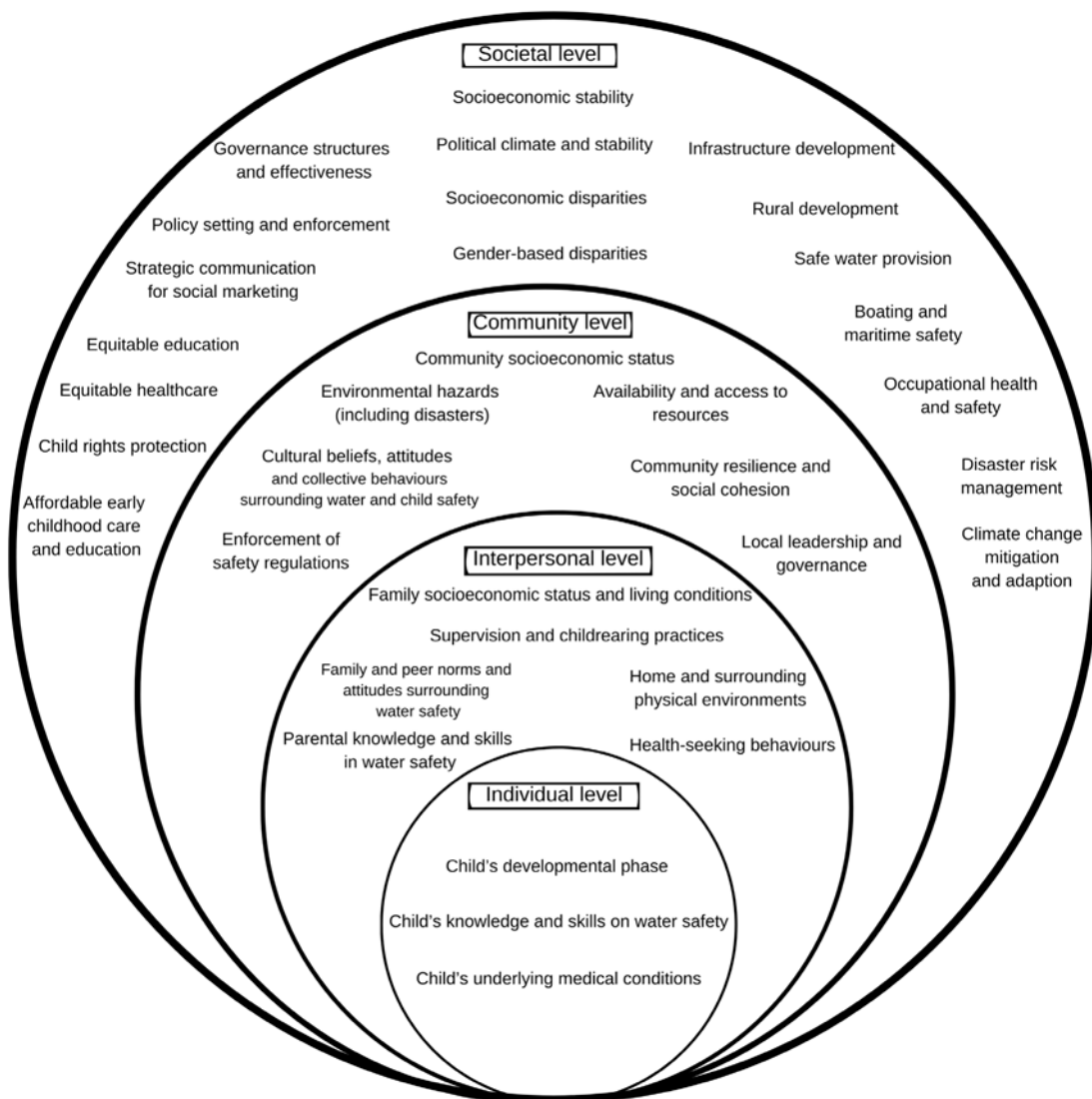


Figure 8.1. Future Research on Socio-Ecological Determinants of Child Drowning in Indonesia

8.7. Limitations

While the sampling method used in this study aimed for geographical diversity by including both coastal and inland areas, it focused on one island in Indonesia, limiting the representation of the country's extensive diversity. Nationwide research is necessary to develop contextually relevant strategies for child drowning prevention. Participant self-selection may also deviate from the broader community's viewpoints.

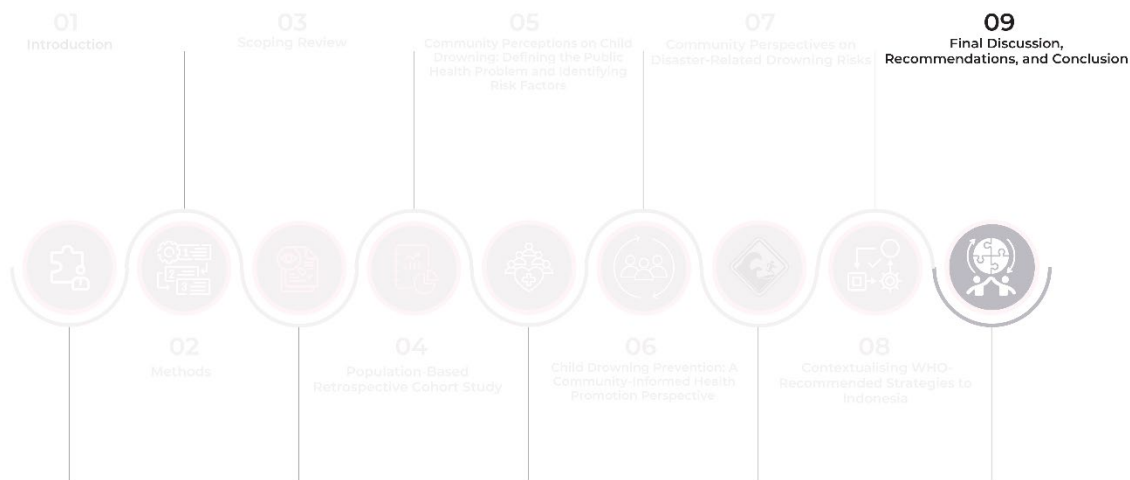
8.8. Conclusion

This study identified community support for WHO-recommended drowning prevention measures, emphasising the need for affordable, culturally suitable community swimming lessons and childcare centres which address community's financial constraints, rurality, and sociocultural issues. A co-design approach and exploration of socio-ecological factors of drowning are crucial for developing effective and contextualised interventions in Indonesia and other LMICs.

8.9. Implications and contributions

- The study contributes to the limited evidence on barriers and facilitators of child drowning prevention in Indonesia and LMICs.
- Findings indicate the need for low-cost, culturally suitable community swimming lessons and childcare facilities to reduce child drowning risks.
- The study highlights the need to address local contexts and social determinants of child drowning to ensure effective and sustainable drowning prevention interventions across Indonesia and similar LMICs.

Chapter 9 Final Discussion, Recommendations, and Conclusion



9.1. Overview: Reflection on Research Questions

This study makes a significant impact by comprehensively examining the burden of unintentional drowning in Indonesia, a topic largely unexplored in previous research. Despite the substantial burden of unintentional drowning in LMICs, and Indonesia's unique geographical characteristics predisposing it to heightened vulnerability to unintentional, disaster-related, and water transport-related drowning incidents, there remains a notable absence of prior investigations into this matter in Indonesia.^{41,61}

This study investigated mortality rates, risk factors, and prevention interventions of unintentional drowning deaths in Indonesia, as well as the interconnection of these aspects with socio-ecological approaches of health promotion, by answering these research questions:

1. What are unintentional drowning incidence and mortality rates in Indonesia?
2. What are fatal unintentional drowning risk factors in Indonesia?
3. What drowning prevention strategies and water safety regulations are currently available and being implemented in Indonesia?
4. What are Indonesian parents' and community perceptions and practices regarding child drowning risk and prevention, based on the HBM?
5. What are the gaps on unintentional drowning preventive measures available in Indonesia, based on the HPF?

Employing a public health and health promotion perspective, this thesis with its accompanying studies answered these research questions by offering a comprehensive understanding of the epidemiology, risk factors, and prevention strategies surrounding unintentional drowning in Indonesia. By laying this groundwork, the research serves to stimulate discussion and prompt action on the burden and prevention of unintentional drowning within the country. By utilising the health behavioural framework of the HBM, this study provides a thorough and nuanced understanding of the burden, risk factors, and prevention strategies related to child drowning within Indonesian communities, an imminent public health issue in Indonesia, given that under-five children were identified as having the highest drowning mortality rates in the country. Hence, the study serves as a framework for initiating further examination of the socio-ecological determinants of child drowning in Indonesia.

Building on this understanding, the research strived to establish an empirically grounded foundation to inform the development of comprehensive drowning surveillance systems, identification of risk factors, assessment of drowning burden, and setting agendas for action, facilitating the integration of water safety, disaster risk management, and boating and maritime safety policies and programs to promote water safety effectively and sustainably. By synthesising empirical evidence and integrating public health and health promotion perspectives, ultimately, the findings of this thesis can contribute to reducing drowning incidents and safeguarding the safety and well-being of Indonesian communities around the ever-present aquatic environments in Indonesia.

9.2. Justification of the Research Methodology

The scoping review in this thesis identified a paucity of information on unintentional drowning rates, risk factors, and prevention in Indonesia, hence necessitating the use of an explanatory sequential mixed methods approach to guide the subsequent studies within this thesis.⁶¹ The mixed methods study design was well-suited for exploring the complex and under-researched nature of drowning in Indonesia by integrating both quantitative and qualitative methods, allowing for an in-depth understanding that would not have been achievable through either method alone. The quantitative component in this study focused on drowning mortality, incidence rates, burden, and risk factors, while the qualitative component investigated parental and community perceptions of child drowning risk and prevention. Therefore, this sequential mixed methods study enabled a thorough exploration of unintentional drowning mortality burden, risk factors, and prevention interventions in Indonesia. Given the complexity of the

phenomenon of drowning across Indonesia, relying solely on a single methodological approach would not have been adequate to achieve a comprehensive understanding.^{202,215,217,219,221}

The explanatory sequence of the mixed methods study involved collecting and analysing quantitative data first, allowing for the exploration of relationships between variables. This step identified that under-five children, particularly in eastern Indonesia, including in WNT, had higher mortality rates and were more likely to fatally drown compared to the developed capital province of Jakarta and other parts of Indonesia. Subsequently, this finding directed the qualitative study to gather additional insights, explanations, and context to better understand the quantitative outcomes.^{202,215,217,219,221}

The scoping review revealed that Indonesia lacks a coordinated national drowning data collection system capable of gathering national and subnational data, which also suggests that drowning mortality in the country may be underrepresented. In addition, the review highlighted that the association between various exposures and drowning incidents has not been thoroughly investigated. Considering these gaps and Indonesia's vast geographic and population size, the population-based retrospective cohort study design was well-suited to analyse the GBD 2019 Study data on unintentional drowning across all provinces in Indonesia. By examining the entire population rather than specific subgroups, this design comprehensively captured drowning incidents across Indonesia's diverse population, allowing for an examination of unintentional drowning mortality and incidence rates at both the national and subnational levels. The design also allowed for the analysis of drowning data collected over an extended period, offering valuable insights into temporal trends and changes over time.²³⁸⁻²⁴⁶

The retrospective aspect of the cohort design provided numerous advantages in the epidemiological research included in this thesis. Firstly, the design enabled an efficient examination of outcomes of fatal and non-fatal drowning incidences across all provinces in Indonesia, ultimately saving time and resources compared to prospective studies. In addition, this design facilitated the investigation of multiple outcomes, encompassing both fatal and non-fatal drowning incidents, ensuring the inclusivity of the study while broadening the scope of research possibilities. Furthermore, the retrospective cohort design allowed for the examination of multiple exposures from the same cohort, leading to a comprehensive understanding of the risk factors of unintentional drowning in Indonesia.²³⁸⁻²⁴⁷ However, while the retrospective cohort study was valuable in examining the relationships between past exposures and negative health outcomes of drowning events, it is important to acknowledge potential sources of recall and information biases in this study and how the findings should be extrapolated with caution. These

issues, as well as efforts in minimising them, are discussed in detail in the Research Strengths and Limitations section of this chapter.

Finally, the exploratory qualitative design was considered appropriate for providing context and explanations of the findings from the quantitative arm of the study, through the exploration of community viewpoints and lived experiences. The design's flexibility facilitated exploration into the relatively unexplored phenomenon of child drowning in rural communities of eastern Indonesia, yielding context-specific and rich data. Initially focusing on the risk of drowning among children under five, the exploratory design also allowed for the qualitative study to explore broader water-related disasters as environmental risk factors contributing to drowning incidents among both adults and children. Thus, the exploratory qualitative design proved valuable in this initial stage of inquiry, facilitating a deeper understanding before advancing to more structured investigations into targeted interventions for each category of drowning in Indonesia in the future.

202,214,263-266

9.3. Key Findings of the Three Study Phases

The explanatory sequential mixed method study conducted in this thesis comprised three phases: 1) a scoping review, 2) a population-based, retrospective cohort quantitative study, and 3) an exploratory qualitative study.

The scoping review revealed a dearth of information regarding unintentional drowning rates, risk factors, and prevention in Indonesia.⁶¹ The absence of a coordinated national drowning data collection system raised concerns about potential under-representation of drowning mortality. Furthermore, there has been inadequate investigation into the association between various exposures and drowning incidents, as outlined in Chapter 3 of this thesis (Table 3.2).⁶¹ An over-reliance on individual-focused, behaviour-based preventive measures was observed across peer-reviewed studies and policy documents regarding drowning prevention in Indonesia (Table 3.3). The review also identified an under-exploration of the socio-ecological approach to health promotion related to drowning prevention in the country. The research area pertaining to community action in creating a safer environment, as well as community participation in decision-making processes, planning and implementing drowning prevention programs, along with the development of evidence-informed policies on water safety, have been insufficiently addressed (Table 3.3). These findings underline the critical need to enhance drowning surveillance for providing reliable and accessible data, and to advance research to comprehend drowning risk factors and develop, implement, and evaluate drowning prevention programs. Furthermore,

there is an urgent need to enhance community action and participation, policy development, and research in drowning prevention efforts in Indonesia. This entails integrating health promotion approaches grounded in a socio-ecological perspective into drowning prevention efforts in Indonesia.⁶¹

The population-based retrospective cohort study identified an average annual mortality rate of 2.58 per 100,000 in Indonesia from 2005 to 2019, as outlined in Chapter 4 of this thesis.²⁵⁹ Although there was a consistent decrease in the drowning mortality rate over this period, from 3.35 per 100,000 in 2005 to 1.93 per 100,000 in 2019, rates remained high among children under five years of age, the elderly population, and individuals residing in Papua, Kalimantan, Sulawesi, Maluku, Sumatra, and Nusa Tenggara (Figure 4.2, Table 4.2). Indonesian males were 1.81 (95% CI: 1.79 - 1.84) times more likely than females to unintentionally drown. Average annual mortality rates were highest among the under 5 age-group, with 9.67 per 100,000, and 70 and over with 5.37 per 100,000, across both sexes (Table 4.2). Children under five years of aged and individuals aged 70 years and more were 3.67 (95% CI: 3.63 - 3.72) times and 2.5 (95% CI: 2.45 - 2.56) times more likely to fatally drown, respectively, in comparison to populations aged 15 to 49 years old (Table 4.2). These findings highlight the urgent need to advance drowning prevention through robust data collection, and tailor drowning prevention strategies to address the heightened risk among children under-five, particularly in less developed eastern Indonesia.²⁵⁹ The discrepancy of drowning mortality rates among Indonesian provinces underlines the crucial need to investigate how socio-economic determinants, infrastructure investments, and social and environmental changes contribute to drowning fatalities, particularly in provinces in Kalimantan, Papua, Sulawesi, Maluku, and the Nusa Tenggara regions, which exhibited the highest rates of drowning mortality alongside some of the lowest GDP per capita nationwide.^{259,267} The discrepancy between provinces also underscores the need for further exploration into how socio-economic progress and implemented interventions can contribute to reducing child drowning fatalities across Indonesia.

The exploratory qualitative study revealed a limited understanding within the community regarding the preventability, vulnerability, and risk factors associated with child drowning. Participants lacked awareness of the susceptibility of children and community members to drowning and the potential severe consequences such as injury and death, as outlined in Chapter 5 of this thesis (Table 5.3).³⁸⁹ Since most participants had not previously recognised drowning as a significant issue with potentially serious consequences, discussions about their intention to alter behaviours to prevent child drowning were limited (Table 5.3). Although some parents who

experienced direct exposure to non-fatal child drowning incidents in their home or community were motivated to increase supervision of children around water, most participants remained in the early stages of behavioural change regarding water safety, compounded by their limited access to preventive measures. According to the Transtheoretical Model of Behaviour Change (TTM), a framework for understanding how individuals progress through five stages of behavioural change—precontemplation, contemplation, preparation, action, and maintenance—which has been widely applied in health research^{185,473,474}, many participants in this study were in the pre-contemplation stage, where they did not yet perceive the need for behavioural changes related to water safety, as illustrated by the participants' responses below:

"No one supervises the children while they play around ditches. Parents let their kids play near water and don't think much about the risk of drowning. If someone gets ill from drowning, then we might think about it [the risk of drowning]. If we haven't experienced it, we don't think about it [drowning]."

Group 1, male, participant ID number: G1M1, village community leader

"But no one worries about the possibility of falling into wells. If there are any children playing around the well, we just need to yell at them to stop playing around the well."

Group 2, male, participant ID number: G2M1, owns an open well in his house

"No one on board boats ever uses lifejackets."

Group 2, female, participant ID number: G2F3

Meanwhile, other participants were in the contemplation stage, where they acknowledged the issue and were considering potential changes but had not yet taken actionable steps to modify their or their children's behaviour regarding water safety. This reflects a significant barrier to effective drowning prevention, as discussed in Chapter 5 and illustrated by the participants' responses below:

"Ditches and streams can perhaps be covered [to reduce the risk of drowning]. ... Such as with fences from bamboo, so that kids can't climb over it."

Group 3, female, participant ID number: G3F2

"Yes, mothers can be busy with house chores, but it shouldn't be like that [not supervising children], should it? Sometimes even the oldest children, who are responsible for watching their younger siblings, are still in primary school. Children might not always be aware of water dangers."

Plus, the water volume in the stream can suddenly increase, which is unpredictable. If children are playing in the neighbourhood, it's probably fine because there are many people around. However, if they play further away, in the stream, it could become dangerous."

Group 4, female, participant ID number: G4F6

The TTM emphasises the importance of customised interventions for each stage of change, therefore employing the framework can be useful for developing focused drowning prevention strategies in Indonesia that align with the unique needs and varying readiness across diverse communities and regions in the country. Further recommendations on applying TTM into drowning prevention efforts in Indonesia are detailed in Section 9.4. Concluding Discussions: Establishing Priorities for National Drowning Prevention Efforts in Indonesia in this thesis.

While drowning was mostly associated with beaches and open seas, participants also recognised home-related hazards such as unprotected wells and tubs (Table 5.3). Although supervision was seen as protective, mothers' obligations in domestic and household care tasks often impeded their ability to supervise children, often leading to the delegation of this responsibility to other family and community members (Table 5.3), consistent with findings observed in other cultures in both LMICs, including Bangladesh¹⁵⁷ and Uganda⁴⁷⁵, and HICs, such as Canada¹⁶⁰ and Australia⁴⁰⁹. The qualitative study also identified the strong focus that participants placed on individual-focused interventions, such as swimming lessons for children and first aid training for parents and community members, as outlined in Chapter 6 of this thesis (Table 6.1).⁴⁰⁶ While participants recognised the importance of population-focused safety measures and intergovernmental agency collaboration, there was limited understanding of the roles that the education and health sectors play in preventing child drowning (Table 6.1). Furthermore, the qualitative study highlighted community concerns regarding water-related disasters as significant drowning risk factors in Indonesia, as outlined in Chapter 7 (Table 7.1).⁴¹⁵ Participants attributed their vulnerability to disaster-related drowning to geographical and geological features of their area, past experiences with water-related disasters, and perceived inadequate disaster preparedness measures (Table 7.1).

Community support for WHO-recommended drowning prevention measures, such as community swimming lessons and childcare facilities, was evident, as outlined in Chapter 8 of this thesis (Table 8.1).⁴³⁶ However, financial constraints and rural settings posed significant barriers to participation and sustainable implementation (Table 8.2). Sociocultural norms also influenced parental decisions regarding children's participation in swimming training (Table 8.3). The qualitative study findings underline the pressing need to raise public awareness about children's

vulnerability to drowning. In addition, there is a critical need for affordable, culturally appropriate community swimming programs and childcare facilities, especially in rural Indonesian areas, to reduce the risk of child drowning.⁴³⁶ Targeted prevention strategies for disaster-related drowning, including risk identification, resilience building in disaster-prone communities, educational interventions to enhance community self-efficacy, and tailored risk communication strategies, are crucial steps to reduce the risk of disaster-related drowning across Indonesian communities. However, deeper exploration of local contexts and socio-ecological determinants of drowning is necessary for effective development and implementation of water safety promotion and drowning prevention strategies. Further research into the development of contextually relevant water safety promotion approaches and the alignment of cross-sector partnerships is imperative to ensure sustainable drowning prevention efforts in Indonesia. Finally, integrating drowning prevention into regulatory frameworks related to disaster risk management, early childhood care, education, health, and rural development, and efforts to address socioeconomic disparities, is vital to reduce drowning fatalities in Indonesia.^{7,59}

There is limited direct evidence from Indonesia on the implementation of an integrated approach to drowning prevention. Also, evidence of effective strategies to reduce drowning deaths and incidences in Indonesia is lacking^{41,61}, however, studies from other countries, including Australia^{476,477} and Thailand⁴⁷⁸, have shown that incorporating drowning prevention into regulatory frameworks and public health policies can contribute to reducing drowning fatalities. A study by Peden, Franklin, Leggat and Scarr⁴⁷⁷ (2021) observed a reduction in river drowning fatalities in Australia between 2015 and 2019, coinciding with the implementation of a multi-faceted approach that included local water safety management plans, boating safety regulations, weather warnings, and social marketing campaigns, and although the study does not establish direct causation or association with the observed reduction in fatalities, it is suggestive that multi-faceted approaches will be required. In addition, a study by Mahony and Scarr⁴⁷⁶ (2021) observed a reduction in child drowning mortality rates from the period 2004–2006 to 2017–2019 during the implementation of Australia’s national water safety strategy, which integrated drowning prevention measures into multisectoral policies and aligned the roles of various stakeholders. These findings support the potential benefits of applying a similar approach in Indonesia.

9.4. Concluding Discussions: Establishing Priorities for National Drowning Prevention Efforts in Indonesia

Strengthening national drowning prevention efforts in Indonesia requires a comprehensive approach that integrates health promotion principles, is tailored to diverse contexts and needs across the country's islands and population groups, and is cost effective.^{7,59} Health promotion principles emphasise the importance of addressing multiple levels of influence—individual, community, and policy.¹⁶⁸⁻¹⁷¹ Given Indonesia's unique context, characterised by its extensive archipelago, diverse local languages and cultural practices, and varying local conditions, a one-size-fits-all approach is inadequate. Instead, strategies must be customised to address specific local needs and nuances and adapt to local geographic and sociocultural contexts. Thus, while nationwide policies are important, localised interventions that tackle specific regional challenges, leverage local knowledge, and in alignment with local sociocultural and religious contexts, will be crucial for achieving long-term effectiveness. In addition, targeted strategies addressing specific high-risk demographics such as under-five children, the elderly, and those in rural, disaster-prone areas are essential. Furthermore, integrating drowning prevention measures into broader regulatory frameworks across sectors such as disaster risk management, education, health, rural development, and maritime and boating safety is essential for sustained impact.^{7,59} By adopting this holistic approach, Indonesia stands to markedly decrease incidences of unintentional drowning and safeguard the well-being of its population around aquatic environments.

As the initial inquiry into the complex public health issue of unintentional drowning in Indonesia, this study aimed to lay robust, evidence-based groundwork to spark discourse and catalyse efforts to reduce the nation's drowning burden. The following recommendations, informed by the findings of the mixed methods study, outline key priorities for strengthening national drowning prevention efforts in Indonesia.

9.4.1. Priority 1: Advancing Drowning Prevention through Robust Data Collection

Despite the WHO recommendation to enhance drowning prevention efforts through comprehensive data collection, the scoping review within this thesis (Chapter 3) unveiled a scarcity of drowning data across Indonesia, with drowning-related studies primarily relying on autopsy records from provincial-level hospitals.⁶¹ This underlines the urgent need to advance drowning prevention in Indonesia through robust and integrated data collection systems. These systems should encompass not only fatal drowning data but also non-fatal drowning incidences, participation in swimming lessons, and detailed information on exposures to drowning, such as

types of aquatic activities, aquatic environments, duration of submersion, swimming ability, comorbidities, rural or urban settings, weather conditions, compliance with boating safety regulations and occupational safety standards, and other relevant risk factors.^{61,83,157,161,378,379,388,411} Collecting such diverse data is crucial for identifying the extent of the problem, understanding associated risk factors, and guiding the prioritisation of drowning prevention agendas. In addition, this data will support the development and ongoing review of regulations and prevention strategies.^{7,59,61} Furthermore, a coordinated data collection and sharing effort across multiple injury sectors can enhance overall public health and safety promotion strategies, ensuring resources are utilised effectively to tackle various forms of unintentional injury, including drowning. By sharing data, best practices, and resources across these sectors, interventions can be made more comprehensive and targeted, reducing duplication of efforts and increasing the impact of prevention initiatives. This collaborative approach fosters a more holistic understanding of injury causes and trends, enabling stakeholders to address systemic issues more efficiently and ultimately leading to a greater reduction in injury rates across the board.

Although medico-legal data is often considered a reliable source providing detailed documentation of deaths, hence often serving as a robust surveillance tool, it is susceptible to selection and reporting biases.⁴⁷⁹⁻⁴⁸² Cases under investigation with pending resolution could also be withheld from reporting or misclassified. In addition, inconsistencies in reporting due to varying capacities among regions and health facilities could also lead to missing information and misclassification.⁴⁷⁹⁻⁴⁸² Determining the manner and cause of drowning deaths can be challenging due to the rapid physical deterioration of bodies within aquatic environments, resulting in a lack of physical evidence of drowning during an autopsy.⁴⁸³ These selection and reporting biases may lead to underreporting or misclassification of drowning incidents, which can skew the overall picture of drowning mortality.^{479,480,482,483} The dependence on hospital-based autopsy reports, driven by inadequate vital registration systems, has also been observed in other LMICs.^{362-364,479,484} This reliance can result in the surveillance system overlooking drowning-related injuries and deaths, especially those happening in and around homes in rural regions.^{362-364,479,484} Underreporting of drowning incidents is frequently ascribed to the swift fatality of drowning victims at the scene, leading to drowning victims not being taken to medical facilities or reported to authorities.^{411,485} Hence, the under-representation of drowning incidents in hospital-based, medico-legal registries poses challenges in accurately estimating the burden of drowning in countries relying on facility-based reporting systems, such as Indonesia.^{7,179,181}

Furthermore, in Indonesia, suicide deaths and attempts are underexplored, with reports indicating potential underreporting of suicide cases.⁴⁸⁶ A study estimated the underreporting rate of suicides in Indonesia to be approximately 859%, suggesting that for every reported suicide, there could be about 8.59 times more suicides that are not reported.⁴⁸⁶ This significant underreporting is attributed to various factors, including limited suicide recording capacity, family's reluctance to formally report cases, healthcare professionals' reluctance to classify incidents as suicide attempts to protect patients' access to insurance, and law enforcement's hesitancy in investigating suicide-related incidents, possibly related to the sociocultural stigma surrounding self-harm, deterring accurate documentation of suicide cases, including those involving drowning, in the health, medico-legal, and coronial system.^{486,487}

In Indonesia, in addition to medico-legal records, sporadic records of investigated shipping incidents, fishing vessel incidents, rescue reports on shipping incidents, and disaster-related fatalities were identified, as outlined in Chapter 3 of this thesis.⁶¹ However, these records offered limited insight into drowning. They did not include the cause of death for fatalities recorded in watercraft incidents and water-related disasters, detailing only the circumstances of the incidents. For instance, incidents were reported as victims falling off ships during shipping or fishing, deaths on ship capsizing, or as deaths of all causes during water-related disasters, but the specific cause of death by drowning was not consistently reported.⁶¹

The absence of drowning data within health and demographic surveillance data, national death and health registry, national health reports, coronial information system, and police department records was also observed in Indonesia, suggesting a potential under-representation of drowning data and underlining a public health concern regarding the health system's capacity for collecting, reporting, and disseminating health data.⁶¹ These limitations highlight the urgent need to establish a standardised, nationally coordinated framework for reporting and integrating health, death, coronial, and disaster data in Indonesia, enabling evidence-based policy formulation and the development of targeted intervention strategies to mitigate the nationwide risk of drowning. Such a framework should employ a data triangulation methodology, combining information from death and coronial registries, organisational reports, including those from health facilities, and media report monitoring. This approach has been shown to be beneficial in capturing drowning and injury incidents in HICs, such as Australia and the United States.^{79,488} This framework could also be expanded to not only capture drowning incidents but also integrate insights from other injury sectors, creating a comprehensive understanding of the burden of all preventable injuries within the population.

To ensure the clarity, consistency, and inclusivity of drowning cases, this consolidated framework should include a standardised definition of drowning and comprehensive documentation of the cause and manner of all drowning deaths.⁴⁸⁹ To support the establishment of the nationally coordinated framework, it is imperative to strengthen the capacity of the public health system to comprehensively report drowning and other injury cases, as well as to lead the multisectoral collaboration in injury data documentation.^{110,365,366,489} The establishment and maintenance of the integrated framework for reporting drowning incidents and other preventable injuries necessitate advocating for substantial and sustained political and financial investments across various injury sectors.^{110,365,366,489}

Developing an integrated, standardised national framework for reporting health, death, coronial, and disaster data requires a collaborative, multisectoral approach involving various stakeholders beyond the public health domain.^{79,110,365,366,479,480,489-491} The multisectoral collaboration in Indonesia may involve: 1) Healthcare and public health sector: Strengthening the capacity of healthcare facilities, emergency services, and public health surveillance systems, along with digital health information systems encompassing insurance coverage data, to accurately document and report drowning incidents; 2) Coronial information system: Strengthening coronial services and legal frameworks for investigating and documenting drowning deaths, particularly in determining the manner and cause of death; 3) Law enforcement: Ensuring thorough documentation and investigation of drowning incidents, particularly in cases involving accidents, intentional self-harm, negligence, or criminal activity, which may still be culturally stigmatised issues; 4) Disaster risk management sector: Reinforcing disaster risk management and rescue services' capability to capture drowning incidents during natural disasters, and integrating drowning data collection into disaster response and recovery efforts; 5) Transportation authorities: Enhancing maritime and aviation authorities' capacity and framework for reporting incidents occurring on or near watercraft or bodies of water; 6) Media organisations: Disseminating timely information on drowning incidents and supporting the public health system in media monitoring for data collection efforts; and 7) Other government agencies: Collaborating with relevant government departments and agencies at national, regional, and local levels to facilitate comprehensive data reporting and management.^{79,110,479,480,489-491}

9.4.2. Priority 2: Prioritising Intervention Strategies to Prevent Child Drowning

The findings of this study highlighting the disproportionately high drowning mortality rates among children under-five serves as a poignant call to action, necessitating the prioritisation of drowning prevention strategies to effectively address this vulnerable demographic (Chapter 3,

Table 3.2).²⁵⁹ Children under the age of five are especially vulnerable to drowning incidents, particularly in rural areas in LMICs.^{37,41,75,76,196,276,399,492} In such regions, children often face limited access to early childhood care and education, as well as insufficient availability of water safety resources.^{37,41,75,399} In addition, their close proximity to water bodies significantly heightens their exposure to potential drowning hazards.^{37,41,75,76,196,276,399,492}

To reduce this heightened risk, targeted interventions are crucial, focusing on several key areas: 1) Increasing awareness among parents and caregivers on the importance of constant supervision for children; 2) Providing survival swimming and water safety training for school-age children; 3) Installing barriers to limit children's access to bodies of water in the community; 4) Advocating for a multi-strategy approach, which combines teaching basic water safety skills, educating caretakers and community members on supervision, and providing supervised safe places in the community; 5) Tailoring community-based programs to the specific needs and contexts of each region; and 6) Fostering community engagement, participation, action, and empowerment, including by enhancing community members' knowledge and skills on water safety, safe rescue techniques, and performing CPR.^{7,37,59,70,99,178}

9.4.2.1. Increasing Parental Awareness of Child Drowning Risk and Prevention

The exploratory qualitative study in this thesis functioned as a needs assessment study, revealing a limited understanding within the community concerning the preventability, vulnerability, and risk factors associated with child drowning, as well as identifying the parents of under-five children as an important target audience for raising awareness. Participants in this study exhibited a lack of awareness concerning the susceptibility of children to drowning, as well as the potential severe consequences of drowning, such as injury, disability, and death, as outlined in Chapter 5 of this thesis (Table 5.3).³⁸⁹ Hence, the qualitative study underlined the importance of directing awareness campaigns toward parents as a key audience, to bolster public awareness regarding the susceptibility and severity of child drowning, emphasising the critical role of supervision as a protective factor (Table 5.3). These efforts align with recommendations from the WHO, advocating for strategic communication initiatives to address this pressing public health concern.⁵⁹

Furthermore, the qualitative study identified a lack of behavioural modifications related to water safety among participants (Table 3).³⁸⁹ To address this, employing TTM can enhance the effectiveness of drowning prevention interventions by tailoring strategies

to each participant's current stage of readiness.^{164,493,494} While targeted educational interventions are crucial for raising awareness about the risks and consequences of child drowning, they must also focus on advancing individuals through the stages of change. This process begins with identifying the need for behavioural change (contemplation), progresses through preparing for changes, and moves on to adopting new habits through action and maintenance, where behavioural changes are implemented and sustained.^{164,493,494} Complementing these educational interventions with community-based prevention programs can help transition individuals from awareness and contemplation to action by providing practical tools and strategies for improving water safety practices. In addition, offering personalised support to parents can facilitate this transition and foster sustained behavioural change.

The qualitative study also highlighted the potential of utilising social media platforms to enhance awareness of water safety behaviours among parents and the public, as many participants noted that they became aware of the risks of child drowning through social media channels (Table 6.1).⁴⁰⁶ This finding aligns with previous research conducted in HICs such as Canada, Australia, New Zealand, and Spain, which reported the benefits of utilising social media platforms for social marketing campaigns aimed at promoting water safety, particularly to reach younger audiences.⁴⁹⁵⁻⁴⁹⁸ In Australia, the benefit of child water safety advertising in mass media has been demonstrated by campaigns such as "Keep Watch" and "This Much Water", underlining the value of disseminating drowning prevention messages through media channels to increase supervision for children to ultimately reduce child drowning fatalities.^{190,499} However, there is an urgent need for heightened focus on developing strategic safety communication campaigns tailored and disseminated to populations in LMICs.⁷ While specific studies on the effectiveness of strategic communication in reducing child drowning deaths within LMICs may be limited, broader studies and best practices suggest its potential impact.^{7,41,61} Strategic communication, known for its pivotal role in promoting health behaviours and fostering behaviour change, emphasises cultural and social nuances, community involvement, and multisectoral collaboration.⁷ Therefore, adapting communication strategies to local contexts of Indonesia and consistently assessing their impact to reduce drowning incidents are crucial for success.⁷

In this study, participants described how witnessing and hearing stories on child drowning incidents, both in their community and through media outlets, heightened

their awareness of the risks and severe consequences associated with child drowning and prompted action to enhance supervision practice, as outlined in Chapter 5 of this thesis (Table 5.3).³⁸⁹ This corresponds with previous research indicating that real-life stories, including those featured in media campaigns, are pivotal in safety communication, influencing mothers to closely supervise young children to prevent injuries.^{190,500,501} Targeted campaigns which share narratives by parents who have experienced the tragedy of child injuries have been shown to significantly enhance the adoption of safety messages.^{190,500,501} The effectiveness of story-based messages lies in their ability to elicit emotions, offer tangible examples of negative health outcomes of childhood injuries, and facilitate self-identification to recognise oneself in external representations in social marketing campaigns.^{190,500,501} Further investigation into the potential of utilising narrative-based health messages for social marketing campaigns on child drowning prevention in Indonesia is warranted, particularly given Indonesia's cultural diversity, to ensure that messages effectively resonate with the audience and align with cultural and social norms.

9.4.2.2. Integrating Survival Swimming Training into School Curricula

The qualitative study identified the community support and recognition on the importance of children learning to swim to reduce the risk of fatal drowning (Table 6.1, Table 8.1).^{406,436} However, although participants reported some level of swimming lessons were available in schools, implementation was inconsistent and formal integration into the curriculum was lacking (Table 6.1).⁴⁰⁶ Despite this limited provision of swimming lessons at schools, these remain the only opportunity for children to receive swimming training, as most parents in the community lack swimming skills and face financial constraints (Table 6.1).⁴⁰⁶

The community's acknowledgment of the significance of teaching swimming to school-age children resonates with the WHO's recommendation, which advocates for teaching survival swimming and water safety skills to children aged over 6 years as a preventative measure against child drowning.^{7,59,70,99} Survival swimming training teaches individuals, particularly children, vital skills to navigate and stay safe in water, enhancing their chances of survival during accidents or emergencies.^{7,59,70,99} It focuses on developing self-rescue abilities and water confidence through techniques such as floating, breath control, treading water, and basic swimming strokes. These skills help individuals keep their airway above water, conserve energy, and await rescue if needed. Survival

swimming programs also emphasise water safety education and staying calm in emergencies to reduce the risk of drowning and promote overall water safety. Therefore, survival swimming skills training covers more than just swimming; it includes instruction on water safety, rescue techniques, and cultivating a thorough understanding of water hazards and managing emergency situations in aquatic environments.^{7,59,70,99}

The advantages of schools serving as the primary entry points for swimming and water safety skills training have been widely reported in HICs, such as in Australia, New Zealand, the United Kingdom, the United States, and South Korea.⁵⁰²⁻⁵⁰⁵ These benefits include efficient delivery, access to qualified educators, monitoring attendance through school registers, access to school health facilities, and potentially secure pool facilities.⁵⁹ However, there have been limited reports from LMICs regarding the feasibility and sustainability of integrating government-supported formal swimming programs into school curricula.⁵⁹

The WHO practical guidance for teaching basic swimming and water safety skills to school-age children could provide valuable recommendations regarding systematic steps for incorporating survival swimming training in resource-limited LMICs, such as Indonesia.^{7,70,99,183} The guideline emphasises the importance of using structured curricula tailored to local contexts, engaging with local authorities and communities, securing health clearance for children and obtaining informed consent from parents or guardians before commencing swimming training, performing safety assessments at training sites, recruiting certified instructors, specifying instructor-participant ratios, developing emergency action plans, and implementing incident-reporting mechanisms. Furthermore, the WHO advises that survival swimming skills should be instructed by culturally appropriate adult instructors who are native speakers and certified in swim teaching, water rescue, first aid, and cardiopulmonary resuscitation (CPR) skills, with expertise to facilitate learning to groups of children. Swimming lessons should primarily target children aged 6 years and above, following a rigorous screening process to ascertain they are free from underlying conditions that may heighten their risk during swimming activities. It is also crucial for the government to establish swimming pool infrastructure in rural and remote regions that lack access to such facilities. Furthermore, it is important to engage parents to disclose and evaluate their children's

health and medical conditions before enrolling them in swimming programs, and to attend informational sessions.^{7,70,99,183}

Integrating survival swimming training into school curricula requires elaborate planning and collaboration among education departments and providers, government agencies, and policymakers.^{7,70,99,183,502-505} This initiative necessitates dedicated resources for instructor training, curriculum development, facility access, and establishment of swimming pool infrastructure in rural and remote regions that lack access to such facilities, to ensure that swimming lessons are accessible to all students regardless of socioeconomic background and geographic location. In addition, ongoing evaluation and research are essential to measure the effectiveness of such programs in reducing drowning incidents and promoting water safety awareness among children. Therefore, this integration requires significant political and economic investment. Securing government funding and policy endorsements is essential for the sustainability and scalability of such programs nationwide. In addition, partnerships with community organisations and sponsors can enhance resources and outreach efforts.^{7,70,99,183,369,502-505}

9.4.2.3. Installing Barriers to Limit Children’s Access to Bodies of Water

According to the Hierarchy of Control, a systematic six-tiered approach that can enhance drowning prevention efforts by prioritising interventions based on their effectiveness in mitigating risks, eliminating the hazard—such as by designing environments to reduce the presence of open water sources near residential areas—represents the highest level of control and provides the most substantial risk reduction.^{80,164,506} However, this elimination approach is often costly and impractical due to the widespread presence of natural water bodies and the need to access the water.^{41,399} Next in the hierarchy is substituting the hazard, which involves replacing high-risk activities with safer alternatives, such as using safer boats, providing swim aids, and employing improved aquatic and rescue practices and equipment. However, implementing such substitutes in LMICs can be challenging due to limited resources and infrastructure.^{41,399} Furthermore, while research shows that engineering controls such as properly installing isolation fencing around pools, especially when combined with self-closing and self-latching gates, can greatly reduce drowning risks in residential settings of HICs^{80,81}, the widespread presence and proximity of open water sources—such as rivers, lakes, and irrigation ditches—to residential areas in LMICs present unique challenges. The

impracticality of fencing these water bodies due to their extensive availability and the necessity of access for daily life and animal use complicates the application of such measures in these contexts.^{7,41,59,399} Therefore, installing barriers to limit children's access to bodies of water in LMICs, including Indonesia, necessitates innovative and flexible approaches tailored to local contexts, which should be trialled and evaluated for effectiveness and sustained impact.^{7,59,369,507}

Introducing playpens as a measure to limit children's access to bodies of water offers a flexible and practical solution in settings where permanent structures are impractical or costly to implement.^{7,59,369} Playpens provide an enclosed and secure play area for young children, effectively limiting their exposure to water bodies and potential drowning risks at a low cost. Furthermore, playpens can be designed as enriched environments that ensure the safety of young children while fostering aspects of Early Childhood Development (ECD). By integrating educational toys and sensory materials, these spaces can stimulate cognitive and motor skills development while minimising the risk of injuries, including drowning.^{508,509} However, it is noteworthy that ECD benefits are more pronounced in children enrolled in childcare centres than in those using playpens, even when both are used to reduce the risk of child drowning, as reported by studies in Bangladesh.^{510,511} Nevertheless, the dual functionality of playpens—both in reducing injury risks and supporting child development—can provide an additional incentive for parents to utilise them, as previous studies indicate high caregiver compliance and willingness to adopt this intervention.^{7,59,369}

To optimise their impact, combining affordable playpen provision with caregiver education on supervision practices could further improve their efficacy.^{369,512} Integrating enriched playpens into community-driven drowning prevention strategies could enhance awareness of water safety and children's developmental needs, encouraging vigilant supervision among caregivers in Indonesia.^{369,512} Trialling these enriched playpens within local communities is essential to ensure their acceptability and refine the approach to align with both local contexts and ECD goals.

9.4.2.4. Promoting a Multi-Strategy, Community-Based Approach to Child Drowning Prevention

The qualitative studies identified financial constraints and rurality as primary obstacles to participating in and maintaining community-based interventions (Table 8.2).⁴³⁶

However, financial subsidies and collective childrearing practices were identified as factors that facilitate the adoption of these interventions (Table 8.4).⁴³⁶ The findings underscore the necessity for affordable, culturally appropriate community childcare facilities to reduce the risk of child drowning, especially in rural areas of Indonesia.⁴³⁶ A review on drowning prevention interventions for children in LMICs and HICs has reported that health education and information alone may not be sufficient to ensure sustained adoption of water safety-promoting behaviours.³⁷ Therefore, there is a need for a multi-strategy approach, combining teaching basic water safety skills; educating mothers, caretakers, and community members on the importance of supervision and water safety behaviours, as well as equipping them with safe water rescue and resuscitation skills; and providing supervised safe places for children in the community, customised to address the unique context of each locality, taking into account cultural and socioeconomic variables.³⁷ As the WHO recommends the establishment of community-based daycare centres and swimming and water safety skills training as measures to prevent child drowning, their combined effectiveness as part of a multi-strategy approach has been evaluated in Bangladesh.^{7,59,70,75,99} This integrated approach could serve as a best practice model for Indonesia.^{75,369}

The PRECISE (Promoting Child Safe Environments) program, a multi-strategy initiative under the Saving of Lives from Drowning (SoLiD) campaign in Bangladesh, has been widely implemented in rural areas in Bangladesh, specifically in 3 upazilas (regions) - Raigangj, Sherpur, and Manohordi.^{75,76,369,512,513} It comprises two main components: Anchal, which establishes community supervised childcare facilities for children aged 1 to 5, and SwimSafe, a community-based swimming training program for school-age children. The Anchal centres offer cognitive stimulation, early childhood education, nutritional supplements, and health education, while also providing parental home visits for safety education and distributing playpens for families with children under 18 months. SwimSafe teaches swimming, water safety, and rescue skills to children aged 4 to 12, alongside promoting general water safety awareness. Beyond preventing drowning, the program fosters holistic child development, injury prevention, and community education, leading to long-term benefits such as reduced drowning mortality rates, improved children's cognitive and motor skills, and increased community participation and empowerment.^{75,76,369,512,513}

The PRECISE program's benefits demonstrate the potential effectiveness of employing a multi-strategy approach to reduce child drowning mortality rates while fostering the overall development of children within a safe and stimulating environment, facilitated by collaboration with international partners.^{75,76,369,512,513} Hence, there is an opportunity to introduce and assess the implementation of such multi-strategic approaches in Indonesia to prevent child drowning, promote child safety and development, and foster community engagement in proactive childhood injury prevention. In collaboration with international agencies for technical assistance, knowledge and data sharing, as well as funding, this would expedite child drowning prevention efforts.

9.4.3. Priority 3: Developing Contextualised and Culturally Appropriate Interventions

Given Indonesia's vast diversity, it is critical to design interventions that resonate on national, regional, and local levels for maximum impact and sustainability for drowning prevention. The qualitative study highlighted several sociocultural factors influencing perceptions of water hazards and drowning prevention in Indonesian communities, as outlined in Chapter 5 (Table 5.3).³⁸⁹ These include fatalistic beliefs about water dangers, gender-related cultural and religious norms regarding swimming, and cultural beliefs and practices related to traditional gender roles in childrearing (Table 5.3).³⁸⁹ These findings emphasise the need to contextualise interventions to be culturally sensitive and tailored to regional and local contexts.

While a national strategy can provide a cohesive framework and essential resources, regional and local adaptations could offer a more nuanced approach to drowning prevention that resonates with relevant customs, languages, and specific water safety challenges. In this context, regional strategies refer to adaptations aimed at multi-province areas that share broader cultural, economic, or geographical characteristics. These may be applied across groups of provinces—such as those within the Papua or Kalimantan regions—where similar water safety challenges, susceptibility to natural hazards, or geographical landscape can be addressed with shared resources and strategies.

However, in many areas of Indonesia, the level of diversity within a single region can be substantial. Consequently, there is a need for localised strategies specifically designed to address the unique cultural practices, language preferences, and socioeconomic factors of individual provinces or communities, which may not be applicable across broader regions. For instance, local strategies might focus on province-specific programs, or even village- or community-level interventions, where particular beliefs, traditions, or resource constraints shape attitudes toward water safety. Therefore, regional strategies may serve as intermediate adaptations, bridging

broad national guidelines with locally specific needs at the provincial or community level. This approach articulates a framework that is flexible enough to be both regionally relevant and locally actionable, maximising the overall impact on drowning prevention across Indonesia.

Specific regional and local challenges impacting drowning prevention efforts could include differing customs influencing community attitudes toward water safety, regional disparities in water safety infrastructure, the presence of water hazards, levels of development, and varying community readiness to adopt water safety-promoting behaviours influenced by local traditions, access to resources, education levels, and socioeconomic conditions.^{61,259,389} A co-design approach would be beneficial in this regard, involving collaboration among researchers, stakeholders, and community members to develop solutions that resonate with local contexts, beliefs, and practices.⁴⁰³⁻⁴⁰⁵ As an example, a co-design initiative in Australia brought together researchers, lifeguards, and students to develop a school-based beach safety education program.⁴⁰³ This collaborative effort not only enhanced the effectiveness of the intervention but also ensured that drowning prevention strategies resonated with local values, facilitating adoption.⁴⁰³ Similarly, in Indonesia, applying co-design could be especially valuable due to the diverse cultural and regional differences across provinces and population groups. By engaging local leaders, officials, and community representatives in the design process, drowning prevention programs would more effectively integrate culturally specific practices, linguistic preferences, and local knowledge. This locally informed approach can help ensure that interventions are not only culturally sensitive but also pertinent, better accepted, and community-owned, thereby promoting sustainability.⁴⁰³⁻⁴⁰⁵

Incorporating cultural considerations into drowning prevention programs has been shown to enhance effectiveness, as reported by previous studies among Indigenous populations, migrants, and rural communities in Australia, Canada, and Bangladesh, where collaborating with local elders and community members helped tailor interventions.^{279,469,470,514-517} In Indonesia, similar approaches could harness local insights to develop culturally resonant interventions, thereby increasing the impact of water safety initiatives.

Developing contextualised, culturally sensitive drowning prevention strategies requires a thorough understanding of the cultural attitudes surrounding water-related activities.^{59,517} For example, research has shown that families of Asian backgrounds in countries such as the United States, Australia, and New Zealand often avoid recreational water activities, lack training in water safety, and delay enrolling their children in swimming lessons.⁵¹⁷⁻⁵¹⁹ This results in limited awareness of water hazards and drowning prevention measures, such as in recognising rip

currents, understanding signage and designated swimming areas, and developing proficiency in swimming, rescue, and resuscitation skills, which increases their risk of drowning.⁵¹⁷⁻⁵¹⁹ These insights highlight the importance of a continuous effort to gain a deeper understanding and consideration of cultural differences and nuances, with efforts made to respect and accommodate these unique contexts.⁵¹⁷

Cultural factors also significantly influence water exposure. In Japan, for instance, deep bathtubs and bathing habits have been linked to unintentional drownings, particularly among young children and the elderly.^{85,520,521} In addition, the cultural context surrounding fatalistic beliefs about drowning may impede proactive preventive measures, as individuals may view drowning incidents as inevitable or beyond their control. This was evident in the qualitative study conducted within this thesis, as well as in similar research findings in Bangladesh¹⁹⁶ and India²⁷⁸. Therefore, the development of drowning prevention programs in Indonesia should begin with establishing a comprehensive understanding of the cultural attitudes surrounding water-related activities and water safety, as these attitudes can expose different communities to various risk factors. For instance, in regions with strong cultural traditions around water-related activities, educational campaigns should prioritise swimming skill enhancement, while communities with lower engagement in water activities may benefit more from awareness-raising initiatives.

By recognising Indonesia's diverse cultural landscape and implementing region-specific and localised strategies to complement a national framework of drowning prevention, the relevance and sustainability of drowning prevention efforts can be improved. Ensuring that prevention strategies are communicated effectively in local languages will further integrate them into everyday practices, ultimately leading to a more significant impact on reducing drowning incidents.

9.4.4. Priority 4: Enhancing Risk Identification, Prevention, and Community Resilience Against Disaster-Related Drowning

Among various contexts of drowning, disaster-related drowning emerges as a pressing issue within Indonesian communities, posing distinct challenges that necessitate targeted interventions (Table 7.1).⁴¹⁵ Similar concerns regarding disaster-related drowning are echoed globally, particularly among vulnerable populations in LMICs facing heightened exposure to water-related disasters.^{7,40,158,416,418} Climate change exacerbates this risk by intensifying the frequency and severity of weather events, altering precipitation patterns and water resources, and damaging critical infrastructure like bridges and flood defences.^{40,42,61} Furthermore, climate change impacts behaviours and water exposure, as underserved populations may be compelled

to venture into unsafe water environments to collect water during water scarcity, or engage in hazardous fishing and boating practices despite worsening weather conditions to sustain their livelihoods.⁴² Despite this vulnerability, the integration of disaster and climate change mitigation and adaption into drowning prevention efforts is often overlooked in global studies on drowning, including those focused on Indonesia.^{40,42,61,418}

While disaster preparedness is crucial for reducing disaster-related drowning fatalities, vulnerability to drowning during disasters is influenced by various factors such as geographical features, infrastructure development, population distribution, social support networks, and individual capabilities to respond to disaster threats.^{40,42,61,447} These interconnected factors highlight the complexity of disaster-related drowning risks and underscore the importance of multi-strategic approaches to disaster risk management and drowning prevention, particularly to better protect at-risk groups of children, elderly populations, low-income rural communities, and coastal residents.^{40,42,110,447} Therefore, it is essential to integrate drowning prevention more effectively within the broader field of disaster risk reduction (DRR).^{42,418} This integration leverages established DRR expertise, resources, and theoretical frameworks. For example, early warning systems can provide timely alerts to at-risk populations, allowing them to take preventive and response actions. Community preparedness strategies can also educate and equip individuals with the skills and knowledge needed to respond effectively during emergencies. Conversely, integrating drowning prevention with DRR facilitates the use of communication channels, operational protocols, and networks of practitioners, advocates, and communities involved in water safety and rescue, such as has been demonstrated in Australia.⁴² This enhances prompt resource mobilisation during disaster events and strengthens community resilience. Furthermore, incorporating water safety skills training, such as survival swimming and safe rescue techniques, into disaster preparedness measures can contribute to reducing fatalities during water-related disasters. This synergy between drowning prevention and DRR ensures that interventions are more robust, coordinated, and tailored to the specific needs of vulnerable communities.^{42,418}

In Indonesia, this multisectoral approach should include these key components: 1) identifying region-specific risks and implementing targeted prevention measures for disaster-related drowning; 2) building resilience in disaster-prone communities; 3) utilising educational programs to enhance self-efficacy in disaster preparedness; 4) customising risk communication strategies by leveraging community networks; 5) addressing resource allocation disparities that prioritise recovery over preparedness; and 6) enhancing coordination mechanism between local and national bodies.^{61,522} This comprehensive approach is essential for aligning, improving

effectiveness, and sustaining efforts in drowning prevention and disaster mitigation and adaptation at both national and community levels in Indonesia.^{61,522} Further discussion of the imperative to improve risk identification, targeted prevention efforts, and community resilience against disaster-related drowning through the integration of research and policy is elaborated upon in Chapter 7.

9.4.5. Priority 5: Advancing Research on Socio-Ecological Determinants of Drowning to Inform Policy Integration and Intervention Development

This study, as the first investigation into the intricate public health problem of unintentional drowning in Indonesia, sought to establish an evidence-driven foundation to initiate discussions and accelerate initiatives aimed at reducing the country's drowning rates. Drawing from the findings from Chapters 1 through 8, this thesis underlines the intricate relationship between drowning prevention and individual, interpersonal, community, societal, and environmental factors. Therefore, this study advocates for integrating these multifaceted dynamics into broader policy frameworks using the socio-ecological health model.^{169-171,472,523} This model, utilised in previous global and national drowning burden studies, including those in Australia, is particularly pertinent to Indonesia given its vast geography, large population, substantial socioeconomic disparities, and diverse cultural landscape.^{39,86,152,161,523}

Guided by the socio-ecological model, this thesis proposes reducing the risk of unintentional drowning in Indonesia by advancing research to develop a deeper understanding of various socio-ecological determinants of drowning across four levels of influence, as illustrated in Figure 9.1.^{169-171,472,523,524} This encompasses research across:

- i. Intrapersonal level: Modifying individual knowledge, attitudes, and behaviours, around aquatic environments and water hazards, through strategic safety communication, educational interventions, and health screening initiatives for children, parents, caregivers, the elderly, community members, and individuals engaging in water-related activities.
- ii. Interpersonal level: Fostering water safety norms and behaviours by leveraging interpersonal relationships and social and environmental dynamics, through strategic safety communication, educational interventions, and advocating for improvements in environmental and living conditions.
- iii. Community level: Enhancing community resources and support structures, through targeted community communication, community-based interventions, environmental modifications, and nurturing social networks.

- iv. Societal level: Establishing societal norms regarding water safety and fostering supportive environments, through the development or modification of public policies, advocacy for policy changes, and the establishment of cultural norms around water safety using media advocacy and educational empowerment.^{169-171,472,523-525}

The socio-ecological model depicted in Figure 9.1 informs the promotion of a nationwide culture of water safety. It advocates the importance of advancing research and policies aimed at fostering water safety behaviours and improving the accessibility and affordability of making safe choices. Ultimately, these efforts aim to mitigate the risk of unintentional drowning across Indonesia. Figure 9.1 serves as an expanded version of Figure 8.1, integrating findings from all chapters (Chapters 1 to 8).

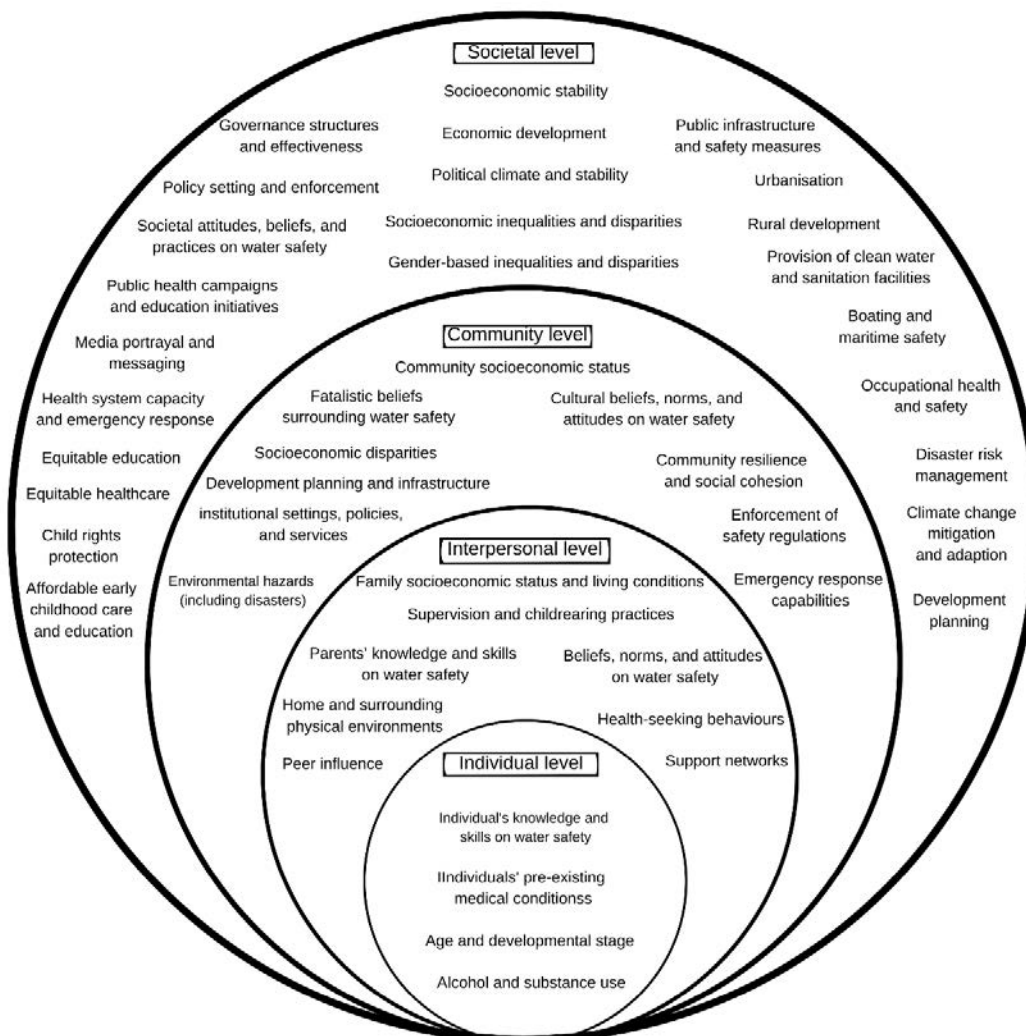


Figure 9.1. Informing Future Research and Policy Integration: Socio-Ecological Determinants of Drowning in Indonesia

9.5. Contribution to International Community: Insights for Global Drowning Prevention Efforts

Drowning disproportionately affects communities in LMICs, yet there has been insufficient exploration of the burden and prevention of drowning in these nations.⁷ By offering comprehensive insights into the epidemiology, risk factors, and prevention strategies of unintentional drowning in Indonesia, this thesis helps to fill crucial gaps in global drowning literature. Policymakers and public health officials can leverage the findings of this research to advocate for and develop drowning prevention measures, not only in Indonesia but also in other regions with similar demographics and environmental factors. Furthermore, this thesis identified areas where further research, training, or infrastructure development is needed to strengthen drowning prevention efforts in Indonesia. This can guide capacity-building initiatives within the country and facilitate knowledge exchange and collaboration with international partners.

By raising awareness of unintentional drowning in Indonesia through research findings and dissemination efforts, this thesis contributes to increasing global attention on drowning as a preventable public health issue. Such efforts can lead to greater advocacy, funding, and support for drowning prevention worldwide, contributing to the collective global effort to reduce drowning incidence and save lives. This study also supports the attainment of the objectives outlined in the 2021 UN General Assembly Resolution and the 2023 WHO call for the acceleration of drowning prevention efforts across all UN member states. Furthermore, the study contributes to the achievement of the UN's SDGs, by promoting the health, safety, and overall well-being of the Indonesian population while striving to reduce preventable deaths from drowning.

9.6. Research Strengths and Limitations

9.6.1. Methodology

The findings and conclusions presented in this thesis should be interpreted in light of certain limitations. Firstly, the methodology and methods employed in the study have specific drawbacks. While the mixed methods approach allows for a deeper understanding of the complex factors influencing unintentional drowning in Indonesia and the effectiveness of prevention strategies, challenges could arise during the integration of qualitative and quantitative findings.^{202,216,217} This integration phase may introduce biases and misinterpretation that could impact the transferability, dependability, and confirmability of the study's conclusions. To minimise biases and limitations in integrating qualitative and quantitative findings, this study employed a structured protocol of data collection and analysis, ensuring that both qualitative and quantitative data were collected systematically. Detailed documentation of data analysis,

including coding, categorisation, and synthesis, was maintained to uphold the rigor of the study. The research team also engaged in ongoing reflection to address potential biases and limitations, and the study explicitly reported these aspects to provide a more nuanced understanding of the findings and their applicability, allowing readers to interpret the results with appropriate caution.^{202,216,217}

The retrospective cohort study design also has several limitations. Primarily, it relies on pre-existing records or data, which may result in inaccuracies or incomplete information due to inconsistencies in data quality or documentation practices, introducing information bias.^{245,246} Furthermore, since the data are collected after the outcomes have occurred, establishing a definitive temporal relationship between exposure and outcome can be challenging. Moreover, controlling for confounding factors is difficult because researchers cannot manipulate exposures or randomise participants.^{202,245,246}

The use of GBD 2019 Study data to analyse drowning mortality and burden in Indonesia also introduces some limitations. While the study offers a standardised approach to estimating global health metrics that facilitates country-to-country comparisons, relying on verbal autopsy instruments in Indonesia may introduce selection, recall, and information biases. However, it can also be argued that sentinel events involving death or serious injury are often remembered vividly by individuals, which could mitigate some of these biases related to the use of verbal autopsy. This is supported by a report from Vietnam which indicates that verbal autopsy has demonstrated 75% to 100% sensitivity in recording road traffic cases.²⁵⁸ Another limitation to the use of GBD Study data is how certain categories of drowning relevant to Indonesia, such as water transport-related or disaster-related drowning incidents, were not captured, potentially underestimating the burden of drowning in Indonesia. Moreover, by specifically examining unintentional drowning, this study did not account for intentional drowning through self-harm or assault, potentially resulting in further underrepresentation of the true extent of drowning cases discussed in this thesis. Furthermore, while GBD data are valuable for estimating health metrics in countries with limited data availability, it is important to acknowledge that these data are modelled rather than directly observed. Consequently, they may obscure short-term variations and anomalies, as has been reported in Portugal.²⁵⁷ While the GBD data are useful for identifying broad trends and patterns, they may not accurately reflect immediate or localised changes. As a result, it is important to interpret GBD data with caution, understanding that while they provide a general overview, they might not capture all the details of year-to-year fluctuations in health metrics.²⁵⁷ Thus, establishing a nationally integrated system for drowning data collection and

registries remains crucial in Indonesia for gaining a more accurate and comprehensive understanding of the drowning burden in the country.

Several measures contributed to minimise biases and limitations related to the retrospective cohort study design and the use of GBD data. First, the study findings underwent rigorous peer review and validation by experts in the field. This included scrutiny by the Institute for Health Metrics and Evaluation (IHME) and its global network of collaborators working with GBD data, which reviewed the methods, data sources, and findings. This external evaluation helped identify and address any inconsistencies or gaps in methods, data source, analysis and interpretation, thus enhancing the credibility and reliability of the study's conclusions. In addition, the GBD 2019 Study data are openly available for both the public and experts, ensuring transparency and allowing for rigorous scrutiny and independent validation of findings. Furthermore, the GBD drowning data in Indonesia were collected through a collaborative effort with the Indonesian Ministry of Health, promoting accountability and ensuring alignment with local expertise and authorities. Furthermore, to address challenges in establishing temporal relationships, careful attention was given to the statistical interpretation of trends and measures of association between exposures and outcomes. This approach provides a clear context for understanding the limitations in establishing causality, allowing readers to interpret the results with appropriate caution.

In addition, while this study engaged with key informants of community stakeholders for input on drowning prevention, it did not seek input from various other relevant stakeholders. These include key informants and key opinion leaders from government agencies responsible for drowning data documentation and prevention, private entities involved in water activities, civil organisations such as NGOs offering swimming lessons and rescue services, humanitarian organisations involved in disaster mitigation, and education providers and schools. Future research on unintentional drowning in Indonesia should consider perspectives from all these stakeholders. It is recommended to conduct a thorough assessment and mapping of relevant stakeholders to ensure comprehensive inclusion.

Limiting the qualitative study to a specific region of Lombok, WNT, instead of conducting nationwide research, has implications for the generalisability of findings. While focusing on a particular area allows for in-depth exploration of local perspectives and experiences in one of the most drowning-prone regions in Indonesia, it may not capture the full spectrum of factors influencing drowning prevention efforts across the country. Disparities in socio-cultural settings, environmental conditions, and resource availability among regions can affect the relevance of the

study's conclusions at the national level. Despite these limitations, the qualitative study offers valuable insights into the socio-cultural determinants of drowning in the specific context of WNT, contributing to the broader understanding of this public health issue.

In addition, the self-selection and purposive and snowball sampling techniques, although widely utilised in qualitative research, come with certain limitations. These methods may lead to a sample that does not adequately represent the broader WNT and Indonesian population, thus constraining the transferability of the findings. Moreover, there might be difficulties in reaching certain subgroups or populations that are not well-connected or accessible through existing networks, thereby limiting the range of viewpoints included in the study. Nevertheless, despite these drawbacks, purposive and snowball sampling techniques can be valuable in accessing specific populations or individuals with unique experiences relevant to the research objectives, and for engaging community members in contributing to the acquisition of new knowledge that is pertinent to them.

In addition to the purposive sampling, efforts to uphold the credibility, dependability, confirmability, and transferability of the qualitative study included: 1) Prolonged engagement at research sites to build rapport with participants and to gain full understanding of participants' narratives; 2) Collection of participant demographics; 3) Continual reflection on assumptions and biases; 4) Member-checking, conducted both informally during each FGD to immediately verify findings, and formally through follow-up interviews after FGD transcriptions, to validate the interpretation of the data collected; 5) Back-translation to validate data accuracy; 6) Iterative cycles of coding, interpreting, and reflecting on data; 7) Consensus discussions on themes and theme definitions; 8) Inclusion of direct quotations as evidence; and 9) Establishment of an audit trail of data collection and analysis. These steps are discussed in detail in Chapter 2, as well as in the Methods sections of Chapters 5 through 8 of this thesis.

9.6.2. Applicability

The qualitative findings in this study pertain specifically to the context of Lombok, WNT, focusing on developing a foundational understanding of community perceptions regarding the cause, risk factors, magnitude, and prevention of child drowning. As each context is unique, it can be argued that the challenges identified are specific to the experiences of communities within this region. Therefore, there is a need for the findings to be applied and validated within the broader context of Indonesia.

In addition, as the FGDs included both fathers and mothers of children under-five years of age in the same discussions, future research could consider separating participants to better

explore the nuances of gender-specific experiences and roles in childrearing and child safety discussions. Furthermore, this study did not involve intervention development, implementation, or evaluation, and thus does not offer insights into the efficacy and effectiveness of specific drowning prevention interventions in the community.

9.7. Future Directions

As this study is envisaged to be a pivotal component of a comprehensive, long-term research initiative on drowning in Indonesia, the findings of this thesis are poised to lay the groundwork for subsequent phases of investigation. Emphasising the need for ongoing research, several key areas are highlighted for future exploration, to contribute to the understanding of drowning burden and dynamics in Indonesia and inform targeted measures aimed at mitigating this critical public health issue, including:

1. Development of an integrated drowning surveillance system and evaluation of its impact on data availability and reliability.
2. Comprehensive and updated examination of mortality and burden associated with all ICD-codes for drowning, encompassing unintentional drowning, water transport-related drowning, disaster-related drowning, drowning of undetermined intent, and intentional drowning, at both the national and subnational levels across the 38 provinces of Indonesia.
3. Assessment of the economic burden of unintentional drowning in Indonesian provinces, by assigning values to direct factors such as medical treatment, emergency response, and rescue and recovery costs, and indirect costs of lost productivity, reduced quality of life, and long-term care for health consequences of non-fatal drowning incidents.
4. Conducting a mapping of stakeholders relevant to drowning prevention efforts in Indonesia, including an analysis of their relationships, interactions, roles, and interests within the stakeholder network, to facilitate comprehensive inclusion and engagement.
5. Investigation of drowning risk factors specific to Indonesia and its individual provinces.
6. Investigation aimed at measuring the association between various drowning risk factors and both fatal and non-fatal drowning incidents.
7. Exploration of the influence of socioeconomic disparities on drowning mortality.
8. Evaluation of the impact of adaptation strategies to changing environmental conditions on drowning mortality.
9. Development of targeted, culturally sensitive drowning prevention advocacy and awareness programs using a co-design approach.

10. Development of contextualised drowning prevention interventions for high-risk populations, including under-five children, the elderly, and underserved populations in Papua, Kalimantan, Sulawesi, Maluku, Sumatra, and the Nusa Tenggara provinces.
11. Investigation into the efficacy and effectiveness of contextualised drowning prevention interventions in reducing drowning mortality rates, and strategies for widespread adoption.
12. Evaluation of the effectiveness of existing water safety promotion and drowning prevention policies in reducing drowning mortality rates.
13. Examination of the interconnectedness of drowning mortality and prevention with initiatives such as provision of safe aquatic environments, infrastructure investments, rural and urban development, affordable childcare and early childhood education, equitable education services, equitable healthcare services, enforcement of boating and maritime safety regulations, disaster risk management, climate change mitigation and adaptation, and efforts to alleviate socioeconomic disparities.
14. Fostering multidisciplinary collaboration across nations for providing technical assistance, sharing knowledge and data, as well as funding, to accelerate drowning prevention efforts in Indonesia and LMICs.

9.8. Conclusion

Drowning persists as a significant global public health challenge despite worldwide initiatives, which particularly affects populations in LMICs. Indonesia, the world's largest archipelagic nation with extensive water areas, a large population, and susceptibility to water-related disasters, faces substantial drowning risks. This study aimed to investigate mortality rates, risk factors, and prevention interventions for unintentional drowning in Indonesia, as well as the interconnection of these aspects with socio-ecological approaches of health promotion. This study provided an initial investigation into unintentional drowning in Indonesia, establishing a comprehensive, evidence-based framework aimed at mitigating drowning incidents.

The study identified a paucity of information on unintentional, water transport-related, and disaster-related drowning rates, risk factors, and prevention in Indonesia. Although Indonesia saw a decline in drowning mortality rates from 2005 to 2019, the rates remained high among children under five years, the elderly, males, and residents of Papua, Kalimantan, Sulawesi, Maluku, Sumatra, and Nusa Tenggara provinces. This highlights the necessity for focused prevention measures aimed at addressing the elevated risk of drowning among these vulnerable populations.

The study identified the urgent need to improve data collection for better drowning prevention strategies. The study findings emphasised the need to tailor drowning prevention strategies to address the heightened risk among children under five. There is a need for low-cost and culturally appropriate, community-based drowning prevention interventions to reduce the risk of child drowning, particularly in rural areas of Indonesia. Immediate measures are required to establish standardised and integrated national reporting structures for health, mortality, and disaster data; foster multisectoral collaboration; secure sustained political and financial investment; and build resilience in drowning-prone communities. A systematic effort is needed to integrate drowning prevention into regulatory frameworks related to water safety, boating and maritime safety, disaster risk management, climate change mitigation and adaptation, early childhood care, education, health, development planning, and efforts to alleviate socioeconomic disparities in Indonesia, with clear obligations, responsibilities, and coordination mechanisms between government agencies and stakeholders.

This study represents the first step in understanding the complexities of unintentional drowning in Indonesia. By laying down a comprehensive, evidence-based groundwork, it offers insights crucial for the development of effective strategies to decrease drowning rates in the country. In light of its findings, the study proposes five critical priorities aimed at bolstering national drowning prevention efforts in Indonesia: 1) Advancing drowning prevention through robust data collection; 2) Prioritising intervention strategies to prevent child drowning; 3) Developing contextualised and culturally appropriate interventions; 4) Enhancing risk identification, prevention, and community resilience against disaster-related drowning; and 5) Advancing research on socio-ecological determinants of drowning to inform policy integration and intervention development.

References

1. United Nations International Children Emergency Funds (UNICEF). Provincial snapshot: West Nusa Tenggara. Accessed 26 May, 2024. https://www.unicef.org/indonesia/sites/unicef.org/indonesia/files/2019-05/West_Nusa_Tenggara_ProvincialBrief.pdf
2. Indonesian National Bureau of Statistics. Total population by province and district in Indonesia 2021-2023. Indonesian National Bureau of Statistics. Updated 11 January 2024. Accessed 17 January, 2024. <https://ntb.bps.go.id/indicator/12/29/1/penduduk-kabupaten-kota.html>
3. Global Facility for Disaster Reduction and Recovery. ThinkHazard - Lombok Barat, Nusa Tenggara Barat, Indonesia. Global Facility for Disaster Reduction and Recovery. Accessed 25 May, 2024. <https://thinkhazard.org/en/report/18145-indonesia-nusatenggara-barat-lombok-barat>
4. Indonesian National Disaster Management Agency. Disaster information database. Indonesian National Disaster Management Agency. Accessed 23 May, 2024. <https://dibi.bnppb.go.id/>
5. Felix RP, Hubbard JA, Bradley KE, Lythgoe KH, Li L, Switzer AD. Tsunami hazard in Lombok and Bali, Indonesia, due to the Flores back-arc thrust. *Natural Hazards and Earth System Sciences*. 2022;22(5):1665-1682. doi:10.5194/nhess-22-1665-2022
6. Franklin RC, Peden AE, Hamilton EB, et al. The burden of unintentional drowning: Global, regional and national estimates of mortality from the Global Burden of Disease 2017 Study. *Inj Prev*. 2020;26(Suppl 2):i83-i166. doi:10.1136/injuryprev-2019-043484
7. World Health Organization. Global report on drowning: Preventing a leading killer. World Health Organization. Accessed 1 March 2024, http://apps.who.int/iris/bitstream/10665/143893/1/9789241564786_eng.pdf?ua=1&ua=1&ua=1&ua=1
8. World Health Organization. Drowning. World Health Organization. Updated 25 July 2023. Accessed 25 May, 2024. <https://www.who.int/news-room/fact-sheets/detail/drowning>
9. Zhu W, He X, San R, et al. Global, regional, and national drowning trends from 1990 to 2021: Results from the 2021 Global Burden of Disease Study. *Acad Emerg Med*. 2024;n/a(n/a)doi:<https://doi.org/10.1111/acem.15003>
10. World Health Organization Regional Office for the South-East Asia. Regional status report on drowning in South-East Asia. World Health Organization. Accessed 25 February 2024, <https://apps.who.int/iris/bitstream/handle/10665/343085/9789290228608-eng.pdf?sequence=1&isAllowed=y>
11. Indonesian National Bureau of Statistics. 2020 Census results. The Indonesian National Bureau of Statistics. Accessed 21 February 2024, <https://www.bps.go.id/pressrelease/2021/01/21/1854/hasil-sensus-penduduk-2020.html>
12. Bierens J. History. In: Bierens J, ed. *Drowning Prevention, Rescue, Treatment*. 2nd 2014. ed. Springer Berlin Heidelberg; 2014.
13. Avramidis S. Drowning in the Bible and contemporary society: Responsibilities of religious caregivers. *Journal of Religion and Health*. 2010;49(2):212-220. doi:10.1007/s10943-009-9235-0
14. Bennett H. The exposure of infants in Ancient Rome. *The Classical Journal*. 1923;18(6):341-351.

15. Murray MA. The cult of the drowned in Egypt. *Zeitschrift für Ägyptische Sprache und Altertumskunde*. 1914;51(1-2):127-135. *Zeitschrift für Ägyptische Sprache und Altertumskunde*. doi:10.1524/zaes.1914.51.12.127
16. Chan SS, Elias JP, Hysell ME, Hallowell MJ. CT of a Ptolemaic period mummy from the ancient Egyptian city of Akhmim. *Radiographics*. 2008;28(7):2023-2032. doi:10.1148/rg.287085039
17. Marsden R. The Drowning of Pharaoh's Army (Exodus, lines 447–564). In: Marsden R, ed. *The Cambridge Old English Reader*. Cambridge University Press; 2004:138-146.
18. Lippsett L. Noah's not-so-big flood: New evidence rebuts controversial theory of Black Sea deluge. *Oceanus*. 2009;47(2):4-6.
19. Schiermeier Q. Oceanography: Noah's flood. *Nature*. 2004;430(7001):718-720. doi:10.1038/430718a
20. Aksu AE, Hiscott RN, Mudie PJ, et al. Persistent holocene outflow from the Black Sea to the Eastern Mediterranean contradicts Noah's Flood hypothesis. *GSA Today*. 2002;12(5):4-10. doi:10.1130/1052-5173(2002)012<0004:PHOFTB>2.0.CO;2
21. Ryan W, Pitman W. *Noah's Flood: The New Scientific Discoveries about the Event That Changed History*. Simon and Schuster; 1998.
22. Avramidis S. Drowning in Ancient Greek history and mythology. *International Journal of Aquatic Research and Education*. 2009;3(4):9. doi:10.25035/ijare.03.04.09
23. Pihlajamäki H. 'Swimming the witch, pricking for the devil's mark': Ordeals in the early modern witchcraft trials. *The Journal of Legal History*. 2000;21(2):35-58. doi:10.1080/01440362108539608
24. Peter T. River ordeal—trial by water—swimming of witches: Procedures of ordeal in witch trials. *Demons, Spirits, Witches*. 2008:129.
25. Wijaczka J. The cold water ordeal (swimming) in witchcraft accusations and trials in the Polish-Lithuanian Commonwealth in the Sixteenth-Eighteenth century. *Odrodzenie i Reformacja w Polsce*. 2016;60(2):149-187.
26. Trubuhovich RV. History of mouth-to-mouth rescue breathing Part 2: the 18th century. *Crit Care Resusc*. 2006;8(2):157-171. doi:10.1016/S1441-2772(23)01417-5
27. Hutter L. "A little spark perhaps may lie conceal'd": Humane societies and the principles of resuscitation to save the drowned. *Configurations*. 2011;19(2):157-190. doi:10.1353/con.2011.0016
28. McCabe C. The humane society movement and the transnational exchange of medical knowledge in the late eighteenth and early nineteenth centuries. *J R Coll Physicians Edinb*. 2019;49(2):158-164. doi:10.4997/jrcpe.2019.218
29. De Frenza L, Tisci C. Frightening Whirlpools: Drowning in France in the 18th Century. In: Ceglia FPd, ed. *The Body of Evidence Corpses and Proofs in Early Modern European Medicine*. Brill Publishers; 2020:270.
30. Jarcho S. Giovanni Battista Morgagni: His interests, ideas and achievements. *Bull Hist Med*. 1948;22(5):503-527.
31. Brod J. The rational basis of diagnosis in internal medicine. *J R Coll Physicians Lond*. 1977;11(4):323.
32. Meursing BJ. The History of Resuscitation. In: Bierens J, ed. *Drowning Prevention, Rescue, Treatment*. 2nd 2014. ed. Springer Berlin Heidelberg; 2014.
33. Vervaecke H. The History of Lifesaving. In: Bierens J, ed. *Drowning Prevention, Rescue, Treatment*. 2nd 2014. ed. Springer Berlin Heidelberg; 2014.

34. Love C. *A Social History of Swimming in England, 1800–1918: Splashing in the Serpentine*. Routledge; 2013.
35. Jaggard E. From Bondi to Bude: Allan Kennedy and the exportation of Australian Surf Lifesaving to Britain in the 1950s. *Sport in History*. 2011;31(1):62-83. doi:10.1080/17460263.2011.554720
36. Scarr J. Partnerships and Collaboration in Drowning Prevention. In: Bierens J, ed. *Drowning Prevention, Rescue, Treatment*. 2nd 2014. ed. Springer Berlin Heidelberg; 2014.
37. Leavy JE, Crawford G, Leaversuch F, Nimmo L, McCausland K, Jancey J. A review of drowning prevention interventions for children and young people in high, low and middle income countries. journal article. *J Community Health*. 2016;41(2):424-441. doi:10.1007/s10900-015-0105-2
38. Moran K. Approaches to drowning prevention in high income countries (HICs). *Inj Prev*. 2012;18(Suppl 1):A84-A84. doi:10.1136/injuryprev-2012-040580n.2
39. Tan H, Lin Z, Fu D, et al. Change in global burden of unintentional drowning from 1990 to 2019 and its association with social determinants of health: Findings from the Global Burden of Disease Study 2019. *BMJ Open*. 2023;13(4):e070772-e070772. doi:10.1136/bmjopen-2022-070772
40. Sindall R, Mecrow T, Queiroga AC, Boyer C, Koon W, Peden AE. Drowning risk and climate change: A state-of-the-art review. *Inj Prev*. 2022;28(2):185. doi:10.1136/injuryprev-2021-044486
41. Cenderadewi M, Franklin R, Devine S. The socio-ecological nature of drowning in low and middle-income countries: A review to inform health promotion approaches. *International Journal of Aquatic Research and Education*. 2020;12(2)(6)doi:10.25035/ijare.12.02.xx
42. Le Dé L. Bridging gaps between disaster risk reduction and drowning prevention. *International Journal of Disaster Risk Reduction*. 2024;106doi:10.1016/j.ijdrr.2024.104445
43. van Beeck EF, Branche CM, Szpilman D, Modell JH, Bierens JJ. A new definition of drowning: Towards documentation and prevention of a global public health problem. *Bull World Health Organ*. 2005;83(11):853-856.
44. Quang CY, Kennedy RO, Blair SG, Brevard SB, Simmons JD. Is there a clinical difference between salt water and fresh water drowning? *Open Journal of Trauma*. 2017;1(1):001-002.
45. Modell JH, Bellefleur M, Davis JH. Drowning without aspiration: Is this an appropriate diagnosis? *J Forensic Sci*. 1999;44(6):1119-1123. doi:10.1520/JFS14580J
46. Modell JH. Drown versus near-drown: A discussion of definitions. *Crit Care Med*. 1981;9(4):351-352.
47. Modell JH. The pathophysiology and treatment of drowning. *Acta Anaesthesiol Scand*. 1968;12:263-279.
48. Modell JH. Near drowning. *Int Anesthesiol Clin*. 1977;15(1):107-116.
49. Modell JH. Drowning. *N Engl J Med*. 1993;328(4):253-256.
50. Pearce N. Traditional epidemiology, modern epidemiology, and public health. *Am J Public Health*. 1996;86(5):678-683.
51. Idris AH, Berg RA, Bierens J, et al. Recommended guidelines for uniform reporting of data from drowning: The "Utstein Style". *Circulation*. 2003;108(20):2565-2574. doi:10.1161/01.CIR.0000099581.70012.68
52. Peden AE. *Building the evidence base for river drowning prevention*. James Cook University; 2019.
53. Sempsrott J, Slattery D, Schmidt A, Penalosa B, Crittle T. 422 Systematic review of Non-Utstein Style drowning rerms. *Ann Emerg Med*. 2011;58(4):S321.

54. Beeck Ev, Branche C. Definition of Drowning: A Progress Report. In: Bierens J, ed. *Drowning Prevention, Rescue, Treatment*. 2nd 2014. ed. Springer Berlin Heidelberg; 2014.
55. Kiakalayeh AD, Mohammadi R, Chabok SY, Kiakalayeh SD. Suitability of existing definitions for drowning to meet the new definition: a scoping review. *Journal of Injury and Violence Research*. 2023;15(2):1-5.
56. Passmore J, Smith JO, Clapperton A. True burden of drowning: Compiling data to meet the new definition. *International Journal of Injury Control and Safety Promotion*. 2007;14(1):1-3.
57. Franklin RC, Pearn JH. Drowning for love: The aquatic victim-instead-of-rescuer syndrome: Drowning fatalities involving those attempting to rescue a child. *J Paediatr Child Health*. 2011;47(1-2):44-47.
58. Nasrullah M, Muazzam S. Drowning mortality in the United States, 1999–2006. *J Community Health*. 2011;36:69-75.
59. World Health Organization. Preventing drowning: An implementation guide. Accessed 25 May 2024, <http://apps.who.int/iris/bitstream/10665/255196/1/9789241511933-eng.pdf>
60. Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2019 (GBD 2019) Results. Institute for Health Metrics and Evaluation (IHME). Accessed 22 May 2024, <http://ghdx.healthdata.org/gbd-results-tool>
61. Cenderadewi M, Devine SG, Sari DP, Franklin RC. Fatal drowning in Indonesia: Understanding knowledge gaps through a scoping review. *Health Promot Int*. 2023;38(5):daad130 (1-22). doi:10.1093/heapro/daad130
62. Vos T, Lim SS, Abbafati C, et al. Global burden of 369 diseases and injuries in 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. *The Lancet*. 2020;396(10258):1204-1222. doi:10.1016/S0140-6736(20)30925-9
63. Peden AE, Franklin RC, Mahony AJ, Scarr J, Barnsley PD. Using a retrospective cross-sectional study to analyse unintentional fatal drowning in Australia: ICD-10 coding-based methodologies verses actual deaths. *BMJ Open*. 2017;7(12):e019407 (1-8). doi:10.1136/bmjopen-2017-019407
64. Norton R, Hyder AA, Bishai D, Peden M. Chapter 39 Unintentional Injuries. In: Jamison DT, Breman JG, Measham AR, et al, eds. *Disease Control Priorities in Developing Countries, Second Edition*. World Bank and Oxford University Press; 2006.
65. World Health Organization. International statistical classification of diseases and related health problems 10th revision (ICD-10) - WHO version for 2019-covid-expanded. World Health Organization. Accessed 25 May, 2024. <https://icd.who.int/browse10/2019/en#/W65-W74>
66. Bonilla-Escobar FJ, Gutiérrez MI. Injuries are not accidents: towards a culture of prevention. *Colomb Med*. 2014;45(3):132-5.
67. Schwebel DC. Why “accidents” are not accidental: Using psychological science to understand and prevent unintentional child injuries. *Am Psychol*. 2019;74(9):1137-1147. doi:10.1037/amp0000487
68. Langley JD. The need to discontinue the use of the term “accident” when referring to unintentional injury events. *Accid Anal Prev*. 1988;20(1):1-8. doi:[https://doi.org/10.1016/0001-4575\(88\)90009-7](https://doi.org/10.1016/0001-4575(88)90009-7)
69. Dicker D, Nguyen G, Abate D, et al. Global, regional, and national age-sex-specific mortality and life expectancy, 1950-2017: A systematic analysis for the Global Burden of Disease Study 2017. *The Lancet*. 2018;392(10159):1684-1735. doi:10.1016/S0140-6736(18)31891-9

70. World Health Organization. WHO Guideline on the prevention of drowning through provision of day-care and basic swimming and water safety skills. World Health Organization. Accessed 19 April 2024, <https://www.who.int/publications/i/item/9789240030008>
71. World Health Organization Regional Office for the Western Pacific. Regional status report on drowning in the Western Pacific. World Health Organization. <https://apps.who.int/iris/handle/10665/343073>
72. Leilei D, Pengpeng Y, Haagsma JA, et al. The burden of injury in China, 1990–2017: findings from the Global Burden of Disease Study 2017. *The Lancet Public Health*. 2019;4(9):e449-e461. doi:10.1016/S2468-2667(19)30125-2
73. Davoudi-Kiakalayeh A, Mohammadi R, Yousefzade-Chabok S, Jansson B. Evaluation of a community-based drowning prevention programme in northern Islamic Republic of Iran. *Eastern Mediterranean Health Journal*. 2013;19(7):629-637. doi:10.26719/2013.19.7.629
74. Ekchaloermkiat S, Gerdmongkolgan S. PW 0768 Merit maker: Child drowning prevention program in thailand. *Inj Prev*. 2018;24(Suppl 2):A150-A150. doi:10.1136/injury-prevention-2018-safety.416
75. Rahman F, Bose S, Linnan M, et al. Cost-effectiveness of an injury and drowning prevention program in Bangladesh. *Pediatrics*. 2012;130(6):e1621-e1628.
76. Alfonso YN, Hyder AA, Alonge O, et al. Cost-effectiveness analysis of a large-scale crèche intervention to prevent child drowning in rural Bangladesh. *Injury Epidemiology*. 2021;8(1):61. doi:10.1186/s40621-021-00351-9
77. Davoudi-Kiakalayeh A, Mohammadi R, Yousefzadeh-Chabok S. Prevention of drowning by community-based intervention: Implications for low- and middle-income countries. *Archives of Trauma Research*. 2012;1(3):112-7. doi:10.5812/atr.7690
78. Szpilman D, de Barros Oliveira R, Mocellin O, Webber J. Is drowning a mere matter of resuscitation? *Resuscitation*. 2018;129:103-106. doi:10.1016/j.resuscitation.2018.06.018
79. Peden AE, Willcox-Pidgeon S, Scarr JP, Franklin RC. Lessons learned through the 20-year development of a national fatal drowning database in Australia. *BMC Public Health*. 2023;23(1):1499-1499. doi:10.1186/s12889-023-16392-2
80. Franklin CR, Peden EA. Improving pool fencing legislation in Queensland, Australia: Attitudes and impact on child drowning fatalities. *Int J Environ Res Public Health*. 2017;14(12)doi:10.3390/ijerph14121450
81. Thompson DC, Rivara F, Rivara F. Pool fencing for preventing drowning of children. *Cochrane Database of Systematic Reviews*. 2000;2010(9):CD001047-CD001047. doi:10.1002/14651858.CD001047
82. Franklin RC, Peden A, Watt K, Peter PL. Pool fencing-Can Australia go much further? *Inj Prev*. 2012;18doi:10.1136/injury-prevention-2012-040590h.13
83. Willcox-Pidgeon S, Peden AE, Franklin RC, Scarr J. Boating-related drowning in Australia: Epidemiology, risk factors and the regulatory environment. *Journal of Safety Research*. 2019;70:117-125. doi:10.1016/j.jsr.2019.06.005
84. Viauoux C, Gungor A. An empirical analysis of life jacket effectiveness in recreational boating. *Risk Anal*. 2016;36(2):302-319. doi:10.1111/risa.12449
85. Quan L, Mills B, Chau SS, Bennett E, Bolt K, Gomez A. Association of designated open water swim area regulations and open water drowning rates. *Inj Prev*. 2021;27(1):10-16. doi:10.1136/injury-prevention-2019-043464

86. Willcox-Pidgeon SM, Peden AE, Scarr J. Exploring children's participation in commercial swimming lessons through the social determinants of health. *Health Promot J Austr.* 2021;32(2):172-181. doi:10.1002/hpja.335
87. Ananthapavan V, Peden AE, Angell B, Macniven R. Barriers to preschool aged children's participation in swimming lessons in New South Wales, Australia. *Health Promot J Austr.* 2024;35(3):770-783. doi:<https://doi.org/10.1002/hpja.811>
88. Chambraud T. Drownings surge on Senegal's "death beaches". Updated 20 July 2021. Accessed 30 October 2024, <https://www.africanews.com/2021/07/20/drownings-surge-on-senegal-s-death-beaches/>
89. World Health Organization. *Health at a Glance: Asia/Pacific 2014 Measuring Progress towards Universal Health Coverage: Measuring Progress towards Universal Health Coverage.* OECD Publishing; 2014.
90. Willcox-Pidgeon SM, Franklin RC, Leggat PA, Devine S. Identifying a gap in drowning prevention: High-risk populations. *Inj Prev.* 2020;26(3):279. doi:10.1136/injuryprev-2019-043432
91. Pan SW, Chong HH, Kao H-C. Unintentional injury mortality among indigenous communities of Taiwan: trends from 2002 to 2013 and evaluation of a community-based intervention. *Inj Prev.* 2019;25(1):26. doi:10.1136/injuryprev-2017-042321
92. Roberts K, Thom O, Devine S, Leggat PA, Franklin RC. A focus on sex differences in drowning deaths in Australia: the need for reporting on sex and gender in drowning research. *Journal of Public Health.* 2024;32(9):1797-1814. doi:10.1007/s10389-023-01931-3
93. Ma WJ, Nie SP, Xu HF, et al. An analysis of risk factors of non-fatal drowning among children in rural areas of Guangdong Province, China: A case-control study. journal article. *BMC Public Health.* 2010;10(1):156. doi:10.1186/1471-2458-10-156
94. Alonge O, Agrawal P, Talab A, et al. Fatal and non-fatal injury outcomes: results from a purposively sampled census of seven rural subdistricts in Bangladesh. *The Lancet global health.* 2017;5(8):e818-e827. doi:10.1016/S2214-109X(17)30244-9
95. Australian Water Safety Council. Australian Water Safety Strategy 2030. Australian Water Safety Council. Accessed 25 May, 2024. https://www.royallifesaving.com.au/data/assets/pdf_file/0003/43275/AWS_Strategy2030_Final_for-web.pdf
96. National Water Safety Forum. A future without drowning: The UK Drowning Prevention Strategy 2016-2026. National Water Safety Forum. Accessed 25 May, 2024. <https://www.nationalwatersafety.org.uk/media/1005/uk-drowning-prevention-strategy.pdf>
97. U.S. National Water Safety Action Plan. US National Water Safety Action Plan 2023-2032. U.S. National Water Safety Action Plan. Accessed 25 May, 2024. https://www.watersafetyusa.org/uploads/7/0/6/0/70608285/usnwsap_v7.pdf
98. World Health Organization. Regional Office for South-East Asia. *Regional status report on drowning in South-East Asia.* World Health Organization. Regional Office for South-East Asia; 2021.
99. World Health Organization. Preventing drowning: Practical guidance for the provision of day-care, basic swimming and water safety skills, and safe rescue and resuscitation training. World Health Organization. Accessed 22 May 2024, <https://www.who.int/publications/i/item/9789240046726>
100. United Nations General Assembly. UN General Assembly Resolution on global drowning prevention. United Nations. Updated 28 April 2021. Accessed 28 May 2024, <https://undocs.org/A/75/L.76>

101. Meddings DR, Scarr J-P, Larson K, Vaughan J, Krug EG. Drowning prevention: Turning the tide on a leading killer. *The Lancet Public Health*. 2021;6(9):e692-e695. doi:10.1016/S2468-2667(21)00165-1
102. United Nations General Assembly. Transforming our world: the 2030 Agenda for Sustainable Development. United Nations General Assembly. Accessed 25 May, 2024. <https://documents.un.org/doc/undoc/gen/n15/291/89/pdf/n1529189.pdf?token=iWUGY5BX4NFVc4YHXT&fe=true>
103. United Nations Department of Economic and Social Affairs Sustainable Development. The 17 Sustainable Development Goals. Accessed 25 May 2024, <https://sdgs.un.org/goals>
104. Ma T, Peden AE, Peden M, et al. Out of the silos: Embedding injury prevention into the Sustainable Development Goals. *Inj Prev*. 2021;27(2):166. doi:10.1136/injuryprev-2020-043850
105. Jagnoor J, Kobusingye O, Scarr J-P. Drowning prevention: Priorities to accelerate multisectoral action. *The Lancet (British edition)*. 2021;398(10300):564-566. doi:10.1016/S0140-6736(21)01601-9
106. World Health Organization. Accelerating Action on Global Drowning Prevention. World Health Organization. Updated 30 May 2023. Accessed 6 June 2024, https://apps.who.int/gb/ebwha/pdf_files/WHA76/A76_R18-en.pdf
107. World Health Organization. WHO urges countries to invest in drowning prevention to protect children. World Health Organization. Accessed 30 May 2024, <https://www.who.int/news/item/25-07-2023-who-urges-countries-to-invest-in-drowning-prevention-to-protect-childrenhttps://www.who.int/news/item/25-07-2023-who-urges-countries-to-invest-in-drowning-prevention-to-protect-children>
108. Royal Life Saving - Australia. WHO forms Global Alliance for Drowning Prevention. World Health Organization. Accessed 30 May 2024, <https://www.royallifesaving.com.au/about/news-and-updates/news/who-forms-global-alliance-for-drowning-prevention>
109. World Health Organization. Hidden Depths: The Global Investment Case for Drowning Prevention. World Health Organization. Accessed 30 May 2024, <https://iris.who.int/bitstream/handle/10665/371701/9789240077720-eng.pdf?sequence=1>
110. Scarr J-P, Jagnoor J. Identifying opportunities for multisectoral action for drowning prevention: A scoping review. *Inj Prev*. 2022;28(6):585-594. doi:10.1136/ip-2022-044712
111. Bloomberg Philanthropies. <https://www.bloomberg.org/public-health/preventing-drowning/>. Accessed 30 May 2024, <https://www.bloomberg.org/public-health/preventing-drowning/>
112. Reid A. Indonesia's New Prominence in the World. ISEAS–Yusof Ishak Institute Singapore; 2018:1-13.
113. Cribb R, Ford M. *Indonesia beyond the Water's Edge : Managing an Archipelagic State*. Indonesia update series. ISEAS Publishing; 2009.
114. Dian Anggraini S, Kusumawardhana I, Ramadhan I. The implication of Indonesia's IUU fishing policy in Natuna territorial waters towards South China Sea geopolitics. *Jurnal Hubungan Internasional*. 2018;7(2):118-132. doi:10.18196/hi.72130
115. Mohammad Fazrulzaman A. Geopolitics of the South China Sea during the Covid-19 pandemic: Indonesia's national interest and geostrategy in the North Natuna Sea. *Politicon*. 2023;5(1):83-100. doi:10.15575/politicon.v5i1.24158
116. Fathiraini N, Darmawan W, Ma'mur T, Fauzi WI. The vantage point of geopolitics: Capturing indonesia's maritime axis. *IOP Conference Series Earth and Environmental Science*. 2022;1089(1):12062. doi:10.1088/1755-1315/1089/1/012062

117. Afiah AN, Widiyanto AA, Yuanda B, Sulistywati E, Fatanti MN, Alam M. Resilience of Local Communities Experiencing Disaster in Lombok. Atlantis Press; 2022:78-89.
118. Reid JA, Mooney WD. Tsunami occurrence 1900–2020: A global review, with examples from Indonesia. *Pure and Applied Geophysics*. 2023;180(5):1549-1571. doi:10.1007/s00024-022-03057-1
119. Parwanto NB, Oyama T. A statistical analysis and comparison of historical earthquake and tsunami disasters in Japan and Indonesia. *International Journal of Disaster Risk Reduction*. 2014;7:122-141. doi:10.1016/j.ijdr.2013.10.003
120. Hall S, Sloan-Aagard C, Harris R, et al. Perceptions of tsunami susceptibility and self-efficacy among adolescents in Indonesia: The influence of gender, religion, location, age, hazard information source, and past experience. *International journal of disaster risk reduction*. 2022;79:103151. doi:10.1016/j.ijdr.2022.103151
121. Chad E, Hall S, Harris R, Prasetyadi C. Tsunami Preparedness in Indonesia: The WAVES Initiative. Utah Valley University; 2023. <https://www.uvu.edu/global/docs/wim22/sdg3/sdg3-chad.pdf>
122. Harris R, Major J. Waves of destruction in the East Indies: The Wichmann catalogue of earthquakes and tsunami in the Indonesian region from 1538 to 1877. *Geohazards in Indonesia: Earth Science for Disaster Risk Reduction*. 2017;441:0.
123. Lay T, Kanamori H, Ammon CJ, et al. The great Sumatra-Andaman earthquake of 26 December 2004. *Science*. 2005;308(5725):1127-1133. doi:10.1126/science.1112250
124. Statista. Risk index of natural disasters in Indonesia for mid 2023, by type. Statista. Updated 31 December 2023. Accessed 5 April, 2024. <https://www.statista.com/statistics/920857/indonesia-risk-index-for-natural-disasters/>
125. Birkmann J, Garschagen M, Mucke P, et al. *World Risk Report 2014*. 2014. 3981449541. <https://i.unu.edu/media/ehs.unu.edu/news/4070/11895.pdf>
126. Hu P, Zhang Q, Shi P, Chen B, Fang J. Flood-induced mortality across the globe: Spatiotemporal pattern and influencing factors. *The Science of the Total Environment*. 2018;643:171-182. doi:10.1016/j.scitotenv.2018.06.197
127. Consulate General of the Republic of Indonesia. Indonesia at a Glance. Consulate General of the Republic of Indonesia - Perth. Accessed 30 May 2024, <https://kemlu.go.id/perth/en/read/indonesia-at-a-glance/4195/etc-menu>
128. Andréfouët S, Paul M, Farhan AR. Indonesia's 13558 islands: A new census from space and a first step towards a One Map for Small Islands Policy. *Marine Policy*. 2022;135:104848. doi:10.1016/j.marpol.2021.104848
129. Martha S. The analysis of geospatial information for validating some numbers of islands in Indonesia. *Indonesian Journal of Geography*. 2017;49(2)doi:10.22146/ijg.12792
130. Cribb R, Ford M. Indonesia as an Archipelago: Managing Islands, Managing the Seas. In: Cribb R, Ford M, eds. *Indonesia beyond the Water's Edge: Managing an Archipelagic State*. ISEAS–Yusof Ishak Institute; 2009:1-27. *Books and Monographs*.
131. Global Facility for Disaster Reduction and Recovery. Indonesia: Natural Hazard Risk. Global Facility for Disaster Reduction and Recovery. Accessed 25 May 2024, <https://www.gfdr.org/en/indonesia>
132. Indonesian National Bureau of Statistics. Statistical Yearbook of Indonesia: 2019. The Indonesian National Bureau of Statistics. Accessed 25 July 2023,

<https://www.bps.go.id/publication/2019/07/04/daac1ba18cae1e90706ee58a/statistik-indonesia-2019.html>

133. Hapsari KA, Jennerjahn T, Nugroho SH, Yulianto E, Behling H. Sea level rise and climate change acting as interactive stressors on development and dynamics of tropical peatlands in coastal Sumatra and South Borneo since the Last Glacial Maximum. *Glob Chang Biol.* 2022;28(10):3459-3479. doi:10.1111/gcb.16131
134. Lovelock CE, Cahoon DR, Friess DA, et al. The vulnerability of Indo-Pacific mangrove forests to sea-level rise. *Nature (London).* 2015;526(7574):559-563. doi:10.1038/nature15538
135. Mehvar S, Filatova T, Syukri I, Dastgheib A, Ranasinghe R. Developing a framework to quantify potential Sea level rise-driven environmental losses: A case study in Semarang coastal area, Indonesia. *Environ Sci Policy.* 2018;89:216-230. doi:10.1016/j.envsci.2018.06.019
136. Suroso DSA, Firman T. The role of spatial planning in reducing exposure towards impacts of global sea level rise case study: Northern coast of Java, Indonesia. *Ocean & Coastal Management.* 2018;153:84-97. doi:10.1016/j.ocecoaman.2017.12.007
137. Nurhidayah L, Davies P, Alam S, Saintilan N, Triyanti A. Responding to sea level rise: Challenges and opportunities to govern coastal adaptation strategies in Indonesia. *Maritime studies.* 2022;21(3):339-352. doi:10.1007/s40152-022-00274-1
138. Institute of Southeast Asian Studies. A new classification of Indonesia's ethnic groups based on the 2010 population census. Institute of Southeast Asian Studies. Accessed 12 May, 2024. https://www.iseas.edu.sg/wp-content/uploads/pdfs/iseas_working_papers_2014_1.pdf
139. Ananta A, Nurvidya Arifin E, Sairi Hasbullah M. *Ethnic Diversity: New Demographic Evidence.* ISEAS–Yusof Ishak Institute Singapore; 2018:68-130.
140. Zein S. *Language Policy in Superdiverse Indonesia.* Routledge Studies in Sociolinguistics. Routledge; 2020.
141. Kim DW. *Religious Transformation in Modern Asia : A Transnational Movement.* Numen Book Series, Volume 148. Brill; 2015.
142. Indonesian Ministry of Home Affairs. Indonesian governance system. Indonesian Ministry of Home Affairs,. Accessed 30 May 2024, <https://simpekabpsdm.kemendagri.go.id/uploads/diklatperengkapancontoh/1/12.pdf>
143. Indonesian National Bureau of Statistics. Statistical Yearbook of Indonesia: 2023. Indonesian National Bureau of Statistics. Accessed 30 May 2024, <https://www.bps.go.id/en/publication/2023/02/28/18018f9896f09f03580a614b/statistical-yearbook-of-indonesia-2023.html>
144. Indonesian Supreme Audit Board. Indonesian National Law No. 29 of 2022 regarding the formation of Southwest Papua Province. Indonesian Supreme Audit Board. Accessed 30 May 2024, <https://peraturan.bpk.go.id/Details/38582/uu-no-6-tahun-2014>
145. Indonesian Supreme Audit Board. Indonesian National Law No. 6 of 2014 on village government administration. Indonesian Supreme Audit Board. Accessed 30 May 2024, <https://peraturan.bpk.go.id/Details/38582/uu-no-6-tahun-2014>
146. Hidayatulloh H, Erdős É, Szabó M. The intricate justice of poverty: A case of the land of gold in Papua Indonesia. *JILS (Journal of Indonesian Legal Studies).* 2022;7(2):557-584. doi:10.15294/jils.v7i2.58030
147. Hill H. *Regional Dynamics in a Decentralized Indonesia.* Indonesia update series. Institute of Southeast Asian Studies; 2014.

148. Usman S. Regional Autonomy in Indonesia: Field Experiences and Emerging Challenges. The SMERU Research Institute. Accessed 30 May 2024, <https://EconPapers.repec.org/RePEc:agg:wpaper:396>
149. Wisesa AR, Salam R. Analysis of new autonomous regional policies in Indonesia. *Influence: International Journal of Scientific Review*. 2023;5(2):297-314.
150. Achmad M, Wati R, Putranto WT. The Dynamics of Regional Autonomy in Indonesia. *Saudi Journal of Humanities and Social Sciences*. 2022;7(5):205-212.
151. World Bank. Indonesia Economic Prospects Report: Climate Action for Development. World Bank. Accessed 30 May 2024, <https://openknowledge.worldbank.org/server/api/core/bitstreams/bd24d9be-9c17-4665-add2-e38fd9e5b8fe/content>
152. World Bank. Indonesia Overview: Development news, research, data. World Bank. Accessed 5 April, 2024. <https://www.worldbank.org/en/country/indonesia/overview>
153. World Bank. Indonesia Poverty Assessment: Pathways Towards Economic Security. World Bank. Accessed 5 April, 2024. <https://www.worldbank.org/en/country/indonesia/publication/indonesia-poverty-assessment>
154. Dwirahmadi F, Rutherford S, Phung D, Chu C. Understanding the operational concept of a flood-resilient urban community in Jakarta, Indonesia, from the perspectives of disaster risk reduction, climate change adaptation and development agencies. *Int J Environ Res Public Health*. 2019;16(20)doi:10.3390/ijerph16203993
155. Farhan AR, Lim S. Resilience assessment on coastline changes and urban settlements: A case study in Seribu Islands, Indonesia. *Ocean & Coastal Management*. 2011;54(5):391-400. doi:10.1016/j.ocecoaman.2010.12.003
156. Jang S, Ekyalongo Y, Kim H. Systematic review of displacement and health impact from natural disasters in Southeast Asia. *Disaster Med Public Health Prep*. 2021;15(1):105-114. doi:10.1017/dmp.2019.125
157. Hossain M, Mani KKC, Sidik SM, Hayati KS, Rahman AKMF. Socio-demographic, environmental and caring risk factors for childhood drowning deaths in Bangladesh. *BMC Pediatr*. 2015;15:114.
158. Rahman A, Peden AE, Ashraf L, Ryan D, Bhuiyan A-A, Beerman S. Drowning: Global burden, risk factors, and prevention strategies. *Oxford Research Encyclopedia of Global Public Health*. 2021;
159. Shen J, Pang S, Schwebel DC. Cognitive and behavioral risk factors for unintentional drowning among rural chinese children. *Int J Behav Med*. 2016;23(2):243-250. doi:10.1007/s12529-015-9518-7
160. Morrongiello BA, Schell SL, Schmidt S. "Please keep an eye on your younger sister": sibling supervision and young children's risk of unintentional injury. *Inj Prev*. 2010;16(6):398-402. doi:10.1136/ip.2010.026377
161. Peden AE, Franklin RC, Pearn JH. The prevention of child drowning: The causal factors and social determinants impacting fatalities in portable pools. *Health Promot J Austr*. 2020;31(2):184-191. doi:10.1002/hpja.282
162. Wang M, Liu Y, Kang L, et al. Social and environmental risk factors for the accidental drowning of children under five in China. *BMC Public Health*. 2020;20(1):1553. doi:10.1186/s12889-020-09650-0
163. Franklin RC, Sleet DA. Injury prevention and health promotion: A global perspective. *Health Promot J Austr*. 2018;29(2):113-116. doi:10.1002/hpja.191

164. Franklin R, Scarr J. A framework for Prevention. In: Bierens JJLM, ed. *Drowning: Prevention, Rescue, Treatment*. Springer Berlin Heidelberg; 2014:153-163.
165. Sleet DA, Hopkins KN, Olson SJ. From discovery to delivery: Injury prevention at CDC. *Health Promotion Practice*. 2003;4(2):98-102. doi:10.1177/1524839902250750
166. Hanson DW, Finch CF, Allegrante JP, Sleet D. Closing the gap between injury prevention research and community safety promotion practice: Revisiting the Public Health Model. *Public Health Rep*. 2012;127(2):147-155. doi:10.1177/003335491212700203
167. Scott D, Lonne B, Higgins D. Public health models for preventing child maltreatment: Applications from the field of injury prevention. *Trauma, Violence & Abuse*. 2016;17(4):408-419. doi:10.1177/1524838016658877
168. Talbot L, Verrinder G. *Promoting Health: The Primary Health Care Approach*. Elsevier Health Sciences; 2017:30-33.
169. Richard L, Potvin L, Kishchuk N, Prlic H, Green LW. Assessment of the Integration of the Ecological Approach in Health Promotion Programs. *Am J Health Promot*. 1996;10(4):318-328. doi:10.4278/0890-1171-10.4.318
170. Wold B, Mittelmark MB. Health-promotion research over three decades: The social-ecological model and challenges in implementation of interventions. *Scandinavian Journal of Public Health*. 2018;46(20_suppl):20-26. doi:10.1177/1403494817743893
171. Golden SD, Earp JAL. Social ecological approaches to individuals and their contexts: Twenty years of Health Education & Behavior health promotion interventions. *Health Educ Behav*. 2012;39(3):364-372. doi:10.1177/1090198111418634
172. Forjuoh SN. Water safety and drowning prevention. *International Journal of Injury Control and Safety Promotion*. 2013;20(3):207-208. doi:10.1080/17457300.2013.822634
173. Hassan Md Abdullah SA, Flora MS. Risk factors for nonfatal drowning in children in rural Bangladesh: A community-based case-control study. *Ann Epidemiol*. 2014;24(9):691-692. doi:10.1016/j.annepidem.2014.06.049
174. Yang B, Lee J, Hwang JS, Kweon HM, Lee JL. Quantitative risk assessment for beach drowning management. *Journal of Coastal Research*. 2014;SI(72):117-121. doi:10.2112/SI72-022.1
175. An NT. Children and drowning in Vietnam. *Inj Prev*. 2012;18(Suppl 1):A68-A69. doi:10.1136/injuryprev-2012-040580f.26
176. Leavy JE, Crawford G, Portsmouth L, et al. Recreational drowning prevention interventions for adults, 1990–2012: A review. journal article. *J Community Health*. 2015;40(4):725-735. doi:10.1007/s10900-015-9991-6
177. Crawford G, Leavy J, Portsmouth L, et al. Development of a systematic review of public health interventions to prevent children drowning. *Open J Prev Med*. 2014;4:100-106. doi:10.4236/ojpm.2014.43014
178. Wallis BA, Watt K, Franklin RC, Taylor M, Nixon JW, Kimble RM. Interventions associated with drowning prevention in children and adolescents: systematic literature review. *Inj Prev*. 2015;21(3):195-204. doi:10.1136/injuryprev-2014-041216
179. Linnan M, Rahman A, Scarr J, et al. Child drowning: Evidence for a newly recognized cause of child mortality in low and middle income countries in Asia. *UNICEF Office of Research Working Papers*. 2012;Working Paper 2012-07(Special Series on Child Injury No. 2)doi:10.18356/6f5e0df6-en

180. Guevarra JP, Franklin RC, Basilio JA, Orbillo LL, Go JLL. Child drowning prevention in the Philippines: The beginning of a conversation. *International Journal of Injury Control and Safety Promotion*. 2015;22(3):243-253. doi:10.1080/17457300.2014.912235
181. Linnan M, Scarr J, Giersing M. Toward a world where children do not drown. *JAMA Pediatrics*. 2013;167(2):110-111. doi:10.1001/jamapediatrics.2013.948
182. Plitponkarnpim A, Chinapa M. Trend of child injury and drowning in Thailand, and child safety promotion initiative. *Southeast Asian J Trop Med Public Health*. 2014;45(Suppl 1):50-52.
183. World Health Organization. Health promotion and disease prevention through population-based interventions, including action to address social determinants and health inequity. World Health Organization. Accessed 25 May 2024, <http://www.emro.who.int/about-who/public-health-functions/health-promotion-disease-prevention.html>
184. Giles AR, Brooks-Cleator LA, Glass CTR. Barriers to sustainable health promotion and injury prevention in the Northwest Territories, Canada. In: Fondahl G, Wilson GN, eds. *Northern Sustainabilities: Understanding and Addressing Change in the Circumpolar World*. Springer International Publishing; 2017:151-162.
185. Glanz K, Bishop DB. The role of behavioral science theory in development and implementation of public health interventions. *Annu Rev Public Health*. 2010;31:399-418.
186. Etheridge JC, Sinyard RD, Brindle ME. Chapter 90 - Implementation research. In: Eitorai AEM, Bakal JA, Newell PC, Osband AJ, eds. *Translational Surgery*. Academic Press; 2023:563-573.
187. Champion VL, Skinner CS. The health belief model. *Health Behavior and Health Education: Theory, Research, and Practice*. 2008;4:45-65.
188. Subedi S, Leal Filho W, Adedeji A. An assessment of the health belief model (HBM) properties as predictors of COVID-19 preventive behaviour. *Journal of Public Health*. 2023;doi:10.1007/s10389-023-02109-7
189. Laranjo L. Chapter 6 - Social Media and Health Behavior Change. In: Syed-Abdul S, Gabarron E, Lau AYS, eds. *Participatory Health Through Social Media*. Academic Press; 2016:83-111.
190. Denehy M, Leavy JE, Jancey J, Nimmo L, Crawford G. This Much Water: A qualitative study using behavioural theory to develop a community service video to prevent child drowning in Western Australia. *BMJ Open*. 2017;7(7):e017005. doi:10.1136/bmjopen-2017-017005
191. Mokdad AH, Forouzanfar MH, Daoud F, et al. Global burden of diseases, injuries, and risk factors for young people's health during 1990-2013: A systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*. 2016;387(10036):2383-2401. doi:10.1016/S0140-6736(16)00648-6
192. Varpio L, Paradis E, Uijtdehaage S, Young M. The Distinctions between theory, theoretical framework, and conceptual framework. *Acad Med*. 2020;95(7):989-994. doi:10.1097/acm.0000000000003075
193. Green HE. Use of theoretical and conceptual frameworks in qualitative research. *Nurse Res*. 2014;21(6):34-8. doi:10.7748/nr.21.6.34.e1252
194. Macfarlane A, O'Reilly-de Brún M. Using a theory-driven conceptual framework in qualitative health research. *Qual Health Res*. 2012;22(5):607-18. doi:10.1177/1049732311431898
195. Hayes AF. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. Guilford Press; 2013:xvii, 507-xvii, 507.
196. Blum LS, Khan R, Hyder AA, Shahanaj S, El Arifeen S, Baqui A. Childhood drowning in Matlab, Bangladesh: An in-depth exploration of community perceptions and practices. *Soc Sci Med*. 2009;68(9):1720-1727. doi:10.1016/j.socscimed.2009.01.020

197. Reynolds JC, Hartley T, Michiels EA, Quan L. Long-term survival after drowning-related cardiac arrest. *The Journal of Emergency Medicine*. 2019;57(2):129-139. doi:10.1016/j.jemermed.2019.05.029
198. Szpilman D, Webber J, Quan L, et al. Creating a drowning chain of survival. *Resuscitation*. 2014;85(9):1149-1152. doi:10.1016/j.resuscitation.2014.05.034
199. Tobin JM, Ramos WD, Pu Y, Wernicki PG, Quan L, Rossano JW. Bystander CPR is associated with improved neurologically favourable survival in cardiac arrest following drowning. *Resuscitation*. 2017;115:39-43. doi:10.1016/j.resuscitation.2017.04.004
200. Australian Research Council. Engagement and Impact Assessment 2018-19: National Report. Australian Research Council,. Accessed 25 May 2024, <https://dataportal.arc.gov.au/EI/NationalReport/2018/pages/introduction/index.html?id=background>
201. Picardi CA, Masick KD. *Research Methods: Designing and Conducting Research with a Real-World Focus*. Sage Publications; 2013.
202. Creswell JW. *Research Design : Qualitative, Quantitative, and Mixed Method Approaches*. Fourth edition, international student edition. ed. SAGE Publications, Inc.; 2014.
203. Guba EG, Lincoln YS. Competing Paradigms in Qualitative Research. In: Denzin NK, Lincoln YS, eds. *Handbook of Qualitative Research*. Sage Publications, Inc; 1994:105-117.
204. Wright S, O'Brien BC, Nimmon L, Law M, Mylopoulos M. Research design considerations. *J Grad Med Educ*. 2016;8(1):97-98. doi:10.4300/JGME-D-15-00566.1
205. Toyon MAS. Explanatory sequential design of mixed methods research: Phases and challenges. *International Journal of Research In Business and Social Science*. 2021;10(5):253-260. doi:10.20525/ijrbs.v10i5.1262
206. Crotty M. *Foundations of Social Research: Meaning and Perspective in the Research Process*. 1st Edition ed. vol 12. Routledge.; 1998:72-75.
207. Bryman A. *Social Research Methods*. Oxford University Press; 2016.
208. May T, Williams M. *An Introduction to the Philosophy of Social Research*. Routledge; 2002.
209. Holmes AGD. Researcher positionality--A consideration of its influence and place in qualitative research--A new researcher guide. *Shanlax International Journal of Education*. 2020;8(4):1-10.
210. Opie C. *Doing Educational Research*. SAGE Publications Ltd; 2004. <http://digital.casalini.it/9781473914032>
211. Coghlan D, Brydon-Miller M. *The SAGE Encyclopedia of Action Research*. Sage; 2014.
212. Levers M-JD. Philosophical paradigms, grounded theory, and perspectives on emergence. *Sage Open*. 2013;3(4):2158244013517243.
213. Williamson T. *Philosophical Method: A Very Short Introduction*. Oxford University Press; 2020.
214. Creswell JW. *Qualitative Inquiry and Research Design : Choosing among Five Approaches*. 4th ed. International Student edition. ed. Qualitative Inquiry and Research Design. SAGE Publications; 2018.
215. Onwuegbuzie AJ, Tucker SA, Icenogle ML, Johnson RB. *Conducting Mixed Methods Research: Using Dialectical Pluralism and Social Psychological Strategies*. Oxford University Press; 2014. *Oxford Library of Psychology*.
216. Hanson WE, Creswell JW, Plano Clark VL, Petska KS, Creswell JD. Mixed methods research designs in counseling psychology. *J Couns Psychol*. 2005;52(2):224-235. doi:10.1037/0022-0167.52.2.224

217. Creswell JW, Clark VLP. *Designing and Conducting Mixed Methods Research*. Sage Publications; 2017.
218. Johnson RB, Onwuegbuzie AJ. Mixed methods research: A research paradigm whose time has come. *Educational Researcher*. 2004;33(7):14-26. doi:10.3102/0013189X033007014
219. Hesse-Biber SJ, Johnson RB. *The Oxford Handbook of Multimethod and Mixed Methods Research Inquiry*. 1 ed. Oxford Library of Psychology. Oxford University Press; 2015.
220. Johnson RB, Onwuegbuzie AJ, Turner LA. Toward a definition of mixed methods research. *Journal of Mixed Methods Research*. 2007;1(2):112-133. doi:10.1177/1558689806298224
221. Teddlie C, Tashakkori A. *Foundations of Mixed Methods Research: Integrating Quantitative and Qualitative Approaches in the Social and Behavioral Sciences*. Sage; 2009.
222. Arksey H, O'Malley L. Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology*. 2005;8(1):19-32. doi:<https://doi.org/10.1080/1364557032000119616>
223. Tricco AC, Lillie E, Zarin W, et al. PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Ann Intern Med*. 2018;169(7):467-473. doi:<https://doi.org/10.7326/M18-0850>
224. Rethlefsen ML, Kirtley S, Waffenschmidt S, et al. PRISMA-S: An extension to the PRISMA statement for reporting literature searches in systematic reviews. *Systematic Reviews*. 2021;10(1):39. doi:<https://doi.org/10.1186/s13643-020-01542-z>
225. McGowan J, Straus S, Moher D, et al. Reporting scoping reviews—PRISMA ScR extension. *J Clin Epidemiol*. 2020;123:177-179. doi:10.1016/j.jclinepi.2020.03.016
226. Joanna Briggs Institute. JBI Manual for Evidence Synthesis. Updated 20 March 2022. Accessed 22 January, 2023. <https://synthesismanual.jbi.global>.
227. Munn Z, Peters MDJ, Stern C, Tufanaru C, McArthur A, Aromataris E. Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Med Res Methodol*. 2018;18(1):143--143. doi:10.1186/s12874-018-0611-x
228. Pham MT, Rajić A, Greig JD, Sargeant JM, Papadopoulos A, McEwen SA. A scoping review of scoping reviews: Advancing the approach and enhancing the consistency. *Research Synthesis Methods*. 2014;5(4):371-385. doi:10.1002/jrsm.1123
229. Hapsari RI, Zenurianto M. View of flood disaster management in Indonesia and the key solutions. *American Journal of Engineering Research*. 2016;5(3):140-151.
230. Handayani W, Fisher MR, Rudiarto I, Setyono JS, Foley D. Operationalizing resilience: A content analysis of flood disaster planning in two coastal cities in Central Java, Indonesia. *International Journal of Disaster Risk Reduction*. 2019;35:101073. doi:10.1016/j.ijdrr.2019.101073
231. Isa M, Fauzi A, Susilowati I. Flood risk reduction in the northern coast of Central Java Province, Indonesia: An application of stakeholder's analysis. *Jamba (Potchefstroom, South Africa)*. 2019;11(1):660. doi:10.4102/jamba.v11i1.660
232. Buchori I, Sugiri A, Mussadun M, et al. A predictive model to assess spatial planning in addressing hydro-meteorological hazards: A case study of Semarang City, Indonesia. Article. *International Journal of Disaster Risk Reduction*. 2018;27:415-426. doi:10.1016/j.ijdrr.2017.11.003
233. Mantong A, Kembara G, Dzakwan M, Kharisma M. Maritime safety In Indonesia: Mapping the challenges and opportunities. Accessed 26 May, 2023. <https://mail.csis.or.id/publications/maritime-safety-in-indonesia-mapping-the-challenges-and-opportunities/>
234. Andry MA, Yuliani F. Implementasi kebijakan keselamatan pelayaran. *Jurnal Administrasi Pembangunan*. 2014;2(3):259-264.

235. Indonesian Ministry of Health. Accountability report: Directorate of occupational and sports health. Indonesian Ministry of Health. Updated 28 January 2020. <https://e-renggar.kemkes.go.id/file2018/e-performance/1-466467-4tahunan-527.pdf>
236. World Health Organization. Estimated general mortality rate. Accessed 30 May 2024, <https://www.who.int/data/gho/indicator-metadata-registry/imr-details/1157>
237. Centers for Disease Control and Prevention. Section 3: Mortality Frequency Measures. Accessed 30 May 2024, https://archive.cdc.gov/www_cdc_gov/csels/dsepd/ss1978/lesson3/section3.html
238. Newman SC. *Epidemiologic Methods : The Essentials*. Academic Press, an imprint of Elsevier; 2023.
239. Elwood M. *Critical Appraisal of Epidemiological Studies and Clinical Trials*. 3rd ed. Oxford Medical Publications. Oxford University Press; 2007.
240. Westreich D. *Epidemiology by Design : A Causal Approach to the Health Sciences*. 1 ed. Oxford University Press; 2019.
241. Miller AB, Goff DC, BammannDr K, Wild P. Cohort Studies. In: Ahrens W, Pigeot I, eds. *Handbook of Epidemiology*. Springer New York; 2014:259-291.
242. Valvi D, Browning S. Cohort Studies. In: Mitra AK, ed. *Statistical Approaches for Epidemiology: From Concept to Application*. Springer International Publishing; 2024:57-75.
243. Aschengrau A, Seage GR. *Essentials of Epidemiology in Public Health*. Fourth edition. ed. Jones & Bartlett Learning; 2020.
244. Woodward M. *Epidemiology: Study Design and Data Analysis*. Third edition. ed. Chapman & Hall/CRC Texts in Statistical Science. Taylor & Francis; 2014.
245. Stewart A. *Basic Statistics and Epidemiology : A Practical Guide*. Fifth edition. ed. CRC Press; 2022.
246. Kestenbaum B, Adeney KL, Weiss NS, Shoben AB. *Epidemiology and Biostatistics: An Introduction to Clinical Research*. 1st 2009. ed. Springer New York; 2009.
247. Nordström P, Ballin M, Nordström A. Risk of infection, hospitalisation, and death up to 9 months after a second dose of COVID-19 vaccine: A retrospective, total population cohort study in Sweden. *The Lancet*. 2022;399(10327):814-823. doi:10.1016/s0140-6736(22)00089-7
248. Haagsma JA, Graetz N, Bolliger I, et al. The global burden of injury: Incidence, mortality, disability-adjusted life years and time trends from the Global Burden of Disease Study 2013. *Inj Prev*. 2015;22:3–18. doi:10.1136/injuryprev-2015-041920
249. World Health Organization. WHO methods and data sources for global burden of disease estimates 2000-2019. World Health Organization. Accessed 21 February 2023, https://cdn.who.int/media/docs/default-source/gho-documents/global-health-estimates/ghe2019_daly-methods.pdf?sfvrsn=31b25009_7
250. Stevens GA, Alkema L, Black RE, et al. Guidelines for Accurate and Transparent Health Estimates Reporting: the GATHER Statement. *The Lancet*. 2016;388(10062):e19-e23. doi:10.1016/S0140-6736(16)30388-9
251. World Health Organization. Regional Office for South-East Asia. Age group codelist. World Health Organization. Regional Office for South-East Asia. Updated 2013. Accessed 16 May 2024, <https://apps.who.int/iris/handle/10665/343085>
252. Cummings P, Quan L. Trends in unintentional drowning: The role of alcohol and medical care. *JAMA*. 1999;281(23):2198-2202. doi:10.1001/jama.281.23.2198

253. Büttner P, Müller R. *Epidemiology*. 2nd ed. Oxford University Press; 2015.
254. Szklo M, Nieto FJ. *Epidemiology: Beyond the Basics*. 2nd ed. Jones and Bartlett Publishers; 2007.
255. Greenland S, Thomas DC, Morgenstern H. The rare-disease assumption revisited. A critique of "estimators of relative risk for case-control studies". *Am J Epidemiol*. 1986;124(6):869-83. doi:10.1093/oxfordjournals.aje.a114476
256. Greenland S, Thomas DC. On the need for the rare disease assumption in case-control studies. *Am J Epidemiol*. 1982;116(3):547-53. doi:10.1093/oxfordjournals.aje.a113439
257. Queiroga AC, Seabra R, Franklin RC, Peden AE. Trends in drowning mortality in Portugal from 1992 to 2019: Comparing Global Burden of Disease and national data. *Inj Prev*. 2022;28(4):318-324. doi:10.1136/injuryprev-2021-044415
258. Tran HT, Nguyen HP, Walker SM, Hill PS, Rao C. Validation of verbal autopsy methods using hospital medical records: A case study in Vietnam. *BMC Med Res Methodol*. 2018;18(1):43-43. doi:10.1186/s12874-018-0497-7
259. Cenderadewi M, Devine SG, Peden AE, Franklin RC. The burden of unintentional drowning in Indonesia: Insights from the Global Burden of Disease Study 2019. *Inj Prev*. 2024;doi:10.1136/ip-2024-045274
260. Eckensberger LH. Integrating the emic (indigenous) with the etic (universal)-A case of squaring the circle or for adopting a culture inclusive action theory perspective. *J Theory Soc Behav*. 2015;45(1):108-140. doi:10.1111/jtsb.12057
261. Morris MW, Leung K, Ames D, Lickel B. Views from inside and outside: Integrating emic and etic insights about culture and justice judgment. *The Academy of Management Review*. 1999;24(4):781-796. doi:10.2307/259354
262. Hardy C, Tolhurst D. Epistemological beliefs and cultural diversity matters in management education and learning: A critical review and future directions. *Academy of Management Learning & Education*. 2014;13(2):265-289.
263. Clarke V, Braun V. *Successful Qualitative Research: A Practical Guide for Beginners*. SAGE Publications. Inc.; 2013.
264. Hunter D, McCallum J, Howes D. Defining exploratory-descriptive qualitative (EDQ) research and considering its application to healthcare. *Journal of Nursing and Health Care*. 2019;4(1)
265. Rendle KA, Abramson CM, Garrett SB, Halley MC, Dohan D. Beyond exploratory: A tailored framework for designing and assessing qualitative health research. *BMJ Open*. 2019;9(8):e030123. doi:10.1136/bmjopen-2019-030123
266. Maxwell JA. Using qualitative methods for causal explanation. *Field methods*. 2004;16(3):243-264.
267. Indonesian National Bureau of Statistics. GDP per capita by province in Indonesia 2022. Indonesian National Bureau of Statistics. Updated 21 February 2023. Accessed 17 January 2024, <https://www.bps.go.id/id/statistics-table/3/YWtoQIRVZzNiMU5qU1VOSIRFeFZiRTR4VDJOTVVUMDkjMw==/produk-domestik-regional-bruto-per-kapita-atas-dasar-harga-berlaku-menurut-provinsi--ribu-rupiah---2022.html?year=2022>
268. Indonesian National Bureau of Statistics. Population density by province in Indonesia 2020-2022. Indonesian National Bureau of Statistics. Accessed 29 April, 2023. <https://www.bps.go.id/indicator/12/141/1/kepadatan-penduduk-menurut-provinsi.html>

269. Hadjij I, Sardou M, Missoum H, Maouche S. Flood-related deaths in Northwestern Algeria from 1966 to 2019. *Arabian Journal of Geosciences*. 2021;14(18)doi:10.1007/s12517-021-08309-3
270. Hobbs M, Hills S, Marek L, Tipton M, Barwood M. Investigating the spatial clustering of drowning events in the United Kingdom: A geospatial cross-sectional study. *Applied geography (Sevenoaks)*. 2023;158:103006. doi:10.1016/j.apgeog.2023.103006
271. Indonesian National Bureau of Statistics. Infant and under-5 mortality rates by province in Indonesia. Indonesian National Bureau of Statistics. Updated 1 February 2023. Accessed 29 April, 2024. <https://mamujukab.bps.go.id/statictable/2023/02/01/106/angka-kematian-ibu-aki-angka-kematian-bayi-akb-dan-angka-kematian-balita-akba-menurut-provinsi-hasil-long-form-sp2020.html>
272. Indonesian National Bureau of Statistics. West Nusa Tenggara's populations living below the poverty line 2021-2023. Indonesian National Bureau of Statistics. Updated 21 January 2024. Accessed 17 April, 2024. <https://ntb.bps.go.id/indicator/23/225/1/jumlah-penduduk-miskin-menurut-kab>
273. United Nations Inter-Agency Group for Child Mortality Estimation. Infant mortality rate - total for Indonesia. United Nations Inter-Agency Group for Child Mortality Estimation. Accessed 5 April, 2024. <https://childmortality.org/all-cause-mortality/data?refArea=IDN&indicator=MRYO>
274. Tsimopoulou V, Mikami T, Hossain TT, Takagi H, Esteban M, Utama NA. Uncovering unnoticed small-scale tsunamis: Field survey in Lombok, Indonesia, following the 2018 earthquakes. *Natural Hazards*. 2020;103(2):2045-2070. doi:10.1007/s11069-020-04071-z
275. Abdullah S, Flora M. Risk factors for nonfatal drowning in children in rural Bangladesh: A community-based case-control study. Original Research. *WHO South-East Asia Journal of Public Health*. 2013;2(2):88-95. doi:10.4103/2224-3151.122939
276. Borse NN, Hyder AA, Streatfield PK, Arifeen SE, Bishai D. Childhood drowning and traditional rescue measures: Case study from Matlab, Bangladesh. *Arch Dis Child*. 2011;96(7):675. doi:10.1136/adc.2010.202010
277. Rahman A, Shafinaz S, Linnan M, Rahman F. Community perception of childhood drowning and its prevention measures in rural Bangladesh: A qualitative study. *The Australian Journal of Rural Health*. 2008;16(3):176-180. doi:10.1111/j.1440-1584.2008.00969.x
278. Lukaszyc C, Mittal S, Gupta M, Das R, Ivers R, Jagnoor J. The impact and understanding of childhood drowning by a community in West Bengal, India, and the suggested preventive measures. *Acta Paediatr*. 2019;108(4):731-739. doi:<https://doi.org/10.1111/apa.14592>
279. Ames H, Glenton C, Lewin S. Purposive sampling in a qualitative evidence synthesis: A worked example from a synthesis on parental perceptions of vaccination communication. *BMC Med Res Methodol*. 2019;19(1):26-26. doi:10.1186/s12874-019-0665-4
280. Palinkas LA, Horwitz SM, Green CA, Wisdom JP, Duan N, Hoagwood K. Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research*. 2015;42(5):533-544. doi:10.1007/s10488-013-0528-y
281. Given LM. *The Sage Encyclopedia of Qualitative Research Methods*. Sage Publications; 2008.
282. Campbell S, Greenwood M, Prior S, et al. Purposive sampling: Complex or simple? Research case examples. *J Res Nurs*. 2020;25(8):652-661. doi:10.1177/1744987120927206
283. Noy C. Sampling knowledge: The hermeneutics of snowball sampling in qualitative research. *International Journal of Social Research Methodology*. 2008;11(4):327-344. doi:10.1080/13645570701401305

284. Richards L, Morse JM. *Readme First for a User's Guide to Qualitative Methods*. SAGE Publications; 2012.
285. Marcus B, Weigelt O, Hergert J, Gurt J, Gelléri P. The use of snowball sampling for multi source organizational research: Some cause for concern. *Pers Psychol*. 2017;70(3):635-673. doi:10.1111/peps.12169
286. Cohen N, Arieli T. Field research in conflict environments: Methodological challenges and snowball sampling. *Journal of Peace Research*. 2011;48(4):423-435. doi:10.1177/0022343311405698
287. Guest G, Bunce A, Johnson L. How many interviews are enough?: An experiment with data saturation and variability. *Field Methods*. 2006;18(1):59-82. doi:10.1177/1525822X05279903
288. Saunders M, Lewis P, Thornhill A. *Research Methods for Business Students*. 9 ed. Pearson Education, Limited; 2023.
289. Fusch P, Ness L. Are we there yet? Data saturation in qualitative research. *Qualitative Report*. 2015;20(9):1408. doi:10.46743/2160-3715/2015.2281
290. Braun V, Clarke V. To saturate or not to saturate? Questioning data saturation as a useful concept for thematic analysis and sample-size rationales. *Qualitative research in sport, exercise and health*. 2021;13(2):201-216. doi:10.1080/2159676X.2019.1704846
291. Krueger RA, Casey MA. *Focus Groups : A Practical Guide for Applied Research*. 5th edition. ed. SAGE; 2015.
292. Hennink MM. *Focus Group Discussions*. 1st ed. Understanding Qualitative Research. Oxford University Press; 2014.
293. Ulin PR, Robinson ET, Tolley EE. *Qualitative Methods in Public Health : A Field Guide for Applied Research*. Jossey-Bass; 2005.
294. Mayan MJ. *Essentials of Qualitative Inquiry*. Second edition. ed. Qualitative Essentials Series. Routledge; 2023.
295. Beck CT. *Routledge International Handbook of Qualitative Nursing Research*. Routledge; 2013.
296. Greenbaum TL. *Moderating Focus Groups: A Practical Guide for Group Facilitation*. 1st ed. SAGE Publications; 1999.
297. Morgan DL. *The Focus Group Guide Book*. 1st ed. SAGE; 1998.
298. Emerson RM, Fretz RI, Shaw LL. *Writing Ethnographic Fieldnotes*. University of Chicago Press; 2011.
299. Richards L. *Handling Qualitative Data: A Practical Guide*. SAGE; 2020.
300. Braun V, Clarke V. Using thematic analysis in psychology. *Qualitative Research in Psychology*. 2006;3(2):77-101.
301. Guest G, MacQueen KM, Namey EE. *Applied Thematic Analysis*. SAGE Publications; 2012.
302. Braun V, Clarke V. Toward good practice in thematic analysis: Avoiding common problems and be(com)ing a knowing researcher. *International Journal of Transgender Health*. 2023;24(1):1-6. doi:10.1080/26895269.2022.2129597
303. Braun V, Clarke V. One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qualitative Research in Psychology*. 2021;18(3):328-352. doi:10.1080/14780887.2020.1769238
304. Graneheim UH, Lindgren B-M, Lundman B. Methodological challenges in qualitative content analysis: A discussion paper. *Nurse Educ Today*. 2017;56:29-34. doi:10.1016/j.nedt.2017.06.002

305. Graneheim UH, Lundman B. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Educ Today*. 2004;24(2):105-112. doi:10.1016/j.nedt.2003.10.001
306. Gray JH, Densten IL. Integrating quantitative and qualitative analysis using latent and manifest variables. *Quality & quantity*. 1998;32(4):419-431. doi:10.1023/A:1004357719066
307. Bradshaw C, Atkinson S, Doody O. Employing a qualitative description approach in health care research. *Global Qualitative Nursing Research*. 2017;4doi:10.1177/2333393617742282
308. Raskind IG, Shelton RC, Comeau DL, Cooper HLF, Griffith DM, Kegler MC. A review of qualitative data analysis practices in health education and health behavior research. *Health Educ Behav*. 2019;46(1):32-39. doi:10.1177/1090198118795019
309. Walsh D, Downe S. Appraising the quality of qualitative research. *Midwifery*. 2006;22(2):108-119. doi:10.1016/j.midw.2005.05.004
310. Gioia DA, Corley KG, Hamilton AL. Seeking qualitative rigor in inductive research: Notes on the Gioia methodology. *Organizational Research Methods*. 2013;16(1):15-31. doi:10.1177/1094428112452151
311. Harley B, Cornelissen J. Rigor with or without templates? The pursuit of methodological rigor in qualitative research. *Organizational Research Methods*. 2022;25(2):239-261. doi:10.1177/1094428120937786
312. Thomas E, Magilvy JK. Qualitative rigor or research validity in qualitative research. *J Spec Pediatr Nurs*. 2011;16(2):151-155. doi:10.1111/j.1744-6155.2011.00283.x
313. Maher C, Hadfield M, Hutchings M, de Eyto A. Ensuring rigor in qualitative data analysis: A design research approach to coding combining NVivo with traditional material methods. *International Journal of Qualitative Methods*. 2018;17(1):160940691878636. doi:10.1177/1609406918786362
314. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care*. 2007;19(6):349-357. doi:10.1093/intqhc/mzm042
315. National Health and Medical Research Council. National Statement on Ethical Conduct in Human Research 2023. National Health and Medical Research Council,. Accessed 5 June 2024, <https://www.nhmrc.gov.au/about-us/publications/national-statement-ethical-conduct-human-research-2023>
316. Mitchell C, Giritli-Nygren K, Molestane R. *Where Am I in the Picture?: Researcher Positionality in Rural Studies*. First edition. ed. University of Toronto Press; 2024.
317. Bukamal H. Deconstructing insider–outsider researcher positionality. *British Journal of Special Education*. 2022;49(3):327-349. doi:10.1111/1467-8578.12426
318. Bucholtz M, Campbell EW, Cevallos T, et al. Researcher positionality in linguistics: Lessons from undergraduate experiences in community-centered collaborative research. *Language and Linguistics Compass*. 2023;17(4):n/a. doi:10.1111/lnc3.12495
319. Martin SB, Dandekar D. *Global South Scholars in the Western Academy: Harnessing Unique Experiences, Knowledges, and Positionality in the Third Space*. Routledge; 2021.
320. Ahlm K, Saveman B-I, Björnstig U. Drowning deaths in Sweden with emphasis on the presence of alcohol and drugs – A retrospective study, 1992–2009. journal article. *BMC Public Health*. 2013;13(1):216. doi:10.1186/1471-2458-13-216

321. World Health Organization. Global health estimates 2015: Deaths by cause, age, sex, by country and by region, 2000-2015. Accessed 21 June 2023, http://www.who.int/healthinfo/global_burden_disease/estimates/en/index1.html
322. Embassy of Indonesia for the United States of America. Indonesia: Facts and figure. Embassy of Indonesia for the United States of America. Accessed 25 July, 2019. <https://www.embassyofindonesia.org/index.php/basic-facts/>
323. United Nations. Country report of the Republic of Indonesia. United Nations Group of Experts on Geographical Names. Accessed 21 February 2022, https://unstats.un.org/unsd/geoinfo/UNGEGN/docs/1st-session/GEGN.2_2019_CRP.132_Country_Report_Indonesia_2019.pdf
324. Leavy JE, Gray C, Della Bona M, D’Orazio N, Crawford G. A review of interventions for drowning prevention among adults. *J Community Health*. 2023;48(3):539-556. doi:10.1007/s10900-023-01189-6
325. Indonesian National Disaster Management Agency. Disaster information database 1815-2023. Indonesian National Disaster Management Agency. Accessed 30 May, 2023. <https://dibi.bnppb.go.id/>
326. Kurisu A, Suga H, Prochazka Z, Suzuki K, Oguri K, Inoue T. Potential technique for improving the survival of victims of tsunamis. *PLoS One*. 2018;13(5):e0197498. doi:10.1371/journal.pone.0197498
327. Doocy S, Robinson C, Moodie C, Burnham G. Tsunami-related injury in Aceh Province, Indonesia. *Global Public Health*. 2009;4(2):205-14. doi:10.1080/17441690802472612
328. Doocy S, Rofi A, Moodie C, et al. Tsunami mortality in Aceh Province, Indonesia. *Bulletin of the World Health Organization*. 2007;85(4):273-8. doi:10.2471/BLT.06.033308
329. Muis S, Guneralp B, Jongman B, Aerts JCJH, Ward PJ. Flood risk and adaptation strategies under climate change and urban expansion: A probabilistic analysis using global data. *The Science of the Total Environment*. 2015;538:445-457. doi:10.1016/j.scitotenv.2015.08.068
330. Sari AD, Prayoga N. Enhancing citizen engagement in the face of climate change risks: A case study of the flood early warning system and health information system in Semarang City, Indonesia. *Climate Change in Cities: Innovations in Multi-Level Governance*. 2018:121-137. doi:10.1007/978-3-319-65003-6_7
331. Djalante R, Garschagen M. A review of disaster trend and disaster risk governance in Indonesia: 1900–2015. In: Djalante R, Garschagen M, Thomalla F, Shaw R, eds. *Disaster Risk Reduction in Indonesia: Progress, Challenges, and Issues*. Springer International Publishing; 2017:21-56.
332. Cenderadewi M, Franklin R, Devine S, Sari DP. 74 Fatal drowning in Indonesia: Understanding the gap of knowledge through scoping review. *Inj Prev*. 2022;28(Suppl 2):A8-A8. doi:10.1136/injuryprev-2022-safety2022.24
333. Astreani ID, Alit IBP. Tanda kardinal pemeriksaan eksternal jenasah diduga tenggelam dari data Bagian Ilmu Kedokteran Forensik RSUP Sanglah Bali tahun 2012-2014. *E-Jurnal Medika Udayana*. 2015;
334. Elsi M, Gusti D. Pengetahuan dan sikap nelayan terhadap pertolongan pertama kejadian tenggelam di Kelurahan Purus Kota Padang. *Jurnal Kesehatan Sainatika Meditory*. 2020;2(2):152-157.
335. Faradisi F, Aktifah N, Kartikasari D. Pelatihan kegawatdaruratan akibat tenggelam (henti nafas henti jantung) pada pedagang makanan di bibir Pantai Joko Tingkir Petarukan Pematang. *Jurnal Batikmu*. 2021;1(1):5-9.
336. Fernalia F, Pawilyah P, Triana N, et al. Pembentukan kelompok masyarakat terlatih water rescue di kampung binaan Segana. *Jurnal Kreativitas Pengabdian kepada Masyarakat (PKM)*. 2022;5(3):705-710. doi:10.33024/jkpm.v5i3.6195

337. Hady A, Simunati S, Dillah R, Hariani H, Yakub AS. Pengaruh metode role play terhadap peningkatan keterampilan menolong korban tenggelam pada masyarakat pesisir di Desa Tamasaju Kabupaten Takalar. *Media Keperawatan: Politeknik Kesehatan Makassar*. 2020;11(2):158-162.
338. Lesmana H, Parman DH, Alfiaanur A, Darni D. Program pemberdayaan masyarakat melalui pelatihan penanganan korban tenggelam. *JMM (Jurnal Masyarakat Mandiri)*. 2018;2(1):108-117.
339. Nugroho C, Suryono. Analisis self efficacy peserta pelatihan penanganan kegawatdaruratan pada korban balita tenggelam. *Jurnal Ilmiah Pamenang*. 2020;2(2)doi:10.53599/jip.v2i2.73.
340. Ose MI, Lesmana H, Parman DH, Tukan RA. Pemberdayaan kader dalam emergency first aid penanganan henti jantung korban tenggelam pada wilayah pesisir Tarakan. *Jurnal Pemberdayaan: Publikasi Hasil Pengabdian kepada Masyarakat*. 2020;4(1)
341. Patimah S. Pengaruh pendidikan kesehatan tentang pertolongan pertama korban tenggelam dan pelatihan BHD terhadap peningkatan pengetahuan masyarakat di Kota Jayapura. *Healthy Papua-Jurnal Keperawatan dan Kesehatan*. 2019;2(2):86-93.
342. Patimah S, Sima Y, Suryani AS. Gambaran pengetahuan dan sikap masyarakat terhadap pertolongan pertama pada penanganan korban tenggelam di Wilayah Hamadi. *Healthy Papua-Jurnal Keperawatan dan Kesehatan*. 2019;2(1):33-38.
343. Pranoto NW, Chaeroni A, Gemaini A, Irawan R. Pembelajaran water rescue pada kelompok sadar wisata di Desa Tua Pejat Kepulauan Mentawai. *Jurnal Pengabdian Masyarakat Olahraga dan Kesehatan (JASO)*. 2023;3(1):25-31.
344. Prasetyo DD. *Identifikasi tingkat pengetahuan masyarakat pesisir tentang pertolongan pertama pada kejadian tenggelam di Desa Batu Gong Kabupaten Konawi Provinsi Sulawesi Tenggara*. Politeknik Kesehatan Kementerian Kesehatan Kendari; 2017. <http://repository.poltekkes-kdi.ac.id/318/1/KTI%20DIMAS%20DWI%20PRASETYO.pdf>
345. Rosmi YF, Mardhika R, Hadi SR, Rohman U, Sumardi S, Nuryadi A. Pembelajaran water rescue sebagai tanggap awal keselamatan menghadapi banjir bagi Karang Taruna Kecamatan Benjeng, Kabupaten Gresik. *Jurnal Pengabdian pada Masyarakat*. 2020;5(3):672-680. doi:10.30653/002.202053.540
346. Sadewa YR, Nugroho S, Amajida A, Manihuruk F. Modification of water rescue tool for saving the drowned people at the swimming pool. *International Journal of Multidisciplinary Research and Analysis*. 2023;6(4)doi:10.47191/ijmra/v6-i4-13
347. Saputra AD. Studi kecelakaan kapal di Indonesia dari tahun 2003-2019 berdasarkan data investigasi Komite Nasional Keselamatan Transportasi. *Warta Penelitian Perhubungan*. 2021;33(2):87-94. doi:10.25104/warlit.v33i2.1502
348. Sillehu S, Kartika D. Hubungan peran satuan Basarnas dengan keselamatan korban tenggelam di laut pada Kantor Basarnas Kota Ambon Provinsi Maluku tahun 2015. *Global Health Science* 2018;3(3):185-190.
349. Sugiantoro MF, Wahyudi WT. Pengaruh promosi kesehatan terhadap tingkat pengetahuan dan sikap masyarakat nelayan tentang pertolongan pertama korban tenggelam air laut di Dusun Mutun Desa Sukajaya Lempasing Kabupaten Pesawaran Lampung. *Malahayati Nursing Journal*. 2021;3(3):374-385. doi:10.33024/mnj.v3i3.3155
350. Sukarna RA, Amiruddin A, Ginanjar SL. Peningkatan pengetahuan dan keterampilan kelompok pedagang tentang evakuasi korban tenggelam di Belitung. *Jurnal of Community Health Development*. 2021;2(1):72-78.
351. Suryono S, Nugroho C. Pelatihan penanganan kegawatdaruratan pada korban balita tenggelam di Desa Darungan. *Journal of Community Engagement in Health*. 2020;3(2):320-324.

352. Suwardjo D, Haluan J, Jaya I, Soen'an HP. Kajian tingkat kecelakaan fatal, pencegahan dan mitigasi kecelakaan kapal-kapal penangkap ikan yang berbasis operasi di PPP Tegalsari, PPN Pekalongan dan PPS Cilacap. *Jurnal Teknologi Perikanan dan Kelautan*. 2010;1(1):61-72.
353. Welebuntu M, Manoppo SJ, Gobel I. Gambaran pengetahuan masyarakat Kampung Kulur II mengenai pertolongan pertama pada kecelakaan laut. *Jurnal Ilmiah Sesebanua*. 2021;5(2):48-53.
354. Wulur RA. Gambaran temuan autopsi kasus tenggelam di BLU RSUD Prof. Dr. RD Kandou Manado periode Januari 2007-Desember 2011. *E-CliniC*. 2013;1(1)doi:10.35790/ecl.v1i1.3296
355. Gobel AM, Kumaat LT, Mulyadi N. Pengaruh pendidikan kesehatan tentang penanganan pertama korban tenggelam air laut terhadap peningkatan pengetahuan masyarakat nelayan di Desa Bolang Itang II Kabupaten Bolaang Mongondow Utara. *Jurnal Keperawatan*. 2014;2(2)
356. Usaputro R, Yulianti K. Karakteristik serta faktor resiko kematian akibat tenggelam berdasarkan data Bagian Ilmu Kedokteran Forensik Rumah Sakit Umum Pusat Sanglah 2010–2012. *E-Jurnal Medika Udayana*. 2013:551-561.
357. Indonesian Ministry of Health. Preventing drowning in children: A handbook. Indonesian Ministry of Health. Updated Februari 2015. Accessed 28 April 2021, <http://p2ptm.kemkes.go.id/uploads/2016/10/Buku-Saku-Pengendalian-Tenggelam-pada-Anak.pdf>
358. Indonesian Ministry of Health. National clinical practice guideline for treatment of trauma cases Indonesian Ministry of Health. Accessed 28 April 2023, https://yankes.kemkes.go.id/unduh/fileunduhan_1610422327_714480.pdf
359. Indonesian National Disaster Management Agency. News on shipping/boating accidents related to drowning. Indonesian National Disaster Management Agency. Accessed 30 May, 2023. <https://bnpb.go.id/cari/tenggelam>
360. Nadapdap LS. *Literature review: Gambaran pengetahuan masyarakat terhadap pertolongan pertama pada penanganan korban tenggelam*. Politeknik Kesehatan Kementerian Kesehatan Medan; 2021. <http://repo.poltekkes-medan.ac.id/jspui/handle/123456789/4643>
361. Widyastuti M, Rustini SA. Gambaran pengetahuan masyarakat pesisir tentang pertolongan korban tenggelam di Kenjeran Surabaya. *Prosiding HEFA (Health Events for All)*. 2017;1(1)
362. Donson H, Van Niekerk A. Unintentional drowning in urban South Africa: A retrospective investigation, 2001-2005. *International Journal of Injury Control and Safety Promotion*. 2013;20(3):218-26. doi:10.1080/17457300.2012.686041
363. Morris NK, du Toit-Prinsloo L, Saayman G. Drowning in Pretoria, South Africa: A 10-year review. *J Forensic Leg Med*. 2016;37:66-70. doi:10.1016/j.jflm.2015.10.010
364. Matzopoulos R. The national injury mortality surveillance system : A profile of fatal injuries in South Africa, 2000. *Injury and Safety Monitor*. 2002;1(1):3.
365. Schuurman N, Cinnamon J, Matzopoulos R, Fawcett V, Nicol A, Hameed SM. Collecting injury surveillance data in low- and middle-income countries: The Cape Town Trauma Registry pilot. *Global Public Health*. 2011;6(8):874-889. doi:10.1080/17441692.2010.516268
366. Reynolds TA, Bisanzo M, Dworkis D, et al. Research priorities for data collection and management within global acute and emergency care systems. *Acad Emerg Med*. 2013;20(12):1246-1250. doi:10.1111/acem.12261
367. Bennett E, Linnan M. Physical barriers. In: Bierens JJLM, ed. *Drowning: Prevention, Rescue, Treatment*. Springer Berlin Heidelberg; 2014:181-185.

368. Linnan M, Scarr J, Linnan H. Drowning prevention in low- and middle-income countries versus high-income countries. In: Bierens JJLM, ed. *Drowning: Prevention, Rescue, Treatment*. Springer Berlin Heidelberg; 2014:165-173.
369. Hyder AA, Alonge O, He S, et al. A framework for addressing implementation gap in global drowning prevention interventions: Experiences from Bangladesh. *J Health Popul Nutr*. 2014;32(4):564-576.
370. Rahman A, Miah AH, Mashreky SR, Shafinaz S, Linnan M, Rahman F. Initial community response to a childhood drowning prevention programme in a rural setting in Bangladesh. *Inj Prev*. 2010;16(1):21. doi:10.1136/ip.2008.021311
371. Stempski S, Liu L, Grow HM, et al. Everyone swims. *Health Educ Behav*. 2015;42(1_suppl):106S-114S. doi:10.1177/1090198115570047
372. Denehy M, Crawford G, Leavy J, Nimmo L, Jancey J. Formative research to develop theory-based messages for a Western Australian child drowning prevention television campaign: Study protocol. *BMJ Open*. 2016;6(5)doi:10.1136/bmjopen-2015-010033
373. Alonge O, Bishai D, Wadhvaniya S, et al. Large-scale evaluation of interventions designed to reduce childhood drownings in rural Bangladesh: A before and after cohort study. *Injury Epidemiology*. 2020;7(1):17-17. doi:10.1186/s40621-020-00245-2
374. Alfonso YN, Hyder AA, Alonge O, et al. Cost-effectiveness analysis of a large-scale crèche intervention to prevent child drowning in rural Bangladesh. *Injury Epidemiology*. 2021;8(1):61-61. doi:10.1186/s40621-021-00351-9
375. Talab A, Rahman A, Rahman F, Hossain J, Scarr J, Linnan M. 270 Survival swimming – effectiveness of swimsafe in preventing drowning in mid and late childhood. *Inj Prev*. 2016;22(Suppl 2):A99-A99. doi:10.1136/injuryprev-2016-042156.270
376. Rahman AF, Rahman A. 456 Childhood drowning prevention efforts in Bangladesh: Exemplary for LMICs. *Inj Prev*. 2022;28(Suppl 2):A69-A70. doi:10.1136/injuryprev-2022-safety2022.207
377. Guevarra JP, Peden AE, Franklin RC. Application of the PRECEDE–PROCEED model in the development of evidence-informed interventions for drowning prevention: A mixed-methods study protocol. *BMJ Open*. 2021;11(7):e050688. doi:10.1136/bmjopen-2021-050688
378. Peden A, Franklin R. Exploring flood-related unintentional fatal drowning of children and adolescents aged 0-19 years in Australia. *Safety*. 2019;5(46)doi:10.3390/safety5030046
379. Pearn J, Franklin R. Disability and drowning: Personal experiences, research, and practicalities of adapted aquatics. *International Journal of Aquatic Research and Education*. 2013;7:157-162. doi:10.25035/ijare.07.02.07
380. Roberts K, Thom O, Devine S, Leggat PA, Peden AE, Franklin RC. A scoping review of female drowning: An underexplored issue in five high-income countries. *BMC Public Health*. 2021;21(1):1072. doi:10.1186/s12889-021-10920-8
381. Clemens T, Peden AE, Franklin RC. Exploring a hidden epidemic: Drowning among adults aged 65 years and older. *J Aging Health*. 2021;33(10):828-837. doi:10.1177/08982643211014770
382. Franklin R, King J, Watt K, Aitken P, Leggat P. Media, risk, and prevention – Lessons for aquatic safety from newsworthy deaths: Precipice for prevention or just good tales? *International Journal of Aquatic Research and Education*. 2014;8:182-194. doi:10.25035/ijare.08.02.07
383. Burnay C, Anderson DI, Button C, Cordovil R, Peden AE. Infant Drowning Prevention: Insights from a New Ecological Psychology Approach. *Int J Environ Res Public Health*. 2022;19(8):1-9. doi:10.3390/ijerph19084567

384. Croft JL, Button C. Interacting factors associated with adult male drowning in New Zealand. *PLoS One*. 2015;10(6):e0130545 (1-13). doi:10.1371/journal.pone.0130545
385. Peden AE, Franklin RC, Queiroga AC. Epidemiology, risk factors and strategies for the prevention of global unintentional fatal drowning in people aged 50 Years and older: A systematic review. *Inj Prev*. 2018;24(3):240–247. doi:10.1136/injuryprev-2017-042351
386. Schumacher AE, Kyu HH, Aali A, et al. Global age-sex-specific mortality, life expectancy, and population estimates in 204 countries and territories and 811 subnational locations, 1950-2021, and the impact of the COVID-19 pandemic: A comprehensive demographic analysis for the Global Burden of Disease Study 2021. *The Lancet*. 2024;1-87. doi:10.1016/S0140-6736(24)00476-8
387. Scarr J-P, Jagnoor J. Identifying strategic priorities for advancing global drowning prevention: A Delphi Method. *BMJ Global Health*. 2023;8(9):e013303 (1-14). doi:10.1136/bmjgh-2023-013303
388. Joanknecht L, Argent AC, van Dijk M, van As AB. Childhood drowning in South Africa: Local data should inform prevention strategies. *Pediatr Surg Int*. 2015;31(2):123-130. doi:10.1007/s00383-014-3637-0
389. Cenderadewi M, Franklin RC, Fathana PB, Devine SG. Child drowning in Indonesia: Insights from parental and community perspectives and practices. *Health Promot Int*. 2024;doi:10.1093/heapro/daae113
390. Indonesian National Bureau of Statistics. Villages ('Desa') and Urban Sub-districts ('Kelurahan') in West Nusa Tenggara. Indonesian National Bureau of Statistics. Accessed 4 June, 2024. <https://data.ntbprov.go.id/dataset/jumlah-desa-dan-kelurahan-menurut-kab-kota-se-ntb>
391. Indonesian National Bureau of Statistics. West Nusa Tenggara Province in figures. Indonesian National Bureau of Statistics. Accessed 4 June, 2024. <https://ntb.bps.go.id/publication/2024/02/28/375b8367273e8c7900e8174e/provinsi-nusa-tenggara-barat-dalam-angka-2024.html>
392. Indonesian National Bureau of Statistics. Employment in West Nusa Tenggara, August 2021. Indonesian National Bureau of Statistics. Accessed 4 June, 2024. https://disnakertrans.ntbprov.go.id/wp-content/uploads/2021/12/BRSbrsInd_20211105214259-compress2.pdf
393. United Nations International Children Emergency Funds (UNICEF). Provincial snapshot: East Java. United Nations International Children's Fund (UNICEF). Accessed 3 July, 2024. https://www.unicef.org/indonesia/sites/unicef.org.indonesia/files/2019-05/East_Java_ProvincialBrief.pdf
394. Abercromby M, Leavy JE, Tohotoa J, Della Bona M, Nimmo L, Crawford G. "Go hard or go home": exploring young people's knowledge, attitudes and behaviours of alcohol use and water safety in Western Australia using the Health Belief Model. *International Journal of Health Promotion and Education*. 2021;59(3):174-191. doi:10.1080/14635240.2020.1759441
395. Tengecha NA, Alimo PK, Agyeman S, Akintunde TY, Lartey-Young G, Zhang X. Schoolchildren's inland water transport adoption barriers in Tanzania: Health belief model application. *Journal of Transport Geography*. 2022;104:103444. doi:10.1016/j.jtrangeo.2022.103444
396. Willcox-Pidgeon SM, Franklin RC, Devine S, Leggat PA, Scarr J. Reducing inequities among adult female migrants at higher risk for drowning in Australia: The value of swimming and water safety programs. *Health Promot J Austr*. 2021;32(S1):49-60. doi:10.1002/hpja.407
397. Glassman TJ, Castor T, Karmakar M, et al. A social marketing intervention to prevent drowning among inner-city youth. *Health Promotion Practice*. 2018;19(2):175-183. doi:10.1177/1524839917732559

398. Zaara MA, Belhaj A, Naceur Y, et al. Patterns of unintentional fatal drowning among children in North Tunisia :A 10-year study. *Rev Epidemiol Sante Publique*. 2022;70(1):31-37. doi:10.1016/j.respe.2021.11.020
399. Tyler MD, Richards DB, Reske-Nielsen C, et al. The epidemiology of drowning in low- and middle-income countries: A systematic review. *BMC Public Health*. 2017;17(1):1-7. doi:10.1186/s12889-017-4239-2
400. Siddiqui SA, Singh MV, Mishra N, Maurya M, Shrivastava A, Yadav RK. Buckets associated home drowning in Indian infants and toddlers: An analysis of 18 fatalities from 2016–2022. *Trop Doct*. 2023;53(4):416-418. doi:10.1177/00494755231177323
401. Kowalski K, Jeznach A, Tuokko HA. Stages of driving behavior change within the Transtheoretical Model (TM). *Journal of Safety Research*. 2014;50:17-25. doi:10.1016/j.jsr.2014.01.002
402. Peden AE, Franklin RC. Understanding lapses in supervision of children 0–4 years who drowned in Australia. *Inj Prev*. 2018;24(Suppl 2):A151. doi:10.1136/injuryprevention-2018-safety.418
403. Koon W, Brander RW, Alonzo D, Peden AE. Lessons learned from co-designing a high school beach safety education program with lifeguards and students. *Health Promot J Austr*. 2023;34(1):222-231. doi:10.1002/hpja.664
404. Clark AT, Ahmed I, Metzger S, Walker E, Wylie R. Moving from co-design to co-research: Engaging youth participation in guided qualitative inquiry. *International Journal of Qualitative Methods*. 2022;21.doi:10.1177/16094069221084793
405. Peden AE, Alonzo D, McMillan F, et al. Co-designing a farm safety gamified educational resource with secondary school students and their teachers: Qualitative study protocol. *International Journal of Qualitative Methods*. 2023;22:160940692311563. doi:10.1177/16094069231156345
406. Cenderadewi M, Franklin RC, Fathana PB, Devine SG. Preventing child drowning in Indonesia: A community-informed health promotion perspective. [Manuscript submitted for publication]. 2024;
407. Guevarra JP, Peden AE, Orbillo LL, et al. Preventing child drowning in the Philippines: The need to address the determinants of health. *Children*. 2021;8(1):29. doi:10.3390/children8010029
408. Franklin RC, Pearn JH, Peden AE. Drowning fatalities in childhood: The role of pre-existing medical conditions. *Arch Dis Child*. 2017;102(10):888-893. doi:10.1136/archdischild-2017-312684
409. Peden AE, Franklin RC. Causes of distraction leading to supervision lapses in cases of fatal drowning of children 0–4 years in Australia: A 15-year review. *J Paediatr Child Health*. 2020;56(3):450-456. doi:10.1111/jpc.14668
410. Kitzinger J. Qualitative research: Introducing focus groups. *BMJ*. 1995;311(7000):299-302. doi:10.1136/bmj.311.7000.299
411. Suominen PK, Vähätalo R. Neurologic long term outcome after drowning in children. journal article. *Scand J Trauma Resusc Emerg Med*. 2012;20(1):55. doi:10.1186/1757-7241-20-55
412. Quan LD, Mack CD, Schiff MA. Association of water temperature and submersion duration and drowning outcome. *Resuscitation*. 2014;85(6):790-794. doi:10.1016/j.resuscitation.2014.02.024
413. Quan L, Bierens JJLM, Lis R, Rowhani-Rahbar A, Morley P, Perkins GD. Predicting outcome of drowning at the scene: A systematic review and meta-analyses. *Resuscitation*. 2016;104:63-75. doi:10.1016/j.resuscitation.2016.04.006
414. Thanel F. Near drowning: Rescuing patients through education as well as treatment. *Postgrad Med*. 1998;103(6):141-153. doi:10.3810/pgm.1998.06.511

415. Cenderadewi M, Devine SG, Fathana PB, Franklin RC. "The seawater is rising!": Community perspectives on water-related disaster and drowning risks in Lombok, Indonesia. [*Manuscript in preparation*]. 2024;
416. Turgut A, Tevfik T. Floods and drowning incidents by floods. *World Applied Sciences Journal*. 2012;16(8):1158-1162.
417. Jonkman SN, Kelman I. An analysis of the causes and circumstances of flood disaster deaths. *Disasters*. 2005;29(1):75-97.
418. Peden AE, Chisholm S, Meddings DR, Abrahams J. Drowning and disasters: Climate change priorities. *The Lancet Planetary Health*. 2024;8(6):e345-e346. doi:10.1016/S2542-5196(24)00090-1
419. Alderman K, Turner LR, Tong S. Floods and human health: A systematic review. *Environ Int*. 2012;47:37-47. doi:10.1016/j.envint.2012.06.003
420. Du W, FitzGerald GJ, Clark M, Hou X-Y. Health impacts of floods. *Prehosp Disaster Med*. 2010;25(3):265-272. doi:10.1017/S1049023X00008141
421. Haque AN. Climate risk responses and the urban poor in the global South: The case of Dhaka's flood risk in the low-income settlements. *International Journal of Disaster Risk Reduction*. 2021;64:102534. doi:10.1016/j.ijdrr.2021.102534
422. United Nations Office for Disaster Risk Reduction. Sendai Framework for Disaster Risk Reduction 2015-2030. United Nations Office for Disaster Risk Reduction. Accessed 30 May 2024, <https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030>
423. Alcántara-Ayala I, Murray V, Daniels P, McBean G. International Council for Science (ICSU)—On the Future Challenges for the Integration of Science into International Policy Development for Landslide Disaster Risk Reduction. Springer International Publishing; 2017:143-154.
424. Rudiarto I, Handayani W, Wijaya HB, Insani TD. Land resource availability and climate change disasters in the rural coastal of Central Java - Indonesia. *IOP Conference Series: Earth and Environmental Science*. 2018;202(1):12029. doi:10.1088/1755-1315/202/1/012029
425. Ningsih RL, Mutaqin BW. Multi-hazard assessment under climate change in the aerotropolis coastal city of Kulon Progo, Yogyakarta – Indonesia. *Journal of Coastal Conservation*. 2024;28(1):5. doi:10.1007/s11852-023-01015-0
426. Oppenheimer M, Glavovic BC, Hinkel J, et al. Sea Level Rise and Implications for Low-Lying Islands, Coasts and Communities. In: Pörtner H-O, Roberts DC, Masson-Delmotte V, et al, eds. *The Ocean and Cryosphere in a Changing Climate: Special Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press; 2022:321-446.
427. Vinata RT, Kumala MT, Yustisia Serfiyani C. Climate change and reconstruction of Indonesia's geographic basepoints: Reconfiguration of baselines and Indonesian Archipelagic Sea lanes. *Marine Policy*. 2023;148:105443. doi:10.1016/j.marpol.2022.105443
428. Sepúlveda I, Haase JS, Liu PLF, Grigoriu M, Winckler P. Non-stationary probabilistic tsunami hazard assessments incorporating climate-change-driven sea level rise. *Earth's Future*. 2021;9(6)doi:10.1029/2021ef002007
429. Alhamid AK, Akiyama M, Ishibashi H, Aoki K, Koshimura S, Frangopol DM. Framework for probabilistic tsunami hazard assessment considering the effects of sea-level rise due to climate change. *Structural Safety*. 2022;94:102152. doi:10.1016/j.strusafe.2021.102152
430. Masih A. An enhanced seismic activity observed due to climate change; preliminary results from Alaska. *IOP Conference Series: Earth and Environmental Science*. 2018;167(1):12018. doi:10.1088/1755-1315/167/1/012018

431. Cugliari L, Cerase A, Amato A. Tsunami risk perception, a state-of-the-art review with a focus in the NEAM region. *Frontiers in Earth Science (Lausanne)*. 2022;10doi:10.3389/feart.2022.995536
432. Cerase A, Cugliari L. Something still remains: Factors affecting tsunami risk perception on the coasts hit by the Reggio Calabria-Messina 1908 event (Italy). *Sustainability*. 2023;15(3):2787. doi:10.3390/su15032787
433. Wicaksono W, Desportes I, Sopaheluwakan J. Disaster cultures and the Indonesia Tsunami Early Warning System:(mis) alignments revealed by the 2018 non-tectonic tsunami in Labuan. *The Australian Journal of Emergency Management*. 2024;39(1):34-40.
434. Global Facility for Disaster Reduction and Recovery. ThinkHazard - Nusa Tenggara Barat, Indonesia. Global Facility for Disaster Reduction and Recovery. Accessed 25 June, 2024. <https://thinkhazard.org/en/report/1528-indonesia-nusatenggara-barat/>
435. Slovic P. Perception of Risk. *Science*. 1987;236(4799):280-285. doi:10.1126/science.3563507
436. Cenderadewi M, Franklin RC, Fathana PB, Devine SG. WHO drowning prevention strategies for children: Lessons and policy implications on enablers and barriers for implementation in LMICs. [Manuscript submitted for publication]. 2024;
437. Barusch A, Gringeri C, George M. Rigor in qualitative social work research: A review of strategies used in published articles. *Soc Work Res*. 2011;35(1):11-19. doi:10.1093/swr/35.1.11
438. Wibowo M, Kongko W, Hendriyono W, Karima S. Tsunami hazard potential modeling as tourism development considerations in the north of Lombok Strait. *IOP Conference Series: Earth and Environmental Science*. 2021;832(1):12047. doi:10.1088/1755-1315/832/1/012047
439. Horspool N, Pranantyo I, Griffin J, et al. A probabilistic tsunami hazard assessment for Indonesia. *Natural Hazards and Earth System Sciences*. 2014;14(11):3105-3122. doi:10.5194/nhess-14-3105-2014
440. Zhao B, Liao H, Su L. Landslides triggered by the 2018 Lombok earthquake sequence, Indonesia. *Catena (Giessen)*. 2021;207:105676. doi:10.1016/j.catena.2021.105676
441. Australian Institute for Disaster Resilience. The Surf Emergency Response System evaluated and improved. Accessed 30 June 2024, <https://knowledge.aidr.org.au/resources/ajem-jan-2016-the-surf-emergency-response-system-evaluated-and-improved/>
442. Surf Life Saving Australia. Tasmania chosen for Surf Life Saving Australia's Flood and Swift Water Rescue National Centre of Excellence. Accessed 30 June 2024, <https://sls.com.au/tasmania-chosen-for-surf-life-saving-australias-flood-swift-water-rescue-national-centre-of-excellence/>
443. Couling M. Tsunami risk perception and preparedness on the east coast of New Zealand during the 2009 Samoan Tsunami warning. *Natural hazards*. 2014;71:973-986. doi:10.1007/s11069-013-0945-y
444. Johnston D, Paton D, Crawford GL, Ronan K, Houghton B, Bürgelt P. Measuring tsunami preparedness in coastal Washington, United States. *Natural Hazards*. 2005;35:173-184. doi:10.1007/s11069-004-2419-8
445. Paton D, Smith L, Johnston D. When good intentions turn bad: Promoting natural hazard preparedness. *Australian Journal of Emergency Management*. 2005;20(1):25-30.
446. Kusumastuti RD, Arviansyah A, Nurmala N, Wibowo SS. Knowledge management and natural disaster preparedness: A systematic literature review and a case study of East Lombok, Indonesia. *International Journal of Disaster Risk Reduction*. 2021;58:102223. doi:10.1016/j.ijdr.2021.102223

447. Hall S, Pettersson J, Meservy W, et al. Awareness of tsunami natural warning signs and intended evacuation behaviors in Java, Indonesia. *Natural Hazards*. 2017;89:473-496. doi:10.1007/s11069-017-2975-3
448. Kang B-A, Barnett DJ, Chhipa U-e-A, et al. The role of self-efficacy and risk perception in the willingness to respond to weather disasters among emergency medicine health care workers in Pakistan. *Disaster Med Public Health Prep*. 2023;17:e461. e461. doi:10.1017/dmp.2023.126
449. Amato A. Some reflections on tsunami Early Warning Systems and their impact, with a look at the NEAMTWS. *Bollettino di Geofisica Teorica ed Applicata*. 2020;doi:10.4430/bgta0329
450. Lindell MK, Prater CS. Tsunami preparedness on the Oregon and Washington coast: Recommendations for research. *Natural Hazards Review*. 2010;11(2):69-81. doi:10.1061/(ASCE)1527-6988(2010)11:2(69)
451. Wei Y, Chamberlin C, Titov VV, Tang L, Bernard EN. Modeling of the 2011 Japan Tsunami: Lessons for Near-Field Forecast. *Pure and Applied Geophysics*. 2013;170(6):1309-1331. doi:10.1007/s00024-012-0519-z
452. Sufri S, Dwirahmadi F, Phung D, Rutherford S. Enhancing community engagement in disaster early warning system in Aceh, Indonesia: opportunities and challenges. *Natural Hazards*. 2020;103(3):2691-2709.
453. Sufri S, Dwirahmadi F, Phung D, Rutherford S. Progress in the early warning system in Aceh province, Indonesia since the 2004 earthquake-tsunami. *Environmental Hazards*. 2020;19(5):463-487.
454. Rafliana I, Jalayer F, Cerase A, et al. Tsunami risk communication and management: Contemporary gaps and challenges. *International Journal of Disaster Risk Reduction*. 2022;70:102771. doi:10.1016/j.ijdr.2021.102771
455. Selva J, Lorito S, Volpe M, et al. Probabilistic tsunami forecasting for early warning. *Nature Communications*. 2021;12(1):5677. doi:10.1038/s41467-021-25815-w
456. Rahayu HP, Comfort LK, Haigh R, Amaratunga D, Khoirunnisa D. A study of people-centered early warning system in the face of near-field tsunami risk for Indonesian coastal cities. *International Journal of Disaster Resilience in the Built Environment*. 2020;11(2):241-262.
457. Federal Emergency Management Agency. Are You Ready? An In-Depth Guide to Citizen Preparedness. Federal Emergency Management Agency. Accessed 30 May 2024, <https://www.ready.gov/sites/default/files/2021-11/are-you-ready-guide.pdf>
458. Federal Emergency Management Agency. Improving Public Messaging for Evacuation and Shelter-in-Place. Federal Emergency Management Agency. Accessed 30 May 2024, https://www.fema.gov/sites/default/files/documents/fema_improving-public-messaging-for-evacuation-and-shelter-in-place_literature-review-report.pdf
459. United States Department of Homeland Security. Planning Considerations: Evacuation and Shelter-in-Place. United States Department of Homeland Security. Accessed 30 May 2024, <https://www.fema.gov/sites/default/files/2020-07/planning-considerations-evacuation-and-shelter-in-place.pdf>
460. International Federation of Red Cross and Red Crescent Societies. Public awareness and public education for disaster risk reduction: Action-oriented key messages for households and schools. International Federation of Red Cross and Red Crescent Societies. Accessed 30 May 2024, <https://www.ifrc.org/sites/default/files/PAPE-2.0-English.pdf>
461. Boston M, Bernie D, Brogden L, et al. Community resilience: A multidisciplinary exploration for inclusive strategies and scalable solutions. *Resilient Cities and Structures*. 2024;3(1):114-130. doi:10.1016/j.rcns.2024.03.005

462. Borie M, Pelling M, Ziervogel G, Hyams K. Mapping narratives of urban resilience in the global south. *Global Environmental Change*. 2019;54:203-213. doi:10.1016/j.gloenvcha.2019.01.001
463. Federal Emergency Management Agency. Community Emergency Response Team (CERT). Federal Emergency Management Agency. Accessed 30 May 2024, <https://www.fema.gov/emergency-managers/individuals-communities/preparedness-activities-webinars/community-emergency-response-team>
464. Ludin SM, Rohaizat M, Arbon P. The association between social cohesion and community disaster resilience: A cross-sectional study. *Health & Social Care in the Community*. 2019;27(3):621-631. doi:10.1111/hsc.12674
465. Haque AKE, Mukhopadhyay P, Nepal M, Shammin R. *Climate Change and Community Resilience Insights from South Asia*. Springer; 2021.
466. Stockholm Resilience Center. Applying resilience thinking: Seven principles for building resilience in social-ecological systems. Stockholm Resilience Center. Accessed 30 May 2024, <https://www.stockholmresilience.org/download/18.10119fc11455d3c557d6928/1459560241272/SR C+Applying+Resilience+final.pdf>
467. Royal Life Saving - Australia. National Drowning Report 2023. Accessed 30 May 2024, https://www.royallifesaving.com.au/data/assets/pdf_file/0009/76824/National_Drowning_Report_2023.pdf
468. Clemens T, Moreland B, Mack KA, Thomas K, Bergen G, Lee R. Vital Signs: Drowning Death Rates, Self-Reported Swimming Skill, Swimming Lesson Participation, and Recreational Water Exposure — United States, 2019–2023. Centers for Disease Control and Prevention. Accessed 30 May 2024, <https://www.cdc.gov/mmwr/volumes/73/wr/mm7320e1.htm>
469. Willcox-Pidgeon S, Franklin R, Leggat P, Devine S, Scarr J. 8B.003 The value of drowning prevention programs for 'high-risk' populations in Australia. *Inj Prev*. 2021;27(Suppl 2):A63-A64. doi:10.1136/injuryprev-2021-safety.193
470. Carswell E. *tiič-mal-Ni: Sharing Drowning Prevention with Nuu-chah-nulth First Nations*. M.A. Royal Roads University (Canada); 2018. <https://www.proquest.com/docview/2049786474/abstract?parentSessionId=Qgwwvtvx0aXmbA4w6KJAvR%2Bm0PMC2saSjnS83cxlxv2c%3D&pq-origsite=primo&accountid=16285&sourcetype=Dissertations%20%20Theses>
471. Willcox-Pidgeon S, Franklin RC, Leggat PA, Devine S. Epidemiology of unintentional fatal drowning among migrants in Australia. *Aust N Z J Public Health*. 2021;45(3):255-262. doi:10.1111/1753-6405.13102
472. Kok G, Gottlieb NH, Commers M, Smerecnik C. The ecological approach in health promotion programs: A decade later. *Am J Health Promot*. 2008;22(6):437-441. doi:10.4278/ajhp.22.6.437
473. Prochaska JO, DiClemente CC. Self change processes, self efficacy and decisional balance across five stages of smoking cessation. *Prog Clin Biol Res*. 1984;156:131-40.
474. Bird EL, Baker G, Mutrie N, Ogilvie D, Sahlqvist S, Powell J. Behavior change techniques used to promote walking and cycling: A systematic review. *Health Psychol*. 2013;32(8):829-838. doi:10.1037/a0032078
475. Siu G, Batte A, Tibingana B, Otwombe K, Sekiwunga R, Paichadze N. Mothers' perception of childhood injuries, child supervision and care practices for children 0–5 years in a peri-urban area in Central Uganda: Implications for prevention of childhood injuries. *Injury Epidemiology*. 2019;6(1):34-7. doi:10.1186/s40621-019-0211-1

476. Mahony A, Scarr J. 1B.002 Reducing drowning in Australia: Analysing progress against the Australian water safety strategy. *Inj Prev.* 2021;27(Suppl 2):A2-A2. doi:10.1136/injuryprev-2021-safety.5
477. Peden A, Franklin R, Leggat P, Scarr J. 1B.001 Mapping policy and programmatic impacts of embedded research: A drowning prevention case-study. *Inj Prev.* 2021;27(Suppl 2):A2-A2. doi:10.1136/injuryprev-2021-safety.4
478. Gerdmongkolgan S, Ekchaloemkiet S. 269 Evolution of the child drowning prevention programme in Thailand. *Inj Prev.* 2016;22(Suppl 2):A98. doi:10.1136/injuryprev-2016-042156.269
479. Bugeja L, Ibrahim JE, Ferrah N, Murphy B, Willoughby M, Ranson D. The utility of medico-legal databases for public health research: A systematic review of peer-reviewed publications using the National Coronial Information System. *Health Research Policy and Systems.* 2016;14(1):28-28. doi:10.1186/s12961-016-0096-1
480. Holder Y, McCaw-Binns A. The value of multi-source data harvesting for injury mortality data: The Jamaican experience. *Inj Prev.* 2012;18(Suppl 1):A81-A81. doi:10.1136/injuryprev-2012-040580g.29
481. Burrows S, Laflamme L. Assessment of accuracy of suicide mortality surveillance data in South Africa: Investigation in an urban setting. *Crisis : the journal of crisis intervention and suicide prevention.* 2007;28(2):74-81. doi:10.1027/0227-5910.28.2.74
482. Cenderadewi M, Franklin RC, Peden AE, Devine S. Pattern of intentional drowning mortality: A total population retrospective cohort study in Australia, 2006–2014. journal article. *BMC Public Health.* 2019;19(1):207. doi:10.1186/s12889-019-6476-z
483. Erskine KL, Armstrong EJ. *Water-Related Death Investigation : Practical Methods and Forensic Applications.* Second edition. ed. CRC Press; 2021.
484. Kipsaina C, Ozanne-Smith J, Bartolomeos K, Routley V. Mortuary based injury surveillance for low-mid income countries: Process evaluation of pilot studies. *Injury.* 2015;46(8):1509-1514. doi:10.1016/j.injury.2015.06.005
485. Wallis BA, Watt K, Franklin RC, Nixon JW, Kimble RM. Drowning mortality and morbidity rates in children and adolescents 0-19yrs: A population-based study in Queensland, Australia. *PLoS One.* 2015;10(2):e0117948. doi:10.1371/journal.pone.0117948
486. Onie S, Usman Y, Widyastuti R, et al. Indonesia's first suicide statistics profile: an analysis of suicide and attempt rates, underreporting, geographic distribution, gender, method, and rurality. *The Lancet Regional Health - Southeast Asia.* 2024;22:100368-100368. doi:10.1016/j.lansea.2024.100368
487. Onie S, Vina A, Taufik K, et al. Indonesian first national suicide prevention strategy: Key findings from the qualitative situational analysis. *The Lancet Regional Health - Southeast Asia.* 2023;16doi:10.1016/j.lansea.2023.100245
488. Coronado VG, Haileyesus T, Cheng TA, et al. Trends in sports- and recreation-related traumatic brain injuries treated in US emergency departments: The national electronic injury surveillance system-all injury program (NEISS-AIP) 2001-2012. *The Journal of Head Trauma Rehabilitation.* 2015;30(3):185-197. doi:10.1097/htr.0000000000000156
489. Jagnoor J, Ponnaiah M, Varghese M, et al. Potential for establishing an injury surveillance system in India: A review of data sources and reporting systems. *BMC Public Health.* 2020;20(1):1909-9. doi:10.1186/s12889-020-09992-9
490. Streatfield PK, Khan WA, Bhuiya A, et al. Mortality from external causes in Africa and Asia: Evidence from INDEPTH Health and Demographic Surveillance System Sites. *Global health action.* 2014;7(1):25366-10. doi:10.3402/gha.v7.25366

491. Lunetta P, Tiirikainen K, Smith GS, Penttilä A, Sajantila A. How well does a national newspaper reporting system profile drowning? *International Journal of Injury Control and Safety Promotion*. 2006;13(1):35-41. doi:10.1080/17457300500131764
492. Hossain MJ, Al-Mamun M, Alam M, Khatun MR, Sarker MMR, Islam MR. Child drownings in Bangladesh: Need for action. *BMJ Paediatr Open*. 2022;6(1)doi:10.1136/bmjpo-2022-001464
493. Friman M, Huck J, Olsson LE. Transtheoretical Model of change during travel behavior interventions: An integrative review. *Int J Environ Res Public Health*. 2017;14(6):581. doi:10.3390/ijerph14060581
494. Nisbet EKL, Gick ML. Can health psychology help the planet? Applying theory and models of health behaviour to environmental actions. *Canadian Psychology*. 2008;49(4):296-303. doi:10.1037/a0013277
495. Smith J, Clemens T, Macpherson A, Pike I. Public response on social media to a social marketing campaign for influencing attitudes towards boating safety. *Int J Environ Res Public Health*. 2021;18(12):6504. doi:10.3390/ijerph18126504
496. Calverley HLM, Petrass LA, Blitvich JD, Nash R. Respecting alcohol, respecting the water: Young adult perspectives on how to reduce alcohol-influenced drownings in Australia. *Health Promot J Austr*. 2021;32(S2):218-228. doi:10.1002/hpja.449
497. Peden AE, Williamson S, Fozard F, Hanly M, Möller H. The effect of the 'Swim Reaper' program on water safety awareness, drowning mortality and morbidity among males aged 15–34 years in Aotearoa, New Zealand. *Journal of Safety Research*. 2024;88:190-198. doi:10.1016/j.jsr.2023.11.006
498. Pino J, Domínguez AM, García A, García I, González I. PW 1697 Impact of drowning prevention campaign #stopahogados. *Inj Prev*. 2018;24(Suppl 2):A154. doi:10.1136/injury-prevention-2018-safety.425
499. Leavy JE, Crawford G, Bona MD, Nimmo L, Jancey J. PW 0287 0 through 5 years: an evaluation of kids drowning prevention program keep watch in western australia. *Inj Prev*. 2018;24(Suppl 2):A148. doi:10.1136/injury-prevention-2018-safety.411
500. Morrongiello BA, Zdzieborski D, Sandomierski M, Lasenby-Lessard J. Video messaging: What works to persuade mothers to supervise young children more closely in order to reduce injury risk? *Soc Sci Med*. 2009;68(6):1030-1037. doi:10.1016/j.socscimed.2008.12.019
501. Ricketts M, Shanteau J, McSpadden B, Fernandez-Medina KM. Using stories to battle unintentional injuries: Narratives in safety and health communication. *Soc Sci Med*. 2010;70(9):1441-1449. doi:10.1016/j.socscimed.2009.12.036
502. Schwamberger B, Wahl-Alexander Z. Children's activity levels and lesson context during summer swim instruction. *The Physical Educator*. 2016;73(4):733-744. doi:10.18666/TPE-2016-V73-I4-6977
503. Lee J, Kim J. Development of survival swimming curriculum for prevention of drowning: Delphi method. *Journal of Coastal Research*. 2019;91(sp1):196-200. doi:10.2112/SI91-040.1
504. Lynch T. Australian aquatic curriculum reform: Treading water carefully? *International Journal of Aquatic Research and Education*. 2015;9(2):201-213. doi:10.1123/ijare.2015-0005
505. Yong-Sun L, Se-Chang K. Examining the role of swimming and Water Safety Education Curriculums (SWSCs) in Korean Physical and Health Education Programs. *Journal of Coastal Research*. 2024;116(sp1):473-473. doi:10.2112/JCR-SI116-096.1

506. Taylor DH, Peden AE, Franklin RC. Next steps for drowning prevention in rural and remote Australia: A systematic review of the literature. *The Australian Journal of Rural Health*. 2020;28(6):530-542. doi:10.1111/ajr.12674
507. Hyder AA, Borse NN, Blum L, Khan R, El Arifeen S, Baqui AH. Childhood drowning in low- and middle-income countries: Urgent need for intervention trials. *J Paediatr Child Health*. 2008;44doi:10.1111/j.1440-1754.2007.01273.x
508. Sangkarit N, Tapanya W, Panmatchaya C, Sangpasit A, Thatawong K. Effects of 4 weeks of play in standing and walking on gross motor ability and segmental trunk control in preterm infants using a playpen: A randomized control trial. *Early Hum Dev*. 2024;198:106121. doi:10.1016/j.earlhumdev.2024.106121
509. Rosenbaum J, Tenaw E, Clemmer R, Israel M, Albert J. Exploring the use and appeal of playpens to protect infants from exposure to animals, animal feces, and dirt in rural Ethiopia. *Am J Trop Med Hyg*. 2021;104(1):346-356. doi:10.4269/ajtmh.20-0445
510. Agrawal P, Nair D, Salam SS, Islam MI, Hamadani JD, Alonge O. Does long-term enrollment in day-care maintain or increase early developmental gains—Findings from an intervention study in rural Bangladesh. *Children*. 2022;9(7):929. doi:10.3390/children9070929
511. Nair D, Alonge O, Derakhshani Hamadani J, Sharmin Salam S, Islam I, Hyder AA. Developmental assessments during injury research: Is enrollment of very young children in crèches associated with better scores? *Int J Environ Res Public Health*. 2017;14(10):1130.
512. Hyder A, Alonge O, He S, et al. Saving of children's lives from drowning project in Bangladesh. *Am J Prev Med*. 2014;47(6):842-845. doi:10.1016/j.amepre.2014.07.050
513. Richter LM, Daelmans B, Lombardi J, et al. Investing in the foundation of sustainable development: Pathways to scale up for early childhood development. *The Lancet*. 2017;389(10064):103-118.
514. Beattie NJ, Shaw P, Larson A. Water safety in the bush: Strategies for addressing training needs in remote areas. *Rural and Remote Health*. 2008;8(855)
515. Williams J, McMillan F, Peden AE. Yarning about river safety: A qualitative study exploring water safety beliefs and practices for First Nations People. *Health Promot J Austr*. 2023;doi:10.1002/hpja.792
516. Matthews B, Grace S. Drowning prevention in culturally and linguistically diverse communities. *Inj Prev*. 2012;18(Suppl 1):A135-A136. doi:10.1136/injuryprev-2012-040590h.14
517. Quan L. Risk Factors for Drowning: Culture and Ethnicity. In: Bierens J, ed. *Drowning Prevention, Rescue, Treatment*. Springer Berlin Heidelberg; 2004:127-130.
518. Woods M, Koon W, Brander RW. Identifying risk factors and implications for beach drowning prevention amongst an Australian multicultural community. *PLoS One*. 2022;17(1):e0262175-e0262175. doi:10.1371/journal.pone.0262175
519. Moran K, Willcox S. Water safety practices and perceptions of "new" New Zealanders. *International Journal of Aquatic Research and Education*. 2013;7(2):136-146.
520. Tsuchiya-Ito R, Iwarsson S, Slaug B. Environmental challenges in the home for ageing societies: a Comparison of Sweden and Japan. *J Cross Cult Gerontol*. 2019;34(3):265-289. doi:10.1007/s10823-019-09384-6
521. Tochihara Y. A review of Japanese-style bathing: Its demerits and merits. *J Physiol Anthropol*. 2022;41(1):5--5. doi:10.1186/s40101-022-00278-0

522. Chang Seng DS. Tsunami resilience: Multi-level institutional arrangements, architectures and system of governance for disaster risk preparedness in Indonesia. *Environ Sci Policy*. 2013;29:57-70. doi:10.1016/j.envsci.2012.12.009
523. Bronfenbrenner U. *The Ecology of Human Development: Experiments by Nature and Design*. Harvard University Press; 1979.
524. Frier A, Devine S, Barnett F, McBain-Rigg K, Dunning T. Improving type 2 diabetes care and self-management at the individual level by incorporating social determinants of health. *Aust N Z J Public Health*. 2022;46(6):865-871. doi:10.1111/1753-6405.13296
525. Baron-Epel O, Ivancovsky M. A socio-ecological model for unintentional injuries in minorities: a case study of Arab Israeli children. *International Journal of Injury Control and Safety Promotion*. 2015;22(1):48-56. doi:10.1080/17457300.2013.855794

Appendices

Appendix 1: Peer-Reviewed Publication – ‘Fatal Drowning in Indonesia: Understanding Knowledge Gaps Through a Scoping Review’

Cenderadewi M, Devine SG, Sari DP, Franklin RC. Fatal drowning in Indonesia: Understanding knowledge gaps through a scoping review. *Health Promotion International*. 2023;38(5):daad130 (1-22). doi:10.1093/heapro/daad130

Article

Fatal drowning in Indonesia: understanding knowledge gaps through a scoping review

Muthia Cenderadewi^{1,2,*}, Susan G. Devine¹, Dian Puspita Sari², and Richard C. Franklin^{1,3}

¹College of Public Health, Medical and Veterinary Sciences, James Cook University, Bebegu Yumba Campus, Douglas, QLD 4811, Australia

²Medical Faculty, University of Mataram, Mataram, West Nusa Tenggara 83126, Indonesia

³Royal Life Saving Society – Australia, Broadway, NSW 2007, Australia

*Corresponding author. E-mail: muthia.cenderadewi@myjcu.edu.au

Abstract

Little is known about unintentional drowning deaths in Indonesia, the world's fourth most populous and largest archipelagic country. This study aimed to describe the epidemiology and risk factors of unintentional drowning in Indonesia and explore existing health promotion and drowning prevention approaches in Indonesia within a socio-ecological health promotion framework. A scoping review, guided by PRISMA-ScR, was conducted to locate peer-reviewed studies and government reports/policy documents published until May 2023, in English or Indonesian language, using MEDLINE (Ovid), CINAHL, Informat, PsycINFO (ProQuest), Scopus, SafetyLit, BioMed Central and Google Scholar, Indonesian journal databases (Sinta, Garuda) and government agencies websites around the terms: drown, swim, flood, hurricane, cyclone, disaster, water rescue and maritime/boat safety. This review identified 32 papers. However, a paucity of information on unintentional drowning rates, risk factors and prevention in Indonesia was noted. The unavailability of a coordinated national drowning data collection system in Indonesia, from which national and subnational subcategory data can be collected, underlines the possibility of under-representation of drowning mortality. The association between various exposures and drowning incidents has not been fully investigated. An over-reliance on individual-focused, behaviour-based, preventive measures was observed. These findings highlight the need for improving drowning surveillance to ensure the availability and reliability of drowning data; and strengthening research to understand the risk factors for drowning and delivery of drowning prevention programs. Further policy development and research focusing on health promotion approaches that reflect a socio-ecological approach to drowning prevention in Indonesia is imperative.

Keywords: Drowning, prevention, risk factors, epidemiology, injury, health promotion, health policy, health promoting policies, evidence-based health promotion, low- and middle-income countries, Indonesia

BACKGROUND

Drowning is the third leading cause of death by unintentional injury worldwide, after road injury and falls (Ahlm *et al.*, 2013; World Health Organization, 2014, 2016; Mokdad *et al.*, 2016; Franklin *et al.*, 2020). Most drowning deaths worldwide (91%, or 337,240 drowning deaths) occurred in low- and middle-income countries (LMICs), particularly in Southeast Asia (35%, or 130,149 drowning deaths), underlining the importance of providing reliable information on

unintentional drowning deaths to inform the development, implementation and evaluation of drowning prevention interventions and policy within countries in this region (World Health Organization, 2014). However, understanding of unintentional drowning deaths in Indonesia, the world's largest archipelagic and fourth most populous country with high numbers of meteorological and hydrological events, is limited (Cenderadewi *et al.*, 2020). To address the global burden of drowning, effective health promotion approaches which address drowning at all levels

© The Author(s) 2023. Published by Oxford University Press.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<https://creativecommons.org/licenses/by/4.0/>), which permits unrestricted reuse, distribution, and reproduction in any medium, provided the original work is properly cited.

Contribution to Health Promotion

- By upholding concepts of health promotion, this review may inform the international health promotion community on potential challenges of drowning prevention efforts in resource-limited settings.
- The over-reliance on educational interventions aimed at individuals and the limited availability of population-focused drowning prevention measures is observed in Indonesia.
- The research area of community participation in creating safe environment and evidence-informed water safety and drowning prevention-related policy development is relatively neglected in Indonesia.
- A demand for further research focused on policy formulation, implementation and evaluation to prevent drowning across low- and middle-income countries is apparent.

will be required, and comprehensive information on drowning incidents, including in Indonesia, is vital for the planning and implementation of relevant prevention approaches.

Indonesia is one of the world's most natural disaster-prone areas and is at risk from multiple hazards, including floodings, landslides, earthquakes, tsunamis, volcanic activities and tropical cyclones (Global Facility for Disaster Reduction and Recovery, 2019). Indonesia is also the largest archipelagic state worldwide, consisting of 16 056 islands, extending 5150 kilometres between the Indian and Pacific Oceans (Global Facility for Disaster Reduction and Recovery, 2019; Indonesian National Bureau of Statistics, 2019; United Nations, 2019; Embassy of Indonesia for the United States of America, 2019). Understanding the potential contribution of water transport-related and disaster-related drowning deaths in Indonesia on top of the rate of unintentional drowning will be important, as they are often left out of studies on drowning worldwide (Sindall *et al.*, 2022).

The prevention of drowning encompasses a wide range of measures, ranging from individual-focused approaches, such as swimming training programmes, to community-based actions, such as community participation in controlling access to open water bodies, policy development on water safety regulations and providing equitable access to safe drinking water (Crawford *et al.*, 2014; Leavy *et al.*, 2015, 2016, 2023). This emphasizes the urgent need for cohesive approaches across the spectrum of upstream, mid-stream, and downstream drowning prevention (Linnan

et al., 2012, 2013; World Health Organization, 2014; Guevarra *et al.*, 2015; Leavy *et al.*, 2023).

Drowning prevention is closely linked to health and safety promotion (Plitponkarnpim and Chinapa, 2014). By connecting drowning prevention and health promotion, a broader understanding of drowning prevention can be achieved, which includes the process of empowering individuals and communities in taking control over their own health-related behaviours and practices (Leavy *et al.*, 2016, 2023; Giles *et al.*, 2017; World Health Organization Regional Office for the Eastern Mediterranean, 2017). Talbot and Verrinder (2017) illustrated the concepts of health promotion in the Health Promotion Framework, which comprises of (i) medical approaches, focusing on individual risk assessment and health information; (ii) behavioural approaches, focusing on health education, skills development and social marketing; and (iii) socio-environmental approaches, focusing on increasing cross-sector partnerships and community capacity, including community action, community participation, structural change, policy development and review and economic and regulatory activities. This framework will be used throughout this review to assess gaps in drowning prevention approaches in Indonesia (Talbot and Verrinder, 2017).

Research aims

This review aimed to describe the epidemiology and risk factors of unintentional drowning in Indonesia and explore health promotion and prevention approaches currently in place.

Research questions

This study answered the following questions:

1. What information is available on fatal unintentional drowning mortality numbers and rates in Indonesia?
2. What is known about risk factors for unintentional drowning in Indonesia?
3. What prevention and health promotion approaches are currently being used in Indonesia to reduce unintentional drowning deaths?
4. How can the Health Promotion Framework (Talbot and Verrinder, 2017) be applied to inform strategy development to prevent unintentional drowning Indonesia?

METHODS

This review was conducted using a scoping review methodology guided by the Arksey and O'Malley methodological framework, Joanna Briggs Institute (JBI) guideline, and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for

Scoping Reviews (PRISMA-ScR) (Arksey and O'Malley, 2005; Tricco *et al.*, 2018; Joanna Briggs Institute, 2020; McGowan *et al.*, 2020; Rethlefsen *et al.*, 2021). Scoping review methodology was selected to explore characteristics of unintentional drowning in Indonesia, a little studied area of interest, and to map evidence from both research and non-research sources, providing a comprehensive overview on unintentional drowning in Indonesia and knowledge gaps for subsequent evidence syntheses (Joanna Briggs Institute, 2020).

Search strategy

A systematic search was conducted in May 2023 to identify relevant literature for all categories of unintentional drowning published to this date. Eight databases were searched including MEDLINE (Ovid), CINAHL, Informit, PsycINFO (ProQuest), Scopus, SafetyLit, BioMed Central and Google Scholar; along with two Indonesian journal databases (Sinta and Garuda); and websites of Indonesian government agencies identified in previous studies as the most important actors for documenting drowning events and undertaking drowning prevention in Indonesia, including for disaster- and water transport-related drowning: (i) Ministry of Health; (ii) Ministry of Education, Culture, Research, and Technology; (iii) Ministry of Marine Affairs and Fisheries; (iv) Ministry of Transportation; (v) National Disaster Management Agency and (vi) National Search and Rescue Agency (Andry and Yuliani, 2014; Hapsari and Zenurianto, 2016; Buchori *et al.*, 2018; Handayani *et al.*, 2019; Isa *et al.*, 2019; Indonesian Ministry of Health, 2020; Mantong *et al.*, 2020). The searches were undertaken in English and Indonesian language, using the most relevant and exhaustive search terms, in accordance with each database utilized (for details on search terms, see Supplementary Appendix 1).

Inclusion and exclusion criteria were used to narrow down the systematic search corresponding to the research objectives. Inclusion criteria included (i) literature published up until May 2023; (ii) original research articles; (iii) comprehensive scientific reviews, meta-analyses, statements of clinical standards, case reports, opinion pieces; (iv) grey literature, such as government or other authoritative reports, policy statements, issues papers, theses and dissertations and conference papers/proceedings; (v) full-text available; (vi) published in English or Indonesian language; (vii) drowning deaths in humans; (viii) drowning specifically taking place in Indonesia; (ix) unintentional drowning deaths, including accidental, disaster-related and water transport-related drowning deaths; (x) drowning risk factors; (xi) drowning prevention; (xii) regulations on water safety, safe boating and shipping, maritime safety and disaster risk management relevant to drowning prevention and (xiii) health promotion approaches on

water safety and drowning prevention. The exclusion criteria excluded all publications on tsunami-related events, intentional drowning (intentional self-harm by drowning, assault by drowning, drowning by undetermined intent), and drowning in war operations.

Unintentional drowning deaths screened in this review included accidental drowning deaths, disaster-related drowning deaths and water transport-related drowning deaths. This inclusion was based on the ICD 10 coding for non-intentional drowning, which includes accidental drowning (W65-W74), disaster-related drowning (X34-X39), and water transport-related drowning (V90-, V92-); while excluding intentional self-harm by drowning (X71), assault by drowning (X92), drowning by undetermined intent (Y21) and drowned in war operations NOS (Y36.4) (World Health Organization, 2019). Studies on the epidemiology of unintentional drowning were included in this review if they reported the epidemiological measures of drowning mortality as a count, proportion or rate. When calculable, mortality rates were inferred from drowning death counts reported in the reviewed studies. Drowning deaths involving a foreign national that occurred in Indonesia were also included. Conversely, instances where Indonesian citizens drowned abroad were excluded.

Despite being disaster-related, tsunami-related drowning deaths were excluded, due to its relatively rare occurrence (only 75 tsunami events, out of 41 470 disaster events, were documented in Indonesia between 1815 and 2023 (Indonesian National Disaster Management Agency, 2023a)), and the low chance of victim survival, even for good swimmers, due to the sheer force of tsunami vortices (Kurusu *et al.*, 2018), underlining the fact that risk factors and prevention of tsunami-related drowning are entirely distinct from those of other causes (Doocy *et al.*, 2007, 2009). Moreover, even though our database searches included papers on boating, shipping and maritime safety and disaster risk management in Indonesia, all studies identified were on regulatory activities and community participation around maritime safety and flood mitigation not specifically linked nor relevant to the efforts of preventing drowning, hence they were excluded. However, it is acknowledged that disaster risk management, including tsunami risk assessment and preparedness, boating, shipping and maritime safety and their link to drowning prevention, are an area of concern urgently needed to be further investigated in Indonesia (Muis *et al.*, 2015; Djalante and Garschagen, 2017; Sari and Prayoga, 2018; Mantong *et al.*, 2020).

Review strategy

Publications were screened for inclusion by title, abstract and full text. Two researchers (M.C. and D.P.S.) independently reviewed search results at the stage of title, abstract and full-text review. The flow

of the selection process of all identified records was as follows:

Title and abstract screening

The titles and abstracts of all records identified through the database searching were screened by the inclusion and exclusion criteria, to ensure the relevance of the studies included for the evidence-informed review.

Full-text screening

Full-text versions of identified articles were then appraised to examine the relevance of the findings of the studies to answer the research questions. The PRISMA-ScR flow diagram summarized the review process, as presented in Figure 1.

Data abstraction

The following data were abstracted from the original peer-reviewed publications: authors, year of study and publication, type of publication (original research article, comprehensive scientific review, meta-analysis, statement of clinical standards, case report, opinion piece or grey literature), data source, study aim, study design, study sample and setting, scale of study (national or subnational), categories of drowning investigated, methods, relevant findings on the mortality rate, risk factors, and prevention of drowning, intervention type and comparator (if applicable). For grey literature, the following data were abstracted: authors (government agency), year of publication, scale of study, categories of drowning investigated and relevant findings. Details of data abstracted from reviewed studies are shown in the online Supplementary Appendix 2.

Synthesis/analysis

Mortality numbers, proportions and rates were extracted or inferred from the identified studies as epidemiological measures of unintentional drowning, either at the subnational or national scale. For this review, the Health Promotion Framework (Talbot and Verrinder, 2017), which comprises medical, behavioural and socio-environmental approaches at the individual through to the population level, was used to map the socio-ecological dimension of drowning prevention and health promotion approaches that have been or are currently being used in Indonesia.

Ethics approval

Ethical approval has been obtained from the Human Research Ethics Committee of the University of Mataram—Indonesia (Ethics Approval number 128/UN18.F8/ETIK/2023). The scoping review did not collect personal, sensitive or confidential information from participants, and only used publicly accessible documents as evidence.

RESULTS

From the 4619 potentially relevant records initially identified via database searching and government websites, 32 articles were included in this review, including 24 (75%) peer-reviewed publications (Suwardjo *et al.*, 2010; Usaputro and Yulianti, 2013; Wulur, 2013; Gobel *et al.*, 2014; Astreani and Alit, 2015; Prasetyo, 2017; Hu *et al.*, 2018; Lesmana *et al.*, 2018; Sillehu and Kartika, 2018; Patimah, 2019; Patimah *et al.*, 2019; Elsi and Gusti, 2020; Hady *et al.*, 2020; Nugroho and Suryono, 2020; Ose *et al.*, 2020; Rosmi *et al.*, 2020; Suryono and Nugroho, 2020; Faradisi *et al.*, 2021; Saputra, 2021; Sugiantoro and Wahyudi, 2021; Sukarna *et al.*, 2021; Welembuntu *et al.*, 2021; Fernalia *et al.*, 2022; Pranoto *et al.*, 2023; Sadewa *et al.*, 2023) and eight (25%) pieces of grey literature consisting of government issues papers, theses and a conference proceeding (Indonesian Ministry of Health, 2015, 2017, 2020; Prasetyo, 2017; Widyastuti and Rustini, 2017; Nadapdap, 2021; Indonesian National Disaster Management Agency, 2023a, 2023b). All but one reviewed articles were published in the Indonesian language. All but one peer-reviewed studies were published in local and national Indonesian journals in Indonesian language. Details of reviewed studies are presented in the Supplementary Appendix 2.

Of the 32 papers reviewed in this study, the information on the number of unintentional drowning deaths in Indonesia at the national and provincial level was only presented in eight (25%) studies, including three (9.4%) studies reporting accidental drowning deaths (Usaputro and Yulianti, 2013; Wulur, 2013; Astreani and Alit, 2015), two (6.3%) papers reporting disaster-related deaths (Hu *et al.*, 2018; Indonesian National Disaster Management Agency, 2023), and three (9.4%) papers reporting water transport-related deaths (Suwardjo *et al.*, 2010; Saputra, 2021; Indonesian National Disaster Management Agency, 2023). Risk factors were investigated in 11 (34.4%) studies, with seven (21.9%) studies discussing factors potentially contributing to accidental drowning events (Usaputro and Yulianti, 2013; Wulur, 2013; Astreani and Alit, 2015; Prasetyo, 2017; Widyastuti and Rustini, 2017; Elsi and Gusti, 2020; Welembuntu *et al.*, 2021), three (9.4%) on contributing factors to water transport-related deaths (Suwardjo *et al.*, 2010; Saputra, 2021; Indonesian National Disaster Management Agency, 2023), and one (2.1%) outlining risk factors to disaster-related deaths (Hu *et al.*, 2018). Details on reviewed studies can be found in the Supplementary Appendix 2.

Twenty (62.5%) studies (Gobel *et al.*, 2014; Indonesian Ministry of Health, 2015, 2017, 2020; Lesmana *et al.*, 2018; Sillehu and Kartika, 2018; Patimah, 2019; Patimah *et al.*, 2019; Hady *et al.*, 2020;

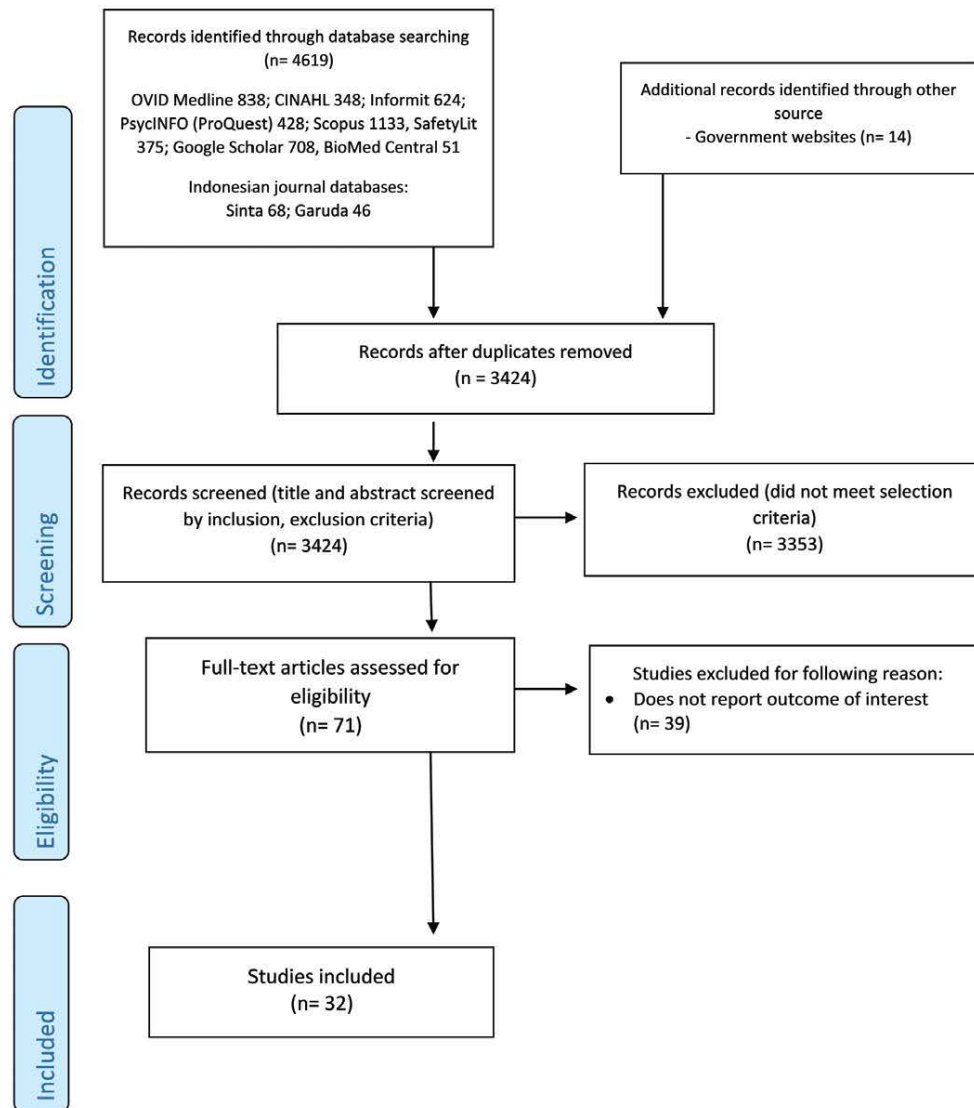


Fig. 1: The PRISMA-ScR 2020 flow diagram for scoping review.

Nugroho and Suryono, 2020; Ose *et al.*, 2020; Rosmi *et al.*, 2020; Suryono and Nugroho, 2020; Faradisi *et al.*, 2021; Nadapdap, 2021; Sugiantoro and Wahyudi, 2021; Sukarna *et al.*, 2021; Fernalia *et al.*, 2022; Pranoto *et al.*, 2023; Sadewa *et al.*, 2023) examined preventative aspects of unintentional drowning. Most of these studies ($n = 19$) described individual-focused approaches.

Numbers and rates of unintentional drowning death in Indonesia

Accidental drowning deaths

Three descriptive observational studies (Usaputro and Yulianti, 2013; Wulur, 2013; Astreani and Alit, 2015) reported accidental drowning deaths at the subnational level, all outlining the epidemiological measures

of drowning mortality as a count. The only data source for drowning deaths identified in these studies was medico-legal/autopsy records. Two of these studies (Usaputro and Yulianti, 2013; Astreani and Alit, 2015) reported drowning mortality at the provincial scale of Bali and included drowning deaths involving Indonesians and foreign nationals. Both studies reported drowning deaths documented by Sanglah Provincial Hospital in the province of Bali, with a total of 209 drowning deaths documented between 2010 and 2014, from which an average annual drowning mortality rate of 1.73/100 000 between 2010 and 2014 can be inferred. Meanwhile, one study (Wulur, 2013) reported 15 drowning deaths documented by the Forensic Department of Prof. Dr. R. D. Kandou Provincial Hospital of North Sulawesi between 2007 and 2011, from which an average annual drowning mortality of 0.18/100 000 can be inferred for the provincial level of North Sulawesi between 2007 and 2011. However, it is important to note that all drowning data reported in these studies were collected from provincial referral hospitals and may miss some incidents.

Disaster-related drowning deaths

Two papers (Hu *et al.*, 2018; Indonesian National Disaster Management Agency, 2023) in this review discussed disaster-related deaths. The Indonesian National Disaster Management Agency (2023) reported the frequency of disasters and disaster-related mortalities and missing cases in Indonesia between 1815 and 2023: (i) 13 927 flooding events, with 22 476 deaths and 8195 missing victims; (ii) 9503 flooding and avalanche events, with 3324 deaths and 379 missing victims; (iii) 499 tidal wave-related disaster events, with 165 deaths and 49 missing victims and (iv) 11 225 cyclone events, with 479 deaths and 49 missing victims. These hydrometeorological disasters, excluding tsunami, contributed to 36.7% ($N = 100\,434/259\,407$) of disaster-related deaths and 17% ($N = 8672/51\,037$) of all disaster-related missing victims in Indonesia, from which disaster-related rate of 186 deaths per 100 000 disaster-affected populations can be inferred.

In a study using the Emergency Disasters Database (EM-DAT) and the Dartmouth Flood Observatory data to analyse floods and flood-induced mortality across the globe between 1975 and 2016, Hu *et al.* (2018) reported Indonesia among countries with the highest flood frequency and flood-induced mortality worldwide, estimating 5000 to 10 000 flood-induced deaths occurred in Indonesia between 1975 and 2016, with tropical cyclones contributing to 0–10% of these deaths, from which flood-induced rates of 1–3 deaths per 100 000 flood-affected populations can be inferred. However, it is important to note that the exact cause of the reported hydrometeorological disaster-related

deaths, either by drowning or other causes, were not stated in these two studies, and that data for the period before 1990 may be severely underestimated. There was also no information available on exact data sources and how at-risk populations were estimated, hence the possibility of selection and measurement/information bias was identified in these studies, resulting in the difficulty of inferring cause-specific or proportionate mortality rates.

Water transport-related drowning deaths

Three studies reported water transport-related deaths in Indonesia (Suwardjo *et al.*, 2010; Saputra, 2021; Indonesian National Disaster Management Agency, 2023). The Indonesian National Disaster Management Agency (2023) reported that a total of 15 shipping/boating accidents occurred across Indonesia between 2014 and 2017, resulting in 121 deaths and 97 missing victims. Saputra (2021) reported on the completed investigations of 120 shipping accidents by the Indonesian National Transportation Safety Committee between 2003 and 2019, and found they contributed to 513 deaths and 701 missing victims across Indonesia. At the subnational level, Suwardjo *et al.* (2010) reported that 61 fishing vessel accidents occurred around the three subdistrict-level fishing ports of Central Java Province between 2006 and 2008, contributing to a total of 68 deaths, or an annual average of 32 dead/missing fishing crews, and an average fatality accident rate for all three study sites of 115 deaths per 100 000 fishermen, with 26.5% ($n = 18/68$) of victims falling off the ships into the water during shipping or fishing, and 45.6% ($n = 31/68$) of victims died due to the ship capsizing. However, it is important to note that the exact cause of the reported water transport-related deaths were not stated in these studies, and that these reports only included cases where the Indonesian Disaster Management Agency was involved in the rescue/evacuation process, or investigated by the Indonesian National Transportation Safety Committee, or reported by the authorities within the study site and period, hence it may miss some incidents and make inferring cause-specific or proportionate mortality rates difficult.

Risk factors of fatal unintentional drowning in Indonesia

Risk factors were investigated in 11 studies, with seven studies reporting factors potentially contributing to accidental drowning events (Usaputro and Yulianti, 2013; Wulur, 2013; Astreani and Alit, 2015; Prasetyo, 2017; Widyastuti and Rustini, 2017; Elsi and Gusti, 2020; Welebuntu *et al.*, 2021), three discussing potential contributing factors to water transport-related drowning (Suwardjo *et al.*, 2010; Saputra, 2021; Indonesian National Disaster Management Agency,

2023), and one outlining risk factors to disaster-related drowning deaths (Hu *et al.*, 2018).

Several factors were identified as potential risk factors of for unintentional drowning in Indonesia: (i) sociodemographic characteristics, including age and sex (males aged 18 and over disproportionately contributed to the majority of drowning death cases in Bali and North Sulawesi (Usaputro and Yulianti, 2013; Wulur, 2013; Astreani and Alit, 2015)), nationality (foreign nationals and Indonesians made up for almost similar proportions of drowning deaths in Bali (Usaputro and Yulianti, 2013; Astreani and Alit, 2015), noting the high population of foreign nationals in the major tourist destination Bali may differ from populations of other provinces), population density (population density had a significantly positive correlation with the number of flood-related deaths (Hu *et al.*, 2018)), and income level (flood-induced mortality increased with the decrease of per capita GDP (Hu *et al.*, 2018)); (ii) environmental factors, including aquatic location of drowning deaths (most accidental and water transport-related drowning cases occurred in open seawater (Usaputro and Yulianti, 2013; Astreani and Alit, 2015; Indonesian National Disaster Management Agency, 2023)), seasonality (highest numbers of fishing vessel accidents were recorded during rainy seasons (Suwardjo *et al.*, 2010)), geographical and environmental conditions (a third of boating/shipping accidents occurred in Indonesia were weather-related (Indonesian National Disaster Management Agency, 2023), and most flooding inundation and flood-induced deaths occurred in low-lying regions with dense river systems (Hu *et al.*, 2018)), and hydrometeorological disasters (the frequency of floods and flood-induced mortality were generally increasing, with a large proportion of flood-induced deaths attributed to tropical cyclone-induced flash floods (Hu *et al.*, 2018)); (iii) risky behaviour (alcohol identified on a fifth of autopsied drowning victims, although there was no information on the blood alcohol content (Usaputro and Yulianti, 2013)); (iv) low knowledge and skills on water safety and water rescue, particularly knowledge on first aid for drowning victims (Prasetyo, 2017; Widyastuti and Rustini, 2017; Elsi and Gusti, 2020; Welembuntu *et al.*, 2021) and (v) low knowledge and compliance for boating, shipping, and maritime safety-related regulations, including poor maintenance of ships, lack of safety equipment on board, poor knowledge and compliance of safety regulations and under-qualified seafarers and poor ship crews' capacity in ensuring safe boating/maritime practice (Suwardjo *et al.*, 2010; Saputra, 2021; Indonesian National Disaster Management Agency, 2023), as summarized in Table 1.

However, it is important to note that despite the importance of providing an understanding of risk

factors for drowning across Indonesia, no relative risk (RR) or odd ratio (OR) was reported across all studies reviewed, and no studies reported statistical correlations of risk factors of interest in association to fatal unintentional drowning incidents. All information on unintentional drowning risk factors was presented as proportions/counts of drowning deaths between categories of risk factors (Table 1).

Drowning prevention in Indonesia

Analysis of the application of the Health Promotion Framework (Talbot and Verrinder, 2017) across 16 peer-reviewed papers (Gobel *et al.*, 2014; Lesmana *et al.*, 2018; Sillehu and Kartika, 2018; Patimah, 2019; Patimah *et al.*, 2019; Hady *et al.*, 2020; Nugroho and Suryono, 2020; Ose *et al.*, 2020; Rosmi *et al.*, 2020; Suryono and Nugroho, 2020; Faradisi *et al.*, 2021; Sugiantoro and Wahyudi, 2021; Sukarna *et al.*, 2021; Fernalia *et al.*, 2022; Pranoto *et al.*, 2023; Sadewa *et al.*, 2023) and four grey literature sources (Indonesian Ministry of Health, 2015, 2017, 2020; Nadapdap, 2021) on drowning prevention interventions revealed that most prevention approaches were midstream and downstream individual-focused, behaviour-based intervention, with a focus on education to build knowledge and skills, as outlined on Table 2. The interventions included providing health information/education on (i) emergency first aid for drowning victims (Gobel *et al.*, 2014; Lesmana *et al.*, 2018; Patimah, 2019; Patimah *et al.*, 2019; Hady *et al.*, 2020; Nugroho and Suryono, 2020; Ose *et al.*, 2020; Suryono and Nugroho, 2020; Faradisi *et al.*, 2021; Nadapdap, 2021; Sugiantoro and Wahyudi, 2021; Sukarna *et al.*, 2021; Fernalia *et al.*, 2022; Pranoto *et al.*, 2023); (ii) water rescue (Sillehu and Kartika, 2018; Rosmi *et al.*, 2020; Sukarna *et al.*, 2021; Sadewa *et al.*, 2023) and (iii) drowning prevention awareness (Indonesian Ministry of Health, 2015, 2020). These educational interventions were aimed at diverse populations, including local street stallholders in coastal areas, fishermen, youth groups, tourism awareness group members and community health workers.

Only one grey literature source (Indonesian Ministry of Health, 2020) reported on regulatory activities and social marketing approaches for drowning prevention. Meanwhile, two studies (Rosmi *et al.*, 2020; Fernalia *et al.*, 2022) outlined the potential of training local community groups to perform and assist on local water rescue efforts (Table 2).

DISCUSSION

This scoping review aimed to describe the epidemiology of and risk factors for unintentional drowning in Indonesia and explore existing health promotion and prevention approaches currently in place. Despite a

Table 1: Studies on risk factors of unintentional drowning in Indonesia

Risk factors investigated	Study findings
Socio-demographic characteristic	<ul style="list-style-type: none"> • Male victims: 84.6% ($n = 77/91$), females: 15.4% ($n = 14/91$) of drowning deaths recorded by the Forensic Department of Sanglah Provincial Hospital of Bali from 2012 to 2014 (Astreani and Alit, 2015). • Male victims: 84.5% ($n = 60/71$), females: 15.5% ($n = 11/71$) of drowning deaths recorded by the Forensic Department of Sanglah Provincial Hospital of Bali between 2010 and 2012 (Usaputro and Yulianti, 2013). • Male victims: 80% ($n = 12/15$), females: 20% ($n = 3/15$) of drowning deaths recorded by the Forensic Department of Prof. Dr. R. D. Kandou General Hospital of North Sulawesi Province between 2007 and 2011 (Wulur, 2013). • No measures of association were reported, and a possibility of selection bias was identified in all three studies above (Usaputro and Yulianti, 2013; Wulur, 2013; Astreani and Alit, 2015).
Age	<ul style="list-style-type: none"> • Adults: 87.9% ($n = 80/91$); children: 12.1% ($n = 11/91$) of drowning deaths in Bali from 2012 to 2014. The definition of the term 'adult' and 'children' were not defined (Astreani and Alit, 2015). • Adults aged 21–30 years: 22.5% ($n = 16/71$), >50 years: 19.7% ($n = 14/71$), 31–40 years: 18.3% ($n = 13/71$) and <20 years: 16.9% ($n = 12/71$) of drowning deaths in Bali between 2010 and 2012 (Usaputro and Yulianti, 2013). • Adults aged ≥20 years: 86.7% ($n = 13/15$), children aged 5–14 years: 6.67% ($n = 1/15$) of drowning deaths in North Sulawesi Province between 2007 and 2011 (Wulur, 2013). • No measures of association were reported, and a possibility of selection and measurement/information bias was identified in all three studies above (Usaputro and Yulianti, 2013; Wulur, 2013; Astreani and Alit, 2015).
Nationality	<ul style="list-style-type: none"> • Indonesians: 54.9% ($n = 50/91$), foreign nationals: 45.1% ($n = 41/91$) of drowning deaths in Bali between 2010 and 2014 (Astreani and Alit, 2015). • Foreign nationals: 49.3% ($n = 35/71$), Indonesians: 40.8% ($n = 29/71$) of drowning deaths in Bali between 2010 and 2012 (Usaputro and Yulianti, 2013). • No measures of association were reported, and a possibility of selection and measurement/information bias was identified in the two studies above (Usaputro and Yulianti, 2013; Astreani and Alit, 2015).
Population density	<ul style="list-style-type: none"> • Significant positive correlation between population density and the number of flood-related deaths. A possibility of selection bias was identified (Hu et al., 2018).
Income level	<ul style="list-style-type: none"> • The flood-affected population and flood-induced mortality increased with the decrease of per capita GDP. A possibility of selection bias was identified (Hu et al., 2018).
Environmental factor	<ul style="list-style-type: none"> • Beaches: 69.2% ($n = 63/91$), swimming pools: 13.2% ($n = 12/91$), river: 13.2% ($n = 12/91$), bathroom and swamps: 4.4% ($n = 4/91$) of drowning deaths in Bali between 2010 and 2014 (Astreani and Alit, 2015). • Open seawater: 53.5% ($n = 38/71$), freshwater bodies: 25.4% ($n = 18/71$), unknown location: 21.1% ($n = 15/71$) of drowning deaths in Bali between 2010 and 2012 (Usaputro and Yulianti, 2013). • Open seas: 60% ($n = 6/15$), rivers (related to river crossings): 26.67% ($n = 4/15$), lakes and during flooding events: 6.67% ($n = 1/15$) of ship accidents between 2013 and 2017 (Indonesian National Disaster Management Agency, 2023). • No measures of association were reported, and a possibility of selection and measurement/information bias was identified in all three studies (Usaputro and Yulianti, 2013; Astreani and Alit, 2015; Indonesian National Disaster Management Agency, 2023). • Of 61 fishing vessel accidents reported to occur around three fishing ports of Central Java Province between 2006 and 2008, the highest numbers of fishing vessel accidents were recorded during rainy seasons (November to February). No measures of association were reported. A possibility of selection bias was identified (Suwardjo et al., 2010).
Geographical and environmental conditions	<ul style="list-style-type: none"> • Weather-related: 33.33% ($n = 5/15$) of ship accidents in Indonesia between 2014 and 2017. No measures of association were reported. A possibility of selection bias and measurement/information bias was identified (Indonesian National Disaster Management Agency, 2023). • Floodings and flood-induced deaths most often occurred in low-lying regions with dense river systems. Plain areas with slope of <0.5°: 40% of flood events and 50% of flood-induced deaths worldwide; plain areas with slopes 0.5°–15°: 60% of flood events and 48% of flood-induced deaths worldwide. No measures of association were reported. A possibility of selection bias was identified (Hu et al., 2018).

Table 1. Continued

Risk factors investigated	Study findings
Hydrometeorological disasters	<ul style="list-style-type: none"> Between 1975 and 2016, the frequency of floods and flood-induced mortality were generally increasing globally, including in Indonesia. The annual variation of mortality per flood event was highly related to floods with higher intensity, with the highest flood frequency and flood-induced mortality worldwide reported to occur in Asia, particularly in China, India, Indonesia and the Philippines. A large proportion of flood-induced deaths and the highest flood-induced mortality rate worldwide can be attributed to tropical cyclone-induced flash floods. No measures of association were reported. A possibility of selection bias was identified in this study (Hu <i>et al.</i>, 2018).
Risky behaviours	<ul style="list-style-type: none"> Blood alcohol was identified in 20% ($n = 4/20$) of autopsyed drowning victims at Sanglah Provincial Hospital of Bali between 2010 and 2012. No information on the blood alcohol content. No measures of association were reported (Usaputro and Yulianti, 2013).
Biological factors	<ul style="list-style-type: none"> Comorbid conditions were recorded on 15% ($n = 3/20$) of drowning victims underwent autopsy at Sanglah Provincial Hospital of Bali between 2010 and 2012. No information on comorbid conditions. No measures of association were reported (Usaputro and Yulianti, 2013).
Knowledge and skills on water safety and water rescue	<ul style="list-style-type: none"> Significant correlation between fishermen's knowledge on Basic Life Support (BLS) and attitude to BLS being given for drowning victims ($p < 0.05$) (Elsi and Gusti, 2020). Coastal area residents with 'sufficient' knowledge on first aid for drowning victims: 4.26% ($n = 2/47$), 'insufficient' level of knowledge: 87.23% ($n = 41/47$). No measures of association were reported (Prasetyo, 2017). Coastal area residents with 'sufficient' level of knowledge on first aid for maritime accidents' victims: 55% ($n = 22/40$), 'good' level of knowledge: 42.5% ($n = 17/40$). No measures of association were reported (Walembumu <i>et al.</i>, 2021). Coastal area residents with 'sufficient' level of knowledge on first aid for drowning victims: 57.14% ($n = 20/35$), 'good' level of knowledge: 31.4% ($n = 11/35$), 'poor' level of knowledge: 11.4% ($n = 4/35$). No measures of association were reported (Widyastuti and Ruslani, 2017). A possibility of selection bias and measurement bias was identified in all four studies above (Prasetyo, 2017; Widyastuti and Ruslani, 2017; Elsi and Gusti, 2020; Walembumu <i>et al.</i>, 2021).
Water safety, safe boating and shipping, and maritime safety-related regulations	<ul style="list-style-type: none"> Passenger boats: 86.67% ($n/13/15$), fishing boat: 6.67% ($n = 1/15$), rescue boat: 6.67% ($n = 1/15$) of ship accidents in Indonesia between 2014 and 2017 (Indonesian National Disaster Management Agency, 2023). Motorboats including cargo ships, bulk carriers, container ships and passenger ships (ferries and Ro-Ro ferries): 89% ($n = 107/120$) of ship accidents investigated by the Indonesian National Transportation Safety Committee between 2003 and 2019 (Saputra, 2021). No measures of association were reported, and a possibility of selection and measurement/information bias was identified in two studies above (Indonesian National Disaster Management Agency, 2023; Saputra, 2021). Boat overloading: 33.33% ($n = 5/15$), collisions: 13.33% ($n = 2/15$) of ship accidents in Indonesia between 2014 and 2017 (Indonesian National Disaster Management Agency, 2023). Fire: 37% ($n = 44/120$); submersion/sinking: 28% ($n = 34/120$), collisions: 18% ($n = 22/120$), other causes: 17% ($n = 20/120$) of ship accidents investigated by the Indonesian National Transportation Safety Committee between 2003 and 2019. Contributing factors to shipping accidents identified were (i) poor maintenance of ships; (ii) unavailability/poor maintenance of safety equipment on board; (iii) poor knowledge, awareness and compliance of safety regulations and (iv) underqualified seafarers and poor ship crews' capacity in ensuring safe shipping/maritime practice (Saputra, 2021). Contributing factors to fishing vessel accidents in Central Java Province between 2006 and 2008: (i) underqualified shipping crews; (ii) poor knowledge, awareness, and compliance of safety regulations; (iii) unfulfillment of safety requirements. Approximately 84.3% of skippers and ship crews did not go beyond primary level education, hence did not qualify to undertake Basic Safety Training for shipping crews. Seventy per cent ($n = 45/64$) of all fishing vessels registered did not fulfil safety requirements due to insufficient number of life jackets and rescue buoys, unequipped with fire extinguishers and life rafts, and lacking in other safety equipment (Suwardjo <i>et al.</i>, 2010). No measures of association were reported, and a possibility of selection and measurement/information bias was identified in all three studies above in all three studies above (Suwardjo <i>et al.</i>, 2010; Saputra, 2021; Indonesian National Disaster Management Agency, 2023).
Knowledge and compliance to regulations on water safety, safe boating and shipping, and maritime safety	<ul style="list-style-type: none"> No measures of association were reported, and a possibility of selection and measurement/information bias was identified in two studies above (Indonesian National Disaster Management Agency, 2023; Saputra, 2021).

Table 2. Analysis of prevention interventions investigated in Indonesia using the Health Promotion Framework

Author	Type of publication	Population investigated	Study design	Intervention method investigated	Prevention aspect investigated in relation to Health Promotion Framework			Relevant findings
					Medical/ Individual approach	Behavioural approach	Socio-environmental approach	
Faradisi <i>et al.</i> (2021)	Original research article	Twenty-one street stallholders on Nyamplung Beach, Central Java Province	Pre-test, post-test study	Health education on Cardio-Pulmonary Resuscitation (CPR) on drowning victims	-	HE ¹	-	<ul style="list-style-type: none"> • Proportion of participants with good level of knowledge; post-intervention > pre-intervention. • No measures of association were reported. • A possibility of selection bias and measurement bias was identified.
Fernalia <i>et al.</i> (2022)	Original research article	Community members at Lingkar Barat Subdistrict, Bengkulu Province (data on the number of participants are not available)	Community service project	Health education on performing water rescue.	-	HE	CA	<ul style="list-style-type: none"> • Water rescue-trained local community group was formed. • No evaluation on participants' level of knowledge and skills on water rescue. • No measures of association were reported. • A possibility of selection bias and measurement bias was identified.
Gobel <i>et al.</i> (2014)	Original research article	Forty-seven fishermen from a coastal area of North Bolaang Mongondow Regency, North Sulawesi Province	Pre-test, post-test study	Health education on first aid for drowning victims	-	HE	-	<ul style="list-style-type: none"> • Significant increase on the mean level of knowledge after the intervention applied ($p < 0.05$). • No information on long-term knowledge retention. • A possibility of selection bias and measurement bias was identified.
Hady <i>et al.</i> (2020)	Original research article	Fifty residents of a coastal area of Takalar Regency, South Sulawesi Province	Pre-test, post-test study	Health education and roleplay on first aid for drowning victims	-	HE	-	<ul style="list-style-type: none"> • Significant increase on the mean level of knowledge after the intervention applied ($p < 0.05$). • No information on long-term knowledge retention. • A possibility of selection bias and measurement bias was identified.

Table 2. Continued

Author	Type of publication	Population investigated	Study design	Intervention method investigated	Prevention aspect investigated in relation to Health Promotion Framework			Relevant findings
					Medical/ Individual approach	Behavioural approach	Socio-environmental approach	
Indonesian Ministry of Health (2020)	Grey literature (government report)	NA	NA	Development of the National Drowning Prevention Strategy and Coordinating Agency; Development of drowning prevention awareness campaign for school-age children	-	SM	PD, RA	<ul style="list-style-type: none"> The Directorate of Occupational and Sports Health (of the Indonesian Ministry of Health) will initiate four aspects of drowning prevention on national level: <ol style="list-style-type: none"> Development of the National Drowning Prevention Coordinating Agency Development of coordinated mechanisms of disseminating and monitoring health data Development of the National Drowning Prevention Strategy Development of drowning prevention awareness campaign targeting school-age children across Indonesia. Indonesian Ministry of Health will initiate a multisectoral coordination with the Indonesian Coordinating Ministry for Maritime and Investment Affairs; Ministry of Marine Affairs and Fisheries; Ministry of Youth and Sports Affairs; Ministry of Transportation; Ministry of Education and Culture; Ministry of Tourism; National Bureau of Statistics; Maritime Security Agency; Sea and Coast Guard; National Search and Rescue Agency; National Agency for Disaster Management; National Police, Seafarers Union; and Maritime Doctors Association.

Table 2. Continued

Author	Type of publication	Population investigated	Study design	Intervention method investigated	Prevention aspect investigated in relation to Health Promotion Framework			Relevant findings
					Medical/ Individual approach	Behavioural approach	Socio-environmental approach	
Indonesian Ministry of Health (2017)	Grey literature (policy statement of clinical standard)	NA	NA	Health information on pre-hospital and intrahospital emergency care for trauma patients	HI	-	-	<ul style="list-style-type: none"> National clinical practice guideline for treatment of trauma cases, including for drowning victims. Targeting Indonesian medical doctors.
Indonesian Ministry of Health (2015)	Grey literature (policy statement)	NA	NA	Health information on preventing drowning in children	HI	-	-	<ul style="list-style-type: none"> Handbook on preventing drowning in children. Targeting health workers and trained community members.
Lesmana <i>et al.</i> (2018)	Original research article	Forty-six respondents living in a coastal area of Amal Beach, Tarakan City, North Kalimantan Province	Pre-test, post-test study	Health education on first aid for drowning victims	-	HE	-	<ul style="list-style-type: none"> Proportion of participants with good level of knowledge; post-intervention > pre-intervention. No measures of association were reported. A possibility of selection bias and measurement bias was identified.
Nadapdap (2021)	Grey literature (thesis)	Systematic search on 7 national journals and three international journals, using keywords "knowledge", "first aid", "drowning" and "basic life support"	Literature review	Health education on Basic Life Support (BLS) for drowning victims	-	HE	-	<ul style="list-style-type: none"> Review identified respondents' knowledge as 'good' after being given health education on BLS for drowning victims. A possibility of selection bias and measurement bias was identified.

Table 2. Continued

Author	Type of publication	Population investigated	Study design	Intervention method investigated	Prevention aspect investigated in relation to Health Promotion Framework			Relevant findings
					Medical/ Individual approach	Behavioural approach	Socio-environmental approach	
Nugroho and Suryono (2020)	Original research article	Fifteen members of a local freshwater fishing community of Kediri Regency, East Java Province	Pre-test, post-test study	Health education on first aid for infant drowning victims	-	HE	-	<ul style="list-style-type: none"> • Significant increase of the mean level of self-efficacy in emergency handling of toddler drowning victims after the intervention applied ($p < 0.05$). • No information on long-term knowledge and self-efficacy retention. • A possibility of selection bias and measurement bias was identified.
Ose <i>et al.</i> (2020)	Original research article	Thirty-two volunteer village health workers overseeing a coastal area of Amal Beach, Tarakan City, North Kalimantan Province	Pre-test, post-test study	Health education on performing CPR on drowning victims	-	HE	-	<ul style="list-style-type: none"> • Significant increase of the mean level of knowledge after the intervention applied ($p < 0.05$). • No information on long-term knowledge retention. • A possibility of selection bias and measurement bias was identified.
Patmah (2019)	Original research article	Eighteen residents of a coastal area of Jayapura City, Papua Province	Pre-test, post-test study	Health education on BLS and evacuation for drowning victims	-	HE	-	<ul style="list-style-type: none"> • Significant increase of the mean level of knowledge after the intervention applied ($p < 0.05$). • No information on long-term knowledge retention. • A possibility of selection bias and measurement bias was identified.
Patmah <i>et al.</i> (2019)	Original research article	Fifty-eight residents of a coastal area of Jayapura District, Papua	Pre-test, post-test study	Health education on first aid for drowning victims	-	HE	-	<ul style="list-style-type: none"> • Proportion of participants with good level of knowledge: post-intervention > pre-intervention. • No measures of association were reported. • A possibility of selection bias and measurement bias was identified.

Table 2. Continued

Author	Type of publication	Population investigated	Study design	Intervention method investigated	Prevention aspect investigated in relation to Health Promotion Framework			Relevant findings
					Medical/ Individual approach	Behavioural approach	Socio-environmental approach	
<i>Pranoto et al. (2023)</i>	Original research article	Sixty members of tourism awareness groups on Mentawai Islands, West Sumatra Province	Community service project	Health education on performing water rescue and CPR on drowning victims	-	HE	-	<ul style="list-style-type: none"> No evaluation on participants' level of knowledge and skills on water rescue and CPR. No measures of association were reported. A possibility of selection bias and measurement bias was identified.
<i>Rosmi et al. (2020)</i>	Original research article	Thirty-six members of youth organizations (Karang Taruna) on Gresik Regency, East Java Province	Community service project	Health education on the dangers of flooding and performing water rescue on flooding-related drowning victims	-	HE	CA	<ul style="list-style-type: none"> Water rescue-trained local community group was formed. No evaluation on participants' level of knowledge and skills on flooding-related water rescue. No measures of association were reported. A possibility of selection bias and measurement bias was identified.
<i>Sadewa et al. (2023)</i>	Original research article	Thirty-five participants consisting of lifeguards, pool attendants, swimming trainers, students, and swimming pool visitors at the Faculty of Sports and Health Sciences, Yogyakarta State University, Yogyakarta Province	Descriptive quantitative and qualitative approach	The development of modified water rescue tools (jerry cans lined with Styrofoam and equipped with ropes) for water rescue efforts, as an effective, cheap, easy to obtain substitute to water rescue equipment	HI	-	-	<ul style="list-style-type: none"> The modified water rescue tool was deemed "very decent" by participants to be utilized on water rescue efforts. No evaluation on the implementation and outcome of the intervention. A possibility of selection bias and measurement bias was identified.
<i>Silelu and Kartika (2018)</i>	Original research article	Thirty-five regency-level National Search and Rescue Agency staff members for Ambon City, Maluku Province	Analytical observational	Water rescue practice	HI	-	-	<ul style="list-style-type: none"> Significant correlation between the performance by the National Search and Rescue Agency and the rescue of drowning victims ($p < 0.05$). A possibility of selection bias and measurement bias was identified.

Table 2. Continued

Author	Type of publication	Population investigated	Study design	Intervention method investigated	Prevention aspect investigated in relation to Health Promotion Framework			Relevant findings
					Medical/ Individual approach	Behavioural approach	Socio-environmental approach	
Sugiantoro and Walyudi (2021)	Original research article	Fifteen fishermen from Lemamping Regency, Lampung Province	Pre-test, post-test study	Health information on first aid for drowning victims	HI	-	-	<ul style="list-style-type: none"> • Significant increase of the mean level of knowledge and attitude after the intervention applied ($p < 0.05$). • No information on long-term knowledge retention. • A possibility of selection bias and measurement bias was identified.
Sukarna <i>et al.</i> (2021)	Original research article	Thirty street stallholders on a coastal area on the province of Bangka Belitung Islands	Pre-test, post-test study	Health education on performing CPR and evacuation on drowning victims	-	HE	-	<ul style="list-style-type: none"> • Significant increase of the mean level of knowledge after the intervention applied ($p < 0.05$). • No information on long-term knowledge retention. • A possibility of selection bias and measurement bias was identified.
Suryono and Nugroho (2020)	Original research article	Fifteen members of a local freshwater fishing community of Kediri Regency, East Java Province	Pre-test, post-test study	Health education on first aid for infant drowning victims	-	HE	-	<ul style="list-style-type: none"> • Proportion of participants with sufficient level of knowledge: post-intervention > pre-intervention. • No measures of association were reported. • A possibility of selection bias and measurement bias was identified.

CA: Community action; HE: Health education; HI: Health information; PD: Policy development; RA: Regulatory activity; SD: Skills development; SM: Social marketing.

dire need to provide better understanding on the magnitude of drowning as a health problem in Indonesia, limited literature reporting on drowning epidemiology, risk factors or prevention and health promotion approaches in Indonesia were identified.

Drowning mortality data across Indonesia: the disparity on data availability

Comprehensive data are imperative for agenda setting (World Health Organization, 2017). However, this review outlined the limited availability of drowning data across Indonesia. The data sources for drowning deaths identified in this review were derived from medico-legal autopsy records, records of investigated shipping accidents and rescue reports, with no drowning data derived from health and demographic surveillance data, national death registry, integrated coronial information system, police department records, national health reports or news reports. This is due to the unavailability of a coordinated national drowning data collection system and national death registry in Indonesia, from which national and subnational data for all categories of unintentional drowning can be recorded (World Health Organization, 2021). This unavailability underlines the possibility of under-representation of drowning data and a public health issue regarding the health system capacity on collecting, reporting and utilizing health data.

A similar reliance on medico-legal reports has been reported in other LMICs, such as in South Africa, where the dependence on hospital-based reports means that the surveillance system may miss drowning-related injuries which occur in and around homes, particularly in rural areas with inadequate access to healthcare facilities (Matzopoulos, 2002; Donson and Van Niekerk, 2013; Morris *et al.*, 2016). The under-reporting of drowning incidents can be linked to the nature of drowning deaths, where victims often suffer a quick death on location and never reach medical facilities or are reported to authorities, which may impede accurate data collection in countries with dependence on facility-based reporting systems, such as in Indonesia (Linnan *et al.*, 2012, 2013; World Health Organization, 2014). These limitations underline the urgent need to strengthen public health system capacity; develop standardized, national health, death and coronial data reporting frameworks; enhance multi-sectoral collaboration and advocate for political and financial investment, to develop a robust drowning data collection system in Indonesia (Schuurman *et al.*, 2011; Reynolds *et al.*, 2013; Scarr and Jagnoor, 2022).

Drowning risk factors in Indonesia: a knowledge gap

This review identified a lack of exploration on predictors for unintentional drowning fatalities, with no

studies reporting RR/OR or statistical correlations of predictors of interest and fatal unintentional drowning incidents. This may hinder the development of prevention interventions needed across different provinces of Indonesia, which may be different to prevention interventions which have been shown to be effective in high income countries (Bennett and Linnan, 2014; Franklin and Scarr, 2014; Hyder *et al.*, 2014; Linnan *et al.*, 2014).

Increasing supervision of children, raising community awareness and skills on water safety, and encouraging community participation have been identified as important protective factors for drowning in LMICs (Rahman *et al.*, 2010, 2012; Cenderadewi *et al.*, 2020). As advocated by the WHO, the effectiveness of community driven crèches in preventing child drowning for children aged 12–59 months, and swimming lessons in reducing the risk of drowning for children aged 6 and above, along with their cost effectiveness, have been widely reported in rural settings in Bangladesh (Rahman *et al.*, 2012; Talab *et al.*, 2016; Alonge *et al.*, 2020; Alfonso *et al.*, 2021; Rahman and Rahman, 2022). Further scaling up of these interventions to other LMICs, including to Indonesia, should be considered, as part of the global effort to reduce the global burden of drowning, particularly among children (Rahman *et al.*, 2012). Further research is required to evaluate the process, impact and outcome of the interventions against key indicators in Indonesia; improving local capacity and understanding in preventing drowning in the country (Guevarra *et al.*, 2021).

Further research on contributing factors to disaster-related and water transport-related drowning deaths is also imperative to inform the development of drowning prevention approaches suitable for Indonesian context, given the high frequency of hydrometeorological disasters and water transport-related incidents and the nation's high vulnerability to the impacts of disasters and climate change (Suwardjo *et al.*, 2010; Muis *et al.*, 2015; Djalante and Garschagen, 2017; Hu *et al.*, 2018; Sari and Prayoga, 2018; Mantong *et al.*, 2020; Saputra, 2021; Indonesian National Disaster Management Agency, 2023a, 2023b).

Understanding the linkage between drowning prevention and health promotion

Using the Health Promotion Framework (Talbot and Verrinder, 2017) to analyse the socio-ecological approaches utilized in the prevention of drowning in Indonesia, this review identified the under-exploration of the concept of the socio-ecological approach of health promotion related to drowning prevention in Indonesia, leaving the research area of community participation and development of evidence-informed policy around water safety relatively neglected. The

limited availability of population-focused midstream and upstream drowning prevention interventions in Indonesia does not align with the underlying premise of the Health Promotion Framework, which supports the need for multisectoral, multi-strategic approaches including educational, behavioural, socio-environmental and regulatory approaches to ensure effective individual and community-level injury prevention (Stempski *et al.*, 2015; Denehy *et al.*, 2016; Leavy *et al.*, 2016; Giles *et al.*, 2017; World Health Organization Regional Office for the Eastern Mediterranean, 2017). A comprehensive approach to drowning prevention in Indonesia requires approaches that go across the downstream, midstream, upstream continuum and include strengthening individual and broader community level knowledge and skills, fostering coalitions and networks, changing organizational practices and policy and legislation setting (Franklin and Scarr, 2014).

Recommendations: highlights for policy development, practice and future research

Policy development and practice

A national, evidence-informed regulatory framework for drowning prevention, guided by the WHO implementation guide on preventing drowning (World Health Organization, 2017) and affirmed by the 2021 United Nations General Assembly Resolution on global drowning prevention (United Nations, 2021), is required to reduce drowning fatalities in Indonesia. To inform this, a situational assessment must be performed in Indonesia, to: (i) review available data on drowning; (ii) assess current efforts regarding drowning prevention including existing policy and regulation; (iii) identify key stakeholders who play a role in drowning prevention and (iv) assess required human and financial resources (World Health Organization, 2017). This approach is supported by the WHO, who also recommends advancing drowning prevention through robust data collection, to inform burden and risk factor identification, and agenda setting, as well as development and evaluation of regulatory frameworks and prevention interventions (World Health Organization, 2017).

Contributing to situational assessment on drowning prevention in Indonesia

Several findings of this review may inform the situational assessment on drowning prevention in Indonesia. Furthermore, although not included in this study, several studies identified during the database searches may provide baseline information around disaster risk management and enforcement of maritime, shipping and boating safety in Indonesia, informing the urgently needed multisectoral collaboration to develop coordinated national drowning prevention efforts:

- 1 The unavailability of coordinated national death registry in Indonesia, from which national and subnational subcategory drowning data can be collected, underlines the possibility of under-representation of drowning data. Developing a robust and consolidated drowning data collection system, which employs data triangulation methodology, combining data from national death and coronial registry, organizational reports and media report monitoring, is imperative to inform the drowning prevention agenda in Indonesia.
- 2 The Indonesian Ministry of Health (2020) initiated the development of the National Drowning Prevention Strategy and Coordinating Agency, in conjunction with the strengthening of health data dissemination and monitoring, and development of social marketing approaches to increase community awareness on drowning prevention. This initiative was undertaken as a response to the WHO call for member nations to strengthen their national drowning data collection (World Health Organization, 2021). Main actors for drowning prevention include the Indonesian Ministry of Health as the lead agency, in coordination with other relevant agencies (outlined in Table 2) (Indonesian Ministry of Health, 2020). Further research is needed to update the progress of the initiative and evaluate the impact and outcome of interventions in reducing drowning against key indicators.
- 3 Main actors on disaster risk management include the National Disaster Management Agency as the lead agency; Meteorological, Climatological, and Geophysical Agency; Ministry of Public Works; Ministry of Environment and Forestry; Spatial Planning Agencies; river basin management authorities; National Search and Rescue Agency; Red Cross Society; and National Police and Military Forces. Limited budget (only 0.1–0.4% of national budgeting were allocated for disaster risk reduction efforts at the local level), low human resource capacity, non-integrated regulations and unclear coordination mechanisms across government agencies were the apparent challenges (Muis *et al.*, 2015; Hapsari and Zenurianto, 2016; Buchori *et al.*, 2018; Handayani *et al.*, 2019; Isa *et al.*, 2019).
- 4 Main actors on maritime and boating safety enforcement include the Ministry of Transportation as the lead agency, harbourmasters and Sea and Coast Guard. Low human resource capacity, low compliance to regulations, overlapping regulatory frameworks with unclear responsibilities and coordination mechanisms between agencies and the geographic nature of Indonesia as a vast archipelagic nation were identified as challenges in

enforcing maritime and boating safety nationwide (Andry and Yuliani, 2014; Mantong *et al.*, 2020).

- 5 A continuous effort to systemically integrate drowning prevention framework across regulatory activities enforcing water safety, adequate supply of clean water, maritime/boating safety, occupational health and safety, disaster risk management and sustainable spatial and non-spatial development planning, emphasizing the importance of disaster risk reduction and climate change adaptation to the efforts of reducing fatalities, with clear obligations, responsibilities and coordination mechanisms between agencies, is required in Indonesia.

Future research

More research on drowning is needed in Indonesia across all domains, however several priorities for future research were noted, with a particular focus on developing and improving the performance of drowning surveillance to ensure the availability and reliability of drowning mortality and morbidity data across Indonesia. Studies investigating the measurement of association between accidental, disaster- and water transport-related drowning risk factors, and the incidence of fatal and non-fatal unintentional drowning incidents are essential to inform the appropriate prevention measures for Indonesia. Further research on drowning cases related to disasters, disabilities, genders, older populations and children is also vital to provide a better understanding of the at-risk populations in the country (Pearm and Franklin, 2013; Franklin *et al.*, 2014; Peden and Franklin, 2019; Clemens *et al.*, 2021; Roberts *et al.*, 2021).

In addition, further investigation on broader health promotion approaches that reflect a socio-ecological approach to drowning prevention is imperative for Indonesian context. It is particularly important to explore the potential vital link between unintentional drowning prevention and safe water provision, boating and maritime safety regulations and enforcement, occupational safety and health, rural development, disaster risk management and efforts to bridge economic inequities and disparities in accessing healthcare across different populations, particularly impacting the socio-economically disadvantaged populations of rural and remote areas of archipelagic Indonesia (Suwardjo *et al.*, 2010; Muis *et al.*, 2015; Djalante and Garschagen, 2017; Hu *et al.*, 2018; Sari and Prayoga, 2018; Mantong *et al.*, 2020; Saputra, 2021; Indonesian National Disaster Management Agency, 2023a, 2023b).

Strengths and limitations

Several factors contributed to the strength of this review, including the inclusion of studies published in Indonesian

language and the use of broad search terms to capture the extensive causes of drowning and the wide areas where drowning may occur. However, several limitations were also identified. Firstly, it is possible that not all studies exploring unintentional drowning in Indonesia were located. In addition, the lack of information on accidental, disaster-related and water transport-related drowning mortality numbers, cause of deaths, data sources and at-risk populations, along with the inconsistency in data collection and reporting between articles, may compromise the accuracy and quality of drowning data identified, limiting the generalizability and mortality rate inference from the findings, potentially resulting in the underestimation of the magnitude of unintentional drowning mortality across Indonesia.

CONCLUSION

Limited publications on drowning rates, risk factors and prevention were observed within Indonesia. The unavailability of a coordinated national drowning data collection system in Indonesia underlines the possibility of under-representation of drowning mortality. The under-investigated measurement of association between various exposures and fatal drowning incidents was identified, potentially hindering the development of prevention interventions. The over-reliance on individual-focused prevention measures was observed in Indonesia, with an apparent under-development of socio-ecological health promotion approaches to drowning prevention. Several highlights for future research were noted, with a particular focus on improving the performance of drowning surveillance, to ensure the availability and reliability of drowning mortality and morbidity data across Indonesia. Broader health promotion approaches that reflect a socio-ecological approach to drowning prevention in Indonesia is also imperative in reducing drowning incidents and fatalities in Indonesia.

FUNDING

Open access publishing facilitated by James Cook University, as part of the Oxford University Press - James Cook University Read and Publish Agreement negotiated by the Council of Australian University Librarians.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

SUPPLEMENTARY MATERIAL

Supplementary material is available at *Health Promotion International* online.

REFERENCES

- Ahlm, K., Saveman, B. -I. and Björnstig, U. (2013) Drowning deaths in Sweden with emphasis on the presence of alcohol and drugs – A retrospective study, 1992–2009. *BMC Public Health*, 13, 216.
- Alfonso, Y. N., Hyder, A. A., Alonge, O., Salam, S. S., Baset, K., Rahman, A. *et al.* (2021) Cost-effectiveness analysis of a large-scale crèche intervention to prevent child drowning in rural Bangladesh. *Injury Epidemiology*, 8, 61–61.
- Alonge, O., Bishai, D., Wadhvaniya, S., Agrawal, P., Rahman, A., Dewan Hoque, E. M. *et al.* (2020) Large-scale evaluation of interventions designed to reduce childhood drownings in rural Bangladesh: a before and after cohort study. *Injury Epidemiology*, 7, 17–17.
- Andry, M. A. and Yuliani, F. (2014) Implementasi kebijakan keselamatan pelayaran. *Jurnal Administrasi Pembangunan*, 2, 259–264.
- Arksey, H. and O'Malley, L. (2005) Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology*, 8, 19–32.
- Astrea, I. D. and Alit, I. B. P. (2015) Tanda kardinal pemeriksaan eksternal jenazah diduga tenggelam dari data Bagian Ilmu Kedokteran Forensik RSUD Sanglah Bali tahun 2012–2014. *E-Jurnal Medika Udayana*, 4, 1–9.
- Bennett, E. and Linnan, M. (2014) Physical barriers. In J. J. L. M. Bierens (eds), *Drowning: Prevention, Rescue, Treatment*. Springer Berlin Heidelberg, Berlin, Heidelberg, 181–185.
- Buchori, I., Sugiri, A., Mussadun, M., Wadley, D., Liu, Y., Pramitasari, A. *et al.* (2018) A predictive model to assess spatial planning in addressing hydro-meteorological hazards: a case study of Semarang City, Indonesia. *International Journal of Disaster Risk Reduction*, 27, 415–426.
- Cenderadewi, M., Franklin, R. and Devine, S. (2020) The socio-ecological nature of drowning in low and middle-income countries: a review to inform health promotion approaches. *International Journal of Aquatic Research and Education*, 12, 1–61.
- Clemens, T., Peden, A. E. and Franklin, R. C. (2021) Exploring a hidden epidemic: drowning among adults aged 65 years and older. *Journal of Aging and Health*, 33, 828–837.
- Crawford, G., Leavy, J., Portsmouth, L., Jancey, J., Leaversuch, F., Nimmo, L. *et al.* (2014) Development of a systematic review of public health interventions to prevent children drowning. *Open Journal of Preventive Medicine*, 04, 100–106.
- Denehy, M., Crawford, G., Leavy, J., Nimmo, L. and Jancey, J. (2016) Formative research to develop theory-based messages for a Western Australian child drowning prevention television campaign: study protocol. *BMJ Open*, 6, e010033.
- Djalante, R. and Garschagen, M. (2017) A review of disaster trend and disaster risk governance in Indonesia: 1900–2015. In R. Djalante, M. Garschagen, F. Thomalla and R. Shaw (eds), *Disaster Risk Reduction in Indonesia: progress, Challenges, and Issues*. Springer International Publishing, Switzerland, 21–56.
- Donson, H. and Van Niekerk, A. (2013) Unintentional drowning in urban South Africa: a retrospective investigation, 2001–2005. *International Journal of Injury Control and Safety Promotion*, 20, 218–226.
- Doocy, S., Robinson, C., Moodie, C. and Burnham, G. (2009) Tsunami-related injury in Aceh Province, Indonesia. *Global Public Health*, 4, 205–214.
- Doocy, S., Rofi, A., Moodie, C., Spring, E., Bradley, S., Burnham, G. *et al.* (2007) Tsunami mortality in Aceh Province, Indonesia. *Bulletin of the World Health Organization*, 85, 273–278.
- Elsi, M. and Gusti, D. (2020) Pengetahuan dan sikap nelayan terhadap pertolongan pertama kejadian tenggelam di Kelurahan Purus Kota Padang. *Jurnal Kesehatan Sainitika Meditory*, 2, 152–157.
- Embassy of Indonesia for the United States of America. (2019) Indonesia: Facts and figure. Embassy of Indonesia for the United States of America. <https://www.embassyofindonesia.org/index.php/basic-facts/> (last accessed 25 July, 2019).
- Faradisi, F., Aktifah, N. and Kartikasari, D. (2021) Pelatihan kegawatdaruratan akibat tenggelam (henti nafas henti jantung) pada pedagang makanan di bibir Pantai Joko Tingkir Petarukan Pemalang. *Jurnal Batikmu*, 1, 5–9.
- Fernalia, F., Pawilyah, P., Triana, N., Colin, V., Listiana, D., Herman, A. *et al.* (2022) Pembentukan kelompok masyarakat terlatih water rescue di kampung binaan Segana. *Jurnal Kreativitas Pengabdian kepada Masyarakat (PKM)*, 5, 705–710.
- Franklin, R., King, J., Watt, K., Aitken, P. and Leggat, P. (2014) Media, risk, and prevention – Lessons for aquatic safety from newsworthy deaths: precipice for prevention or just good tales? *International Journal of Aquatic Research and Education*, 8, 182–194.
- Franklin, R. and Scarr, J. (2014) A framework for prevention. In J. J. L. M. Bierens (eds), *Drowning: Prevention, Rescue, Treatment*. Springer Berlin Heidelberg, Berlin, Heidelberg, 153–163.
- Franklin, R. C., Peden, A. E., Hamilton, E. B., Bisignano, C., Castle, C. D., Dingels, Z. V. *et al.* (2020) The burden of unintentional drowning: global, regional and national estimates of mortality from the Global Burden of Disease 2017 Study. *Injury Prevention*, 26, i83–i95.
- Giles, A. R., Brooks-Cleator, L. A. and Glass, C. T. R. (2017) Barriers to sustainable health promotion and injury prevention in the Northwest Territories, Canada. In G. Fondahl and G. N. Wilson (eds), *Northern Sustainability: Understanding and Addressing Change in the Circumpolar World*. Springer International Publishing, 151–162.
- Global Facility for Disaster Reduction and Recovery. (2019) Indonesia: Natural hazard risk. Global Facility for Disaster Reduction and Recovery. <https://www.gfdrr.org/en/indonesia> (last accessed 25 July 2019).
- Gobel, A. M., Kumaat, L. T. and Mulyadi, N. (2014) Pengaruh pendidikan kesehatan tentang penanganan pertama korban tenggelam air laut terhadap peningkatan pengetahuan masyarakat nelayan di Desa Bolang Itang II Kabupaten Bolaang Mongondow Utara. *Jurnal Keperawatan*, 2, 1–8.
- Guevarra, J. P., Franklin, R. C., Basilio, J. A., Orbillo, L. L. and Go, J. J. L. (2015) Child drowning prevention in the Philippines: the beginning of a conversation. *International Journal of Injury Control and Safety Promotion*, 22, 243–253.
- Guevarra, J. P., Peden, A. E. and Franklin, R. C. (2021) Application of the PRECEDE-PROCEED model in the

- development of evidence-informed interventions for drowning prevention: a mixed-methods study protocol. *BMJ Open*, 11, e050688.
- Hady, A., Simunati, S., Dillah, R., Hariani, H. and Yakub, A. S. (2020) Pengaruh metode role play terhadap peningkatan keterampilan menolong korban tenggelam pada masyarakat pesisir di Desa Tamasaju Kabupaten Takalar. *Media Keperawatan: Politeknik Kesehatan Makassar*, 11, 158–162.
- Handayani, W., Fisher, M. R., Rudiarto, I., Setyono, J. S. and Foley, D. (2019) Operationalizing resilience: a content analysis of flood disaster planning in two coastal cities in Central Java, Indonesia. *International Journal of Disaster Risk Reduction*, 35, 101073.
- Hapsari, R. I. and Zenurianto, M. (2016) View of flood disaster management in Indonesia and the key solutions. *American Journal of Engineering Research*, 5, 140–151.
- Hu, P., Zhang, Q., Shi, P., Chen, B. and Fang, J. (2018) Flood-induced mortality across the globe: Spatiotemporal pattern and influencing factors. *The Science of the Total Environment*, 643, 171–182.
- Hyder, A. A., Alonge, O., He, S., Wadhvaniya, S., Rahman, F., Rahman, A. et al. (2014) A framework for addressing implementation gap in global drowning prevention interventions: experiences from Bangladesh. *Journal of Health, Population, and Nutrition*, 32, 564–576.
- Indonesian Ministry of Health. (2015) Preventing drowning in children: A handbook. <http://p2ptm.kemkes.go.id/uploads/2016/10/Buku-Saku-Pengendalian-Tenggelam-pada-Anak.pdf> (last accessed 28 April 2021).
- Indonesian Ministry of Health. (2017) National clinical practice guideline for treatment of trauma cases https://yankes.kemkes.go.id/unduhuan/fileunduhuan_1610422327_714480.pdf (last accessed 28 April 2023).
- Indonesian Ministry of Health. (2020) Accountability report: Directorate of occupational and sports health. <https://e-renggar.kemkes.go.id/file2018/e-performance/1-466467-4tahunan-527.pdf> (last accessed 30 July 2023).
- Indonesian National Bureau of Statistics. (2019) Statistical Yearbook of Indonesia: 2019. The Indonesian National Bureau of Statistics. <https://www.bps.go.id/publication/2019/07/04/daac1ba18cae1e90706ee58a/statistik-indonesia-2019.html> (last accessed 25 July 2020).
- Indonesian National Disaster Management Agency. (2023a) Disaster information database. <https://dibi.bnpb.go.id/> (last accessed 30 May 2023).
- Indonesian National Disaster Management Agency. (2023b) News on shipping/boating accidents related to drowning. <https://bnpb.go.id/cari/tenggelam> (last accessed 30 May 2023).
- Isa, M., Fauzi, A. and Susilowati, I. (2019) Flood risk reduction in the northern coast of Central Java Province, Indonesia: an application of stakeholder's analysis. *Jamba (Potchefstroom, South Africa)*, 11, 660.
- Joanna Briggs Institute. (2020) JBI Manual for Evidence Synthesis. <https://synthesismanual.jbi.global>. (last accessed 22 January 2023).
- Kurusu, A., Suga, H., Prochazka, Z., Suzuki, K., Oguri, K. and Inoue, T. (2018) Potential technique for improving the survival of victims of tsunamis. *PLoS One*, 13, e0197498.
- Leavy, J. E., Crawford, G., Leaversuch, F., Nimmo, L., McCausland, K. and Jancey, J. (2016) A review of drowning prevention interventions for children and young people in high, low and middle income countries. *Journal of Community Health*, 41, 424–441.
- Leavy, J. E., Crawford, G., Portsmouth, L., Jancey, J., Leaversuch, F., Nimmo, L. et al. (2015) Recreational drowning prevention interventions for adults, 1990–2012: a review. *Journal of Community Health*, 40, 725–735.
- Leavy, J. E., Gray, C., Della Bona, M., D'Orazio, N. and Crawford, G. (2023) A review of interventions for drowning prevention among adults. *Journal of Community Health*, 48, 539–556.
- Lesmana, H., Parman, D. H., Alfaanur, A. and Darni, D. (2018) Program pemberdayaan masyarakat melalui pelatihan penanganan korban tenggelam. *JMM (Jurnal Masyarakat Mandiri)*, 2, 108–117.
- Linnan, M., Rahman, A., Scarr, J., Reinten-Reynolds, T., Linnan, H., Rui-wei, J. et al. (2012) Child drowning: evidence for a newly recognized cause of child mortality in low and middle income countries in Asia. *UNICEF Office of Research, Florence*.
- Linnan, M., Scarr, J. and Giersing, M. (2013) Toward a world where children do not drown. *JAMA Pediatrics*, 167, 110–111.
- Linnan, M., Scarr, J. and Linnan, H. (2014) Drowning prevention in low- and middle-income countries versus high-income countries. In J. J. L. M. Bieren (eds), *Drowning: Prevention, Rescue, Treatment*. Springer Berlin Heidelberg, Berlin, Heidelberg, 165–173.
- Mantong, A., Kembara, G., Dzakwan, M. and Kharisma, M. (2020) Maritime safety In Indonesia: Mapping the challenges and opportunities. Center for Strategic and International Studies. Indonesia. <https://mail.csis.or.id/publications/maritime-safety-in-indonesia-mapping-the-challenges-and-opportunities/> (last accessed 26 May 2023).
- Matzopoulos, R. (2002) The national injury mortality surveillance system: a profile of fatal injuries in South Africa, 2000. *Injury and Safety Monitor*, 1, 3.
- McGowan, J., Straus, S., Moher, D., Langlois, E. V., O'Brien, K. K., Horsley, T. et al. (2020) Reporting scoping reviews—PRISMA ScR extension. *Journal of Clinical Epidemiology*, 123, 177–179.
- Mokdad, A. H., Forouzanfar, M. H., Daoud, F., Mokdad, A. A., El Bcheraoui, C., Moradi-Lakeh, M. et al. (2016) Global burden of diseases, injuries, and risk factors for young people's health during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet (London, England)*, 387, 2383–2401.
- Morris, N. K., du Toit-Prinsloo, L. and Saayman, G. (2016) Drowning in Pretoria, South Africa: a 10-year review. *Journal of Forensic and Legal Medicine*, 37, 66–70.
- Muis, S., Guneralp, B., Jongman, B., Aerts, J. C. J. H. and Ward, P. J. (2015) Flood risk and adaptation strategies under climate change and urban expansion: a probabilistic analysis using global data. *The Science of the Total Environment*, 538, 445–457.
- Nadapdap, L. S. (2021). Literature review: Gambaran pengetahuan masyarakat terhadap pertolongan pertama pada penanganan korban tenggelam, Politeknik Kesehatan Kementerian Kesehatan Medan.
- Nugroho, C. and Suryono. (2020) Analisis self efficacy peserta pelatihan penanganan kegawatdaruratan pada korban balita tenggelam. *Jurnal Ilmiah Pamenang*, 2, 41–45.

- Ose, M. I., Lesmana, H., Parman, D. H. and Tukan, R. A. (2020) Pemberdayaan kader dalam emergency first aid penanganan henti jantung korban tenggelam pada wilayah pesisir Tarakan. *Jurnal Pemberdayaan: Publikasi Hasil Pengabdian kepada Masyarakat*, 4, 47–54.
- Patimah, S. (2019) Pengaruh pendidikan kesehatan tentang pertolongan pertama korban tenggelam dan pelatihan BHD terhadap peningkatan pengetahuan masyarakat di Kota Jayapura. *Healthy Papua-Jurnal Keperawatan dan Kesehatan*, 2, 86–93.
- Patimah, S., Sima, Y. and Suryani, A. S. (2019) Gambaran pengetahuan dan sikap masyarakat terhadap pertolongan pertama pada penanganan korban tenggelam di Wilayah Hamadi. *Healthy Papua-Jurnal Keperawatan dan Kesehatan*, 2, 33–38.
- Pearn, J. and Franklin, R. (2013) Disability and drowning: personal experiences, research, and practicalities of adapted aquatics. *International Journal of Aquatic Research and Education*, 7, 157–162.
- Peden, A. and Franklin, R. (2019) Exploring flood-related unintentional fatal drowning of children and adolescents aged 0–19 years in Australia. *Safety*, 5, 1–13.
- Plitponkarpim, A. and Chinapa, M. (2014) Trend of child injury and drowning in Thailand, and child safety promotion initiative. *The Southeast Asian Journal of Tropical Medicine and Public Health*, 45, 50–52.
- Pranoto, N. W., Chaeroni, A., Gemaini, A. and Irawan, R. (2023) Pembelajaran water rescue pada kelompok sadar wisata di Desa Tua Pejat Kepulauan Mentawai. *Jurnal Pengabdian Masyarakat Olahraga dan Kesehatan (JASO)*, 3, 25–31.
- Prasetyo, D. D. (2017). Identifikasi tingkat pengetahuan masyarakat pesisir tentang pertolongan pertama pada kejadian tenggelam di Desa Batu Gong Kabupaten Konawi Provinsi Sulawesi Tenggara. Politeknik Kesehatan Kementerian Kesehatan Kendari.
- Rahman, A., Miah, A. H., Mashreky, S. R., Shafinaz, S., Linnan, M. and Rahman, F. (2010) Initial community response to a childhood drowning prevention programme in a rural setting in Bangladesh. *Injury Prevention*, 16, 21–25.
- Rahman, A. F. and Rahman, A. (2022) 456 Childhood drowning prevention efforts in Bangladesh: exemplary for LMICs. *Injury Prevention*, 28, A69–A70.
- Rahman, F., Bose, S., Linnan, M., Rahman, A., Mashreky, S., Haaland, B. et al. (2012) Cost-effectiveness of an injury and drowning prevention program in Bangladesh. *Pediatrics*, 130, e1621–e1628.
- Rethlefsen, M. L., Kirtley, S., Waffenschmidt, S., Ayala, A. P., Moher, D., Page, M. J. et al; PRISMA-S Group. (2021) PRISMA-S: an extension to the PRISMA statement for reporting literature searches in systematic reviews. *Systematic Reviews*, 10, 39.
- Reynolds, T. A., Bisanzo, M., Dworkis, D., Hansoti, B., Obermeyer, Z., Seidenberg, P. et al. (2013) Research priorities for data collection and management within global acute and emergency care systems. *Academic Emergency Medicine*, 20, 1246–1250.
- Roberts, K., Thom, O., Devine, S., Leggat, P. A., Peden, A. E. and Franklin, R. C. (2021) A scoping review of female drowning: an underexplored issue in five high-income countries. *BMC Public Health*, 21, 1072.
- Rosmi, Y. F., Mardhika, R., Hadi, S. R., Rohman, U., Sumardi, S. and Nuryadi, A. (2020) Pembelajaran water rescue sebagai tanggap awal keselamatan menghadapi banjir bagi Karang Taruna Kecamatan Benjeng, Kabupaten Gresik. *Jurnal Pengabdian pada Masyarakat*, 5, 672–680.
- Sadewa, Y. R., Nugroho, S., Amajida, A. and Manihuruk, F. (2023) Modification of water rescue tool for saving the drowned people at the swimming pool. *International Journal of Multidisciplinary Research and Analysis*, 6, 1441–1450.
- Saputra, A. D. (2021) Studi kecelakaan kapal di Indonesia dari tahun 2003-2019 berdasarkan data investigasi Komite Nasional Keselamatan Transportasi. *Warta Penelitian Perhubungan*, 33, 87–94.
- Sari, A. D. and Prayoga, N. (2018) Enhancing citizen engagement in the face of climate change risks: a case study of the flood early warning system and health information system in Semarang City, Indonesia. *Climate Change in Cities: Innovations in Multi-Level Governance*, 1, 121–137.
- Scarr, J. -P. and Jagnoor, J. (2022) Identifying opportunities for multisectoral action for drowning prevention: A scoping review. *Injury Prevention*, 28, 585–594.
- Schuerman, N., Cinnamon, J., Matzopoulos, R., Fawcett, V., Nicol, A. and Hameed, S. M. (2011) Collecting injury surveillance data in low- and middle-income countries: the Cape Town Trauma Registry pilot. *Global Public Health*, 6, 874–889.
- Sillehu, S. and Kartika, D. (2018) Hubungan peran satuan Basarnas dengan keselamatan korban tenggelam di laut pada Kantor Basarnas Kota Ambon Provinsi Maluku tahun 2015. *Global Health Science*, 3, 185–190.
- Sindall, R., Mecrow, T., Queiroga, A. C., Boyer, C., Koon, W. and Peden, A. E. (2022) Drowning risk and climate change: a state-of-the-art review. *Injury prevention : journal of the International Society for Child and Adolescent Injury Prevention*, 28, 185–191.
- Stempski, S., Liu, L., Grow, H. M., Pomietto, M., Chung, C., Shumann, A. et al. (2015) Everyone swims. *Health Education & Behavior*, 42, 106S–114S.
- Sugiantoro, M. F. and Wahyudi, W. T. (2021) Pengaruh promosi kesehatan terhadap tingkat pengetahuan dan sikap masyarakat nelayan tentang pertolongan pertama korban tenggelam air laut di Dusun Mutun Desa Sukajaya Lempasing Kabupaten Pesawaran Lampung. *Malabayati Nursing Journal*, 3, 374–385.
- Sukarna, R. A., Amiruddin, A. and Ginanjar, S. L. (2021) Peningkatan pengetahuan dan keterampilan kelompok pedagang tentang evakuasi korban tenggelam di Belitung. *Journal of Community Health Development*, 2, 72–78.
- Suryono, S. and Nugroho, C. (2020) Pelatihan penanganan kegawatdaruratan pada korban balita tenggelam di Desa Darungan. *Journal of Community Engagement in Health*, 3, 320–324.
- Suwardjo, D., Haluan, J., Jaya, I. and Soen'an, H. P. (2010) Kajian tingkat kecelakaan fatal, pencegahan dan mitigasi kecelakaan kapal-kapal penangkap ikan yang berbasis operasi di PPP Tegalsari, PPN Pekalongan dan PPS Cilacap. *Jurnal Teknologi Perikanan dan Kelautan*, 1, 61–72.
- Talab, A., Rahman, A., Rahman, F., Hossain, J., Scarr, J. and Linnan, M. (2016) 270 Survival swimming – effectiveness of swimsafe in preventing drowning in mid and late childhood. *Injury Prevention*, 22, A99.1–A99.9.

- Talbot, L. and Verrinder, G. (2017) *Promoting health: the primary health care approach*. Elsevier Health Sciences, Australia, 30–33.
- Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D. et al. (2018) PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Annals of Internal Medicine*, 169, 467–473.
- United Nations. (2019) Country report of the Republic of Indonesia. United Nations Group of Experts on Geographical Names. https://unstats.un.org/unsd/geoinfo/UNGEGN/docs/1st-session/GEGN.2_2019_CRP.132_Country_Report_Indonesia_2019.pdf (last accessed 21 February 2022).
- United Nations. (2021) UN General Assembly Resolution on global drowning prevention. <https://undocs.org/A/75/L.76> (last accessed 28 April 2021).
- Usaputro, R. and Yulianti, K. (2013) Karakteristik serta faktor resiko kematian akibat tenggelam berdasarkan data Bagian Ilmu Kedokteran Forensik Rumah Sakit Umum Pusat Sanglah 2010–2012. *E-Jurnal Medika Udayana*, 3, 551–561.
- Welebuntu, M., Manoppo, S. J. and Gobel, I. (2021) Gambaran pengetahuan masyarakat Kampung Kulur II mengenai pertolongan pertama pada kecelakaan laut. *Jurnal Ilmiah Sesebanua*, 5, 48–53.
- Widyastuti, M. and Rustini, S. A. (2017) Gambaran pengetahuan masyarakat pesisir tentang pertolongan korban tenggelam di Kenjeran Surabaya. *Prosiding HEFA (Health Events for All)*, 1, 272–279.
- World Health Organization Regional Office for the Eastern Mediterranean. (2017) Health promotion and disease prevention through population-based interventions, including action to address social determinants and health inequity. World Health Organization. <http://www.emro.who.int/about-who/public-health-functions/health-promotion-disease-prevention.html> (last accessed 30 July 2017).
- World Health Organization. (2014) Global report on drowning: preventing a leading killer. World Health Organization. http://apps.who.int/iris/bitstream/10665/143893/1/9789241564786_eng.pdf?ua=1&ua=1&ua=1 (last accessed 12 March 2021).
- World Health Organization. (2016) Global health estimates 2015: deaths by cause, age, sex, by country and by region, 2000–2015. World Health Organization. http://www.who.int/healthinfo/global_burden_disease/estimates/en/index1.html (last accessed 21 June 2022).
- World Health Organization. (2017) Preventing drowning: an implementation guide. <http://apps.who.int/iris/bitstream/10665/255196/1/9789241511933-eng.pdf> (last accessed 21 June 2022).
- World Health Organization. (2019) International statistical classification of diseases and related health problems 10th revision (ICD-10) - WHO version for 2019-covid-expanded. International statistical classification of diseases and related health problems 10th revision. <https://icd.who.int/browse10/2019/en#/W65-W74> (last accessed 25 May, 2023).
- World Health Organization. (2021) Regional status report on drowning in South-East Asia. World Health Organization. <https://apps.who.int/iris/bitstream/handle/10665/343085/9789290228608-eng.pdf?sequence=1&isAllowed=y> (last accessed 25 February 2022).
- Wulur, R. A. (2013) Gambaran temuan autopsi kasus tenggelam di BLU RSU Prof Dr RD Kandou Manado periode Januari 2007-Desember 2011. *E-Clinic*, 1, 1–5.

Appendix 2: Peer-Reviewed Publication – ‘The burden of unintentional drowning in Indonesia: Insights from the Global Burden of Disease Study 2019’

Cenderadewi M, Devine SG, Peden AE, Franklin RC. The burden of unintentional drowning in Indonesia: Insights from the Global Burden of Disease Study 2019. *Injury Prevention*. 2024;doi:10.1136/ip-2024-045274



Burden of unintentional drowning in Indonesia: insights from the Global Burden of Disease Study 2019

Muthia Cenderadewi ^{1,2}, Susan G Devine ¹, Amy E Peden ^{1,3,4}, Richard Charles Franklin ^{1,4} GBD 2019 Indonesia Drowning Collaborators

¹College of Public Health, Medical, and Veterinary Sciences, James Cook University, Townsville, Queensland, Australia

²Faculty of Medicine, University of Mataram, Mataram, West Nusa Tenggara, Indonesia

³School of Public Health and Community Medicine, University of New South Wales, Sydney, New South Wales, Australia

⁴Royal Life Saving Society - Australia, Broadway, New South Wales, Australia

Correspondence to

Professor Richard Charles Franklin, James Cook University, Townsville, Queensland, Australia; Richard.Franklin@jcu.edu.au

Received 7 February 2024
Accepted 22 June 2024

ABSTRACT

Introduction A high burden of unintentional fatal drowning has been reported in low- and middle-income countries. However, little is known about unintentional drowning in Indonesia.

Methods This population-based retrospective cohort study analysed unintentional drowning data for Indonesia sourced from The Global Burden of Disease Study 2019. Estimates of trends, mortality rates, incidence rates, years lived with disability (YLDs) and disability adjusted life years were generated.

Results A decline in unintentional drowning mortality rates was observed, with an average annual mortality rate of 2.58/100 000. Males were 1.81 (95% CI 1.79 to 1.84) times more likely than females to unintentionally drown. Average annual mortality rates were highest among the under-5 age group (9.67/100 000) and 70 and over (5.71/100 000 for males; 5.14/100 000 for females). Distributions of drowning deaths vary depending on region, with mortality rates higher in Papua, Kalimantan, Sulawesi, Maluku, Sumatra and Nusa Tenggara regions.

Discussion While a decline in drowning mortality rates in Indonesia was identified between 2005 and 2019, mortality rates for unintentional drowning remained high among children under 5 years, the elderly population and those residing in Papua, Kalimantan, Sulawesi, Maluku, Sumatra and Nusa Tenggara, warranting further focused attention.

Conclusion A downward trend in the rate of unintentional drowning deaths in Indonesia is observed from 2005 onwards, with risk variation based on age, gender and region. The findings highlight the importance of addressing drowning as a cause of premature mortality and health system burden in Indonesia, including through enhancing drowning data collection systems and identifying drowning risk factors.

WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Most drowning deaths worldwide occurred in low- and middle-income countries (91%), particularly in Southeast Asia (35%).
- ⇒ No publication on the national level of drowning rates in Indonesia has been identified.

WHAT THIS STUDY ADDS

- ⇒ Between 2005 and 2019, a decline in unintentional drowning mortality rates was observed, with an average annual mortality rate of 2.58/100 000.
- ⇒ The unintentional drowning risk varies based on age, sex and region in Indonesia. Being male, aged under 5, aged 70 years and above and residing in provinces in Papua, Kalimantan, Sulawesi, Maluku, Sumatra and Nusa Tenggara, were recognised as risk factors.

HOW MIGHT THIS STUDY AFFECT RESEARCH, PRACTICE, OR POLICY

- ⇒ The findings highlight the importance of continuing to enhance drowning data collection systems, as well as identifying drowning risk factors and developing contextualised drowning preventive strategies in Indonesia.

Located in the Southeast Asia region, Indonesia consists of 16056 islands, with a population of over 270 200 000 and a density of 141 people/km².⁴ Indonesia's vast area comprises 1 919 440 km² of land area, including 93 000 km² of inland seas and 615 9032 km² of water area, exposing Indonesians to a high risk of drowning and submersion^{5 6} (figure 1). Despite this, according to the 2021 Regional Status Report on Drowning in Southeast Asia by the WHO, Indonesia does not have a national coordination mechanism for drowning prevention and water safety, and no coordinated national death registry from which national and subnational drowning data can be collected.⁷

To further understand the magnitude of drowning as a public health problem in Indonesia, this research aims to examine mortality rates, incidence rates, years of life lost (YLLs) and risk factors of fatal unintentional drowning in Indonesia and investigate the overall drowning burden via years lived with disability (YLDs) and disability adjusted life years (DALYs), between 2005 and 2019 using the 2019 Global Burden of Disease (GBD) Study estimates.



© Author(s) (or their employer(s)) 2024. Re-use permitted under CC BY. Published by BMJ.

To cite: Cenderadewi M, Devine SG, Peden AE, et al. *Inj Prev* Epub ahead of print: [please include Day Month Year]. doi:10.1136/ijp-2024-045274

INTRODUCTION

Drowning represents a major challenge for global public health.^{1 2} In 2017, an estimated 295 210 deaths occurred globally due to unintentional drowning, with a global mortality rate of 4/100 000.³ Most drowning deaths worldwide occurred in low- and middle-income countries (LMICs) (91%), particularly in Southeast Asia (35%).¹ However, less is known about unintentional drowning deaths in Indonesia, the world's largest archipelagic state and the fourth most populated nation.⁴

Original research



Figure 1 Map of Indonesia.

METHODS

This study was undertaken as a population-based retrospective cohort study. This study is part of a larger explanatory sequential mixed-methods study investigating unintentional drowning in Indonesia, which comprised three phases: (1) a scoping review⁸; (2) a retrospective cohort study reported here and (3) a qualitative study aimed to expand the quantitative findings. The scoping review⁸ revealed the limited availability of drowning data in Indonesia, informing our decision to use the GBD Study 2019 data as the primary source for this investigation.

An analysis of quantitative, national data sourced from the GBD Study 2019⁹ by the Institute for Health Metrics and Evaluation (IHME) database was performed to generate estimates of mortality rates, incidence rates, YLDs, YLLs and DALYs for unintentional drowning at a national and subnational level in Indonesia, including all its 34 provinces. The data collected, spanned the period of 2005–2019 and, in coordination with the Indonesian Ministry of Health, was collected using verbal autopsy survey instruments and modelling.⁹ This current study focuses on unintentional drowning, as defined by the International Classification of Disease (ICD) ninth revision (ICD-9) and ICD-10 codes. The GBD Study 2019 used the ICD-9 code, E910 and ICD-10 codes (W65–W74) for unintentional drowning.^{3 10–12} These codes do not include unintentional drowning due to water transport and disaster, nor drowning of intentional or undetermined intent and are considered an underestimation of drowning.¹³

In this study, ‘incidence’ pertains specifically to the frequency of non-fatal drowning incidents within the Indonesian population throughout the study duration. This definition excludes drowning-related fatalities, which were treated distinctly as mortality events. Information on DALYs, YLDs and YLLs due to drowning were also inferred to assess the overall burden of drowning in Indonesia.¹⁴ One DALY represents the loss of an equivalence of one year of life with full health. DALYs for drowning are the sum of YLLs due to premature mortality caused by drowning and YLDs due to drowning and/or submersion.¹⁴

Data were downloaded using the IHME GBD results tool between March 2021 until March 2022 for collecting drowning data for the period of 2005–2019 for Indonesia and the subnational provinces.⁹ The year 2005 is chosen as the starting year of investigation, as a consensus on the establishment for a definition of drowning was issued by the WHO in 2005, which included both fatal and non-fatal drowning cases.¹⁵

This study complies with the Guidelines for Accurate and Transparent Health Estimates Reporting recommendations.¹⁶

Data abstraction

The following data were extracted on unintentional drowning deaths and non-fatal submersion in Indonesia: mortality rates, incidence rates, YLDs, YLLs and DALYs,¹⁴ based on year, gender, age group (under 5, 5–14 years, 15–49 years, 50–69 years and 70+ years) and province of Indonesia.

Analysis

Data were extracted from the GBD Study 2019 and entered into Microsoft Excel and analysed using IBM SPSS Statistics V.27. Trend analysis between the period of 2005 and 2019 was inferred with linear regression. Relative risk (RR), with a 95% CI (Confidence Interval), was calculated to measure the association between exposures of interest (sex, age group, jurisdiction or province) and unintentional drowning deaths. Where RR was calculated, the predictor group with the lowest annual mortality rate was used as the reference point (except for provinces, where the rate for Jakarta as the capital province of Indonesia was used as the reference point).

Ethics approval

Ethics approval was granted by the University of Mataram of Indonesia (Ethics Approval number 128/UN18.F8/ETIK/2023).

Funding

GBD is supported by the Bill and Melinda Gates Foundation. The funders of the study had no role in the study design, data collection, data analysis, data interpretation, writing of the report or the decision to submit the article for publication. All authors had full access to the data in the study and had final responsibility for the decision to submit for publication.

RESULTS

In total, there were 94 035 (95% UI (Uncertainty Interval): 77 135.3 to 108 737.1) unintentional drowning deaths in Indonesia between 2005 and 2019, of which 69% were males.

Incidence and mortality rates

The average annual mortality rate in Indonesia between 2005 and 2019 was 2.58/100 000. Notably, there was a consistent

decrease observed in the drowning mortality rate over this period, from 3.35/100 000 in 2005 to 1.93/100 000 in 2019 (table 1). This trend is supported by a high R^2 of 0.99 obtained from the regression model. The regression equation ($y = -0.10x + 209.53$) reinforces this pattern, with a negative coefficient indicating a declining trend. These results collectively suggest a significant decrease in drowning mortality rates throughout the years under analysis. While there is evidence suggesting a negative trend in non-fatal drowning incidence rates over the study period, the linear regression model fails to sufficiently explain the overall relationship between the variables ($y = -0.11x + 243.86$, $R^2 = 0.06$).

Mortality rates by age group and gender

Between 2005 and 2019, drowning mortality rates for both males and females of all ages decreased in Indonesia (figure 2 and online supplemental table S2). The highest drowning mortality rate across the 15-year period was identified among under-5 males, with an average annual mortality rate of 9.67/100 000 between 2005 and 2019, contributing the largest proportion of deaths by unintentional drowning in Indonesia (34.74%) (figure 2, online supplemental table S1). Between 2005 and 2019, unintentional drowning mortality rates were higher for males than females across all age groups (figure 2, table 2, online supplemental table S2).

Mortality rates by province

Distributions of drowning deaths by sex vary depending on region. Of 34 provinces in Indonesia, the highest drowning death rates for all age groups in the year 2019 were observed in male populations in the provinces of North Kalimantan (10.95/100 000), Central Kalimantan (10.06/100 000), Papua (5.51/100 000 populations) and Gorontalo (5.21/100 000), which are located in the central and eastern part of Indonesia, in comparison with mortality rates from unintentional drowning in other provinces in the western part of Indonesia (figure 3, online supplemental table S1).

In 2019, the highest male under-5 drowning mortality rates were observed in North Kalimantan (26.50/100 000), Papua (24.46/100 000) and West Sulawesi (18.38/100 000) (figure 4 and online supplemental table S1). For female populations, the highest drowning death rates for the under-5 age group in the year 2019 were observed in the province of Papua (32.58/100 000), which was higher than in other provinces (figure 4 and online supplemental table S1). Between 2005 and 2019, several provinces experienced the highest reductions in child drowning cases, including Maluku ($y = -1.44x + 30.51$, $R^2 = 0.97$), West Nusa Tenggara ($y = -0.99x + 23.35$, $R^2 = 0.98$), Papua ($y = -0.92x + 42.45$, $R^2 = 0.92$), West Sulawesi ($y = -0.97x + 27.19$, $R^2 = 0.98$), North Maluku ($y = -0.86x + 25.07$, $R^2 = 0.98$), South Sulawesi ($y = -0.85x + 18.42$, $R^2 = 0.98$), East Nusa Tenggara ($y = -0.83x + 21.37$, $R^2 = 0.96$), South Sumatra ($y = -0.81x + 22.90$, $R^2 = 0.98$), North Kalimantan ($y = -0.72x + 27.42$, $R^2 = 0.94$) and Riau ($y = -0.61x + 15.34$, $R^2 = 0.96$).

YLDs and DALYs

Unintentional drowning DALYs showed a decrease between 2005 and 2019 ($y = -8.26x + 243.95$, $R^2 = 0.99$), with rate of DALYs of 239.46 (95% UI: 182.48 to 281.34) in 2005 and 125.13 (95% UI: 99.76 to 148.05) in 2019 (table 1).

Risk factors

In Indonesia, males were 1.81 times (95% CI 1.79 to 1.84) more likely than females to unintentionally drown (table 2). Indonesian children aged less than 5 years old were 3.67 times (95% CI 3.63 to 3.72) more likely to become victims of fatal drowning in comparison to individuals aged between 15 and 49 years (table 2). Elderly populations were also an important contributor, with individuals aged 70 years and above 2.5 times (95% CI 2.45 to 2.56) more likely to fatally drown in comparison to individuals aged 15–49 years (table 2).

The top three highest average annual mortality rates for unintentional drowning were registered in the provinces of North Kalimantan (7.23/100 000), Papua (6.92/100 000) and Central Kalimantan (6.78/100 000), and individuals in Papua had the highest likelihood of dying from unintentional drowning (RR=3.98), compared with the reference group of the metropolitan capital of Indonesia, Jakarta (table 2).

DISCUSSION

Unintentional drowning is a little studied public health issue in Indonesia. Overall, this study identifies a decline in drowning mortality rates in Indonesia between 2005 and 2019 ($R^2 = 0.99$, $y = -0.10x + 209.53$). During the 15-year study period, mortality rates for unintentional drowning were higher in males than females and also higher among children aged under 5 years, elderly populations aged 70 years and above, and populations residing in the Papua, Kalimantan, Sulawesi, Maluku, Sumatra and Nusa Tenggara regions. These findings underscore the need for further focused attention and interventions in these demographic groups and geographical areas.

The rates and trends of unintentional drowning in Indonesia

Overall, there was a decrease in drowning mortality rates, with an average annual mortality rate between 2005 and 2019 of 2.58/100 000. However, it is acknowledged that the GBD Study 2019 data for Indonesia was mostly sourced from verbal autopsy data, and only reported unintentional drowning, while excluding cases caused by water-transport related and disaster-related drowning incidents, thus potentially underrepresenting the actual magnitude of drowning in Indonesia. A previous study in Australia has reported how different ICD-10 coding combinations affected the capture of drowning deaths in the national register.¹³ When specific ICD codes of W65–W74 for accidental drowning and submersion were used, as in the GBD Study 2019, only 61% of unintentional drowning deaths were captured. However, inclusion of additional drowning-related codes for accidental drowning related to watercrafts, floodings and undetermined intent increased the capture rate to 78%, and when the drowning codes used were expanded to include intentional drowning events, with multiple causes of death considered, the capture rate rose to 92%.¹³

DALYs attributed to unintentional drowning in Indonesia declined between 2005 and 2019 (table 1 and online supplemental table S1). The observed decrease in incidents of drowning among children under the age of 5 in Indonesia during the study period ($y = -0.36x + 740.01$, $R^2 = 0.98$) likely contributes to the overall reduction in DALYs. In this study, the low YLDs correspond with findings from a previous study, which reported lower YLDs for children aged under 5 in LMICs, compared with high-income

Original research

Table 1 Drowning incidence, mortality, YLLs, YLDs and DALYs in Indonesia 2005–2019

Year	Number of non-fatal drowning cases	95% UI (Uncertainty interval)	Non-fatal drowning incidence rates (per 100,000)	95% UI (Uncertainty interval)	Number of drowning deaths	95% UI (Uncertainty interval)	Mortality rates (per 100,000)	95% UI (Uncertainty interval)	YLD	95% UI (Uncertainty interval)	YLDs (per 100,000)	95% UI (Uncertainty interval)	YLLs	95% UI (Uncertainty interval)	YLLs (per 100,000)	95% UI (Uncertainty interval)	Ratio of YLLs (per 100,000)	95% UI (Uncertainty interval)	95% UI (Uncertainty interval)	95% UI (Uncertainty interval)	Ratio of DALYs (per 100,000)	95% UI (Uncertainty interval)	95% UI (Uncertainty interval)	
2005	61,352.4	46,075.2 to 84,026.33	26.98	19.82 to 36.95	7,616	6,020.7 to 87,485.9	3.35	2.73 to 3.95	2513.69	1738.27 to 3482.23	1.11	0.76 to 1.52	541,007.91	412,684.15 to 637,405.50	238.35	167.20 to 290.28	187.20 to 238.35	544,591.60	414,986.38 to 639,666.26	238.46	182.48 to 281.24	544,591.60	414,986.38 to 639,666.26	
2006	71,758.46	52,714.19 to 101,862.47	31.61	22.98 to 44.26	7,279	5,945.22 to 84,782.78	3.21	2.59 to 3.66	2530.15	1732.76 to 3489.02	1.10	0.75 to 1.52	511,000.01	393,000.54 to 610,907.60	228.53	170.24 to 285.42	170.24 to 228.53	533,939.16	395,220.40 to 618,833.36	228.62	171.75 to 265.69	533,939.16	395,220.40 to 618,833.36	
2007	69,358.17	48,260.77 to 101,862.47	25.55	18.85 to 35.87	7,087	5,837.65 to 83,334.34	3.04	2.52 to 3.53	2536.56	1746.95 to 3204.65	1.09	0.75 to 1.50	498,411.02	385,035.04 to 521,807.99	214.02	165.35 to 254.42	165.35 to 214.02	509,647.59	389,152.79 to 594,969.96	215.11	166.68 to 255.47	509,647.59	389,152.79 to 594,969.96	
2008	69,170.82	48,260.77 to 84,026.33	25.55	18.41 to 35.69	7,051	5,837.65 to 81,282.72	2.99	2.48 to 3.45	2537.32	1,745.10 to 3,486.62	1.08	0.74 to 1.48	495,300.81	381,165.60 to 584,817.20	210.17	162.02 to 248.11	162.02 to 210.17	497,818.13	384,129.77 to 589,972.59	211.34	163.08 to 245.09	497,818.13	384,129.77 to 589,972.59	
2009	61,336.06	45,240.77 to 86,650.32	26.09	19.07 to 36.47	6,946	5,578.32 to 80,111.40	2.92	2.34 to 3.38	2536.73	1,747.54 to 3,514.79	1.07	0.73 to 1.48	486,051.52	363,275.60 to 574,788.41	204.09	152.59 to 241.34	152.59 to 204.09	488,588.65	365,705.73 to 577,254.86	205.15	153.55 to 242.37	488,588.65	365,705.73 to 577,254.86	
2010	61,051.52	45,705.06 to 88,193.95	26.19	18.99 to 36.64	6,917	5,490.69 to 77,785.91	2.79	2.28 to 3.23	2536.61	1,754.11 to 3,498.70	1.05	0.73 to 1.45	486,659.88	352,554.59 to 551,056.60	198.87	146.47 to 229.20	146.47 to 198.87	489,196.59	354,600.35 to 554,969.94	194.92	147.32 to 230.57	489,196.59	354,600.35 to 554,969.94	
2011	61,240.39	44,072.92 to 88,333.37	25.19	18.12 to 35.50	6,920	5,375.99 to 74,357.72	2.68	2.16 to 3.06	2525.79	1,737.92 to 3,467.77	1.04	0.71 to 1.42	450,292.95	330,202.55 to 525,400.36	185.16	135.81 to 216.66	135.81 to 185.16	452,808.74	333,438.39 to 527,808.40	186.2	137.10 to 217.04	452,808.74	333,438.39 to 527,808.40	
2012	60,690.65	43,623.47 to 85,781.12	24.79	17.77 to 34.53	6,839	5,191.51 to 7,239.70	2.57	2.09 to 2.95	2465.40	1,722.69 to 3,448.42	1.02	0.70 to 1.40	432,086.69	329,442.74 to 496,006.56	175.93	134.16 to 206.93	134.16 to 175.93	434,532.08	331,671.73 to 510,824.33	176.96	135.05 to 208.08	434,532.08	331,671.73 to 510,824.33	
2013	60,758.66	43,559.89 to 85,504.81	24.30	17.43 to 34.16	5,818	4,819.67 to 68,073.30	2.46	1.94 to 2.84	2400.63	1,693.25 to 3,369.29	0.99	0.69 to 1.37	419,522.00	309,632.54 to 471,771.23	167.64	126.60 to 199.67	126.60 to 167.64	417,962.02	307,151.16 to 474,465.89	168.84	127.13 to 195.69	417,962.02	307,151.16 to 474,465.89	
2014	60,951.40	43,976.42 to 85,465.30	24.13	17.28 to 33.69	6,905	4,621.39 to 65,613.4	2.35	1.84 to 2.72	2401.33	1,697.56 to 3,369.29	0.97	0.67 to 1.35	398,972.31	292,356.70 to 471,771.23	158.76	120.60 to 189.67	120.60 to 158.76	399,408.04	294,104.71 to 474,465.89	159.73	121.79 to 193.33	399,408.04	294,104.71 to 474,465.89	
2015	63,786.57	45,662.89 to 89,662.94	25.10	17.99 to 35.28	6,835	4,492.61 to 62,319.7	2.12	1.77 to 2.45	2602.20	1,799.32 to 3,533.91	1.02	0.72 to 1.41	346,334.33	279,104.49 to 423,859.44	140.23	109.83 to 168.80	109.83 to 140.23	348,926.53	281,762.31 to 428,335.69	141.25	110.88 to 167.68	348,926.53	281,762.31 to 428,335.69	
2016	61,569.59	47,182.44 to 86,070.90	25.77	18.49 to 36.36	12,515	4,983.57 to 61,558.09	2.06	1.71 to 2.41	2756.08	1,928.99 to 3,847.81	1.09	0.75 to 1.50	343,300.19	263,388.63 to 410,362.08	134.13	102.88 to 160.27	102.88 to 134.13	346,155.20	265,125.58 to 412,660.11	135.22	103.96 to 150.79	346,155.20	265,125.58 to 412,660.11	
2017	61,569.59	47,182.44 to 86,070.90	25.77	18.49 to 36.36	12,515	4,983.57 to 61,558.09	2.06	1.71 to 2.41	2756.08	1,928.99 to 3,847.81	1.09	0.75 to 1.50	343,300.19	263,388.63 to 410,362.08	134.13	102.88 to 160.27	102.88 to 134.13	346,155.20	265,125.58 to 412,660.11	135.22	103.96 to 150.79	346,155.20	265,125.58 to 412,660.11	
2018	61,569.59	47,182.44 to 86,070.90	25.77	18.49 to 36.36	12,515	4,983.57 to 61,558.09	2.06	1.71 to 2.41	2756.08	1,928.99 to 3,847.81	1.09	0.75 to 1.50	343,300.19	263,388.63 to 410,362.08	134.13	102.88 to 160.27	102.88 to 134.13	346,155.20	265,125.58 to 412,660.11	135.22	103.96 to 150.79	346,155.20	265,125.58 to 412,660.11	
2019	61,569.59	47,182.44 to 86,070.90	25.77	18.49 to 36.36	12,515	4,983.57 to 61,558.09	2.06	1.71 to 2.41	2756.08	1,928.99 to 3,847.81	1.09	0.75 to 1.50	343,300.19	263,388.63 to 410,362.08	134.13	102.88 to 160.27	102.88 to 134.13	346,155.20	265,125.58 to 412,660.11	135.22	103.96 to 150.79	346,155.20	265,125.58 to 412,660.11	
DALYs, disability-adjusted life years; YLDs, years of living with disability; YLLs, years of life lost.																								

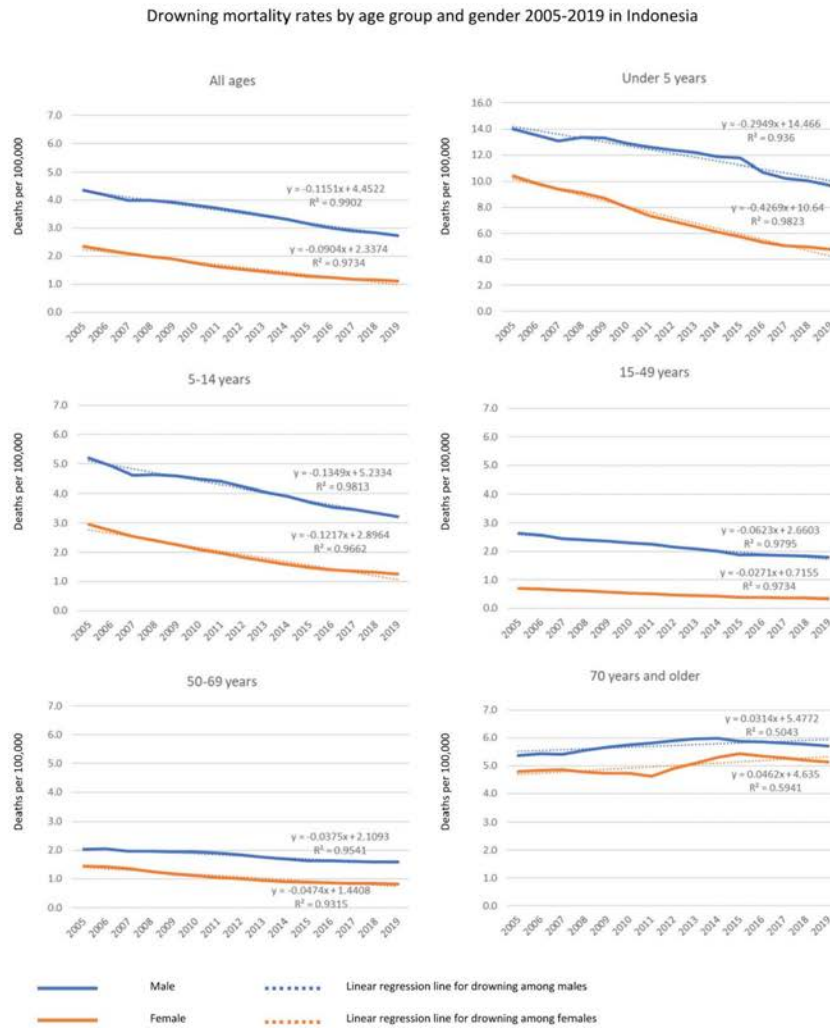


Figure 2 Unintentional drowning mortality rates by age group and gender in Indonesia 2005–2019

nations. This is attributed to the higher proportion of fatal drownings in LMICs.¹⁷

The risk of drowning among males in Indonesia: informing preventive measures

This study found that in Indonesia, males were 1.81 times (95% CI 1.79 to 1.84) more likely than females to unintentionally drown. Among high-income nations, a common observation is the higher likelihood of males experiencing unintentional drowning, which has been linked to risky behaviours. This includes males tending to underestimate the risk of experiencing unintentional drowning and overestimate their knowledge and skill in water-related activities.¹⁸ Therefore, further research on the contributing factors and protective factors related to the risk of drowning is crucial.

These factors may encompass behavioural and sociocultural aspects of drowning and are important in understanding drowning prevention suitable for the Indonesian context.

Unintentional drowning as a leading cause of injury death for Indonesian children

Indonesian children aged under 5 years were 3.67 times (95% CI 3.63 to 3.72) more likely to die from unintentional drowning compared with populations aged 15–49 years. Under-5 drowning mortality rates in Indonesia vary across regions. For instance, in Papua, the under-5 mortality rate in 2019 was 32.6/100 000 for females and 25.4/100 000 for males, surpassing those of other provinces in the country. This finding corresponds to the 2014 WHO Global Report on Drowning which showed children aged under 5 years being disproportionately at risk for drowning.¹

Original research

Table 2 Risk factors of fatal unintentional drowning in Indonesia

	Total deaths by unintentional drowning (n=94 035)	Average annual mortality rate per 100 000 (between 2005 and 2019)	Relative risk (RR)	95% CI
Sex				
Male	64 898	5.227	1.81	1.79 to 1.84
Female*	29 137	3.142	1*	Ref
Age group				
Under 5	32 663	9.665	3.67	3.63 to 3.72
5–14 years	21 222	3.038	1.97	1.94 to 2.00
15–49 years*	26 892	1.331	1*	Ref
50–69 years	7149	1.436	0.87	0.85 to 0.89
70+ years	6109	5.367	2.50	2.45 to 2.56
Jurisdictions/provinces				
Aceh	2082	2.998	1.63	1.54 to 1.73
Bali	868	1.464	0.84	0.78 to 0.91
Bangka-Belitung Islands	568	2.972	1.60	1.47 to 1.76
Banten	4576	2.790	1.49	1.42 to 1.56
Bengkulu	668	2.490	1.41	1.30 to 1.54
Central Java	10 141	2.051	1.23	1.18 to 1.28
Central Kalimantan	2382	6.783	3.69	3.49 to 3.90
Central Sulawesi	874	2.133	1.20	1.12 to 1.30
East Java	11 619	2.062	1.23	1.18 to 1.29
East Kalimantan	993	2.076	1.12	1.04 to 1.21
East Nusa Tenggara	3115	4.286	2.40	2.28 to 2.53
Gorontalo	804	4.899	2.81	2.60 to 3.04
Jakarta*	2510	1.755	1*	Ref
Jambi	1468	3.066	1.70	1.60 to 1.82
Lampung	2778	2.365	0.73	0.69 to 0.78
Maluku	1198	5.004	2.79	2.61 to 3.00
North Kalimantan	623	7.226	3.53	3.23 to 3.85
North Maluku	769	4.808	2.57	2.38 to 2.79
North Sulawesi	470	1.393	0.79	0.71 to 0.87
North Sumatra	8137	4.062	2.35	2.25 to 2.46
Papua	3203	6.918	3.98	3.781 to 4.20
Riau	2085	2.370	1.26	1.19 to 1.33
Riau Islands	529	2.050	1.02	0.93 to 1.12
South Kalimantan	1899	3.286	1.88	1.77 to 1.99
South Sulawesi	4511	3.666	2.14	2.04 to 2.25
South Sumatra	4249	3.701	2.11	2.01 to 2.22
Southeast Sulawesi	988	2.835	1.54	1.43 to 1.65
West Java	12 442	1.857	1.06	1.02 to 1.11
West Kalimantan	1557	2.271	1.29	1.21 to 1.38
West Nusa Tenggara	2443	3.520	2.03	1.92 to 2.14
West Papua	397	3.350	1.74	1.57 to 1.93
West Sulawesi	837	4.605	2.55	2.36 to 2.76
West Sumatra	1435	1.940	1.11	1.04 to 1.18
Yogyakarta	824	1.573	0.33	0.30 to 0.36

*Where RR was calculated, the group with the lowest annual mortality rate (except for jurisdictions, where the rate for Jakarta was used) for unintentional drowning deaths was used as the reference point.

This underscores the urgent need for tailoring drowning prevention strategies in Indonesia to effectively address the heightened risk of drowning among children under the age of 5, particularly across rural populations of eastern Indonesia.

There is limited understanding on contributing factors to the observed decline in child drowning rates in Indonesia.⁸ However, the advancement of socioeconomic determinants of health, particularly the rise in gross domestic product (GDP) per capita, educational attainments and healthcare expenditure, has been identified as an instrumental driver to the reduction of

drowning prevalence, including in under-5 populations, worldwide.¹² This highlights the critical need for further investigation into how socioeconomic advancements and implemented interventions can effectively mitigate the burden of child drowning fatalities across Indonesia.

Fatal unintentional drowning among elderly Indonesians

Individuals aged 70 years and above were 2.5 times more likely to fatally drown compared with individuals aged 15–49 years (table 2). This finding corresponds to reported higher mortality rates among older populations in other countries, including Japan, China, Australia, Canada and New Zealand.^{19–20} From 1950 to 2021, the average global life expectancy at birth has risen by 22.7 years,²¹ and this prolonged lifespan may contribute to the concurrent increase in drowning-related fatalities among older age groups. However, efforts to reduce drowning among older populations have lagged behind that of young children.²⁰ The findings of the current study should be a call to action to invest in drowning prevention among older people in Indonesia.

Jurisdiction as a determinant for unintentional drowning in Indonesia

The distribution of drowning deaths across Indonesia exhibits regional disparities, with the highest mortality rates recorded in the provinces of North Kalimantan (7.23/100 000), Papua (6.92/100 000) and Central Kalimantan (6.78/100 000). This discrepancy underscores the crucial need to investigate how socioeconomic determinants, infrastructure investments and social and environmental changes influence drowning fatalities. Particularly notable are provinces in Kalimantan, Papua, Sulawesi, Maluku and Nusa Tenggara regions, which present some of the nation's lowest GDP per capita, alongside the highest rates of drowning mortality and the highest reductions of child drowning mortalities throughout the 15-year study period.²² Therefore, it is imperative to evaluate the availability and effectiveness of water safety promotion strategies and drowning prevention interventions at both national and provincial levels in Indonesia and their impact on the varying mortality rates across provinces, particularly in provinces that have experienced the highest reductions in Maluku, Nusa Tenggara, Papua, Sulawesi and Kalimantan.

Recommendations

Future research

While this study has provided insight into the issue of unintentional drowning in Indonesia, several key areas for future research are noted: (1) comprehensive examination of mortality and burden associated with all ICD codes for drowning, encompassing unintentional drowning, water transport-related drowning, disaster-related drowning, drowning of undetermined intent and intentional drowning; (2) investigation of drowning risk factors specific to Indonesia and its individual provinces; (3) exploration of the interconnectedness between drowning prevention efforts and initiatives aimed at improving social determinants of health and (4) evaluation of the availability and effectiveness of water safety promotion and drowning prevention interventions.

Policy development

The study underscores the urgent need to advance drowning prevention efforts through robust data collection to inform burden and risk factor identification, as well as agenda

Original research

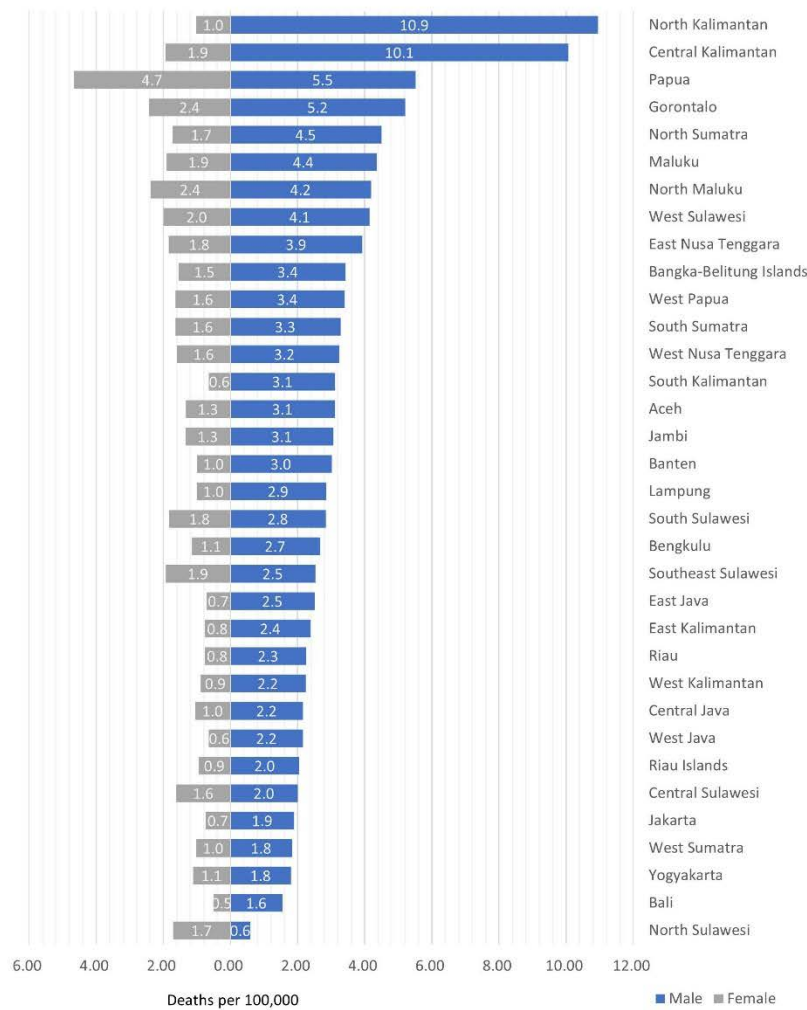


Figure 3 The 2019 mortality rates of unintentional drowning of all ages by sex and province in Indonesia.

setting.²³ Immediate measures are required to strengthen the capabilities of the Indonesian public health system, establish standardised national reporting structures for health and mortality data, foster collaboration across multiple sectors and secure political and financial investment to construct an integrated drowning data collection system in Indonesia. In addition, the study emphasises the urgent need to tailor drowning prevention strategies in Indonesia to effectively address the heightened risk of drowning among children under 5 years of age, particularly in rural populations across eastern Indonesia.

Practice

The increased risk of drowning among children under 5 years of age emphasises the importance of adopting WHO-recommended prevention strategies aimed at reducing drowning fatalities in younger children, including enhancing supervision, establishing community-based child-care centres and installing barriers to limit children’s access to water bodies.^{23 24} However, effective implementation of these interventions requires tailoring to local contexts to ensure the effectiveness and sustainability of drowning

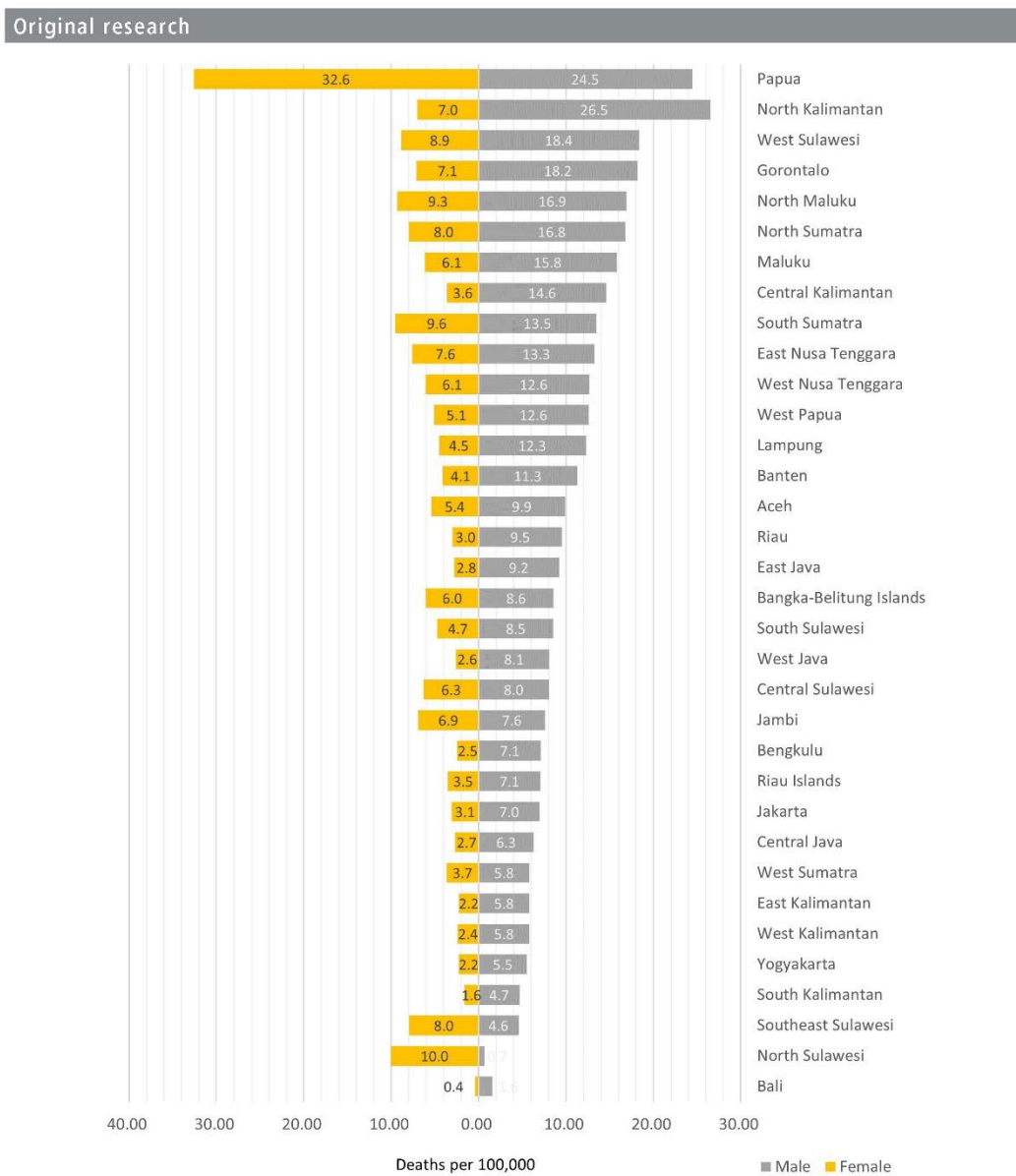


Figure 4 The 2019 under-5 unintentional drowning mortality rates by sex and province in Indonesia.

prevention efforts in reducing child drowning fatalities in Indonesia.²⁵⁻²⁷

Strengths and limitations

This is the first study to explore the epidemiology of drowning in Indonesia. A key strength of this study is the mutually exclusive and exhaustively collected data available via the GBD Study, for both ICD-9 and ICD-10 coded cases for different time periods.^{3 11 12}

However, as in many cases of less optimal injury surveillance systems in developing nations, including in Indonesia, the data on drowning as a cause of death has been collected from verbal autopsy survey instruments, which may result in the underestimation of the actual number of unintentional drowning cases in Indonesia.^{10 11} Moreover, the GBD Study 2019 only reported accidental drowning and submersion events (coded by ICD-10 as W65-W74), excluding disaster-related and water transport-related incidents, which may

further limit understanding of the magnitude of drowning in Indonesia, where hydrometeorological disasters and water transport-related injuries frequently take place.¹³

CONCLUSIONS

Between 2005 and 2019, there was a downward trend in the rate of drowning deaths in Indonesia. Being male, aged under 5 years, aged 70 years and above and residing in provinces of Kalimantan, Papua, Sulawesi, Maluku, Sumatra and Nusa Tenggara regions, were recognised as risk factors. The findings highlight the importance of continuing to enhance data collection systems, identifying risk factors and developing contextualised preventive strategies for drowning in Indonesia.

Acknowledgements R Franklin reports grants or contracts with Heatwaves in Queensland Queensland Government, Arc Flash - Human Factors Queensland Government, and with Mobile Plant Safety Agrifutures; honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events with the World Safety Conference as Conference Convener; support for attending meetings and/or travel for the ACTM Tropical Medicine and Travel Medicine Conference 2022, and the ISTM Travel Medicine Conference, Basel 2023; leadership or fiduciary role in other board, society, committee or advocacy group, paid or unpaid, as Director of Kidsafe, Director of Farnisafe, Director of Auschem, Convener of PHAA Injury Prevention SIG, and member of the Governance Committee of ISASH; all outside the submitted work. N E Ismail reports an unpaid leadership or fiduciary role as the bursar of the Malaysian Academy of Pharmacy, Malaysia, outside the submitted work. S Martini reports an unpaid leadership or fiduciary role as a member of the Indonesian Public Health Expert Association, outside the submitted work. A E Peden reports support for the present manuscript from Australian National Health and Medical Research Council (NHMRC) Emerging Leadership Fellowship (APPID: APP2009306) through her employment at the time of writing. Y L Samodra reports grants or contracts from Taipei Medical University, Taipei, Republic of China through a doctoral scholarship, and from the Faculty of Medicine, Universitas Katolik Parahyangan, Bandung, Indonesia through a commitment fee as a contract based academic staff, mentoring fees from Benang Merah Research Center; other financial interests in idebeasiswa.com through a scholarship mentoring fee; all outside the submitted work. J H V Ticoalu reports other financial or non-financial interests in Benang Merah Research Center as it's co-founder, outside the submitted work.

Collaborators GBD 2019 Indonesia Drowning Collaborators: Muthia Cenderadewi (College of Public Health, Medical, and Veterinary Sciences, James Cook University, Townsville, Queensland, Australia; Faculty of Medicine, University of Mataram, Mataram, West Nusa Tenggara, Indonesia), Susan G Devine (College of Public Health, Medical, and Veterinary Sciences, James Cook University, Townsville, Queensland, Australia), Amy E Peden (College of Public Health, Medical, and Veterinary Sciences, James Cook University, Townsville, Queensland, Australia; School of Public Health and Community Medicine, University of New South Wales, Sydney, New South Wales, Australia; Royal Live Saving Society - Australia, Broadway, New South Wales, Australia), Qorinah Estiningtyas Sakilah Adnani (Faculty of Medicine, Padjadjaran University, Bandung, Indonesia), Ali Ahmed (School of Pharmacy, Monash University Malaysia, Bandar Sunway, Malaysia; Department of Pharmacy, Quaid-i-Azam University Islamabad, Islamabad, Pakistan), Ernoiz Antriyandarti (Agribusiness Study Program, Sebelas Maret University, Surakarta, Indonesia), Sumadi Lukman Anwar (Department of Surgery, Gadjah Mada University, Yogyakarta, Indonesia), Kurnia Dwi Artanti (Department of Epidemiology, Airlangga University, Surabaya, Indonesia), Ni Ketut Ariyastami (National Research and Innovation Agency, Jakarta, Indonesia), Vijayalakshmi S Bhojaraja (Department of Anatomy, Royal College of Surgeons in Ireland Medical University of Bahrain, Busesiteen, Bahrain), Dinh-Toi Chu (Center for Biomedicine and Community Health, Vietnam National University-International School, Hanoi, Viet Nam), Samath Dhamminda Dharmaratne (Department of Community Medicine, University of Peradeniya, Peradeniya, Sri Lanka; Department of Health Metrics Sciences, School of Medicine, University of Washington, Seattle, WA, USA; Institute for Health Metrics and Evaluation, University of Washington, Seattle, WA, USA), Ferry Efendi (Department of Community Health Nursing, Airlangga University, Surabaya, Indonesia; School of Nursing and Midwifery, La Trobe University, Melbourne, Victoria, Australia), Nelsensus Klau Fauk (Torrens University Australia, Adelaide, South Australia, Australia; Institute of Resource Governance and Social Change, Kupang, Indonesia), Ghozali Ghozali (Department of Public Health, University of Muhammadiyah Kalimantan Timur, Samarinda, Indonesia), Arief Hargono (Department of Epidemiology, Airlangga University, Surabaya, Indonesia), Lalu Muhamad Irfan (Faculty of Pharmacy, University of Ahmad Dahlan, Yogyakarta, Indonesia), Nahlah Elkudssiah Ismail (Department of Clinical Pharmacy

and Pharmacy Practice, Asian Institute of Medicine, Science and Technology, Kedah, Malaysia; Malaysian Academy of Pharmacy, Puchong, Malaysia), Umesh Jayarajah (Postgraduate Institute of Medicine, University of Colombo, Colombo, Sri Lanka; Department of Surgery, National Hospital, Colombo, Sri Lanka), Soewarta Kosen (Independent Consultant, Jakarta, Indonesia), Dian Kusuma (Department of Health Services Research and Management, City University of London, London, UK; Faculty of Public Health, University of Indonesia, Depok, Indonesia), Trias Mahmudiono (Institute of Resource Governance and Social Change, Kupang, Indonesia), Santi Martini (Faculty of Public Health, Airlangga University, Surabaya, Indonesia; Indonesian Public Health Association, Surabaya, Indonesia), Madeline E Moberg (Institute for Health Metrics and Evaluation, University of Washington, Seattle, WA, USA), Dina Nur Anggraini Ningrum (Public Health Department, State University of Semarang, Semarang, Indonesia; Graduate Institute of Biomedical Informatics, Taipei Medical University, Taipei, Taiwan), Helena Ulyartha Pangaribuan (National Research and Innovation Agency, Jakarta, Indonesia), Agung Purnomo (Entrepreneurship Department, Bina Nusantara University, Jakarta, Indonesia; Department of Management, Airlangga University, Surabaya, Indonesia), Setyaningrum Rahmawaty (Department of Nutrition Science, Muhammadiyah University of Surakarta, Surakarta, Indonesia), Yohanes Andy Rias (College of Nursing, Bhakti Wiyata Kediri Institute of Health Sciences, Kediri, Indonesia; College of Nursing, Taipei Medical University, Taipei, Taiwan), Elsa Rosyidah (Environmental Engineering Department, Nahdlatul Ulama Sidoarjo University, Sidoarjo, Indonesia), Leo Rulino (Department of Academic Affairs, Husada Karya Jaya Academy of Nursing, Jakarta Utara, Indonesia), Yoseph Leonardo Samodra (School of Public Health, Taipei Medical University, Taipei, Taiwan), Jeevan K Shetty (Department of Biochemistry, Royal College of Surgeons in Ireland Medical University of Bahrain, Busesiteen, Bahrain), Agus Sudyananto (Department of Nursing, Muhammadiyah University of Surakarta, Surakarta, Indonesia), Henry Surendra (Public Health Department, Monash University Indonesia, Tangerang, Indonesia; Oxford University Clinical Research Unit Indonesia, Jakarta, Indonesia), Ingan Ukur Tarigan (National Research and Innovation Agency, Jakarta, Indonesia), Jansje Henry Vera Ticoalu (Faculty of Public Health, Sam Ratulangi University, Manado, Indonesia), Nuwan Darshana Wickramasinghe (Department of Community Medicine, Rajarata University of Sri Lanka, Anuradhapura, Sri Lanka), Richard Charles Franklin (College of Public Health, Medical, and Veterinary Sciences, James Cook University, Townsville, Queensland, Australia; Royal Live Saving Society - Australia, Broadway, New South Wales, Australia).

Contributors MC is the first author. RCF is the senior author. MC, RCF and SD designed the study and drafted the initial manuscript. AEP provided critical feedback to the first draft. MC and RCF analysed the data. All other authors contributed data, interpreted the data or revised the manuscript. All authors read and approved the final manuscript. RCF is the guarantor. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Funding The GBD study is funded by The Bill & Melinda Gates Foundation. The funders of the study had no role in study design; collection, analysis, and interpretation of data; or writing of the report. The corresponding authors had full access to the data and had responsibility for final submission of the manuscript.

Map disclaimer The depiction of boundaries on this map does not imply the expression of any opinion whatsoever on the part of BMJ (or any member of its group) concerning the legal status of any country, territory, jurisdiction or area or of its authorities. This map is provided without any warranty of any kind, either express or implied.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by the University of Mataram of Indonesia (ethics approval number: 128/UN18.F8/ETIK/2023). The participants were deceased.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution 4.0 Unported (CC BY 4.0) license, which permits

Original research

others to copy, redistribute, remix, transform and build upon this work for any purpose, provided the original work is properly cited, a link to the licence is given, and indication of whether changes were made. See: <https://creativecommons.org/licenses/by/4.0/>.

ORCID iDs

Muthia Cenderadewi <http://orcid.org/0000-0002-1349-7613>
 Susan G Devine <http://orcid.org/0000-0001-6687-6003>
 Amy E Peden <http://orcid.org/0000-0002-6424-1511>
 Richard Charles Franklin <http://orcid.org/0000-0003-1864-4552>

REFERENCES

- World Health Organization. Global report on drowning: preventing a leading killer: world health organization. 2014. Available: http://apps.who.int/iris/bitstream/10665/143893/1/9789241564786_eng.pdf?ua=1&ua=1&ua=1
- Tyler MD, Richards DB, Reske-Nielsen C, et al. The epidemiology of drowning in low- and middle-income countries: a systematic review. *BMC Public Health* 2017;17:413.
- Franklin RC, Peden AE, Hamilton EB, et al. The burden of unintentional drowning: global, regional and national estimates of mortality from the global burden of disease 2017 study. *Inj Prev* 2020;26:i83–95.
- Indonesian National Bureau of Statistics. Census results jakarta: the Indonesian national bureau of statistics. 2021. Available: <https://www.bps.go.id/pressrelease/2021/01/21/1854/hasil-sensus-penduduk-2020.html> [Accessed 21 Feb 2024].
- Global Facility for Disaster Reduction and Recovery. Indonesia: natural hazard risk: global facility for disaster reduction and recovery. 2019. Available: <https://www.gfdrr.org/en/indonesia> [Accessed 25 May 2024].
- Indonesian National Bureau of Statistics. Statistical yearbook of Indonesia: 2019. Jakarta: The Indonesian National Bureau of Statistics; 2019. Available: <https://www.bps.go.id/publication/2019/07/04/daac1ba18cae1e90706ee58a/statistik-indonesia-2019.html>
- World Health Organization Regional Office for the South-East Asia. Regional status report on drowning in South-East Asia. World Health Organization; 2021. Available: <https://apps.who.int/iris/bitstream/handle/10665/343085/9789290228608-eng.pdf?sequence=1&isAllowed=y> [Accessed 25 Feb 2024].
- Cenderadewi M, Devine SG, Sari DP, et al. Fatal drowning in Indonesia: understanding knowledge gaps through a scoping review. *Health Promot Int* 2023;38:daad130:1–22.
- Global Burden of Disease Collaborative Network. Global burden of disease study 2019 (GBD 2019) results seattle. United States: Institute for Health Metrics and Evaluation (IHME). 2022. Available: <http://ghdx.healthdata.org/gbd-results-tool> [Accessed 22 May 2024].
- Dicker D, Nguyen G, Abate D, et al. Global, regional, and national age-sex-specific mortality and life expectancy, 1950–2017: a systematic analysis for the global burden of disease study 2017. *Lancet* 2018;392:1684–735.
- Haagsma JA, Graetz N, Bolliger I, et al. The global burden of injury: incidence, mortality, disability-adjusted life years and time trends from the global burden of disease study 2013. *Inj Prev* 2015;22:3–18.
- Tan H, Lin Z, Fu D, et al. Change in global burden of unintentional drowning from 1990 to 2019 and its association with social determinants of health: findings from the global burden of disease study 2019. *BMI Open* 2023;13:e070772.
- Peden AE, Franklin RC, Mahony AJ, et al. Using a retrospective cross-sectional study to analyse unintentional fatal drowning in Australia: ICD-10 coding-based methodologies verses actual deaths. *BMI Open* 2017;7:e019407.
- World Health Organization. The global burden of disease concept. World Health Organization; 2002. Available: https://www.who.int/quantifying_ehimpacts/publications/en/9241546204chap3.pdf [Accessed 21 Feb 2022].
- van Beeck EF, Branche CM, Sapitman D, et al. A new definition of drowning: towards documentation and prevention of a global public health problem. *Bull World Health Organ* 2005;83:853–6.
- Stevens GA, Alkema L, Black RE, et al. Guidelines for accurate and transparent health estimates reporting: the GATHER statement. *Lancet* 2016;388:e19–23.
- Burnay C, Anderson DI, Button C, et al. Infant drowning prevention: insights from a new ecological psychology approach. *Int J Environ Res Public Health* 2022;19:4567:1–9.
- Croft JL, Button C. Interacting factors associated with adult male drowning in New Zealand. *PLoS ONE* 2015;10:e0130545.
- Clemens T, Peden AE, Franklin RC. Exploring a hidden epidemic: drowning among adults aged 65 years and older. *J Aging Health* 2021;33:828–37.
- Peden AE, Franklin RC, Queiroga AC. Epidemiology, risk factors and strategies for the prevention of global unintentional fatal drowning in people aged 50 years and older: a systematic review. *Inj Prev* 2018;24:240–7.
- Schumacher AE, Kyu HH, Aali A, et al. Global age-sex-specific mortality, life expectancy, and population estimates in 204 countries and territories and 811 subnational locations, 1950–2021, and the impact of the COVID-19 pandemic: a comprehensive demographic analysis for the global burden of disease study 2021. *Lancet* 2024;403:1989–2056.
- Indonesian National Bureau of Statistics. GDP per capita by province in Indonesia 2022: Indonesian national bureau of statistics. 2023. Available: <https://www.bps.go.id/id/statistics-table/3/YWtoQIRVZzNlMlU5U1V0SIRFefZiRTR4VDJOVVUMDMjMw==/produkt-domestik-regional-bruto-per-kapita-atas-dasar-harga-berlaku-menurut-provinsi--ribu-rupiah---2022.html?year=2022> [Accessed 17 Jan 2024].
- World Health Organization. Preventing drowning: an implementation guide 2017. Available: <http://apps.who.int/iris/bitstream/10665/255196/1/9789241511933-eng.pdf> [Accessed 25 May 2024].
- Linnam M, Rahman A, Scarr J, et al. *Child Drowning: Evidence for a Newly Recognized Cause of Child Mortality in Low and Middle Income Countries in Asia*. Florence, 2012.
- Scarr J-P, Jagnoor J. Identifying strategic priorities for advancing global drowning prevention: a delphi method. *BMI Glob Health* 2023;8:e013303:1–14.
- Joanknecht L, Argent AC, van Dijk M, et al. Childhood drowning in South Africa: local data should inform prevention strategies. *Pediatr Surg Int* 2015;31:123–30.
- Lukaszyc C, Mittal S, Gupta M, et al. The impact and understanding of childhood drowning by a community in West Bengal, India, and the suggested preventive measures. *Acta Paediatr* 2019;108:731–9.

Supplementary Tables

Supplementary Table S1. Mortality rates of unintentional drowning by sex, age group and province in Indonesia between 2005 and 2019

Year	Jurisdictions	Mortality rates (per 100,000)											
		Under 5		5-14 years		15-49 years		50-69 years		70+ years		All Ages	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
2005	Aceh	16.039	13.927	6.034	3.189	2.832	0.545	1.811	1.032	6.937	6.007	5.136	2.830
	Bali	5.949	2.332	3.235	0.894	2.545	0.396	2.759	0.959	4.832	2.812	3.095	0.826
	Bangka-Belitung Islands	8.691	9.591	4.731	3.148	4.133	1.281	2.292	2.143	7.384	5.766	4.604	2.736
	Banten	18.781	9.981	7.012	2.930	2.652	0.595	1.577	1.019	6.301	6.610	5.275	2.242
	Bengkulu	12.311	6.607	5.120	2.708	2.850	1.055	1.711	1.392	5.224	6.522	4.348	2.183
	Central Java	7.055	6.787	3.043	3.211	2.168	0.797	2.387	2.142	4.214	5.516	2.896	2.158
	Central Kalimantan	19.038	8.008	14.214	3.874	11.198	1.425	12.530	3.323	23.715	14.111	12.989	3.024
	Central Sulawesi	3.103	13.571	0.778	4.707	1.092	1.328	1.109	2.157	1.873	4.833	1.282	3.660
	East Java	13.405	5.348	5.027	1.913	2.396	0.453	1.778	1.044	6.148	3.400	3.823	1.295
	East Kalimantan	10.416	5.794	4.162	1.484	2.739	0.551	1.826	1.282	5.811	6.740	3.849	1.495
	East Nusa Tenggara	23.750	19.566	10.421	6.083	3.649	0.975	2.342	1.588	5.537	4.796	8.035	4.721
	Gorontalo	21.765	13.266	12.564	7.181	3.627	2.194	2.758	3.308	4.317	6.124	7.543	4.647
	Jakarta	10.422	6.464	4.017	1.841	2.009	0.434	1.486	0.834	6.158	6.293	3.190	1.394
	Jambi	9.694	13.395	6.807	1.495	6.590	0.955	5.342	1.359	11.815	7.925	6.935	2.535
	Lampung	12.655	7.123	5.288	2.024	2.292	0.311	1.582	0.878	6.260	6.123	4.039	1.584
	Maluku	36.404	25.145	9.915	6.506	3.238	1.914	2.415	2.316	4.861	5.515	9.326	6.176
	North Kalimantan	40.665	15.850	10.632	2.042	10.568	0.314	17.242	0.513	35.387	2.547	15.150	2.757
	North Maluku	25.003	25.703	9.514	7.056	3.203	2.289	2.088	3.148	4.835	6.709	7.440	6.509
North Sulawesi	0.722	14.386	0.673	2.528	0.737	0.664	1.099	1.346	1.674	7.081	0.794	2.642	

1

	North Sumatra	20.465	14.110	8.118	3.803	3.829	0.865	2.659	1.697	7.264	7.111	6.912	3.364
	Papua	30.656	55.952	8.876	4.900	3.322	0.976	2.157	1.583	6.593	7.550	8.336	9.628
	Riau	19.300	9.119	5.219	2.444	1.540	0.402	1.281	0.904	5.357	6.183	4.587	2.040
	Riau Islands	12.673	8.384	5.298	3.115	1.767	0.501	1.051	1.018	5.117	6.778	3.647	2.020
	South Kalimantan	21.368	2.888	12.110	1.043	9.807	0.352	3.514	0.252	15.282	0.957	10.959	0.749
	South Sulawesi	17.910	16.729	7.852	6.726	1.911	2.885	1.568	5.928	2.652	14.485	5.111	5.886
	South Sumatra	19.781	24.438	6.945	4.546	3.664	0.922	2.884	0.771	8.147	2.618	6.149	4.231
	Southeast Sulawesi	5.071	14.136	3.795	4.670	3.091	1.473	1.852	2.214	3.749	5.448	3.421	3.941
	West Java	11.360	5.926	3.247	1.833	1.877	0.387	1.492	0.581	4.361	2.224	3.176	1.319
	West Kalimantan	14.813	10.109	4.945	2.676	2.613	0.626	1.899	1.170	6.347	6.344	4.519	2.319
	West Nusa Tenggara	19.153	26.834	4.570	6.827	1.798	1.016	1.639	1.711	2.830	3.568	4.465	5.070
	West Papua	19.333	13.785	5.486	3.037	2.100	1.615	1.917	2.697	4.527	6.181	5.109	3.685
	West Sulawesi	31.432	22.496	9.799	5.060	2.895	0.904	1.988	1.674	6.056	7.770	8.466	4.872
	West Sumatra	9.074	11.454	2.697	1.707	1.353	0.610	1.244	0.832	2.171	1.795	2.584	2.106
	Yogyakarta	5.153	2.632	1.969	0.913	1.479	0.465	1.387	1.309	4.929	7.094	2.015	1.255
	Indonesia	13.985	10.451	5.213	2.959	2.633	0.715	2.035	1.441	5.383	4.794	4.349	2.340
2006	Aceh	15.324	12.875	5.717	2.914	2.763	0.532	1.844	1.065	7.028	6.181	4.928	2.639
	Bali	5.624	2.122	2.955	0.801	2.392	0.369	2.681	0.940	4.784	2.785	2.914	0.774
	Bangka-Belitung Islands	8.550	9.083	4.565	2.858	3.967	1.207	2.250	2.114	7.320	5.804	4.447	2.573
	Banten	17.909	9.302	6.547	2.667	2.585	0.564	1.611	1.011	6.441	6.778	5.026	2.089
	Bengkulu	11.855	6.128	4.817	2.480	2.773	1.020	1.722	1.384	5.296	6.615	4.176	2.055
	Central Java	6.945	6.495	2.922	3.028	2.141	0.774	2.425	2.143	4.329	5.618	2.853	2.091
	Central Kalimantan	18.330	7.487	13.312	3.516	10.841	1.357	12.735	3.236	24.121	14.153	12.533	2.841
	Central Sulawesi	3.030	12.537	0.733	4.314	1.054	1.261	1.096	2.123	1.893	4.851	1.240	3.401
	East Java	13.054	5.104	4.781	1.762	2.319	0.426	1.775	1.009	6.198	3.410	3.698	1.231
	East Kalimantan	9.770	5.274	3.972	1.381	2.761	0.538	1.815	1.258	5.722	6.705	3.747	1.403
	East Nusa Tenggara	22.299	17.973	9.743	5.608	3.465	0.929	2.319	1.587	5.593	4.925	7.557	4.378
	Gorontalo	21.121	12.518	11.914	6.795	3.542	2.145	2.775	3.310	4.384	6.200	7.248	4.449

	Jakarta	9.974	6.035	3.824	1.708	1.932	0.410	1.463	0.807	6.101	6.233	3.056	1.308
	Jambi	9.419	13.288	6.509	1.384	6.621	0.940	5.477	1.349	11.914	7.963	6.874	2.487
	Lampung	12.591	6.905	5.069	1.965	2.251	0.311	1.572	0.874	6.285	6.235	3.943	1.546
	Maluku	33.889	22.819	9.350	5.905	3.201	1.828	2.473	2.303	5.030	5.565	8.810	5.672
	North Kalimantan	37.673	14.293	10.013	1.888	10.295	0.297	17.387	0.504	35.671	2.556	14.489	2.485
	North Maluku	23.769	23.808	8.916	6.410	3.030	2.190	2.064	3.138	4.872	6.781	7.009	6.041
	North Sulawesi	0.704	13.519	0.647	2.432	0.706	0.643	1.078	1.339	1.663	7.111	0.770	2.518
	North Sumatra	19.820	13.308	7.685	3.458	3.718	0.807	2.647	1.645	7.305	7.107	6.640	3.139
	Papua	29.928	53.364	8.457	4.571	3.168	0.914	2.150	1.549	6.582	7.563	8.024	9.107
	Riau	18.638	8.583	4.918	2.226	1.497	0.380	1.283	0.882	5.395	6.180	4.398	1.909
	Riau Islands	11.969	7.796	5.015	2.880	1.694	0.494	1.060	1.051	5.192	6.981	3.488	1.915
	South Kalimantan	20.017	2.716	11.215	0.975	9.396	0.334	3.474	0.254	15.197	0.982	10.363	0.705
	South Sulawesi	17.486	15.629	7.345	6.093	1.838	2.715	1.577	5.767	2.707	14.228	4.876	5.510
	South Sumatra	19.165	22.998	6.657	4.388	3.558	0.892	2.849	0.776	8.067	2.677	5.932	4.002
	Southeast Sulawesi	4.984	13.442	3.618	4.332	2.978	1.397	1.843	2.182	3.725	5.484	3.303	3.723
	West Java	11.013	5.618	3.090	1.700	1.810	0.369	1.493	0.578	4.434	2.292	3.057	1.245
	West Kalimantan	13.776	9.204	4.568	2.419	2.499	0.594	1.891	1.164	6.357	6.395	4.241	2.134
	West Nusa Tenggara	18.206	24.340	4.276	6.244	1.738	0.960	1.627	1.669	2.850	3.590	4.234	4.620
	West Papua	19.686	13.677	5.996	3.540	2.603	1.817	1.952	2.777	4.490	6.236	5.523	3.897
	West Sulawesi	30.291	21.200	9.224	4.762	2.779	0.894	1.957	1.694	5.995	7.848	8.055	4.606
	West Sumatra	8.672	10.612	2.496	1.537	1.315	0.578	1.249	0.826	2.199	1.809	2.460	1.949
	Yogyakarta	5.065	2.542	1.908	0.861	1.447	0.438	1.388	1.275	4.964	7.057	1.982	1.225
	Indonesia	13.518	9.855	4.937	2.741	2.559	0.682	2.042	1.418	5.443	4.834	4.191	2.212
2007	Aceh	14.755	11.927	5.406	2.665	2.727	0.520	1.888	1.094	7.162	6.375	4.760	2.469
	Bali	5.542	2.030	2.787	0.749	2.297	0.355	2.621	0.921	4.773	2.773	2.812	0.747
	Bangka-Belitung Islands	8.486	8.793	4.377	2.744	3.894	1.123	2.219	1.978	7.291	5.634	4.347	2.448
	Banten	17.302	8.806	6.093	2.411	2.507	0.531	1.636	0.998	6.607	6.968	4.806	1.958
	Bengkulu	11.469	5.751	4.545	2.287	2.707	0.981	1.727	1.371	5.393	6.744	4.026	1.945
	Central Java	6.844	6.426	2.682	2.783	1.796	0.628	2.061	1.782	3.852	5.000	2.535	1.877

Central Kalimantan	17.724	6.741	12.495	3.132	10.575	1.537	12.892	4.091	24.346	15.148	12.154	2.868
Central Sulawesi	2.779	11.707	0.688	3.974	0.992	1.145	1.060	1.955	1.848	4.698	1.158	3.133
East Java	12.815	4.949	4.562	1.641	2.260	0.412	1.773	1.010	6.278	3.527	3.594	1.197
East Kalimantan	9.227	4.855	3.839	1.307	2.811	0.530	1.808	1.236	5.642	6.761	3.683	1.334
East Nusa Tenggara	21.449	16.929	9.209	5.299	3.392	0.904	2.285	1.555	5.596	4.957	7.242	4.145
Gorontalo	20.861	12.027	11.413	6.480	3.490	2.092	2.790	3.281	4.455	6.265	7.039	4.284
Jakarta	9.704	5.749	3.640	1.595	1.849	0.385	1.435	0.780	6.079	6.214	2.938	1.242
Jambi	9.054	12.933	5.674	1.295	5.535	0.917	4.279	1.340	11.166	8.358	5.906	2.418
Lampung	12.684	6.739	4.810	1.855	2.142	0.301	1.544	0.862	6.300	6.356	3.813	1.495
Maluku	31.000	20.865	8.394	5.293	2.983	1.655	2.421	2.166	5.020	5.438	8.040	5.150
North Kalimantan	36.436	13.081	9.929	1.730	10.225	0.267	17.462	0.468	35.891	2.478	14.257	2.247
North Maluku	22.206	22.064	8.018	5.795	2.745	1.998	1.951	2.945	4.731	6.613	6.394	5.528
North Sulawesi	0.706	13.174	0.622	2.362	0.678	0.633	1.055	1.334	1.650	7.193	0.747	2.454
North Sumatra	19.694	12.981	7.356	3.267	3.693	0.783	2.652	1.595	7.380	7.136	6.506	3.025
Papua	28.927	50.373	7.966	4.188	2.915	0.826	2.110	1.500	6.545	7.491	7.599	8.506
Riau	18.179	8.209	4.553	2.028	1.445	0.357	1.280	0.855	5.460	6.199	4.214	1.801
Riau Islands	11.333	7.237	4.723	2.631	1.590	0.473	1.056	1.072	5.244	7.154	3.316	1.802
South Kalimantan	19.374	2.510	10.676	0.900	9.382	0.322	3.552	0.249	15.740	0.990	10.163	0.659
South Sulawesi	16.060	14.855	6.219	5.600	1.705	2.807	1.548	6.206	2.680	16.748	4.351	5.507
South Sumatra	19.082	22.034	6.736	4.262	3.695	0.862	3.054	0.736	9.094	2.568	6.033	3.822
Southeast Sulawesi	4.942	12.785	3.456	4.022	2.893	1.273	1.828	2.040	3.724	5.353	3.209	3.477
West Java	10.312	5.297	2.806	1.557	1.728	0.334	1.496	0.569	4.530	2.352	2.867	1.159
West Kalimantan	12.886	8.362	4.195	2.171	2.388	0.554	1.867	1.141	6.380	6.440	3.980	1.954
West Nusa Tenggara	16.756	22.142	3.794	5.688	1.608	0.867	1.586	1.578	2.814	3.458	3.864	4.183
West Papua	18.336	12.390	5.323	3.109	2.291	1.629	1.840	2.620	4.237	6.015	4.986	3.501
West Sulawesi	29.056	19.891	8.588	4.428	2.620	0.866	1.900	1.697	5.948	7.983	7.586	4.319
West Sumatra	8.239	9.412	2.260	1.319	1.266	0.528	1.248	0.772	2.222	1.738	2.319	1.725
Yogyakarta	5.297	2.636	1.905	0.863	1.447	0.429	1.404	1.244	5.081	7.111	2.006	1.232
Indonesia	13.067	9.393	4.613	2.536	2.440	0.641	1.971	1.357	5.417	4.852	3.988	2.089

4

2008	Aceh	14.611	11.566	5.212	2.571	2.661	0.509	1.866	1.085	7.181	6.477	4.643	2.392
	Bali	5.685	2.030	2.712	0.718	2.271	0.345	2.593	0.902	4.775	2.759	2.788	0.734
	Bangka-Belitung Islands	8.498	8.613	4.248	2.533	3.750	1.033	2.190	1.907	7.274	5.830	4.225	2.326
	Banten	16.886	8.448	5.735	2.235	2.425	0.505	1.642	0.982	6.688	7.097	4.623	1.862
	Bengkulu	11.240	5.504	4.365	2.146	2.626	0.946	1.713	1.345	5.441	6.853	3.901	1.862
	Central Java	7.668	6.017	3.111	2.551	1.919	0.637	2.132	1.740	4.232	5.345	2.772	1.814
	Central Kalimantan	17.434	6.418	12.265	2.973	10.358	1.452	12.908	3.875	24.575	15.069	11.949	2.733
	Central Sulawesi	3.920	11.358	0.740	3.767	1.106	1.089	1.144	1.897	2.220	4.852	1.375	2.996
	East Java	12.753	4.872	4.442	1.563	2.264	0.361	1.763	0.786	6.385	2.982	3.557	1.088
	East Kalimantan	8.762	4.496	3.698	1.224	2.744	0.503	1.781	1.204	5.605	6.811	3.555	1.257
	East Nusa Tenggara	20.673	15.838	8.689	4.873	3.195	0.839	2.256	1.515	5.758	4.998	6.881	3.854
	Gorontalo	21.247	12.026	11.101	6.298	3.463	2.042	2.808	3.227	4.535	6.305	6.946	4.191
	Jakarta	9.585	5.579	3.531	1.528	1.790	0.371	1.407	0.764	6.041	6.234	2.862	1.202
	Jambi	8.948	12.041	5.203	1.228	4.710	0.852	3.498	1.262	10.478	8.414	5.229	2.260
	Lampung	13.011	6.752	4.674	1.803	2.102	0.294	1.542	0.843	6.388	6.452	3.774	1.476
	Maluku	30.380	19.162	8.478	4.807	3.055	1.556	2.452	2.088	5.342	5.591	7.984	4.740
	North Kalimantan	34.976	12.577	9.496	1.661	9.951	0.251	17.351	0.455	35.805	2.580	13.789	2.131
	North Maluku	22.244	21.022	8.154	5.464	2.796	1.898	1.977	2.855	5.005	6.838	6.420	5.231
	North Sulawesi	0.700	12.824	0.606	2.306	0.659	0.608	1.018	1.305	1.633	7.160	0.730	2.374
	North Sumatra	19.599	12.737	7.079	3.103	3.605	0.749	2.607	1.536	7.395	7.157	6.346	2.920
	Papua	29.034	50.957	7.802	4.172	3.097	0.863	2.120	1.480	6.566	7.479	7.647	8.555
	Riau	17.755	7.905	4.291	1.875	1.411	0.344	1.281	0.833	5.509	6.219	4.064	1.716
	Riau Islands	10.662	6.670	4.415	2.398	1.509	0.441	1.062	1.053	5.318	7.169	3.151	1.679
	South Kalimantan	16.701	2.771	9.269	1.050	7.742	0.311	3.024	0.297	13.758	1.261	8.545	0.715
	South Sulawesi	16.193	14.271	6.273	5.096	1.942	2.313	1.766	4.905	3.307	14.142	4.507	4.816
	South Sumatra	18.734	20.922	5.941	4.012	3.267	0.880	2.743	0.953	9.208	3.536	5.535	3.681
	Southeast Sulawesi	4.961	12.583	3.346	3.849	2.845	1.200	1.818	1.974	3.725	5.529	3.154	3.357
	West Java	11.714	5.125	3.306	1.459	1.768	0.312	1.502	0.563	4.614	2.445	3.116	1.105
	West Kalimantan	12.137	7.719	3.909	1.998	2.311	0.532	1.846	1.127	6.381	6.476	3.775	1.823

	West Nusa Tenggara	18.619	20.810	4.352	5.163	1.817	0.993	1.718	1.783	3.270	4.285	4.313	4.028
	West Papua	18.273	11.642	5.426	2.945	2.353	1.541	1.831	2.516	4.358	6.087	5.010	3.301
	West Sulawesi	28.178	19.093	8.135	4.197	2.559	0.836	1.890	1.671	5.992	8.060	7.261	4.113
	West Sumatra	8.657	11.322	2.475	1.624	1.330	0.579	1.290	0.917	2.330	2.229	2.441	2.041
	Yogyakarta	5.557	2.749	1.915	0.865	1.442	0.416	1.407	1.210	5.158	7.174	2.026	1.237
	Indonesia	13.351	9.142	4.621	2.387	2.404	0.605	1.965	1.254	5.559	4.779	3.983	1.993
2009	Aceh	14.333	10.910	5.057	2.468	2.603	0.497	1.848	1.082	7.215	6.585	4.522	2.280
	Bali	5.442	1.905	2.570	0.669	2.255	0.336	2.556	0.879	4.735	2.713	2.722	0.706
	Bangka-Belitung Islands	8.457	8.261	4.133	2.281	3.564	0.940	2.156	1.834	7.256	5.930	4.076	2.174
	Banten	16.415	8.013	5.454	2.082	2.358	0.481	1.634	0.964	6.735	7.175	4.459	1.764
	Bengkulu	11.024	5.198	4.245	2.012	2.535	0.907	1.691	1.317	5.470	6.960	3.784	1.774
	Central Java	8.003	5.588	3.359	2.359	1.994	0.631	2.146	1.660	4.475	5.541	2.888	1.737
	Central Kalimantan	16.955	5.980	12.027	2.818	10.167	1.393	12.950	3.764	24.869	15.097	11.742	2.612
	Central Sulawesi	5.013	10.929	0.818	3.592	1.203	1.037	1.206	1.836	2.570	4.946	1.573	2.857
	East Java	12.648	4.717	4.337	1.499	2.255	0.328	1.753	0.647	6.464	2.634	3.507	1.005
	East Kalimantan	8.385	4.160	3.597	1.155	2.681	0.475	1.752	1.172	5.572	6.834	3.446	1.185
	East Nusa Tenggara	19.520	14.476	8.226	4.502	3.074	0.795	2.226	1.475	5.840	5.016	6.514	3.550
	Gorontalo	21.344	11.835	10.747	6.119	3.364	1.995	2.783	3.202	4.587	6.431	6.763	4.083
	Jakarta	9.313	5.301	3.421	1.464	1.737	0.356	1.379	0.748	5.989	6.235	2.774	1.153
	Jambi	8.728	10.525	4.822	1.171	4.026	0.793	2.923	1.201	9.794	8.484	4.658	2.046
	Lampung	13.179	6.617	4.550	1.720	2.037	0.281	1.532	0.824	6.460	6.549	3.704	1.431
	Maluku	28.663	17.512	8.303	4.534	3.054	1.492	2.471	2.060	5.571	5.799	7.673	4.409
	North Kalimantan	33.746	11.844	9.250	1.598	9.765	0.238	17.270	0.444	35.706	2.638	13.441	1.988
	North Maluku	21.631	19.609	8.016	5.078	2.712	1.775	1.962	2.759	5.149	6.960	6.218	4.860
	North Sulawesi	0.702	12.101	0.595	2.234	0.631	0.578	0.977	1.270	1.610	7.133	0.708	2.254
	North Sumatra	19.641	12.463	6.901	2.982	3.561	0.720	2.579	1.481	7.430	7.193	6.250	2.824
Papua	28.726	49.527	7.620	4.054	3.083	0.838	2.111	1.443	6.562	7.415	7.518	8.260	
Riau	17.294	7.505	4.122	1.770	1.389	0.334	1.276	0.814	5.556	6.259	3.933	1.631	
Riau Islands	10.085	6.184	4.195	2.228	1.446	0.416	1.058	1.044	5.369	7.170	3.019	1.580	

	South Kalimantan	14.336	2.823	8.223	1.142	6.564	0.305	2.735	0.349	12.339	1.570	7.337	0.743
	South Sulawesi	15.840	13.481	6.193	4.713	2.118	1.968	1.936	4.058	3.893	12.488	4.539	4.294
	South Sumatra	18.518	20.168	5.504	3.898	3.024	0.888	2.549	1.114	9.351	4.323	5.241	3.592
	Southeast Sulawesi	4.943	12.129	3.255	3.659	2.794	1.125	1.795	1.903	3.713	5.627	3.095	3.197
	West Java	12.130	4.769	3.594	1.363	1.780	0.296	1.506	0.553	4.678	2.506	3.202	1.035
	West Kalimantan	11.371	6.973	3.692	1.859	2.234	0.509	1.809	1.114	6.368	6.512	3.580	1.690
	West Nusa Tenggara	19.333	19.333	4.716	4.751	1.960	1.082	1.809	1.950	3.656	5.068	4.543	3.859
	West Papua	17.625	10.660	5.302	2.677	2.184	1.397	1.788	2.414	4.375	6.077	4.778	3.016
	West Sulawesi	26.746	17.577	7.715	3.929	2.472	0.798	1.856	1.642	6.014	8.156	6.852	3.805
	West Sumatra	8.474	11.743	2.550	1.812	1.353	0.603	1.302	1.012	2.404	2.656	2.435	2.147
	Yogyakarta	5.622	2.733	1.909	0.860	1.436	0.403	1.411	1.170	5.236	7.217	2.027	1.230
	Indonesia	13.293	8.718	4.590	2.258	2.365	0.575	1.953	1.176	5.662	4.743	3.930	1.890
2010	Aceh	13.615	9.944	4.862	2.329	2.532	0.483	1.830	1.077	7.268	6.709	4.335	2.126
	Bali	5.406	1.707	2.474	0.626	2.253	0.334	2.538	0.854	4.781	2.685	2.695	0.677
	Bangka-Belitung Islands	7.944	6.901	3.686	1.380	2.709	0.705	2.051	1.705	7.144	5.946	3.420	1.704
	Banten	15.659	7.385	5.182	1.942	2.291	0.460	1.635	0.946	6.767	7.230	4.267	1.649
	Bengkulu	10.296	4.608	4.033	1.826	2.399	0.858	1.662	1.281	5.491	7.058	3.567	1.638
	Central Java	8.033	5.080	3.484	2.180	2.038	0.623	2.157	1.600	4.677	5.722	2.935	1.658
	Central Kalimantan	16.115	5.350	11.581	2.614	9.678	1.302	12.855	3.647	25.090	15.098	11.269	2.442
	Central Sulawesi	5.990	9.971	0.859	3.186	1.201	0.915	1.247	1.745	2.932	5.017	1.688	2.566
	East Java	12.275	4.411	4.202	1.416	2.239	0.302	1.738	0.544	6.517	2.360	3.426	0.920
	East Kalimantan	7.933	3.787	3.458	1.096	2.628	0.459	1.721	1.142	5.524	6.829	3.326	1.117
	East Nusa Tenggara	17.930	12.393	7.560	3.893	2.811	0.714	2.180	1.438	5.921	5.090	5.969	3.087
	Gorontalo	21.151	10.657	10.447	5.650	3.459	1.831	2.871	2.923	4.686	5.893	6.679	3.709
	Jakarta	8.912	4.888	3.299	1.385	1.677	0.342	1.346	0.734	5.925	6.238	2.667	1.089
	Jambi	8.490	9.168	4.513	1.106	3.515	0.743	2.527	1.148	9.235	8.580	4.215	1.855
	Lampung	13.080	6.267	4.393	1.628	1.997	0.275	1.525	0.808	6.526	6.665	3.614	1.368
	Maluku	26.359	15.059	7.871	3.983	2.848	1.343	2.423	1.988	5.737	5.931	7.112	3.862
North Kalimantan	32.702	11.101	9.047	1.537	9.546	0.226	17.073	0.433	35.547	2.697	13.095	1.847	

7

	North Maluku	20.758	17.834	7.716	4.719	2.618	1.692	1.928	2.683	5.249	7.105	5.938	4.478
	North Sulawesi	0.699	11.777	0.581	2.194	0.616	0.560	0.946	1.240	1.596	7.142	0.694	2.183
	North Sumatra	19.413	11.844	6.719	2.846	3.508	0.693	2.556	1.432	7.465	7.229	6.111	2.684
	Papua	27.349	44.939	7.326	3.748	2.791	0.730	2.043	1.361	6.476	7.267	7.057	7.437
	Riau	16.477	6.876	3.934	1.652	1.362	0.324	1.270	0.795	5.618	6.322	3.750	1.515
	Riau Islands	9.460	5.500	3.998	2.063	1.362	0.385	1.056	1.031	5.404	7.147	2.866	1.449
	South Kalimantan	11.945	2.693	7.170	1.168	5.541	0.297	2.532	0.406	11.170	1.937	6.237	0.742
	South Sulawesi	15.225	12.319	6.025	4.333	2.248	1.665	2.086	3.402	4.489	11.147	4.499	3.793
	South Sumatra	17.979	18.825	5.133	3.712	2.828	0.895	2.398	1.252	9.465	5.053	4.955	3.423
	Southeast Sulawesi	4.845	11.370	3.146	3.443	2.730	1.061	1.786	1.842	3.729	5.755	3.017	3.000
	West Java	11.959	4.268	3.738	1.248	1.766	0.279	1.513	0.541	4.735	2.542	3.183	0.947
	West Kalimantan	10.427	6.020	3.459	1.711	2.153	0.485	1.773	1.098	6.340	6.545	3.362	1.533
	West Nusa Tenggara	18.947	17.244	4.882	4.305	2.056	1.155	1.871	2.111	3.999	5.868	4.572	3.619
	West Papua	14.943	8.274	4.308	1.805	1.347	0.995	1.587	2.193	4.272	5.978	3.714	2.258
	West Sulawesi	25.163	15.854	7.295	3.675	2.394	0.768	1.827	1.609	6.025	8.273	6.432	3.484
	West Sumatra	8.012	11.314	2.542	1.921	1.370	0.616	1.318	1.089	2.468	3.071	2.377	2.138
	Yogyakarta	5.634	2.650	1.897	0.846	1.431	0.390	1.412	1.132	5.307	7.274	2.021	1.217
	Indonesia	12.882	7.997	4.486	2.096	2.303	0.543	1.941	1.114	5.751	4.729	3.813	1.754
2011	Aceh	12.957	8.622	4.610	2.052	2.293	0.439	1.776	1.058	7.233	6.721	4.044	1.884
	Bali	5.174	1.599	2.191	0.570	2.134	0.321	2.394	0.835	4.677	2.780	2.530	0.655
	Bangka-Belitung Islands	8.113	7.194	3.891	2.106	3.420	0.863	2.092	1.725	7.189	6.059	3.879	1.962
	Banten	15.080	6.765	4.934	1.799	2.220	0.439	1.616	0.922	6.772	7.210	4.093	1.534
	Bengkulu	9.659	4.005	3.796	1.583	2.164	0.782	1.598	1.228	5.442	7.058	3.294	1.472
	Central Java	7.983	4.510	3.481	1.943	1.999	0.572	2.066	1.448	4.812	5.618	2.888	1.514
	Central Kalimantan	15.484	4.727	11.180	2.446	9.552	1.266	12.821	3.576	25.372	15.078	11.051	2.318
	Central Sulawesi	6.960	9.570	1.031	3.227	1.368	0.944	1.301	1.717	3.299	5.106	1.918	2.525
	East Java	12.016	4.049	4.082	1.326	2.207	0.276	1.713	0.452	6.570	2.029	3.346	0.829
	East Kalimantan	7.464	3.346	3.310	1.005	2.523	0.430	1.677	1.104	5.471	6.767	3.170	1.026
	East Nusa Tenggara	16.939	11.394	7.206	3.703	2.853	0.718	2.210	1.430	5.991	5.097	5.735	2.901

	Gorontalo	21.250	9.631	9.817	5.080	3.376	1.642	2.905	2.670	4.822	5.472	6.449	3.324
	Jakarta	8.555	4.504	3.169	1.312	1.613	0.327	1.312	0.719	5.894	6.201	2.560	1.028
	Jambi	8.244	9.125	4.278	1.051	3.245	0.721	2.287	1.111	8.776	8.625	3.943	1.814
	Lampung	13.091	5.890	4.271	1.536	1.948	0.266	1.510	0.790	6.612	6.739	3.536	1.301
	Maluku	25.071	13.423	7.519	3.778	2.859	1.327	2.381	1.953	5.858	6.033	6.809	3.573
	North Kalimantan	31.867	10.468	8.860	1.499	9.328	0.219	16.897	0.422	35.365	2.718	12.785	1.729
	North Maluku	20.764	16.772	7.577	4.595	2.695	1.679	1.894	2.629	5.290	7.210	5.887	4.275
	North Sulawesi	0.693	11.105	0.566	2.121	0.586	0.538	0.904	1.211	1.573	7.103	0.668	2.073
	North Sumatra	19.241	11.098	6.578	2.698	3.437	0.660	2.523	1.374	7.406	7.104	5.975	2.520
	Papua	26.476	41.727	7.031	3.525	2.639	0.673	1.995	1.304	6.397	7.091	6.737	6.847
	Riau	15.793	6.269	3.749	1.535	1.324	0.311	1.249	0.773	5.650	6.328	3.577	1.400
	Riau Islands	8.897	4.860	3.803	1.911	1.280	0.355	1.035	1.012	5.365	7.001	2.715	1.323
	South Kalimantan	10.017	2.490	6.288	1.165	4.731	0.290	2.359	0.463	10.183	2.337	5.354	0.731
	South Sulawesi	14.912	11.384	5.950	4.068	2.394	1.443	2.252	2.888	5.083	9.923	4.525	3.403
	South Sumatra	17.895	17.872	4.896	3.618	2.654	0.905	2.277	1.397	9.513	5.796	4.756	3.318
	Southeast Sulawesi	4.773	10.759	3.048	3.276	2.686	1.010	1.765	1.781	3.725	5.820	2.953	2.838
	West Java	11.868	3.815	3.901	1.152	1.757	0.264	1.514	0.520	4.748	2.467	3.177	0.865
	West Kalimantan	9.533	4.868	3.218	1.495	1.998	0.444	1.709	1.073	6.291	6.499	3.106	1.332
	West Nusa Tenggara	18.074	15.506	4.922	3.957	2.124	1.251	1.904	2.312	4.266	6.755	4.499	3.458
	West Papua	15.686	8.446	4.844	2.219	1.850	1.189	1.624	2.237	4.284	6.014	4.187	2.480
	West Sulawesi	24.007	14.390	6.847	3.431	2.313	0.740	1.788	1.581	6.008	8.341	6.059	3.202
	West Sumatra	7.312	10.527	2.474	1.989	1.355	0.623	1.309	1.160	2.486	3.469	2.261	2.081
	Yogyakarta	5.611	2.533	1.877	0.829	1.414	0.377	1.403	1.093	5.342	7.264	2.004	1.198
	Indonesia	12.588	7.373	4.398	1.965	2.252	0.516	1.908	1.045	5.808	4.616	3.714	1.633
2012	Aceh	12.925	8.533	4.601	2.145	2.399	0.461	1.761	1.064	7.305	6.845	4.069	1.895
	Bali	4.951	1.450	1.949	0.508	2.016	0.312	2.210	0.814	4.605	2.916	2.369	0.633
	Bangka-Belitung Islands	8.393	7.026	3.906	2.279	3.564	0.845	2.084	1.658	7.258	6.442	3.978	1.961
	Banten	14.877	6.326	4.789	1.699	2.168	0.421	1.609	0.907	6.802	7.230	3.989	1.448
	Bengkulu	9.740	3.941	3.721	1.674	2.278	0.803	1.603	1.237	5.417	7.180	3.334	1.495

9

Central Java	7.900	4.109	3.299	1.735	1.904	0.514	1.929	1.325	4.929	5.750	2.765	1.402
Central Kalimantan	14.824	4.206	10.721	2.284	9.434	1.223	12.759	3.496	25.692	15.092	10.820	2.204
Central Sulawesi	7.900	8.605	1.134	2.791	1.353	0.799	1.312	1.616	3.638	5.387	2.021	2.222
East Java	12.140	4.068	4.021	1.269	2.139	0.271	1.672	0.487	6.591	2.561	3.279	0.847
East Kalimantan	7.170	3.088	3.197	0.959	2.484	0.420	1.648	1.076	5.462	6.773	3.079	0.976
East Nusa Tenggara	17.455	11.809	6.945	3.717	2.846	0.734	2.073	1.377	6.127	5.434	5.669	2.936
Gorontalo	21.704	9.463	9.625	4.940	3.294	1.585	2.880	2.667	4.856	5.610	6.340	3.226
Jakarta	8.439	4.262	3.083	1.257	1.561	0.315	1.281	0.708	5.862	6.224	2.490	0.987
Jambi	8.258	8.009	4.094	0.997	2.901	0.670	2.055	1.064	8.344	8.698	3.663	1.650
Lampung	13.224	5.578	4.169	1.461	1.901	0.256	1.501	0.771	6.745	6.850	3.473	1.243
Maluku	23.945	11.710	7.075	3.360	2.766	1.197	2.283	1.886	6.140	6.487	6.447	3.175
North Kalimantan	31.536	9.659	8.746	1.388	9.128	0.198	16.687	0.400	35.277	2.886	12.553	1.571
North Maluku	20.438	15.045	7.149	4.070	2.506	1.490	1.795	2.522	5.494	7.639	5.580	3.811
North Sulawesi	0.708	11.074	0.552	2.098	0.569	0.521	0.875	1.183	1.557	7.113	0.655	2.031
North Sumatra	18.754	10.989	6.163	2.560	3.322	0.619	2.398	1.336	7.734	7.775	5.711	2.449
Papua	26.531	39.441	6.922	3.338	2.502	0.613	1.965	1.255	6.348	6.974	6.583	6.382
Riau	15.266	5.764	3.614	1.437	1.296	0.299	1.235	0.754	5.694	6.381	3.437	1.303
Riau Islands	8.541	4.667	3.665	1.837	1.288	0.357	1.031	1.003	5.366	6.919	2.651	1.284
South Kalimantan	8.655	2.370	5.608	1.177	4.124	0.290	2.251	0.525	9.422	2.787	4.699	0.737
South Sulawesi	13.810	9.739	5.396	3.500	2.277	1.264	2.129	2.548	5.383	9.682	4.185	2.971
South Sumatra	17.034	15.802	4.477	3.099	2.422	0.766	2.082	1.245	9.859	5.710	4.405	2.881
Southeast Sulawesi	4.802	10.026	2.983	2.984	2.644	0.901	1.757	1.689	3.744	6.131	2.911	2.606
West Java	11.445	3.831	3.731	1.127	1.660	0.257	1.434	0.539	4.906	2.925	3.017	0.867
West Kalimantan	8.961	4.348	3.044	1.407	1.939	0.430	1.671	1.062	6.285	6.542	2.956	1.246
West Nusa Tenggara	17.237	12.384	4.732	3.198	2.068	1.039	1.850	2.061	4.552	6.670	4.305	2.836
West Papua	15.353	7.624	4.599	1.968	1.741	1.067	1.548	2.162	4.401	6.264	4.001	2.239
West Sulawesi	23.565	13.494	6.585	3.253	2.243	0.706	1.749	1.553	6.008	8.470	5.822	3.003
West Sumatra	7.670	8.806	2.471	1.790	1.341	0.558	1.298	1.079	2.669	3.588	2.276	1.811
Yogyakarta	5.722	2.470	1.882	0.817	1.401	0.362	1.410	1.057	5.448	7.335	2.006	1.186

	Indonesia	12.365	6.930	4.213	1.826	2.165	0.479	1.833	1.002	5.910	4.897	3.577	1.540
2013	Aceh	12.368	8.014	4.485	2.083	2.313	0.455	1.721	1.048	7.156	6.891	3.899	1.808
	Bali	4.575	1.274	1.710	0.446	1.905	0.303	2.038	0.790	4.523	3.083	2.202	0.611
	Bangka-Belitung Islands	8.889	6.842	4.017	2.221	3.428	0.785	2.054	1.571	7.165	6.663	3.944	1.882
	Banten	14.776	5.995	4.632	1.604	2.104	0.405	1.589	0.886	6.770	7.174	3.882	1.374
	Bengkulu	9.780	3.766	3.727	1.714	2.366	0.806	1.586	1.217	5.688	7.245	3.372	1.482
	Central Java	7.983	3.833	3.160	1.545	1.829	0.461	1.818	1.203	5.052	5.834	2.678	1.303
	Central Kalimantan	15.056	3.987	10.474	2.186	9.417	1.202	12.685	3.400	25.876	14.981	10.777	2.144
	Central Sulawesi	8.796	8.102	1.429	2.772	1.554	0.802	1.357	1.548	3.964	5.557	2.276	2.144
	East Java	12.173	3.984	3.918	1.213	2.052	0.265	1.620	0.505	6.573	3.032	3.182	0.853
	East Kalimantan	6.896	2.847	3.070	0.911	2.411	0.406	1.616	1.046	5.448	6.741	2.966	0.927
	East Nusa Tenggara	16.698	10.665	6.308	3.215	2.559	0.649	1.913	1.297	6.176	5.680	5.210	2.615
	Gorontalo	22.132	9.228	9.766	4.929	3.425	1.573	2.888	2.627	4.840	5.606	6.418	3.168
	Jakarta	8.193	3.974	2.959	1.179	1.509	0.301	1.252	0.686	5.805	6.159	2.400	0.933
	Jambi	8.183	9.168	3.993	0.965	2.817	0.680	1.958	1.042	8.024	8.763	3.554	1.745
	Lampung	13.167	5.464	4.086	1.391	1.817	0.250	1.467	0.755	6.554	6.917	3.363	1.207
	Maluku	22.574	10.076	6.718	3.059	2.707	1.105	2.201	1.804	6.264	6.752	6.091	2.833
	North Kalimantan	31.927	9.088	8.665	1.307	8.955	0.182	16.469	0.380	34.975	2.967	12.414	1.451
	North Maluku	20.122	13.507	6.887	3.737	2.424	1.354	1.731	2.389	5.591	7.857	5.370	3.442
	North Sulawesi	0.711	11.526	0.539	2.109	0.563	0.518	0.851	1.155	1.531	7.081	0.646	2.036
	North Sumatra	18.791	9.929	5.912	2.435	3.164	0.571	2.268	1.218	7.657	7.614	5.512	2.240
	Papua	27.953	40.567	7.005	3.473	2.736	0.665	1.946	1.251	6.284	6.891	6.844	6.491
	Riau	15.033	5.425	3.486	1.353	1.272	0.291	1.220	0.736	5.717	6.396	3.332	1.230
	Riau Islands	8.362	4.407	3.568	1.753	1.259	0.339	1.014	0.980	5.364	6.796	2.586	1.219
	South Kalimantan	7.560	2.240	5.029	1.176	3.649	0.294	2.146	0.585	8.724	3.253	4.171	0.744
South Sulawesi	12.951	8.404	4.950	3.033	2.186	1.084	2.043	2.212	5.687	9.223	3.918	2.586	
South Sumatra	16.780	14.002	4.238	2.645	2.228	0.652	1.959	1.129	10.643	5.751	4.188	2.511	
Southeast Sulawesi	4.834	9.345	2.939	2.796	2.586	0.827	1.711	1.591	3.708	6.286	2.860	2.419	
West Java	11.003	3.713	3.590	1.080	1.578	0.249	1.367	0.551	4.995	3.311	2.870	0.850	

	West Kalimantan	8.520	3.987	2.891	1.354	1.938	0.427	1.659	1.047	6.294	6.521	2.860	1.189
	West Nusa Tenggara	16.877	10.301	4.691	2.705	2.061	0.899	1.805	1.857	4.818	6.658	4.219	2.422
	West Papua	15.292	7.106	4.682	2.015	2.054	1.102	1.544	2.099	4.495	6.385	4.162	2.191
	West Sulawesi	22.875	12.483	6.402	3.095	2.203	0.680	1.711	1.516	5.970	8.514	5.591	2.801
	West Sumatra	7.835	7.296	2.464	1.618	1.345	0.513	1.298	1.030	2.870	3.796	2.279	1.592
	Yogyakarta	5.739	2.367	1.871	0.800	1.370	0.348	1.391	1.024	5.485	7.395	1.980	1.171
	Indonesia	12.210	6.519	4.060	1.699	2.087	0.449	1.765	0.952	5.968	5.091	3.456	1.452
2014	Aceh	12.067	7.583	4.318	2.005	2.221	0.419	1.691	1.032	7.077	6.944	3.746	1.726
	Bali	4.234	1.141	1.499	0.397	1.793	0.289	1.871	0.764	4.459	3.284	2.045	0.598
	Bangka-Belitung Islands	9.513	6.885	4.176	2.164	3.292	0.681	2.028	1.490	7.077	6.875	3.928	1.827
	Banten	14.741	5.841	4.584	1.567	2.073	0.368	1.569	0.864	6.756	7.102	3.820	1.331
	Bengkulu	9.231	3.396	3.601	1.614	2.334	0.740	1.565	1.185	5.895	7.281	3.255	1.398
	Central Java	7.772	3.627	3.063	1.395	1.776	0.378	1.707	1.083	5.212	5.938	2.587	1.221
	Central Kalimantan	16.726	4.192	10.839	2.230	9.283	1.157	12.501	3.288	25.906	14.912	10.906	2.155
	Central Sulawesi	9.381	7.419	1.704	2.527	1.638	0.687	1.377	1.466	4.313	5.735	2.426	1.964
	East Java	12.107	4.018	3.854	1.166	2.003	0.242	1.577	0.520	6.540	3.574	3.105	0.872
	East Kalimantan	6.287	2.511	2.915	0.836	2.363	0.373	1.580	1.010	5.393	6.667	2.828	0.859
	East Nusa Tenggara	15.519	9.574	5.680	2.737	2.326	0.582	1.784	1.219	6.255	6.011	4.736	2.317
	Gorontalo	22.205	8.960	9.622	4.776	3.392	1.455	2.853	2.568	4.840	5.602	6.307	3.051
	Jakarta	7.716	3.652	2.830	1.106	1.472	0.265	1.231	0.666	5.773	6.052	2.298	0.877
	Jambi	8.808	8.851	3.852	0.934	2.617	0.628	1.819	1.007	7.658	8.779	3.427	1.676
	Lampung	13.579	5.451	4.043	1.345	1.751	0.236	1.408	0.735	6.362	6.934	3.306	1.182
	Maluku	21.053	8.775	6.288	2.701	2.585	0.939	2.109	1.721	6.317	7.051	5.668	2.515
	North Kalimantan	32.547	8.879	8.731	1.248	8.822	0.158	16.204	0.360	34.517	3.046	12.342	1.379
	North Maluku	19.606	12.282	6.615	3.404	2.355	1.152	1.672	2.279	5.634	8.106	5.141	3.132
	North Sulawesi	0.725	11.644	0.532	2.078	0.552	0.496	0.830	1.126	1.519	7.073	0.638	2.001
	North Sumatra	18.459	9.230	5.684	2.250	3.008	0.498	2.149	1.114	7.628	7.552	5.277	2.068
Papua	28.109	39.024	6.991	3.363	2.633	0.618	1.886	1.200	6.194	6.698	6.719	6.131	
Riau	14.863	5.143	3.406	1.286	1.254	0.272	1.205	0.717	5.719	6.432	3.245	1.168	

	Riau Islands	8.232	4.218	3.444	1.602	1.214	0.325	1.002	0.962	5.366	6.698	2.508	1.160
	South Kalimantan	6.690	2.111	4.566	1.168	3.232	0.302	2.060	0.641	8.157	3.719	3.729	0.750
	South Sulawesi	11.690	7.054	4.549	2.589	2.130	0.890	1.974	1.856	6.069	8.668	3.649	2.200
	South Sumatra	15.788	12.075	4.025	2.245	2.098	0.469	1.834	1.028	9.558	5.845	3.901	2.160
	Southeast Sulawesi	5.001	9.148	2.970	2.692	2.543	0.718	1.673	1.503	3.681	6.486	2.849	2.317
	West Java	10.393	3.613	3.384	1.052	1.492	0.227	1.298	0.557	5.061	3.707	2.694	0.837
	West Kalimantan	7.754	3.413	2.701	1.244	1.893	0.394	1.626	1.025	6.258	6.446	2.699	1.092
	West Nusa Tenggara	15.858	8.353	4.578	2.223	2.039	0.666	1.749	1.654	5.089	6.612	4.040	2.030
	West Papua	14.673	6.401	4.534	1.825	1.934	0.976	1.465	1.970	4.483	6.445	3.950	1.977
	West Sulawesi	22.030	11.782	5.976	2.946	2.151	0.620	1.684	1.482	5.988	8.615	5.283	2.640
	West Sumatra	7.725	5.881	2.448	1.444	1.342	0.424	1.294	0.985	3.101	4.040	2.248	1.388
	Yogyakarta	5.548	2.221	1.817	0.767	1.346	0.322	1.371	0.998	5.499	7.416	1.935	1.150
	Indonesia	11.878	6.110	3.916	1.574	2.012	0.392	1.697	0.901	5.984	5.307	3.320	1.365
2015	Aceh	11.802	6.865	4.146	1.857	2.064	1.032	1.634	1.005	6.884	7.047	3.554	1.594
	Bali	3.592	0.951	1.239	0.341	1.678	0.764	1.674	0.739	4.322	3.535	1.849	0.585
	Bangka-Belitung Islands	9.712	6.934	4.131	2.101	3.186	1.490	1.987	1.435	7.121	7.047	3.849	1.775
	Banten	14.987	5.461	4.366	1.460	1.902	0.864	1.516	0.840	6.564	7.080	3.660	1.246
	Bengkulu	8.530	3.074	3.391	1.542	2.252	1.185	1.543	1.163	5.811	7.278	3.075	1.330
	Central Java	7.774	3.344	2.859	1.269	1.658	1.083	1.631	1.028	5.179	6.040	2.458	1.155
	Central Kalimantan	16.483	4.151	10.781	2.194	9.149	3.288	12.298	3.204	25.733	14.798	10.762	2.123
	Central Sulawesi	9.578	6.961	1.669	2.326	1.586	1.466	1.348	1.417	4.278	5.877	2.380	1.829
	East Java	12.043	3.711	3.605	1.068	1.805	0.520	1.506	0.518	6.414	3.820	2.908	0.837
	East Kalimantan	6.409	2.446	2.800	0.822	2.133	1.010	1.513	0.978	5.246	6.646	2.662	0.836
	East Nusa Tenggara	15.202	8.933	5.215	2.634	2.215	1.219	1.723	1.208	6.254	5.869	4.472	2.198
	Gorontalo	21.418	8.456	9.366	4.589	3.349	2.568	2.829	2.510	4.835	5.581	6.095	2.905
	Jakarta	7.869	3.481	2.663	1.031	1.345	0.666	1.183	0.648	5.606	6.097	2.186	0.835
	Jambi	8.356	8.118	3.760	0.880	2.606	1.007	1.814	0.981	7.708	8.772	3.343	1.568
	Lampung	14.150	5.299	3.918	1.280	1.629	0.735	1.354	0.716	6.210	6.872	3.214	1.141
	Maluku	20.143	7.740	5.884	2.454	2.465	1.721	2.043	1.674	6.244	7.271	5.329	2.289

	North Kalimantan	31.734	8.451	8.637	1.179	8.666	0.360	15.946	0.348	34.168	3.084	12.089	1.284
	North Maluku	19.476	11.159	6.261	3.088	2.232	2.279	1.626	2.208	5.585	8.315	4.905	2.855
	North Sulawesi	0.726	11.477	0.523	2.050	0.534	1.126	0.804	1.113	1.497	7.230	0.623	1.961
	North Sumatra	18.689	8.996	5.396	2.136	2.800	1.114	2.058	1.063	7.514	7.513	5.063	1.975
	Papua	29.347	39.663	6.909	3.409	2.508	1.200	1.826	1.172	5.993	6.599	6.684	6.095
	Riau	13.655	4.496	3.221	1.183	1.223	0.717	1.186	0.700	5.694	6.415	3.017	1.057
	Riau Islands	7.923	4.000	3.223	1.560	1.103	0.962	0.961	0.934	5.176	6.553	2.342	1.107
	South Kalimantan	5.611	2.339	4.081	1.185	2.889	0.641	1.990	0.701	7.642	4.308	3.315	0.798
	South Sulawesi	10.918	6.395	4.135	2.454	1.966	1.856	1.859	1.887	5.980	8.744	3.354	2.113
	South Sumatra	15.338	10.536	3.808	1.909	1.966	1.028	1.761	0.937	9.091	5.944	3.685	1.872
	Southeast Sulawesi	4.905	8.737	2.905	2.530	2.461	1.503	1.630	1.443	3.648	6.620	2.764	2.182
	West Java	10.201	3.386	3.124	0.974	1.369	0.557	1.244	0.550	4.973	3.896	2.523	0.794
	West Kalimantan	7.288	3.109	2.568	1.172	1.841	1.025	1.589	1.008	6.226	6.370	2.577	1.033
	West Nusa Tenggara	16.062	7.275	4.412	1.948	1.921	1.654	1.688	1.516	5.156	6.754	3.918	1.801
	West Papua	14.646	5.973	4.408	1.756	1.989	1.970	1.436	1.927	4.441	6.575	3.916	1.893
	West Sulawesi	22.423	10.607	5.747	2.717	1.996	1.482	1.625	1.460	5.854	8.644	5.100	2.414
	West Sumatra	7.769	4.944	2.484	1.320	1.382	0.985	1.307	0.951	3.443	4.406	2.271	1.259
	Yogyakarta	5.433	2.189	1.807	0.766	1.314	0.998	1.336	0.962	5.445	7.397	1.890	1.133
	Indonesia	11.776	5.756	3.698	1.469	1.879	0.901	1.632	0.875	5.894	5.445	3.157	1.294
2016	Aceh	10.783	6.309	4.030	1.784	2.074	0.411	1.637	0.989	6.930	7.061	3.404	1.506
	Bali	1.995	0.525	0.850	0.249	1.698	0.287	1.603	0.691	3.912	3.331	1.653	0.527
	Bangka-Belitung Islands	9.518	6.913	4.112	2.106	3.101	0.668	1.969	1.411	7.070	6.877	3.755	1.744
	Banten	13.510	4.940	4.205	1.381	1.882	0.357	1.501	0.819	6.554	7.022	3.444	1.162
	Bengkulu	7.687	2.721	3.225	1.438	2.193	0.705	1.523	1.134	5.755	7.225	2.908	1.251
	Central Java	6.975	3.029	2.679	1.204	1.641	0.372	1.643	1.033	5.136	5.939	2.347	1.116
	Central Kalimantan	15.350	3.854	10.361	2.073	9.019	1.122	12.148	3.121	25.607	14.625	10.482	2.045
	Central Sulawesi	8.946	6.808	1.572	2.308	1.544	0.678	1.310	1.391	4.164	5.781	2.248	1.783
	East Java	10.431	3.205	3.414	0.993	1.804	0.235	1.497	0.505	6.398	3.683	2.746	0.778
	East Kalimantan	6.997	2.733	3.011	0.867	2.018	0.347	1.513	0.951	5.340	6.641	2.683	0.854

	East Nusa Tenggara	13.556	7.869	4.971	2.417	2.209	0.558	1.728	1.185	6.280	5.879	4.181	1.998
	Gorontalo	19.411	7.669	8.870	4.280	3.287	1.386	2.799	2.459	4.829	5.575	5.726	2.712
	Jakarta	7.314	3.277	2.584	0.990	1.325	0.256	1.162	0.631	5.557	5.989	2.096	0.801
	Jambi	7.638	7.449	3.598	0.835	2.599	0.606	1.817	0.965	7.764	8.744	3.230	1.474
	Lampung	13.306	5.056	3.872	1.245	1.634	0.230	1.357	0.699	6.207	6.859	3.102	1.100
	Maluku	17.837	6.871	5.525	2.286	2.428	0.901	2.029	1.658	6.181	7.178	4.902	2.110
	North Kalimantan	29.055	7.741	8.386	1.134	8.469	0.155	15.614	0.339	33.734	3.022	11.612	1.174
	North Maluku	17.810	10.226	5.959	2.907	2.208	1.119	1.615	2.173	5.521	8.187	4.589	2.665
	North Sulawesi	0.668	10.494	0.507	1.928	0.529	0.479	0.804	1.094	1.501	7.251	0.615	1.839
	North Sumatra	18.331	8.909	5.376	2.124	2.798	0.494	2.050	1.057	7.470	7.495	4.967	1.940
	Papua	27.556	37.840	6.731	3.316	2.580	0.626	1.801	1.149	5.895	6.505	6.379	5.731
	Riau	10.532	3.314	2.834	0.997	1.185	0.251	1.176	0.683	5.707	6.324	2.552	0.870
	Riau Islands	7.473	3.774	3.143	1.504	1.100	0.314	0.958	0.912	5.184	6.451	2.255	1.052
	South Kalimantan	5.296	2.034	4.030	1.096	2.932	0.286	1.968	0.655	7.750	4.085	3.293	0.733
	South Sulawesi	9.555	5.444	3.894	2.253	1.945	0.864	1.844	1.881	5.897	8.755	3.137	1.978
	South Sumatra	14.808	10.532	3.755	1.911	1.963	0.471	1.775	0.937	9.165	5.852	3.594	1.847
	Southeast Sulawesi	4.584	8.188	2.800	2.433	2.415	0.699	1.598	1.413	3.613	6.529	2.667	2.067
	West Java	9.033	2.980	3.002	0.908	1.368	0.219	1.249	0.534	4.936	3.753	2.378	0.732
	West Kalimantan	6.725	2.807	2.459	1.110	1.828	0.386	1.575	0.990	6.216	6.322	2.480	0.982
	West Nusa Tenggara	15.087	7.166	4.329	1.989	1.910	0.675	1.676	1.522	5.076	6.686	3.755	1.793
	West Papua	12.964	5.308	4.153	1.600	1.837	0.894	1.399	1.868	4.368	6.459	3.548	1.718
	West Sulawesi	20.737	9.940	5.541	2.595	1.976	0.594	1.603	1.426	5.843	8.690	4.785	2.274
	West Sumatra	6.469	4.181	2.262	1.212	1.346	0.414	1.277	0.938	3.294	4.217	2.056	1.146
	Yogyakarta	5.481	2.257	1.876	0.797	1.294	0.314	1.337	0.950	5.521	7.520	1.891	1.146
	Indonesia	10.698	5.322	3.553	1.396	1.868	0.383	1.627	0.862	5.861	5.350	3.004	1.225
2017	Aceh	10.255	5.882	3.946	1.722	2.043	0.400	1.614	0.968	6.902	7.022	3.286	1.430
	Bali	1.146	0.295	0.615	0.192	1.668	0.279	1.541	0.663	3.620	3.258	1.521	0.496
	Bangka-Belitung Islands	9.856	7.068	4.188	2.117	3.022	0.650	1.940	1.386	7.025	6.781	3.722	1.728
	Banten	12.820	4.684	4.130	1.334	1.876	0.348	1.493	0.803	6.518	6.957	3.329	1.112
	Bengkulu	7.324	2.553	3.139	1.388	2.142	0.680	1.512	1.113	5.723	7.172	2.810	1.206

Central Java	6.592	2.855	2.559	1.152	1.625	0.365	1.639	1.027	5.087	5.870	2.276	1.089
Central Kalimantan	15.005	3.752	10.236	2.015	8.944	1.099	11.971	3.062	25.514	14.507	10.359	2.008
Central Sulawesi	8.733	6.708	1.532	2.303	1.517	0.665	1.286	1.367	4.100	5.717	2.181	1.744
East Java	9.847	2.992	3.299	0.950	1.790	0.230	1.480	0.497	6.351	3.617	2.657	0.748
East Kalimantan	7.180	2.843	3.048	0.911	2.014	0.351	1.505	0.943	5.344	6.603	2.688	0.872
East Nusa Tenggara	12.992	7.520	4.833	2.320	2.213	0.552	1.736	1.175	6.310	5.902	4.046	1.916
Gorontalo	18.573	7.262	8.619	4.131	3.237	1.332	2.757	2.408	4.825	5.534	5.518	2.592
Jakarta	7.460	3.332	2.591	0.988	1.315	0.252	1.147	0.618	5.489	5.950	2.087	0.798
Jambi	7.369	6.941	3.506	0.806	2.563	0.583	1.801	0.945	7.767	8.686	3.151	1.397
Lampung	13.472	5.034	3.897	1.234	1.633	0.226	1.351	0.689	6.173	6.830	3.081	1.084
Maluku	16.535	6.335	5.310	2.206	2.427	0.884	2.008	1.632	6.115	7.095	4.648	2.003
North Kalimantan	28.273	7.434	8.309	1.110	8.374	0.152	15.398	0.333	33.447	2.954	11.428	1.112
North Maluku	17.712	9.989	5.995	2.915	2.171	1.088	1.604	2.137	5.483	8.110	4.501	2.592
North Sulawesi	0.680	10.630	0.512	1.931	0.528	0.472	0.798	1.071	1.495	7.188	0.618	1.821
North Sumatra	18.273	8.791	5.324	2.080	2.764	0.482	2.023	1.042	7.404	7.427	4.876	1.889
Papua	26.055	35.247	6.569	3.183	2.474	0.588	1.753	1.111	5.783	6.351	6.017	5.249
Riau	9.659	2.981	2.654	0.917	1.156	0.241	1.152	0.667	5.638	6.190	2.378	0.803
Riau Islands	7.412	3.741	3.102	1.481	1.097	0.307	0.949	0.893	5.164	6.375	2.214	1.026
South Kalimantan	5.261	1.945	4.047	1.066	2.933	0.277	1.934	0.629	7.762	3.997	3.278	0.707
South Sulawesi	8.471	4.720	3.623	2.067	1.920	0.837	1.821	1.869	5.808	8.666	2.943	1.863
South Sumatra	14.502	10.301	3.689	1.876	1.947	0.464	1.773	0.927	9.150	5.786	3.509	1.789
Southeast Sulawesi	4.578	8.118	2.808	2.443	2.396	0.691	1.571	1.386	3.603	6.490	2.645	2.032
West Java	8.371	2.715	2.889	0.856	1.355	0.213	1.239	0.523	4.889	3.658	2.272	0.688
West Kalimantan	6.202	2.549	2.332	1.034	1.792	0.372	1.542	0.967	6.153	6.206	2.368	0.929
West Nusa Tenggara	14.264	6.789	4.183	1.931	1.873	0.661	1.655	1.501	5.049	6.631	3.583	1.727
West Papua	12.594	5.101	4.130	1.602	1.910	0.901	1.403	1.848	4.369	6.438	3.511	1.688
West Sulawesi	19.698	9.382	5.387	2.523	1.953	0.577	1.582	1.396	5.846	8.685	4.558	2.164
West Sumatra	5.741	3.669	2.101	1.121	1.312	0.402	1.242	0.919	3.206	4.081	1.916	1.062
Yogyakarta	6.042	2.498	1.994	0.857	1.272	0.307	1.337	0.941	5.620	7.689	1.929	1.177
Indonesia	10.230	5.063	3.456	1.347	1.849	0.374	1.612	0.849	5.816	5.286	2.909	1.178

2018	Aceh	10.181	5.686	3.852	1.689	2.015	0.388	1.601	0.953	6.860	7.003	3.214	1.384
	Bali	1.576	0.415	0.685	0.215	1.665	0.275	1.544	0.651	3.662	3.202	1.569	0.507
	Bangka-Belitung Islands	9.096	6.431	3.938	2.008	2.983	0.632	1.898	1.356	6.845	6.623	3.561	1.621
	Banten	12.156	4.424	3.954	1.272	1.837	0.334	1.475	0.790	6.458	6.868	3.180	1.057
	Bengkulu	7.375	2.566	3.045	1.364	2.118	0.659	1.499	1.096	5.670	7.103	2.764	1.186
	Central Java	6.529	2.832	2.431	1.119	1.595	0.356	1.642	1.026	5.056	5.788	2.223	1.073
	Central Kalimantan	14.880	3.696	9.940	1.966	8.856	1.069	11.805	3.003	25.369	14.340	10.217	1.973
	Central Sulawesi	8.407	6.523	1.444	2.224	1.484	0.646	1.266	1.339	4.040	5.655	2.094	1.681
	East Java	9.616	2.933	3.190	0.925	1.774	0.224	1.470	0.491	6.300	3.552	2.594	0.730
	East Kalimantan	6.326	2.465	2.786	0.826	1.970	0.337	1.466	0.916	5.189	6.415	2.510	0.803
	East Nusa Tenggara	13.440	7.718	4.751	2.313	2.211	0.541	1.744	1.163	6.344	5.912	4.032	1.906
	Gorontalo	18.667	7.322	8.348	4.028	3.197	1.285	2.745	2.368	4.813	5.495	5.399	2.527
	Jakarta	7.241	3.216	2.381	0.924	1.271	0.239	1.133	0.612	5.439	5.816	1.993	0.766
	Jambi	7.701	7.111	3.447	0.801	2.537	0.562	1.800	0.934	7.758	8.631	3.136	1.385
	Lampung	12.792	4.726	3.757	1.179	1.616	0.219	1.346	0.678	6.136	6.809	2.956	1.036
	Maluku	16.498	6.368	5.135	2.198	2.421	0.873	1.999	1.611	6.046	6.986	4.545	1.976
	North Kalimantan	27.511	7.305	8.142	1.096	8.199	0.147	14.992	0.326	32.772	2.898	11.161	1.070
	North Maluku	17.420	9.676	5.777	2.818	2.168	1.063	1.590	2.102	5.413	8.000	4.360	2.495
	North Sulawesi	0.675	10.365	0.495	1.872	0.521	0.459	0.792	1.054	1.495	7.148	0.612	1.765
	North Sumatra	17.348	8.306	5.124	2.002	2.722	0.467	1.993	1.030	7.324	7.360	4.665	1.797
	Papua	25.578	34.288	6.350	3.103	2.460	0.580	1.728	1.094	5.683	6.266	5.816	4.999
	Riau	9.852	3.054	2.612	0.912	1.143	0.235	1.139	0.655	5.546	6.146	2.351	0.798
	Riau Islands	7.319	3.683	2.950	1.427	1.086	0.299	0.949	0.873	5.109	6.245	2.140	0.990
	South Kalimantan	4.978	1.783	3.899	1.005	2.883	0.264	1.908	0.607	7.749	3.915	3.185	0.670
	South Sulawesi	8.745	4.879	3.586	2.067	1.898	0.828	1.797	1.853	5.711	8.643	2.921	1.867
	South Sumatra	14.000	9.903	3.555	1.822	1.921	0.452	1.771	0.916	9.087	5.720	3.390	1.712
	Southeast Sulawesi	4.634	8.119	2.737	2.403	2.348	0.673	1.545	1.356	3.586	6.466	2.595	1.988
	West Java	8.458	2.724	2.830	0.844	1.343	0.206	1.235	0.513	4.847	3.573	2.240	0.675
	West Kalimantan	6.108	2.527	2.243	1.004	1.781	0.365	1.528	0.955	6.098	6.132	2.322	0.913
	West Nusa Tenggara	13.358	6.368	3.956	1.838	1.832	0.641	1.646	1.482	5.030	6.590	3.392	1.649

	West Papua	12.970	5.243	4.061	1.609	1.954	0.897	1.393	1.816	4.328	6.398	3.526	1.692
	West Sulawesi	19.234	9.267	5.132	2.438	1.911	0.554	1.566	1.370	5.837	8.686	4.366	2.095
	West Sumatra	6.043	3.850	2.054	1.121	1.298	0.392	1.230	0.904	3.153	4.007	1.909	1.060
	Yogyakarta	5.742	2.345	1.850	0.798	1.260	0.297	1.311	0.921	5.488	7.472	1.862	1.136
	Indonesia	10.064	4.968	3.343	1.313	1.827	0.364	1.602	0.839	5.770	5.213	2.836	1.147
2019	Aceh	9.880	5.427	3.732	1.623	1.979	0.377	1.575	0.938	6.812	6.977	3.112	1.328
	Bali	1.592	0.424	0.662	0.210	1.646	0.269	1.526	0.638	3.622	3.159	1.558	0.506
	Bangka-Belitung Islands	8.587	6.032	3.754	1.905	2.918	0.609	1.856	1.329	6.728	6.492	3.424	1.537
	Banten	11.294	4.098	3.772	1.199	1.800	0.320	1.453	0.778	6.377	6.770	3.017	0.997
	Bengkulu	7.125	2.469	2.909	1.304	2.078	0.636	1.474	1.078	5.601	7.018	2.675	1.147
	Central Java	6.309	2.709	2.314	1.069	1.574	0.347	1.632	1.025	4.996	5.688	2.165	1.049
	Central Kalimantan	14.585	3.602	9.635	1.891	8.758	1.038	11.705	2.951	25.186	14.152	10.065	1.931
	Central Sulawesi	8.024	6.273	1.367	2.129	1.448	0.625	1.238	1.313	3.984	5.598	2.006	1.610
	East Java	9.194	2.782	3.058	0.887	1.747	0.218	1.443	0.486	6.236	3.501	2.510	0.708
	East Kalimantan	5.817	2.241	2.628	0.776	1.919	0.325	1.430	0.895	5.115	6.289	2.385	0.759
	East Nusa Tenggara	13.265	7.581	4.579	2.227	2.189	0.525	1.736	1.151	6.345	5.899	3.923	1.845
	Gorontalo	18.189	7.095	7.940	3.824	3.144	1.236	2.713	2.328	4.782	5.449	5.205	2.422
	Jakarta	6.993	3.107	2.198	0.855	1.234	0.228	1.108	0.604	5.361	5.688	1.904	0.736
	Jambi	7.592	6.920	3.333	0.770	2.507	0.542	1.789	0.921	7.746	8.571	3.071	1.340
	Lampung	12.328	4.498	3.647	1.125	1.586	0.211	1.340	0.672	6.119	6.801	2.852	0.998
	Maluku	15.819	6.132	4.891	2.101	2.399	0.847	1.971	1.583	5.974	6.873	4.355	1.896
	North Kalimantan	26.497	7.008	7.966	1.064	8.089	0.143	14.798	0.321	32.433	2.859	10.950	1.014
	North Maluku	16.924	9.296	5.538	2.681	2.146	1.030	1.567	2.063	5.345	7.872	4.191	2.382
	North Sulawesi	0.652	10.024	0.480	1.802	0.508	0.446	0.777	1.036	1.479	7.092	0.600	1.707
	North Sumatra	16.775	7.994	4.970	1.919	2.673	0.454	1.961	1.017	7.233	7.277	4.502	1.725
Papua	24.459	32.579	6.057	2.940	2.401	0.559	1.685	1.071	5.559	6.135	5.511	4.654	
Riau	9.532	2.966	2.511	0.870	1.122	0.228	1.118	0.644	5.476	6.065	2.258	0.769	
Riau Islands	7.069	3.533	2.799	1.364	1.071	0.290	0.940	0.854	5.078	6.137	2.048	0.943	
South Kalimantan	4.709	1.642	3.770	0.951	2.863	0.256	1.872	0.591	7.694	3.862	3.114	0.640	

South Sulawesi	8.518	4.732	3.465	1.991	1.868	0.813	1.768	1.838	5.627	8.572	2.837	1.830
South Sumatra	13.504	9.565	3.432	1.755	1.891	0.439	1.763	0.908	9.086	5.665	3.278	1.642
Southeast Sulawesi	4.572	7.965	2.661	2.327	2.298	0.654	1.510	1.330	3.555	6.439	2.531	1.924
West Java	8.110	2.591	2.725	0.807	1.326	0.200	1.219	0.504	4.784	3.484	2.162	0.647
West Kalimantan	5.812	2.393	2.145	0.950	1.752	0.356	1.499	0.940	6.031	6.059	2.245	0.882
West Nusa Tenggara	12.643	6.050	3.762	1.744	1.797	0.620	1.624	1.461	4.999	6.547	3.232	1.583
West Papua	12.596	5.071	3.901	1.547	1.933	0.871	1.376	1.777	4.293	6.336	3.406	1.633
West Sulawesi	18.378	8.881	4.880	2.316	1.869	0.532	1.535	1.342	5.798	8.667	4.144	1.997
West Sumatra	5.826	3.685	1.954	1.066	1.270	0.381	1.203	0.888	3.094	3.922	1.838	1.019
Yogyakarta	5.529	2.245	1.769	0.763	1.233	0.287	1.286	0.905	5.415	7.401	1.807	1.113
Indonesia	9.687	4.771	3.213	1.256	1.799	0.354	1.581	0.829	5.711	5.141	2.742	1.106

Supplementary Table S2. The trend of unintentional drowning mortality rates by sex and age group in Indonesia between 2005 and 2019

Age Group		Mortality rates (per 100,000)														Linear Trend Model	R-squared	
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018			2019
Under 5	Male	13.9 9	13.5 2	13.0 7	13.3 5	13.2 9	12.8 8	12.5 9	12.3 6	12.2 1	11.8 8	11.7 8	10.7 0	10.23 6	10.0 6	9.69	$y = -0.30x + 14.45$	$R^2 = 0.94$
	Female	10.4 5	9.86	9.39	9.14	8.72	8.00	7.37	6.93	6.52	6.11	5.76	5.32	5.06	4.97	4.77	$y = -0.43x + 10.64$	$R^2 = 0.98$
5-14 years	Male	5.21	4.94	4.61	4.62	4.59	4.49	4.40	4.21	4.06	3.92	3.70	3.55	3.46	3.34	3.21	$y = -0.14x + 5.23$	$R^2 = 0.98$
	Female	2.96	2.74	2.54	2.39	2.26	2.10	1.96	1.83	1.70	1.57	1.47	1.40	1.35	1.31	1.26	$y = -0.12x + 2.90$	$R^2 = 0.97$
15-49 years	Male	2.63	2.56	2.44	2.40	2.36	2.30	2.25	2.16	2.09	2.01	1.88	1.87	1.85	1.83	1.80	$y = -0.06x + 2.66$	$R^2 = 0.98$
	Female	0.71	0.68	0.64	0.61	0.58	0.54	0.52	0.48	0.45	0.42	0.39	0.38	0.37	0.36	0.35	$y = -0.03x + 0.72$	$R^2 = 0.97$
50-69 years	Male	2.03	2.04	1.97	1.96	1.95	1.94	1.91	1.83	1.76	1.70	1.63	1.63	1.61	1.60	1.58	$y = -0.04x + 2.12$	$R^2 = 0.95$
	Female	1.44	1.42	1.36	1.25	1.18	1.11	1.05	1.00	0.95	0.90	0.88	0.86	0.85	0.84	0.83	$y = -0.05x + 1.44$	$R^2 = 0.93$
70+ years	Male	5.38	5.44	5.42	5.56	5.66	5.75	5.81	5.91	5.97	5.98	5.89	5.86	5.82	5.77	5.71	$y = 0.03x + 5.48$	$R^2 = 0.50$
	Female	4.79	4.83	4.85	4.78	4.74	4.73	4.62	4.90	5.09	5.31	5.44	5.35	5.29	5.21	5.14	$y = 0.05x + 4.64$	$R^2 = 0.59$
All Ages	Male	4.35	4.19	3.99	3.98	3.93	3.81	3.71	3.58	3.46	3.32	3.16	3.00	2.91	2.84	2.74	$y = -0.12x + 4.45$	$R^2 = 0.99$
	Female	2.34	2.21	2.09	1.99	1.89	1.75	1.63	1.54	1.45	1.36	1.29	1.23	1.18	1.15	1.11	$y = -0.09x + 2.34$	$R^2 = 0.97$

Appendix 3: Peer-Reviewed Publication – ‘Child drowning in Indonesia: Insights from parental and community perspectives and practices’

Cenderadewi M, Franklin RC, Fathana PB, Devine SG. Child drowning in Indonesia: Insights from parental and community perspectives and practices. Health Promotion International. 2024;doi:10.1093/heapro/daae113

Article

Child drowning in Indonesia: insights from parental and community perspectives and practices

Muthia Cenderadewi^{1,2,*}, Richard C. Franklin^{1,3}, Prima B. Fathana², Susan G. Devine¹

¹Department of Public Health and Tropical Medicine, College of Public Health, Medical and Veterinary Sciences, James Cook University, Bebegu Yumba Campus, 1 James Cook Dr, Townsville, Queensland 4811, Australia

²Faculty of Medicine, University of Mataram, Jalan Pemuda Nomor 37, Mataram, West Nusa Tenggara 83127, Indonesia

³Research, Policy and Advocacy, Royal Life Saving Society—Australia, Suite 6, Level 4, 173-179 Broadway (Cnr Mountain St), Broadway, Sydney, New South Wales 2007, Australia

*Corresponding author. E-mail: muthia.cenderadewi@myjcu.edu.au

Abstract

Child drowning is a significant public health issue in Indonesia, however, there is insufficient understanding of the issue and its associated risk factors within communities. This qualitative study aimed to explore parental and community perceptions and practices related to child drowning in Indonesian communities, and the perceived causes and risk factors. Seven focus group discussions ($n = 62$) were conducted with parents of children aged under-5 years and village community leaders in seven villages across all districts of Lombok Island, West Nusa Tenggara Province of Indonesia. Participants were recruited using purposive and snowball sampling. The thematic analysis, guided by Braun and Clarke's framework, used both deductive approaches, utilizing the Health Belief Model's constructs and inductive approaches. Most participants were unaware of the susceptibility of their children and others in their community to drowning and of the potential severe outcomes of drowning such as injury, disability and death. Participants generally associated drowning with beaches or open seas. Unprotected wells, tubs and buckets were identified as notable risk factors for child drowning in and around the home, shaped by some experience of child drowning incidents in the community. Supervision was identified as protective factor, however, mothers were often unavailable to supervise children, and supervision responsibility was often delegated to other family and community members. This study highlights the urgent need to enhance public awareness regarding children's susceptibility to drowning. Further exploration of local contexts and social determinants of drowning in Indonesian communities is crucial for ensuring effective water safety and drowning prevention strategies.

Keywords: drowning, prevention, health promotion, community health promotion, health behaviour, community safety promotion, community engagement, low- and middle-income countries

Contribution to Health Promotion

- This review informs contextualization of drowning prevention and water safety strategies in resource-limited settings of low- and middle-income countries (LMICs).
- This study identified limited community understanding of child drowning preventability, vulnerability and risk factors. Applying the Health Belief Model (HBM), the study revealed a pervasive lack of awareness regarding the susceptibility of children and others in the community to drowning and potential severe consequences of drowning, including injury, disability and death.
- Further investigation of the local contexts and social determinants of drowning, using a health promotion approach, is crucial for effective and sustainable water safety promotion and drowning prevention strategies in Indonesia and other LMICs.

INTRODUCTION

Despite considerable progress in reducing child mortality from various causes, child drowning persists as a significant yet preventable public health issue worldwide, especially in low- and middle-income countries (LMICs) in the South-East Asia Region, where over 33% of drowning deaths occur (Franklin *et al.*, 2020; World Health Organization, 2021; World Health Organization Regional Office for the South-East Asia, 2021). Indonesia, with its vast archipelago of 17,500 islands and population of over 270,000,000, faces particularly high risk,

especially among children under 5 years of age (Cenderadewi *et al.*, 2024).

Between 2005 and 2019, the under-5 population in Indonesia consistently had the highest drowning mortality rates, averaging 9.67/100,000 population annually (Cenderadewi *et al.*, 2024). Children under 5 were 3.67 times (95% CI: 3.63–3.72) more likely to fatally drown than individuals aged 15–49 years, with particularly high risks in Papua, Kalimantan, Sulawesi, Maluku and Nusa Tenggara regions (Cenderadewi *et al.*, 2024). Indonesia's vulnerability to natural disasters such

as floods, cyclones, earthquakes and tsunamis, as well as climate change-induced sea-level rise, further compounds the risk (Indonesian National Bureau of Statistics, 2021a; Indonesian National Disaster Management Agency, 2023; Statista, 2023). Despite this heightened risk, there is a lack of understanding about child drowning prevention in Indonesia (Cenderadewi *et al.*, 2023). Hence, it is crucial to develop a clear understanding of parental and community perceptions regarding child drowning vulnerability and the associated risk and protective factors to inform drowning prevention and water safety promotion.

The Public Health Model (PHM) is a useful framework that can be used to understand and respond to public health issues, including drowning prevention (Sleet *et al.*, 2003; Franklin and Scarr, 2014). The PHM offers a systematic approach, progressing from issue identification to the development, implementation and evaluation of interventions. It emphasizes active community engagement and collaboration with stakeholders to bridge the gap between injury prevention research and health promotion, and its first two stages, of defining the public health problem and risk factor identification, form the foundation of this study (Hanson *et al.*, 2012).

There is also a growing recognition of the value of incorporating behavioural science theories into health promotion and injury prevention efforts (Glanz and Bishop, 2010). Given the multifaceted nature of drowning, including its behavioural, natural, physical and social aspects, integrating theories such as the Health Belief Model (HBM) can be beneficial in developing a deeper understanding of perceptions, behaviours and motivations relevant to drowning (Champion and Skinner, 2008; Etheridge *et al.*, 2023). The HBM suggests that individuals' motivation for health-promoting behaviours is influenced by their perceptions of susceptibility and severity of an issue, the perceived benefits and barriers to action, as well as cues to action and perceptions of self-efficacy that influence their likelihood of engaging in health-promoting behaviour (Champion and Skinner, 2008; Etheridge *et al.*, 2023). By integrating these constructs, this study seeks to deepen the understanding of community perceptions of child drowning in Indonesia, to inform the development of effective health promotion interventions tailored to local contexts, empowering individuals and communities to adopt water safety-promoting behaviours more effectively.

Research aims

This qualitative study aimed to explore parental and community perceptions and practices related to perceived causes and risk factors for child drowning in Indonesian communities.

Research questions

This study answered the following questions:

1. What are Indonesian parental and community perceptions on child drowning as a public health issue in their community?
2. What are Indonesian parental and community perceptions and practices related to causes and risk factors of drowning?

METHODS

Study design

This qualitative study is part of a larger mixed-methods study investigating fatal unintentional drowning in Indonesia. The

overall study comprised three phases: (i) a scoping review investigating the epidemiology, risk factors and prevention strategies of unintentional drowning in Indonesia (Cenderadewi *et al.*, 2023), (ii) a population-based retrospective cohort quantitative study examining mortality rates, incidence rates, risk factors and burden of unintentional drowning in Indonesia between 2005 and 2019 (Cenderadewi *et al.*, 2024) and (iii) the qualitative study reported here. The exploratory qualitative design was chosen to expand and explain the findings of the quantitative study, which highlighted high mortality rates among children under 5, particularly in eastern Indonesia (Cenderadewi *et al.*, 2024). The qualitative inquiry was grounded in constructivist ontology and interpretivist epistemology, which perceive reality as socially constructed and subjective, acknowledging that participants' realities are shaped by their social, historical and cultural contexts, emphasizing the uniqueness and subjectivity of their experiences and perceptions (Creswell, 2014; Wright *et al.*, 2016). This exploratory qualitative approach was selected for its potential to provide rich insights into participants' perceptions and experiences of drowning and perceived risk factors for child drowning in their communities, an area with limited exploration in existing literature (Creswell, 2014; Hunter *et al.*, 2019).

Research setting

This study was conducted in seven rural villages in all districts (West Lombok, North Lombok, East Lombok, Central Lombok and Mataram districts) of Lombok Island, West Nusa Tenggara Province of Indonesia, representing coastal and inland communities, and child exposures to beaches, oceans, rivers and other hazards around the household. West Nusa Tenggara was chosen as the study site due to its high under-5 drowning rates of 12.6/100,000 for males and 6.1/100,000 for females in 2019 (Cenderadewi *et al.*, 2024) and its predominantly rural character and status as one of Indonesia's poorest health-performing provinces (Indonesian National Bureau of Statistics, 2021a, 2023a, 2023b, 2024a). The province is characterized by a blend of rural villages, agricultural areas and growing urban centres, with the province's economy largely reliant on agriculture and fisheries (Indonesian National Bureau of Statistics, 2021b, 2023c, 2024b). While West Nusa Tenggara hosts urban centres with some degree of urbanization and economic activity, a substantial proportion of the province's population resides in its 1021 rural villages (called 'desa' in Indonesia's administrative hierarchy), in contrast to 141 urban sub-districts (known as 'kelurahan', the urban administrative equivalent of 'desa') (Indonesian National Bureau of Statistics, 2023d, 2024b).

In 2023, 19% of its population lived below the national poverty threshold, and many barely above it, with key health indicators, such as infant mortality (25 per 1000 live births) and under-5 mortality (29 per 1000 live births), remaining among the nation's highest in 2022 (Indonesian National Bureau of Statistics, 2023b, 2024a; United Nations Inter-Agency Group for Child Mortality Estimation, 2023). Economic disparities persist, and as reported by the United Nations International Children Emergency Funds (UNICEF) (2019a), only half the population has access to basic sanitation at home, heightening the risk of child drowning near open water bodies. UNICEF also reported that only 20% of 3-year-olds and 40% of 4-year-olds in West Nusa Tenggara

are in preschool, whereas preschool attendance is higher in more developed provinces (United Nations International Children Emergency Funds (UNICEF), 2019a, 2019b; Indonesian National Bureau of Statistics, 2023a). For instance, in East Java, where the per capita GDP is nearly 2.5 times that of West Nusa Tenggara, 40% of 3-year-olds and 80% of 4-year-olds attend preschool (United Nations International Children Emergency Funds (UNICEF), 2019a, 2019b). This limited access to early childhood care and education does not align with the World Health Organization's (WHO) recommendation to promote daycare as a child drowning preventive measure for high-risk under-5 populations (World Health Organization, 2014, 2017, 2021, 2022).

Sample selection and recruitment

Participants were eligible for inclusion if they were parents of children under the age of 5 or village community leaders, residing in rural villages of densely populated sub-districts located in coastal areas and/or near the inland water bodies of Lombok Island, West Nusa Tenggara Province of Indonesia. Parents were selected due to prior research highlighting their supervisory role as pivotal in preventing child drowning in LMICs (Hossain *et al.*, 2015; Cenderadewi *et al.*, 2020). Village community leaders, such as village chiefs, elders, religious figures and voluntary community health workers, were chosen for their deep community connections and understanding of local community norms and practices (Rahman *et al.*, 2008).

Recruitment employed purposive and snowball sampling, facilitated by village chiefs and community health workers to identify critical informants with substantial insights into the subject. Face-to-face recruitment occurred during social village meetings and activities. Interested individuals were provided with a detailed information sheet and a consent form. Data saturation determined the final sample size of 62 participants.

Data collection

Between October 2023 and March 2024, seven focus group discussions (FGDs) ($n = 62$) were conducted at various community locations in the local language. This methodology facilitated in-depth data collection, capturing individual narratives and personal experiences regarding child drowning, as well as group-level insights into community norms, practices and decision-making processes related to child drowning prevention. Participants from both groups (parents and village community leaders) were included together in the same FGD. This approach can facilitate discussions where different perspectives interact simultaneously, potentially leading to deeper insights into shared concerns or differing viewpoints. It also allows for the articulation of nuances of the issue and dimensions of social dynamics that might not emerge as readily in separate groups (Hennink, 2014).

Written consent to participate in the study, as well as permission to be audio-recorded, was obtained from each participant. Characteristics such as age, gender, education, occupation, number and ages of children and details about the home environment, including nearby water bodies in the participant's community and dwelling, were collected via a short questionnaire at the start of each focus group.

A moderator guide was developed by the research team members and informed by the HBM and the findings of the previous scoping review (Champion and Skinner, 2008;

Cenderadewi *et al.*, 2023). The moderator guide was then translated into Indonesian language. Prior to the implementation, the lead researcher (M.C.) pilot tested the moderator guide for face validity, resulting in minor modifications of the prompts (Table 1).

Two female Indonesian researchers (M.C. and P.B.F.) facilitated the focus groups, with one (M.C.) facilitating discussions and the other (P.B.F.) taking notes. Both were fluent in Indonesian, Sasak and English. Discussions were primarily in Indonesian, but participants could also use the local Sasak language. Each group lasted 50–60 min and consisted of 5–12 participants.

Discussions were audiotaped and transcribed verbatim. The Indonesian transcripts were translated into English by the lead researcher (M.C.) and then back into Indonesian by another team member (P.B.F.) to ensure accuracy. Senior researchers (S.G.D. and R.C.F.) reviewed translated transcripts to verify data accuracy.

Analysis

Translated transcripts, demographic data and field notes were entered into NVivo Version 20. This study employed thematic analysis (TA), guided by Braun and Clarke's framework (Braun and Clarke, 2006), for its suitability in exploring child drowning in Indonesia, offering a flexible method to investigate a range of research questions in this under-explored area. While this study acknowledged the theoretical grounding provided by the HBM (Champion and Skinner, 2008) and integrated it into a deductive approach to analysis, the analysis favoured open and organic coding. Themes emerged through iterative data immersion, reflection and questioning, underscoring the subjective and interpretative nature of TA. Thus, researcher reflexivity is crucial, rather than emphasizing objectivity, reliability, or coding accuracy, aligning with reflexive TA principles which allow for flexibility and adaptability (Braun and Clarke, 2006, 2021, 2023). This approach allowed for in-depth exploration and interpretation, uncovering rich insights into the complexity of child drowning in rural Indonesian communities.

The TA progressed through several stages (Braun and Clarke, 2006, 2023). First, data immersion involved the researchers thoroughly familiarizing themselves with the dataset by repeatedly reading focus group transcripts. Second, code development entailed generating initial codes across the dataset by systematically labelling segments of data representing meaningful concepts, ideas and patterns. The researchers started with deductive coding based on the theoretical framework of the HBM to guide the initial stages of analysis. However, as analysis progressed, new sights emerged organically beyond the original framework. This approach allowed for a nuanced exploration of both theoretical expectations and unexpected findings within the data, reflecting a balance between deductive and inductive approaches. Thirdly, relevant codes were grouped together into potential themes.

The next step was iterative organizing, structuring and refining of data to capture key concepts and phenomena within the data set. This was followed by clearly defining each theme, setting its scope and boundaries, developing its narrative and giving it an informative name, ensuring that each theme was distinct and coherent. The researchers then moved beyond descriptive analysis to interpret the meaning and significance of the themes within the research context, exploring relationships between themes, considering

Table 1: Focus group moderator guide's domains of enquiry and examples of follow-up questions

Domains of enquiry and examples of follow-up questions and probes	Constructs of Health Belief Model applied
<ul style="list-style-type: none"> • Q1. 'Could you tell me some of the activities your family engaged with around water bodies?' <ul style="list-style-type: none"> - Family's relationship with water: <ul style="list-style-type: none"> • 'Could you tell me about your family's and children's activities around water?' • 'Could you tell me what water bodies exist in your community and in and around your home?' • 'Could you tell me your use of watercrafts and flotation devices on board?' - Supervision for children: <ul style="list-style-type: none"> • 'Could you tell me more about your family structure and the main caretaker in your household?' • 'Could you tell me who in your family is responsible to supervise children while they are doing activities around water?' • Q2. 'What do you think are the greatest health concerns for your community?' <ul style="list-style-type: none"> - 'How important do you think drowning is as a health issue in your community?' - 'Where do you think drowning fits among these greatest health concerns in your community?' - 'Have you ever experienced/witnessed/heard stories about drowning events in your community?' - 'Are you aware of local beliefs and practices surrounding the issue of drowning in your community?' • Q3. 'Who do you think is at most risk for drowning in your community?' • Q4. 'What do you think of drowning as a cause of injury/death for children?' • Q5. 'What do you think are the reasons that might cause a child to drown?' • Q6. 'Can you tell me about aspects of the environment and community in which you live that could increase the risk of a child drowning?' • Q7. 'What are some of the things that might make it hard to keep children safe from drowning?' • Q8. 'Can you tell me about how and what have you taught your children about water dangers?' • Q9. 'What would you like to see put in place to prevent children from drowning in your community?' - 'Who do you think are responsible for preventing drowning?' - 'Where do you get your information on drowning prevention from?' 	<ul style="list-style-type: none"> • Perceived susceptibility • Perceived susceptibility • Perceived severity • Cues to action • Perceived susceptibility • Perceived severity • Perceived barriers • Self-efficacy • Cues to action • Perceived barriers • Perceived benefits • Self-efficacy • Cues to action

how specific social, cultural and historical contexts shaped meanings, identifying underlying assumptions or theoretical frameworks and considering the broader implications of the findings. The findings were subsequently organized and presented in a thematic table (Table 3), which provided detailed theme definitions and scopes and representative excerpts of each theme. The researchers then developed narratives for the four identified themes, integrating the data and providing the contextual basis, as presented in the *Results* section of this publication (Braun and Clarke, 2006, 2023).

Researcher reflexivity on positionality

This study acknowledges the positionality of two Indonesian researchers (M.C. and P.B.F.) as middle-class, well-educated medical doctors, alongside the senior researchers' (R.C.F. and S.G.D.) non-Indonesian backgrounds. Both Indonesian researchers are from Lombok, fluent in Sasak and Indonesian, offering a unique connection to the region. Throughout the analysis, the researchers consistently reflected on and critically examined how their socioeconomic positions, privileges and assumptions, as well as the power dynamics with the underserved populations studied, might introduce biases and they explored strategies to mitigate them. Advice from community leaders and prolonged engagement at the study site deepened the researchers' understanding of the research setting and participants, centring community voices and ensuring an authentic representation of participants' perspectives.

Rigor

To ensure the dependability, credibility, conformability and transferability of the study, several measures were taken: (i) purposive sampling; (ii) prolonged engagement at research sites to build rapport with participants and to gain a full

understanding of participants' narratives, (iii) collection of participant demographics; (iv) continual reflection on assumptions and biases; (v) member-checking, conducted both informally during each FGD to immediately verify findings, and formally through follow-up interviews after FGD transcriptions, to validate the interpretation of the data collected; (vi) back-translation to validate data accuracy; (vii) iterative cycles of coding, interpreting and reflecting on data; (viii) consensus discussions on themes and theme definitions; (ix) inclusion of direct quotations as evidence and (x) establishment of an audit trail of data collection and analysis (Ras-kind et al., 2019; Braun and Clarke, 2021).

RESULTS

Sixty-two parents of children under-5 years of age and village community leaders participated in the focus groups. The majority were female ($n = 47$, 75.8%), aged between 25 and 44 ($n = 32$, 51.6%), and had not completed primary education ($n = 36$, 58.1%). Most participants recruited were mothers of children under the age of 5 ($n = 33$, 53.2%), followed by village community leaders ($n = 23$, 37.1%) and fathers ($n = 6$, 9.7%) (Table 2). The village community leaders were predominantly parents of children aged over 5 years or grandparents of children under 5. This demographic composition provided a deeper understanding of the community context surrounding child drowning.

Data analysis revealed four key themes: (i) concepts of drowning as an issue; (ii) perceived preventability of child drowning; (iii) drowning risk factors; and (iv) implications of cultural norms and collectivism in childrearing practice on drowning risk. Results are presented below under each theme heading and summarized in Table 3, which includes further illustrative participant quotes.

Table 2: Focus group participants' characteristics and home environment

Focus group participants' characteristics and home environment (n = 62)			
		n	%
Gender	Female	47	75.8
	Male	15	24.2
Type of participant	Mothers	33	53.2
	Fathers	6	9.7
	Village community leaders	23	37.1
Age group	18–24 years	6	9.7
	25–34 years	16	25.8
	35–45 years	16	25.8
	44–54 years	11	17.7
	55 and above	13	21.0
Education level	Did not complete primary education	36	58.1
	Completed primary education	14	22.6
	Completed high school	12	19.4
Occupation	Homemaker	34	54.8
	Daily labourer	7	11.3
	Farmer	4	6.5
	Fisherman	2	3.2
	Others	15	24.2
Number of children	0	1	1.6
	1	10	16.1
	2	11	17.7
	3	16	25.8
	4	12	19.4
	5 and over	12	19.4
Number of children under the age of 5	0	23	37.1
	1	28	45.2
	2	11	17.7
Water bodies exist within 500 metres from participant's home	Wells	62	100.0
	Ditches	46	74.2
	Creeks	46	74.2
	Rivers/larger streams	13	21.0
	Beaches	12	19.4
	Ponds	1	1.6
Water bodies exist in and around participant's home	Wells	60	96.8
	Bathtubs (serves as water containers)	50	80.7
	Bucket	55	88.7

Theme 1—Concepts of drowning as an issue

Most participants across all age groups, particularly village community leaders, did not perceive drowning as a risk in their community. Those who did view drowning as a possibility, mostly saw it as an issue for those who lived near a beach. Only a few participants acknowledged drowning as a health concern in the community, mostly those who had personal experience of a non-fatal child drowning incident in their home or community.

There is no such thing [as children drowning]. Maybe it's them who live by the beach. Perhaps they are the ones who

should pay more attention and supervise their children. It (drowning in children) seems like too far away of an idea.

Group 3, female, participant ID number: G3F1

Actually, at times we are worried about it [drowning], especially when the kids are playing in the streams. That is why we look for them when they've been gone playing for too long.

Group 2, female, participant ID number: G2F4

Overwhelmingly, participants had considered drowning as a risk for adults working on the open seas. However, they had not considered the susceptibility of children drowning and showed limited awareness of the possibility of children drowning in and around the home environment.

I think maybe it [drowning] is for people who work at the sea. Boaters, fishermen go to the sea every day. Drowning depends on the location, really. If it's in and around the home, where would these children drown?

Group 2, male, participant ID number: G2M2

While some participants recognized that drowning could be serious and cause death, many, particularly those who appeared to be in older age groups, downplayed its severity. Most participants cited other illnesses such as fever, respiratory tract symptoms and diarrhoea as the primary health concerns for children in their community, with little consideration of drowning.

No, not death [by drowning]. No. Maybe [drowning causes] like regular runny nose, from inhaling the water.

Group 1, female, participant ID number: G1F3

The most important health problems here are usually related to children's illnesses. Fever, coughs, shortness of breath. But these kinds of illnesses are common in this village.

Group 5, female, participant ID number: G5F2

Some participants who appeared to be in younger age groups were more likely to recognize the severe consequences and potential fatality of drowning. Many of these participants cited acquiring awareness of the fatal consequences of drowning, including in children, from various media outlets, including news broadcasts on television and social media, emphasizing the importance of preventive measures, particularly parental supervision of children.

Drowning is important, and it is fatal because it can cause death from lack of oxygen. Children can pass out from it. It is a serious matter. 50:50 chance of survival, between life or death.

Group 6, male, participant ID number: G6M1

There are more news reports on drowning deaths these days, including those involving celebrities. If any celebrity or their children drown, we become more aware. The news report becomes a lesson for us that we need to be more cautious. We need to be careful not to trust other people

Table 3: Definitions of themes and illustrative quotes supporting interpretations of themes

Themes	Definition and inclusions	Sub-themes	Representative excerpts
Concepts of drowning as an issue	Participants' views and concepts of drowning as a public health problem in their community, and of the severity of drowning consequences.	Perceptions of drowning susceptibility Perceptions of severity of drowning consequences <ul style="list-style-type: none"> Personal experiences shaped children's susceptibility to drown 	<p>'We never worried about drowning. We don't have people drown around here. Where would they drown? We don't have big rivers or lakes. Maybe for those closer by the beach'. (Group 2, female, participant ID number: G2F1)</p> <p>'Maybe it's fishermen who are more at risk for drowning. People who go to the sea every day'. (Group 7, female, participant ID number: G7F2)</p> <p>'I never thought about drowning like that [as a cause of injury/death in children]'. (Group 1, male, participant ID number: G1M1)</p> <p>'Children could be ill or die from drowning'. (Group 2, female, participant ID number: G2F5)</p> <p>'Yes, death by drowning in children is possible. They could die from swallowing too much water'. (Group 3, female, participant ID number: G3F5)</p> <p>'I entered the bathroom, just by pure coincidence, then I saw the child was already in the bathtub, [falling them closely]. (Group 6, male, participant ID number: G6M1, rescued his nephew from drowning)</p> <p>'[Name redacted]'s child almost drowned once. In the bathtub. He put his head into the water in the tub. Yes, it could happen around us, especially with young children. And particularly when the tub is large, and the child is little. Especially in the bathroom, and with children as young as around 5 years old. You need to accompany your children when they are in the bathroom... Experience is a lesson'. (Group 6, female, participant ID number: G6F1, witnessed a non-fatal drowning incident of her neighbour's son)</p> <p>'Drowning is destiny. It is a tragedy, an accident'. (Group 1, female, participant ID number: G1F5)</p> <p>'Drowning happens because the child slips and falls into the water'. (Group 3, female, participant ID number: G3F2)</p> <p>'Drowning is a matter of death. Death comes from God. Death from drowning is usual. It's destiny. When death by drowning is destined for them, it's their fate, as promised by God'. (Group 1, male, participant ID number: G1M1)</p> <p>'This person, an adult, as old as me perhaps, drowned in a waterfall ... The person drowned within minutes and cannot be found in those minutes. Perhaps the water has spirits, spirits that wait on it'. (Group 5, female, participant ID number: G5F3)</p> <p>'[Child drowning happens] because children are curious. Even if they're in the swimming pools with their parents, for example, pools have different level of depths, and children can just run and plunge into the deeper pool. So as parents you need to tell them what to do beforehand'. (Group 4, female, participant ID number: G4F3)</p> <p>'Drowning happens because children will go with many friends, but they're all children. If anyone drowns, they will help one another and they will drown, since none of them can swim'. (Group 2, female, participant ID number: G2F1)</p> <p>'Children are the most prone to drown'. (Group 5, female, participant ID number: G5F2)</p> <p>'That's why we are concerned about children going out by themselves, such as to the beach, for we have small children'. (Group 4, female, participant ID number: G4F3)</p> <p>'Teenagers, three teenagers died from drowning'. (Group 6, female, participant ID number: G6F1)</p> <p>'In East Lombok, here, some time ago, university students, while undertaking a community project, had their legs pulled in by the water. Three university students. They all died'. (Group 5, female, participant ID number: G5F6)</p>
Perceived preventability of child drowning	Participants' views that child drowning is an inevitable accidental event, including underlying local cultural and religious beliefs that drowning is destined by God or caused by the presence of spirits.	Drowning is an inevitable event	
Drowning risk factors	Participants' views that child drowning is a preventable event, including their logical reasonings behind their practices in reducing the risk of drowning. Demographic, behavioural, cultural and environmental characteristics that participants associated with a higher likelihood of drowning event taking place.	<p>Drowning is a preventable event</p> <p>Age</p> <ul style="list-style-type: none"> Young children Adolescent and young adults 	

Table 3. Continued

Themes	Definition and inclusions	Sub-themes	Representative excerpts
		Gender	<p>'Especially boys [are prone to drowning]. It is very difficult to tell boys what to do. They tend not to listen to you'. (Group 2, female, participant ID number: G2F4)</p> <p>'Oh no, boys are not more at risk to drown. My granddaughters are much braver than the boys. They are very brave in playing with waves on the beach'. (Group 3, female, participant ID number: G3F5)</p> <p>'We heard many [drowning] cases these days from the news, especially on the beach'. (Group 6, female, participant ID number: G6F1)</p> <p>'Drowning occurs to people who are on board of boats, in the sea'. (Group 3, female, participant ID number: G3F1)</p>
		Locations	
	<ul style="list-style-type: none"> Natural environments 		<p>'I tell my kids not to go the public bathing ponds. I tell them you might drown there'. (Group 2, female, participant ID number: G2F1)</p> <p>'Perhaps there will be drowning in places like Narmada [a sub-district in West Lombok, known for its water springs; public swimming pools, and bathing ponds, serves as popular public destinations], where there are plenty of water-related destinations. In bathing pool and ponds there'. (Group 5, female, participant ID number: G5F4)</p>
	<ul style="list-style-type: none"> Man-modified bathing pools/ponds 		<p>'Drowning can happen in buckets. People these days have big, tall buckets. So, it's dangerous, when bathtubs and buckets are not covered. But the thing is, because we often use the tubs and the buckets, that, even if they are covered, we will uncover and cover them back and forth because we take water from them multiple times a day. And children can open them themselves too ... The bathtubs here are big sometimes, so children can fit in easily. My child can plunge all into it!'. (Group 5, female, participant ID number: G5F1)</p>
	<ul style="list-style-type: none"> Home environments 		<p>'Perhaps children could drown when wells are not covered'. (Group 5, female, participant ID number: G5F2)</p>
	Environmental factors		<p>'We truly stress it to them to avoid playing around uncovered wells, to avoid them falling over the edge of the wells'. (Group 2, female, participant ID number: G2F1)</p>
	<ul style="list-style-type: none"> Lack of barriers to water bodies 		<p>'The ditches in this village are not covered. Ditches perhaps can be covered [to reduce the risk of drowning]'. (Group 3, female, participant ID number: G3F2)</p>
	<ul style="list-style-type: none"> Weather conditions 		<p>'I told my children that when the volume of water on the stream is high, it's better for you not to go there. I often scare them, telling them that you could drown and there will be no one to save you, so that they will not play there. Especially during rainy season'. (Group 2, female, participant ID number: G2F4)</p>
	<ul style="list-style-type: none"> Disasters 		<p>'On ferries, lifejackets are being stored in one area. I observe the weather, usually. If the weather looks bad, I will sit near where lifejackets are stored ... Everyone can drown, depending on the situation. It depends on the weather'. (Group 6, male, participant ID number: G6M1)</p> <p>'No drowning in this community. We don't have floodings around here, maybe on the coast, near the sea ... No drowning. It's drier these days. If never floods in this area'. (Group 1, male, participant ID number: G1M1)</p> <p>'Never heard of drowning, but we have experienced earthquakes, when they said there will be tsunami'. (Group 2, female, participant ID number: G2F1)</p>
	Behavioural factors		<p>'No lifejackets [on board public boats], which irked me, especially because the tides were so strong. There were lifejackets on the top deck, but we were not given them to wear. No one gave instructions or warned the passengers to wear lifejackets ... I observe the weather, usually. If the weather looks bad, I'll sit near where lifejackets are stored'. (Group 6, male, participant ID number: G6M1)</p> <p>'No, the boat crews never do that [informing passengers where the lifejackets are stored]. We took public boat sometimes, going out from the island, with kids. No one uses lifejackets. I don't know if it's available'. (Group 2, male, participant ID number: G2M2)</p>
	<ul style="list-style-type: none"> Lifejackets use 		

Table 3. Continued

Themes	Definition and inclusions	Sub-themes	Representative excerpts
Implications of cultural norms and collectivivism in child-drowning practice on drowning risk	Participants' views and practices on childrearing, including the influence of local cultural and gender norms, as well as the involvement of family and community members in childrearing and supervision practices.	<ul style="list-style-type: none"> Children's behaviours 	<p>'Drowning happens if the children are naughty. Some of the kids are too naughty. They know that the pond is deep, but they are still willing to take the risk'. (Group 2, female, participant ID number: G2F2)</p> <p>'We give them a lot of advice, not to play when the water rises. But kids are stubborn. They will always go on their own way with their friends'. (Group 5, female, participant ID number: G5F2)</p> <p>'Maybe children being playful with each other causes drowning. Their friends being playful while playing. Young children probably don't understand anything about the danger in water'. (Group 5, female, participant ID number: G5F1)</p>
		Childrearing practices in the local community	<p>'It's different with fathers. Fathers leave for work every day, while the responsibility to keep children safe at home is with the mothers'. (Group 2, female, participant ID number: G2F1)</p> <p>'For me, as a homemaker, it is difficult for me to keep an eye on my children. Here, in this community, usually parents have, like, a spare parent, the grandmother, who often act as a caretaker, the second caretaker of the children'. (Group 7, female, participant ID number: G7F2)</p> <p>'There are always many community members doing their activities around, so they can look after the children from any harm'. (Group 2, female, participant ID number: G2F4)</p> <p>'I told my older children, to take care of their younger siblings, so they will not drown. And to not take their younger siblings to the beach, for fear of them being dragged away by the waves'. (Group 1, female, participant ID number: G1F2)</p>
		Supervision while children play around water bodies	<p>'Yes, it's common here, mothers letting their kids playing on their own. Children often play around streams too. And many older children go play further from here, to ponds around here, ... Many children are not accompanied by their parents while playing around water'. (Group 4, female, participant ID number: G4F1)</p> <p>'Yes, it's common for children here to play unsupervised. Mothers often let children play among themselves, because the mothers are probably busy at home as well'. (Group 4, female, participant ID number: G4F3)</p>

too easily, including in letting our children be supervised by others.

Group 6, female, participant ID number: G6F1

Interestingly, none of the participants mentioned how non-fatal drowning can cause injuries or disabilities. While some participants acknowledged the consequences of non-fatal drowning, they primarily referred to it as an 'illness' resulting from drowning, with no mention of injuries or disabilities caused by drowning.

Not only can drowning cause an illness in children, but drowning can also cause children to die.

Group 4, female, participant ID number: G4F1

Drowning can cause illness from wrongly inhaling the water.

Group 1, female, participant ID number: G1F2

Some participants reported that witnessing non-fatal child drowning incidents in their home and community changed their perception of children's susceptibility to drowning and the potential severity of its consequences. These incidents also heightened their awareness of the importance of providing constant supervision for children.

My child almost drowned. My youngest child. Four and a half years old... My child almost didn't have the strength to survive, because he is still very young. I was the one who was being careless. I asked my son's friend to watch over him, but he didn't pay attention. I left both of them to play, thinking they would be fine. I went inside. The water level was very shallow, so I didn't think my son could drown in it, but apparently, children can still drown in shallow waters. It [the experience] must have changed my opinion [on child drowning risk]. Accidents could happen and cause deaths.

Group 6, female, participant ID number: G6F3

Theme 2—Perceived preventability of child drowning

Many participants viewed child drowning as 'accidents'. They perceived drowning incidents as unexpected and inevitable occurrences rather than preventable events that can be mitigated through appropriate measures. Some participants also described drowning as an unintentional event.

I think drowning is similar to road traffic accidents. It is an accident caused by carelessness.

Group 6, male, participant ID number: G6M1

Children drown if they slip. Slip and fall into the water.

Group 1, female, participant ID number: G1F2

Participants' perception of the inevitability of child drowning incidents is influenced by deeply rooted cultural and religious-based fatalistic beliefs surrounding drowning. Many participants cited local cultural and religious beliefs, attributing drowning to destiny or supernatural causes such as 'spirits'.

In our culture, in Sasak culture, death is our destiny, the end of life. It is a promise already made by God, determining

how our lives will end. If drowning is our destiny, we must accept it.

Group 4, female, participant ID number: G4F1

Well, there are local beliefs. It's, I don't know how to explain it because these things cannot be seen with our eyes, but the water spirits are believed to drag people in. Logically, perhaps, if we would like to rationalise, there could be a whirlpool in the water that drags people in. But people still believe in such things. There are sacred places and sacred waterways believed to cause people to drown.

Group 6, male, participant ID number: G6M1

However, some participants, despite believing drowning is inevitable due to destiny, still recognized the importance of taking preventive measures, especially for their children. They outlined specific safety skills children need to be equipped with, particularly swimming ability, and safety approaches parents would adopt to reduce the risk of their children drowning, such as providing supervision and attempting to access lifejackets on public boats, even though lifejackets are often not provided to passengers.

If the boat goes down, you're going to drown. That's it. If I'm on my own, yes, I can say it [drowning] is my destiny, I can accept that. But if I'm with my kids, I don't think I can accept that [drowning] that easily, that I'm going to drown with my children. That's why I'm looking for a safer spot on the ferry ... if the winds were strong, we told our children to sit under the lifejackets, near where the lifejackets were hanged, as if we could quickly grab them [lifejackets].

Group 4, female, participant ID number: G4F3

Child drowning happens because no children here know how to swim.

Group 5, female, participant ID number: G5F6

Theme 3—Drowning risk factors

Participants identified a range of risk factors that make children vulnerable to drowning including age and gender of the child, behavioural practices and exposure to water hazards in the wider home, community and natural environments.

The age of children was discussed as a risk for drowning with younger children being perceived as being particularly vulnerable. Some participants reported incidents of younger children drowning in public aquatic environments such as beaches. Several others recognized that children are prone to drowning but believe that such incidents will occur outside of their community.

There [on the beach], we often heard people drowned, especially little children.

Group 4, female, participant ID number: G4F1

Young kids are prone to drown. Kids from other villages. Not here.

Group 1, female, participant ID number: G1F7

Others viewed adolescents or young adults to be at particular risk, basing their views on past incidents observed in their

communities and reported on the news, including on social media. Some participants attributed the heightened risk in adolescents to the difficulty of supervising them, their newfound independence and their tendency to engage in unsafe water environments influenced by peers.

There were drowning cases in Bima, I heard. There were several cases of drowning there, where young men drowned in the streams. Drowning is also commonly heard where I'm from, in my village. Also, many drowning cases here in Lombok. I heard it some time ago on tv and on social media, of a young man drowned and being carried by the stream up to Ampenan [a coastal sub-district in Mataram, Lombok Island].

Group 5, female, participant ID number: G5F6

When our children were younger, they only played around the house. But once they grew bigger, it's a different level of delinquency, isn't it? They can travel outside of the village by themselves. They can go to the bathing ponds by themselves

Group 2, female, participant ID number: G2F1

Participants had differing views regarding whether gender was a risk factor for drowning. Some suggested boys were more prone to being 'naughty' and disobey parents' advice to stay away from open or unsafe water bodies, hence more likely to drown, while others saw no difference in drowning risk between boys and girls and perceived that drowning could result from 'naughty' behaviour in both.

I think boys and girls these days are the same regarding the risk of drowning. Both can be naughty.

Group 4, female, participant ID number: G4F1

Participants discussed various environments posing drowning risks for children, including natural, built and home settings. Most cited natural aquatic locations, emphasizing beaches and open seas as the main locations of concern, while some also mentioned larger rivers and lakes.

In general, everyone has the risk to drown on the beach, with big waves, and people who cannot swim. I once helped rescue a female who was drowning on the beach ... I helped drag her out of the water.

Group 6, male, participant ID number: G6M1

Participants recognized bathing pools/ponds as potential drowning sites. Participants described that bathing pools/ponds can be either manmade structures resembling swimming pools, albeit shallower and smaller, or modified natural water sources with embankments and coping built around them (Figure 1). Locals, especially in rural areas, often lack swimming skills, hence referring to these facilities as 'bathing pools' or 'bathing ponds' for dipping and cooling off rather than swimming.

Many participants noted children often went to bathing pools without parental or lifeguard supervision, which heightened their risk of drowning. Some mentioned that the low entrance fees of privately owned bathing pools make them accessible to children. Participants also noted that these pools do not require parental attendance or impose minimum age limits for children.

The children went there [to public bathing pools] with their friends. So, I think they could drown without the parents knowing. We call it "Kolam dua ribu" [in English: ten US\$ cents bathing pool, referring to the entrance fee]. Some of the pools are quite deep, and these kids can plunge into the deeper pool, and nobody will know.

Group 2, female, participant ID number: G2F5

Children can enter these bathing ponds without parents, any time they wish.

Group 4, female, participant ID number: G4F3

Several participants, particularly those who appeared to be younger parents, recognized the risk of child drowning at home. They identified 'tubs' or 'bathtubs', common as water containers inside Indonesian bathrooms, along with buckets and uncovered wells (example provided in Figure 1), as potential drowning sites in and around home. Incidents of non-fatal drowning in these household water sources were also cited by some participants. They mentioned that the drownings occurred when they were not supervising their children while playing around water in and around their homes.

My son was also once played in the bathtub and almost drowned! I wasn't aware of that because he was playing in the bathroom. People here don't close their doors, their bathroom doors, so children can walk in and out ... I heard the sound; "Gulp. Gulp." It was my son! I wasn't aware of him drowning. I thought, where is my child? The next thing I saw was his head was in the tub! He was still little at that time. Five years old.

Group 5, female, participant ID number: G5F1

Unprotected wells and ditches in communities were also perceived as environmental risk factors of child drowning. Some participants mentioned that they had covered their wells to prevent children from falling in. However, they noted that some community members still maintain open wells in their houses.

Yes, kids were curious about the uncovered well and what was inside, so they got closer to it and peeked in. We were worried about the possibility of children falling into the well, so most of us have covered our wells.

Group 2, female, participant ID number: G2F1

But no one worries about the possibility of falling into wells. If there are any children playing around the well, we just need to yell at them to stop playing around the well.

Group 2, male, participant ID number: G2M1, owns an open well in his house

Participants identified various weather conditions as environmental risk factors for drowning, particularly during the rainy season. They also highlighted the dangers posed by powerful waves, high tides and strong offshore winds, which increase the risk of drowning both in natural water bodies and during water transport-related incidents.

I tell them [the children] not to go around water during the rainy season, because the water will rise, and we might get carried away by the water flow.

Group 7, female, participant ID number: G7F1



Description of images from top left to right, to bottom: Image A: man-made bathing pool in study site, with the water drained. Dimensions: 12 x 3 x 1 metre; Image B: Modified, natural bathing ponds in study site; Image C: 1) An open well in participant's home, with pulley system, 2) a cement tub serves as a water container, 3) a covered bucket, serves as a water container, with a water scoop on top

Fig. 1: Examples of water bodies in study site.

In addition to rainy season flooding, most participants, whether coastal or inland residents, voiced their concerns about earthquakes and the risk of tsunamis. They referenced the 2018 series of 6.9 magnitude earthquakes in northern

Lombok, which triggered small-scale tsunamis on the northern coast of the island, as a significant event that heightened their awareness of their susceptibility to tsunamis and the associated risk of disaster-related drowning.

We were afraid of the seawater! Nowhere felt safe! ... We're not afraid of floodings, but we're very afraid of tsunamis!
Group 2, female, participant ID number: G2F4

While several participants viewed lifejackets as an important safety device, most stated that lifejackets were rarely available or used on public boats. This lack of access to lifejackets was seen as a factor contributing to their vulnerability to drowning in watercraft-related incidents.

No one on board of boats use lifejackets. Never. The boat crews never let people know that we must use lifejackets and where the lifejackets are stored. And I have taken a few boat and ferry rides, to Bali and to Java, but no such information on lifejackets. Sometimes there were lifejackets around, sometimes no lifejackets can be seen around. But no there was no information on that [lifejackets], especially on smaller boats.

Group 2, male, participant ID number: G2M1

Many participants identified children's behaviours as drowning risks. Some perceived children's behaviours as 'naughty' which led them to being in risky situations. Meanwhile, some participants who appeared to be younger parents, attributed the risky behaviour to children being naturally curious and active as part of their developmental phase.

Mostly, it depends on the child's bravery. Even though the parents have watched their children, but children can be stubborn.

Group 5, female, participant ID number: G5F3

Especially children around the age of 5 years old. That's why we need to supervise them closely. They're very active around this age. We need to watch them, what are they playing, how they are playing.

Group 6, male, participant ID number: G6M1

Theme 4—Implications of cultural norms and collectivism in childrearing practice on drowning risk

Participants highlighted the crucial role of supervision in preventing child drowning and discussed cultural norms and practices related to childrearing. Predominantly, participants across different age groups and both genders noted the cultural significance of mothers in childrearing. Participants described traditional gender roles in childcare and household duties, where mothers were primarily responsible for child safety alongside household chores, while fathers were seen as providers. Many mothers expressed challenges in balancing these responsibilities.

The younger kids are usually with the mothers. While we hand-wash the clothes, with the water from the well in the buckets, our kids also play around the well and buckets. They're with us. We tell them not to play far near the streams or ditches. We're afraid that they may slip and fall into the water.

Group 2, female, participant ID number: G2F2

As a stay-at-home mother, who must do everything by myself, yes, it is particularly difficult to balance between completing house tasks and taking care of my children. But

it's different for men. It seems as if men only need to earn money and that's it. Meanwhile, women must wash, cook, clean the house, care for the children, some also work—everything.

Group 5, female, participant ID number: G5F6

Most participants also highlighted the cultural tradition of involving extended family, including in-laws, grandmothers and older children, and neighbours in caring for young children. Mothers are often unable to provide constant supervision for their children, leading them to rely on their older children or children in the neighbourhood to supervise their children while playing, including around water bodies. These practices could either protect children from drowning or heighten their vulnerability.

Children can be watched by in-laws. Or helped by their grandmothers, usually. Many members in this community play an important role in caretaking children. The grandparents, aunts, neighbours. We could watch each other's children.

Group 6, female, participant ID number: G6F1

Children will watch themselves. It is common here in the village. They'll take care of each other.

Group 7, female, participant ID number: G7F1

DISCUSSION

Child drowning is a significant public health issue in Indonesia. As highlighted in the first and second stages of the PHM, it is important to understand current parental and community perceptions and practices related to child drowning, to better comprehend how child drowning is perceived as a public health problem in the community as well as its perceived causes and risk factors, to inform future health promotion approaches to address the issue (Sleet et al., 2003; Hanson et al., 2012). This study has yielded valuable insights into the community's views on drowning as a cause of childhood mortality and injury, as well as identifying contextual factors that put children at risk of drowning in Indonesia.

Despite evidence of child drowning as a leading cause of death among Indonesian children (Cenderadewi et al., 2024), the study identified a limited understanding regarding children's vulnerability to drowning, its preventability and associated risk factors. Utilizing constructs from the HBM, this study identified that most participants were unaware of the susceptibility of their children and others in the community to drowning, and the severe outcomes that can result such as injury, disability and death, highlighting the urgent need to enhance public awareness about drowning.

The study explored HBM constructs to identify perceived risk factors contributing to drowning, including being young children, adolescents and young adult males, behavioural practices such as inadequate supervision and non-usage of life jackets, and broader environmental factors within homes, communities and natural settings. HBM has been widely recognized and applied in various studies to better understand individual attitudes and behaviours towards drowning risks and related preventive behaviours (Mel et al., 2017; Glassman et al., 2018; Abercromby et al., 2021; Willcox-Pidgeon et al., 2021; Tengecha et al., 2022). For instance, research by Mel et al. (2017) applied the HBM to assess parental and caretakers'

perceptions regarding a mass media messaging campaign on child drowning risk. Their study highlighted how the model serves to identify the campaign's effectiveness in communicating children's susceptibility to drowning and the presence of water hazards in and around the home (Mel *et al.*, 2017). Another study by Abercromby *et al.* (2021) utilized the HBM to explore young adults' beliefs and behaviours related to alcohol consumption and water safety, revealing the role of peers, social influences and cultural norms in their decision-making regarding alcohol consumption during water-based activities through the exploration of HBM constructs.

Participants generally associated drowning with beaches or open seas, despite evidence indicating that child drowning incidents often occur in smaller water bodies such as unprotected wells, canals, ponds and streams, similar to those that exist in participants' communities (Tyler *et al.*, 2017; Zaara *et al.*, 2022). Direct exposure to child drowning incidents prompted some awareness on the likelihood of such occurrences in and around homes, with participants identifying open wells, tubs and buckets as notable risk factors in and around homes, consistent with previous research in other LMICs (Morris *et al.*, 2016; Tyler *et al.*, 2017; Zaara *et al.*, 2022; Siddiqui *et al.*, 2023). Participants highlighted that they acquired awareness of child drowning risks and consequences through media, particularly social media. This underscores the need for enhanced strategic communication, aligning with WHO recommendations, via media outlets, including social media, with parents being a key target audience, to bolster public awareness on child drowning risks and prevention, and to support effective implementation of prevention strategies (World Health Organization, 2017).

Due to most participants not having previously considered child drowning as a significant issue or one that potentially has serious consequences, there was little discussion about intent to change behaviour or practices to prevent drowning (Glanz and Bishop, 2010). While direct exposure to drowning incidents prompted some awareness of the issue, most participants were in the early stages of behavioural change regarding protective strategies (Kowalski *et al.*, 2014). Although supervision was acknowledged as crucial to prevent child drowning, Indonesian mothers found it challenging to supervise their children constantly and often delegated supervision to other family and community members, despite previous research suggesting that this practice may be inadequate to prevent child drowning (Blum *et al.*, 2009; Morrongiello *et al.*, 2010; Peden and Franklin, 2018). The failure to perceive children being susceptible to drowning and lack of acknowledgement of the potential severe consequences of a drowning incident could stem from cultural norms accepting drowning occurrences as inherently inevitable and part of destiny. This perception of drowning as predestined by fate is similar to what has been reported in Bangladesh (Blum *et al.*, 2009) and India (Lukaszuk *et al.*, 2019). This view of the inevitability of drowning is further compounded by inadequate resources and infrastructure at both the home and community levels. Therefore, further exploration of the local context and social determinants of drowning across Indonesian communities is essential to ensure that proposed health promotion approaches are effective and feasible.

The study also highlighted a gap in understanding awareness and attitudes towards child drowning risks among various community segments, emphasizing the necessity for

separate investigations into parents and community leaders. These studies would inform targeted strategies tailored to each group. To develop effective strategies aligned with local contexts, beliefs and practices, a collaborative co-design approach involving researchers, stakeholders and community members is recommended (Clark *et al.*, 2022; Koon *et al.*, 2023; Peden *et al.*, 2023). Previous research, such as in Australia, has demonstrated that co-design effectively customises drowning prevention interventions to meet local needs, bolstering community support and ensuring their long-term sustainability (Koon *et al.*, 2023). Further investigation is needed to assess its applicability in designing culturally sensitive and context-specific interventions suitable for different community segments in Indonesia.

While this study provides useful information that enhances our understanding of how parents and community members feel about child drowning as an issue and what they see as risk factors, further research into comprehensive health promotion strategies, grounded in a socio-ecological approach, is imperative to achieve effective and sustainable drowning prevention efforts in Indonesia. This involves examining the interconnectedness of drowning prevention with initiatives such as provision of safe aquatic environments, infrastructure investments, affordable childcare and early childhood education, equitable education, rural development, enforcement of boating and maritime safety regulations, disaster risk management and efforts to alleviate socioeconomic disparities. This investigation is particularly crucial for socioeconomically disadvantaged populations in rural and remote regions across Indonesia's archipelago.

Strengths and limitations

A strength of this study was the utilization of the HBM to gain a deep understanding of community perspectives on child drowning and its seriousness within their communities. This, coupled with insights into risk factors, some of which are specific to the Indonesian context, is an important starting point for further research into contextually relevant health promotion approaches to address child drowning.

There are, however, some limitations that need to be acknowledged. This study was conducted on just one Indonesian island, although the sampling approach ensured a diverse geographical representation. Indonesia's vast diversity necessitates further research across the country to gauge if perceptions of drowning and risk factors align consistently. In addition, participants self-selected into the study, which may bias the sample towards those with a particular interest in or experience in drowning. This could result in findings that do not fully represent the broader community's views. Furthermore, parents and village community leaders were grouped in the same focus groups, hence it was not always possible to distinguish between their perspectives. This potential overlap in perspectives due to the composition of the focus group may have influenced the interpretation of findings, limiting the ability to compare perspectives distinctly between parents and village community leaders.

CONCLUSION

This qualitative study identified limited community understanding of the preventability, vulnerability and risk factors of child drowning. Utilizing constructs from the HBM, this

study revealed that most participants were unaware of the susceptibility of their children and others in the community to drowning, and of the potential severe outcomes of drowning such as injury, disability and death. This highlights the urgent need to enhance public awareness about the susceptibility of children to drowning and the severe consequences it can entail. While direct exposure to drowning incidents prompted some awareness of the issue, most participants were in the early stages of behavioural change regarding protective strategies. Further exploration of local contexts and social determinants of drowning in Indonesian communities is imperative for ensuring effective and sustainable water safety promotion and drowning prevention strategies.

AUTHOR CONTRIBUTIONS

Study conception and design: M.C., R.C.F., S.G.D.; data collection: M.C., P.B.F.; analysis and interpretation of results: M.C., R.C.F., S.G.D.; draft manuscript preparation: M.C., R.C.F., S.G.D. All authors reviewed the results and approved the final version of the manuscript.

FUNDING

Open access publishing facilitated by James Cook University, as part of the Oxford University Press—James Cook University Read and Publish Agreement negotiated by the Council of Australian University Librarians.

DATA AVAILABILITY

The direct and anonymized quotes supporting this article are available within the article itself. Complete transcripts cannot be shared publicly due to privacy considerations for the study participants, in accordance with ethical approval. All anonymized transcripts are stored at the James Cook University Research Data Management Repository, in line with ethical approval protocols.

ETHICAL APPROVAL

Ethical approval was granted by the University of Mataram—Indonesia (Ethics Approval number 044/UN18.F8/ETIK/2024) and acknowledged by James Cook University's Human Research Ethics Committee (External HREC Approval Acknowledgement reference number H9088).

REFERENCES

- Abercromby, M., Leavy, J. E., Tohotoa, J., Della Bona, M., Nimmo, L. and Crawford, G. (2021) 'Go hard or go home': exploring young people's knowledge, attitudes and behaviours of alcohol use and water safety in Western Australia using the Health Belief Model. *International Journal of Health Promotion and Education*, 59, 174–191.
- Blum, L. S., Khan, R., Hyder, A. A., Shahanaj, S., El Arifeen, S. and Baqui, A. (2009) Childhood drowning in Matlab, Bangladesh: an in-depth exploration of community perceptions and practices. *Social Science & Medicine*, 68, 1720–1727.
- Braun, V. and Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3, 77–101.
- Braun, V. and Clarke, V. (2021) One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qualitative Research in Psychology*, 18, 328–352.

- Braun, V. and Clarke, V. (2023) Toward good practice in thematic analysis: avoiding common problems and becoming a knowing researcher. *International Journal of Transgender Health*, 24, 1–6.
- Cenderadewi, M., Devine, S. G., Peden, A. E. and Franklin, R. C. (2024) The burden of unintentional drowning in Indonesia: insights from the Global Burden of Disease Study 2019. *Injury Prevention*, 10.1136/ip-2024-045274.
- Cenderadewi, M., Devine, S. G., Sari, D. P. and Franklin, R. C. (2023) Fatal drowning in Indonesia: understanding knowledge gaps through a scoping review. *Health Promotion International*, 38, daad130.
- Cenderadewi, M., Franklin, R. and Devine, S. (2020) The socio-ecological nature of drowning in low- and middle-income countries: a review to inform health promotion approaches. *International Journal of Aquatic Research and Education*, 12, 1–61.
- Champion, V. L. and Skinner, C. S. (2008) The health belief model. *Health Behavior and Health Education: Theory, Research, and Practice*, 4, 45–65.
- Clark, A. T., Ahmed, I., Metzger, S., Walker, E. and Wylie, R. (2022) Moving from co-design to co-research: engaging youth participation in guided qualitative inquiry. *International Journal of Qualitative Methods*, 21, 160940692210847.
- Creswell, J. W. (2014) *Research Design: Qualitative, Quantitative, and Mixed Method Approaches*. SAGE Publications, Inc, Thousand Oaks, CA.
- Etheridge, J. C., Sinyard, R. D. and Brindle, M. E. (2023) Chapter 90—Implementation research. In Eltorai, A. E. M., Bakal, J. A., Newell, P. C. and Osband, A. J. (eds), *Translational Surgery*. Academic Press, London, pp. 563–573.
- Franklin, R. and Scarr, J. (2014) A framework for prevention. In Bieren, J. J. L. M. (eds), *Drowning: Prevention, Rescue, Treatment*. Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 153–163.
- Franklin, R. C., Peden, A. E., Hamilton, E. B., Bisignano, C., Castle, C. D., Dingels, Z. V. et al. (2020) The burden of unintentional drowning: global, regional and national estimates of mortality from the Global Burden of Disease 2017 Study. *Injury Prevention*, 26, 183–195.
- Glanz, K. and Bishop, D. B. (2010) The role of behavioral science theory in development and implementation of public health interventions. *Annual Review of Public Health*, 31, 399–418.
- Glassman, T. J., Castor, T., Karmakar, M., Blavos, A., Dagenhard, P., Domigan, J. et al. (2018) A social marketing intervention to prevent drowning among inner-city youth. *Health Promotion Practice*, 19, 175–183.
- Hanson, D. W., Finch, C. E., Allegrante, J. P. and Sleet, D. (2012) Closing the gap between injury prevention research and community safety promotion practice: revisiting the Public Health Model. *Public Health Reports*, 127, 147–155.
- Hennink, M. M. (2014) *Focus Group Discussions*. Oxford University Press, New York, NY.
- Hossain, M., Mani, K. K. C., Sidik, S. M., Hayati, K. S. and Rahman, A. K. M. F. (2015) Socio-demographic, environmental and caring risk factors for childhood drowning deaths in Bangladesh. *BMC Pediatrics*, 15, 114.
- Hunter, D., McCallum, J. and Howes, D. (2019) Defining exploratory-descriptive qualitative (EDQ) research and considering its application to healthcare. *Journal of Nursing and Health Care*, 4, 1–7.
- Indonesian National Bureau of Statistics. (2021a) 2020 Census results. <https://www.bps.go.id/pressrelease/2021/01/21/1854/hasil-sensus-penduduk-2020.html> (last accessed 21 February 2024).
- Indonesian National Bureau of Statistics. (2021b) Employment in West Nusa Tenggara, August 2021. Indonesian National Bureau of Statistics. https://disnakertrans.ntbprov.go.id/wp-content/uploads/2021/12/BRsbrsInd_20211105214259-compress2.pdf (last accessed 4 June 2024).
- Indonesian National Bureau of Statistics. (2023a) GDP per Capita by Province in Indonesia 2022. Indonesian National Bureau of Statistics. <https://www.bps.go.id/id/statistics-table/3/YWtoQIRVZzNiMU5qU1VOSIRFeFZiRTR4VDJOTVVUMDkjMw==/produk-domestik-regional-bruto-per-kapita-atas-dasar-harga-berlaku-menurut-provinsi-ribu-rupiah-2022.html?year=2022> (last accessed 17 January 2024).

- Indonesian National Bureau of Statistics. (2023b) Infant and under-5 mortality rates by province in Indonesia. Indonesian National Bureau of Statistics. <https://mamujukab.bps.go.id/statistable/2023/02/01/106f-angka-kematian-ibu-aki-angka-kematian-bayi-akb-dan-angka-kematian-balita-akba-menurut-provinsi-hasil-long-form-sp2020.html> (last accessed 29 April 2024).
- Indonesian National Bureau of Statistics. (2023c) Total population by province and district in Indonesia 2021–2023. Indonesian National Bureau of Statistics. <https://ntb.bps.go.id/indicator/12/29/1/penduduk-kabupaten-kota.html> (last accessed 17 January 2024).
- Indonesian National Bureau of Statistics. (2023d) Villages ('Desa') and Urban Sub-districts ('Kelurahan') in West Nusa Tenggara. Indonesian National Bureau of Statistics. <https://data.ntbprov.go.id/dataset/jumlah-desadan-kelurahan-menurut-kabkota-se-ntb> (last accessed 4 June 2024).
- Indonesian National Bureau of Statistics. (2024a) West Nusa Tenggara's populations living below the poverty line 2021–2023. Indonesian National Bureau of Statistics. <https://ntb.bps.go.id/publication/2024/02/28/375b8367273e8c7900e8174e/provinsi-nusa-tenggara-barat-dalam-angka-2024.html> (last accessed 4 June 2024).
- Indonesian National Disaster Management Agency. (2023) Disaster information database. <https://dibi.bnppb.go.id/> (last accessed 30 May 2023).
- Koon, W., Brander, R. W., Alonzo, D. and Peden, A. E. (2023) Lessons learned from co-designing a high school beach safety education program with lifeguards and students. *Health Promotion Journal of Australia*, 34, 222–231.
- Kowalski, K., Jeznach, A. and Tuokko, H. A. (2014) Stages of driving behavior change within the Transtheoretical Model (TM). *Journal of Safety Research*, 50, 17–25.
- Lukaszuk, C., Mittal, S., Gupta, M., Das, R., Ivers, R. and Jagnoor, J. (2019) The impact and understanding of childhood drowning by a community in West Bengal, India, and the suggested preventive measures. *Acta Paediatrica*, 108, 731–739.
- Mel, D., Justine, E. L., Jonine, J., Lauren, N. and Gemma, C. (2017) This Much Water: a qualitative study using behavioural theory to develop a community service video to prevent child drowning in Western Australia. *BMJ Open*, 7, e017005.
- Morris, N. K., du Toit-Prinsloo, L. and Saayman, G. (2016) Drowning in Pretoria, South Africa: a 10-year review. *Journal of Forensic and Legal Medicine*, 37, 66–70.
- Morrongiello, B. A., Schell, S. L. and Schmidt, S. (2010) 'Please keep an eye on your younger sister': sibling supervision and young children's risk of unintentional injury. *Injury Prevention*, 16, 398–402.
- Peden, A. E., Alonzo, D., McMillan, F., Tran, T. P., Hawke, C., Ivers, R. et al. (2023) Co-designing a farm safety gamified educational resource with secondary school students and their teachers: qualitative study protocol. *International Journal of Qualitative Methods*, 22, 160940692311563.
- Peden, A. E. and Franklin, R. C. (2018) Understanding lapses in supervision of children 0–4 years who drowned in Australia. *Injury Prevention*, 24, A151.
- Rahman, A., Shafiq, S., Linnan, M. and Rahman, F. (2008) Community perception of childhood drowning and its prevention measures in rural Bangladesh: a qualitative study. *The Australian Journal of Rural Health*, 16, 176–180.
- Raskind, I. G., Shelton, R. C., Comeau, D. L., Cooper, H. L. F., Griffith, D. M. and Kegler, M. C. (2019) A review of qualitative data analysis practices in health education and health behavior research. *Health Education & Behavior*, 46, 32–39.
- Siddiqui, S. A., Singh, M. V., Mishra, N., Maurya, M., Shrivastava, A. and Yadav, R. K. (2023) Buckets associated home drowning in Indian infants and toddlers: an analysis of 18 fatalities from 2016–2022. *Tropical Doctor*, 53, 416–418.
- Sleet, D. A., Hopkins, K. N. and Olson, S. J. (2003) From discovery to delivery: injury prevention at CDC. *Health Promotion Practice*, 4, 98–102.
- Statista. (2023) Risk index of natural disasters in Indonesia for mid 2023, by type. Natural disasters in Indonesia—statistics and facts. <https://www.statista.com/statistics/920857/indonesia-risk-index-for-natural-disasters/> (last accessed 5 April 2024).
- Tengecha, N. A., Alimo, P. K., Agyeman, S., Akintunde, T. Y., Lartey-Young, G. and Zhang, X. (2022) Schoolchildren's inland water transport adoption barriers in Tanzania: health belief model application. *Journal of Transport Geography*, 104, 103444.
- Tyler, M. D., Richards, D. B., Reske-Nielsen, C., Saghaifi, O., Morse, E. A., Carey, R. et al. (2017) The epidemiology of drowning in low- and middle-income countries: a systematic review. *BMC Public Health*, 17, 1–7.
- United Nations Inter-Agency Group for Child Mortality Estimation. (2023) Infant mortality rate—total for Indonesia. <https://childmortality.org/all-cause-mortality/data?refArea=IDN&indicator=MRY0> (last accessed 5 April 2024).
- United Nations International Children Emergency Funds (UNICEF). (2019a) Provincial snapshot: West Nusa Tenggara. SDGs for Children in Indonesia. https://www.unicef.org/indonesia/sites/unicef.org/indonesia/files/2019-05/West_Nusa_Tenggara_ProvincialBrief.pdf (last accessed 26 May 2024).
- United Nations International Children Emergency Funds (UNICEF). (2019b) Provincial snapshot: East Java. SDGs for Children in Indonesia. https://www.unicef.org/indonesia/sites/unicef.org/indonesia/files/2019-05/East_Java_ProvincialBrief.pdf (last accessed 3 July 2024).
- Willcox-Pidgeon, S. M., Franklin, R. C., Devine, S., Leggat, P. A. and Scarr, J. (2021) Reducing inequities among adult female migrants at higher risk for drowning in Australia: the value of swimming and water safety programs. *Health Promotion Journal of Australia*, 32, 49–60.
- World Health Organization. (2014) Global report on drowning: preventing a leading killer. World Health Organization. <https://www.who.int/publications/i/item/global-report-on-drowning-preventing-a-leading-killer> (last accessed 1 March 2024).
- World Health Organization. (2021) WHO Guideline on the prevention of drowning through provision of day-care and basic swimming and water safety skills. World Health Organization. <https://www.who.int/publications/i/item/9789240030008> (last accessed 19 April 2024).
- World Health Organization. (2022) Preventing drowning: Practical guidance for the provision of day-care, basic swimming and water safety skills, and safe rescue and resuscitation training. World Health Organization. <https://www.who.int/publications/i/item/9789240046726> (last accessed 22 May 2024).
- World Health Organization Regional Office for the South-East Asia. (2021) Regional status report on drowning in South-East Asia. World Health Organization. <https://apps.who.int/iris/bitstream/handle/10665/343085/9789290228608-eng.pdf?sequence=1&isAllowed=y> (last accessed 25 February 2024).
- World Health Organization. (2017) Preventing drowning: An implementation guide. <https://www.who.int/publications/i/item/preventing-drowning-an-implementation-guide> (last accessed 25 May 2024).
- Wright, S., O'Brien, B. C., Nimmon, L., Law, M. and Mylopoulos, M. (2016) Research design considerations. *Journal of Graduate Medical Education*, 8, 97–98.
- Zaara, M. A., Belhaj, A., Naceur, Y., Makni, C., Gharbaoui, M., Bellali, M. et al. (2022) Patterns of unintentional fatal drowning among children in North Tunisia: a 10-year study. *Revue D'epidemiologie et de Sante Publique*, 70, 31–37.

Appendix 4: University of Mataram Human Research Ethics Committee – Letters of Approval

Scoping Review

This administrative form
has been removed

Population-Based Retrospective Cohort Study

This administrative form
has been removed

Qualitative Study

This administrative form
has been removed

**Appendix 5: James Cook University Human Research Ethics Committee – Letters of Acknowledgment
of External HREC Approval**

This administrative form
has been removed

Appendix 6: Focus Group Moderator Guide in English

Focus Group Moderator Guide

Welcome Section

"Welcome and thank you for making the time to participate in our study and share your viewpoints on childhood drowning as an issue in your community. My name is Thia, and I will be your moderator for today's session."

Brief Synopsis of Research

"Today, we will be discussing your thoughts and feelings on the risk of childhood drowning and its prevention. We will also look at your experiences and common local practices to prevent children from drowning."

Rules

"First, there are several guidelines we should all follow to ensure today's session runs smoothly.

1. You are invited to express your opinions freely today. There is no right or wrong answer.
2. Everyone's opinion is valued, so we will listen respectfully to all participants. Please take turns when sharing your opinions.
3. Please turn off your cellphone, to avoid any interruption during the discussion.
4. The discussion will take about 60-90 minutes to complete, and we would appreciate it if you can be in attendance for the whole time.
5. Please feel free to eat and drink during our meeting, but please get your refreshments before we start to avoid interrupting the on-going conversation.
6. Please use the facilities before we begin. If you need to leave the room during the discussion, please do so without distracting the ongoing conversation.
7. Please refrain from sharing any information regarding the individuals attending this session and the answers they share within this forum to other people outside of this session.

Explanation of Privacy Compliance

"All recordings and transcripts will be stored in a secure site and only members of the research team will have access to them. Data and records will be coded so that you cannot be identified. The data from the study will be used in journal articles, presentations, and thesis. You will not be identified in any way in these publications."

Introductions

"Let's look around the room and get to know each other. Please introduce yourself to the group one by one by stating your first name only, your occupation, and how many young children you have and their ages."

Key questions, follow-up questions, and probes

Introduction

- "Could you tell me a bit about your family?"
Domains of interest: number of children, age of children, family structure.

Warm-up

- Q1. "Could you tell me about your family's and children's activities around water?"
Follow-up questions:

- “Could you tell me what water bodies exist in your community and in and around your home?”
- “Could you tell me your use of watercrafts and flotation devices on board?”
- “Could you tell me who in your family is responsible to supervise children while they are doing activities around water?”
- “Could you tell me more about your family structure and the main caretaker in your household?”

Domains of interest: family’s relationship with water (e.g., children’s activities near water bodies in and around home, collecting water/bathing/washing/swimming/fishing in open water bodies, use of water transport vehicle and use of flotation devices on board), water bodies in and around home, distance to water bodies, supervision around water bodies, relevant childrearing practices.

- Q2. “What do you think are the greatest health concerns for your community?”
Follow-up question:
 - “How important do you think drowning is as a health issue in your community?”
 - “Where do you think drowning fits among these greatest health concerns in your community?”, or depending on the flow: “Have you ever thought of drowning as a part of injury-related health issues?”
 - “Have you ever experienced/witnessed/heard stories about drowning events in your community?”
 - “Are you aware of local beliefs and practices surrounding the issue of drowning?”

Core Discussion

- Q3. “Who do you think is at most risk for drowning in your community?”
- Q4. “What do you think of drowning as a cause of injury/death for children?”
- Q5. “What do you think are the reasons that might cause a child to drown?”
- Q6. “Can you tell me about aspects of the environment and community in which you live that could increase the risk of a child drowning?”
- Q7. “What are some of the things that might make it hard to keep children safe from drowning?”
- Q8. “Can you tell me about how you have taught your children about water dangers?”
- Q9. “What would you like to see put in place to prevent children from drowning in your community?”

Follow up questions:

- “Who do you think are responsible for preventing drowning?”
- “Where do you get your information on drowning prevention from?”

Conclusion

“We have shared a lot of important information today on the risk of childhood drowning and its prevention. We thank you for sharing your valuable insights. I will summarise the aspects you have shared with us today: Did I correctly capture what you are trying to say? Is there anything else you would like to add?”

Appendix 7: Participant Information Sheet in English

Participant Information Sheet



- Title of the study: Investigating Indonesian parents' and community's perceptions and practices on childhood drowning risk and prevention: A qualitative study.
- Lead researcher:
 - Name : dr. Muthia Cenderadewi MPHTM
 - Employment identification number :
 - Phone number :
 - Address : Faculty of Medicine, University of Mataram, Jalan Pemuda No. 37 Mataram, West Nusa Tenggara.
- The ethical approval for this study is granted by the Ethical Committee for Medical Research, University of Mataram (No: 129/UN18.F8/ETIK/2023).

We would like to invite you to take part in the above research study, taking place at your local village centre, Lombok Island, West Nusa Tenggara. Before you decide whether to take part, it is important for you to understand why the study is being done and what it will involve. Please read the following information carefully and if you have any queries or would like more information, please contact Muthia Cenderadewi of Faculty of Medicine, University of Mataram (muthia.cenderadewi@my.jcu.edu.au).

Take your time to decide whether or not you wish to take part. Thank you for reading this.

The research is looking at Indonesian parents' and community's perceptions and practices regarding childhood drowning risk and prevention in and around home. Our research questions are: 1) What are the parents' and village community leaders', residing in coastal areas of West Nusa Tenggara Province of Indonesia, perceptions regarding childhood drowning risk in and around home? and 2) What are the parents' and village community leaders', residing in coastal areas of West Nusa Tenggara Province of Indonesia, practices to prevent children from drowning in and around home? To help us answer these questions, we will be conducting focus groups discussions aimed to collect information that will be made anonymous.

Participation in this study is voluntary. You do not have to take part in this research, and it is up to you to decide whether or not you want to be involved. If you do decide to take part, you will be given a copy of this information sheet to keep and will be asked to sign a consent form. You are able to withdraw from the research without giving a reason. If you want to withdraw from the study, please contact Muthia Cenderadewi at muthia.cenderadewi@my.jcu.edu.au or . Deciding not to take part or to withdrawal from the study does not have any penalty.

If you agree to take part in this study, you will be asked to take part in focus group discussions. The team are all experienced in the subject matter and are sensitive to issues it may raise. The focus group

discussions will take approximately 60 to 90 minutes. The interviewers will travel to your local village centre.

The subject and focus of the discussion will be your views, experiences, and practices regarding the risk and prevention of child drowning in and around home. By taking part in this research, you will be helping us to gain a better understanding on Indonesian parents' and community's perceptions and practices regarding the risk and prevention of childhood drowning, hence informing the development, implementation, and evaluation of drowning preventive efforts to reduce the risk of childhood drowning in Indonesia, particularly in West Nusa Tenggara.

Your confidentiality will be strictly protected. Your interview will be recorded on an audio/video recorder, solely for convenience and accuracy. Only members of the study team will have access to the audio/video recording, no one else will listen to it and it will not be used for any other purpose. Your responses will be anonymised and combined with all the responses from all the focus groups and all the participants, so that there will be no identifying factors in the report. No names of participants will be used in the report. No likeness or identifying details will be used in the report.

We do not foresee any significant risk to you in taking part in this study. If, however, you feel uncomfortable at any time, you can ask for the discussion to be stopped. If you need any support during or after the focus group discussion, then the researchers will be able to put you in touch with suitable support agencies. The research team have experience in conducting qualitative study and are sensitive to the subject area. The focus group discussions have been designed with these considerations in mind.

Reports, publications, presentations, and thesis will be written containing our research findings. However, only anonymous, and non-identifying direct quotes may be used for publication and presentation purposes.

To pursue any concerns and/or complaints, please contact the lead researcher (Muthia Cenderadewi at muthia.cenderadewi@my.jcu.edu.au or _____), the Ethical Committee for Medical Research, University of Mataram (komisietik.kedokteran@unram.ac.id), or the Associate Dean of Research Education of College of Public Health, Medical and Veterinary Sciences, James Cook University (A/Prof Zhanming Liang at zhanming.liang@jcu.edu.au).

If you would like any further information about the research, please contact the lead researcher in the first instance.

Thank you for agreeing to take part in this study.

You will be given a copy of this Participant Information Sheet and your signed Consent Form to keep.

Appendix 8: Consent Form in English

Consent Form



Investigating Indonesian parents' and community's perceptions and practices on childhood drowning risk and prevention: A qualitative study.

This consent form will have been given to you with the Participant Information Sheet. Please ensure that you have read and understood the information contained in the Participant Information Sheet and asked any questions before you sign this form. If you have any questions, please contact a member of the research team, whose details are set out on the Participant Information Sheet

If you are happy to take part in focus group discussions, please sign and date the form. You will be given a copy to keep for your records.

- I have been informed, read, and understood the information in the Participant Information Sheet which I have been given before asked to sign this form.
- I have been given the opportunity to ask questions about the study.
- I have had my questions answered satisfactorily by the research team.
- I agree to have the discussion audio taped.
- I agree that anonymised quotes may be used in the reporting of this study.
- I understand that my participation is voluntary and that I am free to withdraw at any time until the data has been anonymised.
- I agree to take part in the research.

Name.....

Signature..... Date.....

Appendix 9: Household Demographic Questionnaire in English**Household Demographics Questionnaire**

We would like to start by asking you some background information about you and your family. Please try to be as truthful and specific as possible when answering these questions. Please be assured that the answers you give will be kept confidential. Please circle the most appropriate answer(s) for your situation.

1. What is your age group?

a. 18-25	d. 36-40	g. 51 years or older
b. 26-30	e. 41-45	
c. 31-35	f. 46-50	
2. What is your gender?
 - a. Male
 - b. Female
3. What is your highest qualification?
 - a. Incomplete primary education
 - b. Primary school
 - c. Junior high school
 - d. High school
 - e. Bachelor's degree or equivalent degree
 - f. Master's degree
 - g. Doctoral degree
4. What is your occupation?
 - a. Farmer
 - b. Fishermen
 - c. Unemployed
 - d. Homemaker
 - e. Other (please specify): _____
5. How many children do you have?
 - a. 1
 - b. 2
 - c. 3
 - d. 4
 - e. 5 and over
6. How many children under the age of 5 do you have?
 - a. 0
 - b. 1
 - c. 2
 - d. 3 and over
7. What water bodies exist within 500 metres from your dwelling? (Please select all that apply)
 - a. Seawater/beach
 - b. River
 - c. Lake
 - d. Pond
 - e. Other (please specify): _____
8. What water bodies exist in your dwelling? (Please select all that apply)
 - a. Swimming pool
 - b. Pond
 - c. Bathtub
 - d. Well
 - e. Other (please specify): _____