

# Who rescues who? Understanding aquatic rescues in Australia using coronial data and a survey

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In many cultures water plays an important role; from recreation to ceremonial use.

This use comes at a price with the World Health Organization (WHO) estimating 372,000 drowning deaths per annum globally,<sup>1,2</sup> although this is likely to be an underestimate of drowning risk.<sup>2</sup> Drowning and its prevention is complex and varied,<sup>3,4</sup> and has been called a 'wicked problem', in the challenge it represents,<sup>4</sup> namely the diversity of risk factors requiring targeted prevention stratagems. Successful drowning prevention is best achieved through targeted interventions, for example, targeting at-risk age groups, locations or activities using education, improved design (e.g. safety barriers or environmental modification), legislation, and rescue and resuscitation services.<sup>5</sup> To this we add provision of supervision and acquisition of survival skills as outlined by the International Life Saving Federation.<sup>6</sup>

Primary prevention ensures people stay safe when around water, however, secondary prevention such as rescues and effective tertiary prevention (resuscitation) is important for reducing drowning.<sup>7,8</sup> Undertaking rescues are primarily seen as the domain of trained lifesavers/lifeguards. However, many rescues are undertaken by a bystander: member(s) of the public, be they family, friend or stranger, who attempt to rescue someone in distress.<sup>9,10</sup> Unfortunately, bystanders' level of experience with aquatic environments and/or skills involved in undertaking rescues vary considerably<sup>11</sup> and it is not uncommon for the bystander rescuer to drown attempting a rescue, called aquatic

## Abstract

**Objective:** To examine fatal drowning associated with aquatic rescues and prior self-reported experience of undertaking an aquatic rescue in Australia.

**Methods:** Previous aquatic rescue experience was sourced through the 2013 Queensland Computer Assisted Telephone Instrument Survey and compared to data on rescue-related fatal unintentional drowning between 1 January 2006 and 31 December 2015.

**Results:** Twenty-three per cent (n=294/1291) of survey respondents had previously performed an aquatic rescue. Males ( $X^2=35.2$ ;  $p<0.001$ ) were more likely to have performed a rescue; commonly at a beach/ocean/harbour location ( $X^2=13.5$ ;  $p<0.001$ ). Females were more likely to have rescued a child (0-4 years of age) ( $X^2=29.2$ ;  $p<0.001$ ) from a swimming pool ( $X^2=34.3$ ;  $p<0.001$ ). Fifty-one people drowned while performing an aquatic rescue (Males=82.4%; 25-44 years of age=53.0%; beaches=54.9%).

**Conclusions:** Drownings are prevented by bystanders; this is not without risk to the rescuer. Most people perform only one rescue in their life, often at a younger age, on an altruistic basis, of family members or young children. Community-wide rescue skills, taught at a young age, with consideration for coastal, inland and swimming pool environments, may prevent drowning.

**Implications for public health:** There is a need to train people early in their life on how to undertake a safe rescue and provide resuscitation, including promoting regular updates, in particular if supervising children.

**Key words:** drowning, rescues, epidemiology, injury prevention

victim instead of rescuer (AVIR) syndrome.<sup>9</sup> The WHO has identified that every country should "... train bystanders in safe rescue and resuscitation ..." to prevent drowning.<sup>12(p47)</sup> The WHO Drowning Prevention Implementation Guide outlines the steps to be undertaken to achieve this goal.<sup>12</sup>

In Australia, an average of 281 people die from drowning annually<sup>13</sup> and, on average, a further 474 are hospitalised due to non-fatal drowning.<sup>14</sup> Many fatal drownings are prevented each year due to the aquatic rescues performed by lifesavers,<sup>15</sup> public pool lifeguards,<sup>16</sup> surfers<sup>17</sup> and bystanders.<sup>11</sup> Surf

Life Saving Australia performs more than 13,000 rescues annually along Australia's coastline.<sup>18</sup> Pool lifeguard surveillance<sup>19</sup> contributes to low rates of drowning in public swimming pools,<sup>13</sup> with lifeguards responding to hundreds of major and minor incidents each year.<sup>20,21</sup>

Rescues by bystanders are often undertaken altruistically, on impulse, to rescue a person often known to the rescuer.<sup>9,10</sup> In many instances, the intended rescuee will survive, in some cases, however, the rescue attempt can result in a multiple fatality event (MFE).<sup>22</sup> The risk of untrained rescuers has been

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Submitted: October 2018; Revision requested: February 2019; Accepted: March 2019

The authors have stated they have no conflict of interest.

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*Aust NZ J Public Health.* 2019; 43:477-83; doi: 10.1111/1753-6405.12900

identified,<sup>23</sup> with bystanders trained in safe rescue and resuscitation identified as being less likely to place themselves at risk of drowning.<sup>12</sup>

Tragically, every year there are cases of AVIR syndrome,<sup>9,10</sup> a global phenomenon recognised in studies from mainland China,<sup>24</sup> New Zealand,<sup>11</sup> Turkey,<sup>25</sup> the Netherlands<sup>26</sup> and Brazil.<sup>27</sup> A study of Chinese media reports in 2013 identified 225 rescue-related fatal drownings.<sup>24</sup> In New Zealand, 81 people have fatally drowned while attempting a rescue in the 32 years between 1980 and 2012, with all occurring in natural waterways.<sup>11</sup> In Turkey, 88 incidents claimed the lives of 114 rescuers and 60 rescuees between 2005 and 2008.<sup>25</sup> An analysis of 289 Dutch rescue reports from 1999–2004 found rescues often occurred in dangerous circumstances with multiple victims, deep or cold water, swimming to the victims and the young age (<5 years) of the rescuers.<sup>26</sup> At Rio de Janeiro beaches in Brazil, data shows 290 rescues for each reported death and one death for each 10 victims admitted for medical care.<sup>27</sup> Across all studies, the majority of rescuers were male.<sup>11,24–27</sup>

In Australia, studies of fatal drowning statistics show 1.9% of all drowning deaths between 2002 and 2007 were a result of attempting a rescue, commonly in coastal environments.<sup>28</sup> Similar proportions (2.0%) are reported among international travellers.<sup>29</sup> When focusing on child rescues, 17 rescuers drowned in 15 incidents between 2002 and 2017, commonly male parents or first degree relatives (76%) where victims were unfamiliar with the aquatic location.<sup>9</sup>

A study of experience in and attitudes towards conducting an aquatic rescue has not previously been examined. This study aimed to examine the frequency and nature of aquatic rescues performed, and compare this to the profile of unintentional drowning deaths as a result of performing an aquatic rescue.

## Methods

This study used two data sources; a Computer Assisted Telephone Interviewing (CATI) survey and data derived from the Royal Life Saving Society – Australia (RLSSA) National Fatal Drowning Database (the Database).

### CATI Survey

The Queensland Social Survey (QSS) is an annual state-wide omnibus-style survey of households in the Australian

state of Queensland. The survey uses CATI methodology and surveys a random state sample. For the purposes of data collection, Queensland was subdivided into two areas for telephone interviewing, South East Queensland (SEQ) (around the Brisbane and Moreton areas) and the remainder of the state (OTHER). The survey used a two-stage selection process, firstly selecting the households and secondly selecting respondent gender within the household. A minimum sample size of 400 or more for each subdivision was deemed necessary to permit the analysis of each area as a separate entity.<sup>30</sup> The survey sample's representativeness is calculated by using the index of dissimilarity for age distributions,<sup>31</sup> using the most recent Australian Bureau of Statistics (ABS) population census data.<sup>32</sup>

The target population was all persons 18 years of age or older, who at the time of the survey were living in a dwelling unit in Queensland that could be contacted by direct-dialled, land-based telephone service.<sup>30</sup> If the interviewers were unsuccessful in establishing contact on their first call, a minimum of five call-back attempts were made.

The survey was piloted prior to the full roll-out and questions on aquatic rescues were tested for comprehension and categories of response. The questionnaire was pilot-tested by trained interviewers on a total of 56 randomly-selected households in Queensland. Interviewer comments (e.g. confusing wording, inadequate response categories, question order effect, etc.) and pre-test frequency distributions were reviewed before modifications were made. There were a total of 184 questions in the survey, however, the number of questions a participant was asked varied based on other answers. The average interview length was 34 minutes.

The survey response rate was 41.2%. The estimated sampling error, at the 95% confidence level, for the Other Queensland area sample of 438 households and a 50/50 binomial percentage distribution was  $\pm 4.7\%$ . For the SEQ sample of 855 households, it was  $\pm 3.3\%$ . Responses were provided to researchers as an SPSS file.

The survey asked Queensland residents if they had ever performed a rescue for the purpose of saving someone from drowning. If yes, they were asked if they were a lifeguard or lifesaver at the time, how long ago the rescue was, where the rescue occurred,

who the person was that they rescued, and the age of the person rescued. All survey respondents, regardless of whether they had performed a rescue or not, were asked a range of demographic questions including age, gender and marital status.

A total of 1,293 people responded to the survey. Two respondents, who did not provide an answer to the question of whether they had performed a rescue or not, were removed from the dataset for analysis, leaving a dataset of 1,291 responses. Respondent's residential postcodes were collected and coded by the researchers into the categories of urban, rural and unknown/no response.

### Royal Life Saving National Fatal Drowning Database (the Database)

Unintentional drowning deaths among people who drowned as a result of performing a rescue in Australia between 1 January 2006 and 31 December 2015 were sourced from the Royal Life Saving Society – Australia National Fatal Drowning Database (the Database). The Database draws information through a data triangulation method from the National Coronial Information System (NCIS), year round media monitoring and reports from police. Through ethical access to the NCIS, researchers match drowning cases reported in the media and determine inclusion/exclusion based on intent and cause of death. Key word searches are also run on the NCIS to pick up those cases not reported in the media. Once a case is confirmed for inclusion, information is transcribed across a number of variables for each case into an SPSS dataset that houses the Database. The method for sourcing drowning data from the NCIS and the Database has been published in depth previously.<sup>2,33–35</sup>

Cases within the coronial system remain open while they are under investigation by a coroner. A case is closed when a coroner makes a ruling on cause of death and/or takes the case to coronial inquest, where coronial recommendations may be made to prevent future similar deaths. Data within this study is correct as at 26 September 2017. At this time, 90.4% of cases in this study were closed. As the CATI survey only interviewed adults (18 years and over), the one drowning death in a child under 18 years that occurred as a result of a rescue, was removed. The fatal drowning category of 'rocks' was coded into 'beach/ocean/harbour' CATI location category and the fatal drownings as a result of rescuing

an animal were removed for the purposes of analysis with the CATI dataset.

The remoteness classification of the postcode of the drowning incident location was determined by using the Doctor Locator website.<sup>36</sup> Residential postcode of those who drowned was recorded and coded into the corresponding CATI categories of urban, rural and unknown/no response/overseas. Season of drowning incident in Australia spans Summer (December, January, February), Autumn (March, April, May), Winter (June, July, August), and Spring (September, October, November). Time of day of drowning incident was classified into four time bands: morning (6:01 am to 12 pm), afternoon (12:01 pm to 6 pm), evening (6:01 pm to 12 am) and early morning (12:01 am to 6 am). A MFE relates to a single event where more than one person fatally drowns. Alcohol is defined as a blood alcohol concentration (BAC)  $\leq 0.05\%$ . For the purposes of fatal drowning, a rescue was defined as “the act of attempting to pull a person or animal out of the water who may be in danger”.<sup>22</sup>

### Data analysis

Data was analysed using SPSS V20.<sup>37</sup> Chi square analysis with a 95% confidence interval was performed without the ‘unknown’ or ‘don’t know/no response’ variables. A modified Bonferonni, as suggested by Keppel,<sup>38</sup> has been applied, deeming statistical significance  $p < 0.001$ . Drowning rates per 100,000 population were calculated using population data from June of each year drawn from the Australian Bureau of Statistics.<sup>39</sup> The drowning deaths of people who died attempting to rescue an animal have been reported in Table 2, but have been omitted from Table 3 when comparing deaths to survey results as the CATI survey did not ask about rescuing animals.

### Ethics

The 2013 CATI survey received approval by the Human Research Ethics Review Panel at CQUniversity (H13/06-120). This study was approved by the Department of Justice and Regulation Human Research Ethics Committee (JHREC) (CF/07/13729; CF/10/25057, CF/13/19798).

## Results

### CATI Survey

A total of 1,291 people (51.8% male) were surveyed. People aged 55 years and over

accounted for 55.6%, with three-quarters (77.9%) of respondents born in Australia. Just over one-fifth ( $n=294$ ; 22.8%) had performed an aquatic rescue. Of those who had performed a rescue, most had performed only one (72.4%), 25.5% had performed between two and ten rescues, while 2.0% of the sample reported having undertaken more than ten rescues. When compared to females, males were significantly more likely to have performed a rescue ( $X^2=35.2$ ;  $p < 0.001$ ) (Table 1).

The majority (85.4%) of those who had performed a rescue were not acting in a formal capacity as a lifesaver/lifeguard at the time. When asked how long ago the rescue had been performed, the majority had been undertaken more than five years ago (84.7%). Just 3.1% of rescues had been performed within the past six months (Table 1). Respondents aged 18-24 years were significantly more likely to have performed a rescue within the past five years ( $X^2=37.5$ ;  $p < 0.001$ ).

Rescues were commonly performed at beach/ocean/harbour locations and swimming pools, each accounting for 35.0%. The third leading location for rescues was river/creek/stream locations (19.8%). Males were more likely to have performed a rescue at a beach/ocean/harbour location ( $X^2=13.5$ ;  $p < 0.001$ ). Females were more likely to have undertaken a rescue at a swimming pool ( $X^2=34.6$ ;  $p < 0.001$ ) (Table 1).

Unrelated persons were the group respondents reported most commonly rescuing (46.6%), followed by family members (32.2%) and friends (21.2%). Females were more likely to self-report rescuing a family member ( $X^2=9.6$ ;  $p=0.002$ ). (Table 1) Young children under five years of age were the age group most commonly rescued (23.8%), followed by 5-9 year olds (21.8%) and 10-14 year olds (17.3%). Females were significantly more likely to be rescuing children aged 0-4 years ( $X^2=29.2$ ;  $p < 0.001$ ) (Table 1). Those rescued from swimming pools were significantly more likely to be aged under five years ( $X^2=64.1$ ;  $p < 0.001$ ).

Respondents aged 45-54 years and 55-64 years were more likely to have performed an aquatic rescue during their lifetime (23.8% respectively, of those who had performed a rescue). Those aged 55-64 years were also the age group with the largest proportion of respondents who stated they had never performed an aquatic rescue (25.0%);

however, age group was not found to be statistically significant (Supplementary Table 1).

The majority of those who had performed a rescue (81.0%) were born in Australia, however, country of birth was not statistically significant (Supplementary Table 1). Two-thirds (62.6%) of those who stated they had performed an aquatic rescue did not have children under the age of 18 years living at home, although presence of children under the age of 18 years in the household did not have a statistically significant impact on whether the respondent had performed a rescue. Remoteness had no impact on likelihood of having undertaken a rescue (Supplementary Table 1).

### Rescue-related unintentional fatal drowning

Between 1 January 2006 and 31 December 2015, there were 51 people who died as a result of an unintentional fatal drowning while performing an aquatic rescue in Australia.

Forty-two (82.4%) of those who drowned while performing a rescue were male. People aged 25-34 years (27.5%) and 35-44 years (25.5%) were the leading age groups who drowned while performing a rescue. There were no fatal drownings as a result of performing a rescue in those aged 75 years and over (Table 2).

Beaches were the leading location for rescue-related fatal drowning (54.9%), followed by rivers, creeks and streams (19.6%), and rocks (15.7%). There were no rescue-related drowning fatalities in bathtubs or swimming pools (Table 2).

Over half of those rescued were family members of the person who drowned (51.0%), followed by friends (19.6%) and unrelated people (17.6%). There were six people (11.8%) who drowned as a result of rescuing animals (Table 2).

The afternoon was the most common time when a person drowned performing a rescue (60.8%) (Table 3). There were no rescue related fatal drownings during the early morning hours. Summer (45.1%), followed by Spring (27.5%) were the two most common seasons for rescue-related drownings. Over two-thirds of all rescue-related fatal drownings occurred in areas classified as rural (70.6%). (Table 2)

Three victims (5.9%) who fatally drowned while undertaking a rescue were known

to have a BAC  $\geq 0.05\%$ . Ten victims (19.6%) drowned during seven MFEs ranging from two to three fatalities. Two deaths (3.9%) were known to be associated with floodwaters.

### Comparing rescue-related fatalities to self-reported rescues

When comparing those who fatally drowned while undertaking an aquatic rescue with those who self-reported having undertaken a rescue in the past, sex was not found to be statistically significant. Those aged 18-24

( $X^2=12.1$ ;  $p=0.001$ ) and 25-34 years ( $X^2=21.0$ ;  $p<0.001$ ) were found to be more likely to drown as a result of undertaking a rescue. Rescues undertaken at beaches, ocean and harbour locations were significantly more likely to be fatal ( $X^2=35.0$ ;  $p<0.001$ ) (Table 3).

Those who drowned undertaking a rescue were more likely to do so while rescuing a family member(s) ( $X^2=11.0$ ;  $p=0.001$ ). Self-report respondents were significantly more likely to report rescuing an unrelated person ( $X^2=11.3$ ;  $p=0.001$ ) (Table 3).

**Table 1: CATI Survey Responses by Sex, chi square (*p* value), Queensland, Australia, 2013 (N=1,291).**

	Total		Male		Female		Chi square analysis comparing males and females ( <i>p</i> value)
	N	%	N	%	N	%	
Total	1,291	100.0	669	51.8	622	48.2	-
<b>Q1. Have you ever performed a rescue to save or attempt to save a person from drowning?</b>							
Yes	294	22.8	197	67.0	97	33.0	35.17 ( $p<0.001$ )*
No	997	77.2	472	47.3	525	52.7	
<b>Q2. Were you a lifeguard or lifesaver at the time of the rescue?</b>							
Yes, I was and still am lifeguard/lifesaver	8	2.7	5	62.5	3	37.5	2.05 ( $p=0.360$ )
Yes, I was but am no longer lifeguard/lifesaver	32	10.9	25	78.1	7	21.9	
No	251	85.4	165	65.7	86	34.3	
No response	3	1.0	2	66.7	1	33.3	-
<b>Q3. How long ago was this rescue (or your most recent rescue) performed?</b>							
Within last 6 months	9	3.1	8	4.1	1	1.0	2.26 ( $p=0.688$ )
6-12 months ago	4	1.4	3	1.5	1	1.0	
1-2 years ago	13	4.4	9	4.6	4	4.1	
2-5 years ago	19	6.5	13	6.6	6	6.2	
More than 5 years ago	249	84.7	164	83.2	85	87.6	
<b>Q4. What type of water was the rescue performed in?</b>							
Beach/ocean/harbour	99	35.0	80	42.3	19	20.2	13.50 ( $p<0.001$ )*
River/creek/stream	56	19.8	46	24.3	10	10.6	7.42 ( $p=0.006$ )
Lake/dam/lagoon	22	7.8	16	8.5	6	6.4	0.38 ( $p=0.538$ )
Swimming Pool	99	35.0	44	23.3	55	58.5	34.26 ( $p<0.001$ )*
Bathtub	2	0.7	0	0.0	2	2.1	4.05 ( $p=0.044$ )
Other	4	1.4	3	1.6	1	1.1	0.12 ( $p=0.725$ )
No response	1	0.4	0	0.0	1	1.1	-
<b>Q5. Who was the person rescued?</b>							
Family member(s)	95	32.3	52	26.4	43	44.3	9.56 ( $p=0.002$ )
Friend(s)	62	21.1	44	22.3	18	18.6	0.56 ( $p=0.455$ )
Unrelated person(s)	137	46.6	101	51.3	36	37.1	5.23 ( $p=0.022$ )
<b>Q6. What was the age of the person rescued?</b>							
0-4 years	70	23.8	28	14.2	42	43.3	29.22 ( $p<0.001$ )*
5-9 years	64	21.8	39	19.8	25	25.8	1.16 ( $p=0.281$ )
10-14 years	51	17.3	39	19.8	12	12.4	2.74 ( $p=0.098$ )
15-17 years	18	6.1	12	6.1	6	6.2	0.00 ( $p=0.991$ )
18-24 years	29	9.9	23	11.7	6	6.2	2.36 ( $p=0.125$ )
25-34 years	23	7.8	20	10.2	3	3.1	4.67 ( $p=0.031$ )
35-44 years	14	4.8	12	6.1	2	2.1	2.43 ( $p=0.119$ )
45-54 years	12	4.1	12	6.1	0	0.0	6.29 ( $p=0.012$ )
55-64 years	8	2.7	7	3.6	1	1.0	1.62 ( $p=0.203$ )
65-74 years	0	0.0	0	0.0	0	0.0	UTBC
75+ years	1	0.3	4	2.0	0	0.0	0.504 ( $p=0.478$ )
Unknown age	4	1.4	4	2.0	0	0.0	-

Notes:

UTBC=Unable to be calculated

\*=Statistically significant

## Discussion

Aquatic rescues by bystanders help prevent drowning deaths, but are not without risk to the rescuer. On average, five bystander rescue-related drowning deaths occur in Australia each year. This study found rescues are often performed when the rescuer is young and, in general, people only undertake one rescue in their lifetime, usually of a family member or loved one. Males were most likely to perform rescues at the beach, while females were more likely to perform rescues of young children at swimming pools. There is a need to train people early in their life on how to undertake a safe rescue and it would be useful to refresh these skills regularly, in particular if supervising young children around water. Preventing rescuer drowning deaths will be an ongoing challenge due to the altruistic nature of the rescue attempt.

### Rescue experience

This study found respondents aged 18-24 years were significantly more likely to have performed a rescue within the last five years. This highlights the importance of learning rescue skills at a young age. Results from an Australian national water safety quiz have highlighted a knowledge gap in rescue safety among children aged 5-12 years,<sup>40</sup> with males performing more poorly than females. Further work is required to explore the rescue skills of males and how they change over their lifespan.

Thirty-five per cent of all rescues performed by CATI survey respondents took place in coastal waters (beach, ocean or harbour). With just 4% of Australia's approximately 11,000 beaches patrolled by surf lifesavers and lifeguards,<sup>41</sup> rescues undertaken by bystanders contribute to safety on our beaches and preventing further coastal drowning fatalities. In this study, 86.3% were not lifesavers or lifeguards at the time of the rescue. This is reinforced by a study of rescues undertaken by surfers on Australian beaches, which highlights that surfers are performing similar numbers of rescues to surf lifesavers, on both patrolled and unpatrolled beaches<sup>17</sup> Further research should be conducted to examine people's attitudes and behaviours when selecting a beach, as well as the experiences of non-surfers undertaking rescues at aquatic locations.

A third (35%) of rescues took place in the home swimming pool. Such rescues were significantly more likely to be children

under five years of age. Children under five are the age group at highest risk of drowning and swimming pools represent the leading location for drowning among this cohort.<sup>13</sup> While pool fencing and active adult supervision are known prevention strategies for drowning among this age group,<sup>42</sup> such a large number of rescues are likely to occur in this age group due to the proximity of adults, commonly females as this study has shown. Of concern are supervision lapses leading to the need to perform aquatic rescues for this age group. Continuing to ensure the four key stratagems for drowning prevention in this age group (active adult supervision, restricting access to water, water familiarisation and cardiopulmonary resuscitation [CPR]) are actively applied, is vital.<sup>3,5</sup>

Less than one-third (29%) of respondents who had previously performed an aquatic rescue resided in rural areas, however, 71% of fatal drownings as a result of a rescue took place in areas deemed rural. Having lay people in the community who have safe rescue skills and CPR skills<sup>43</sup> is vital to community safety, particularly in rural locations where medical assistance may be some distance away. This is particularly true for the prevention of river drowning, with river drowning risk 29 times higher in very remote locations compared to major cities.<sup>33</sup> Options for ensuring community-wide safe rescue and resuscitation skills in rural communities must be explored as part of a wider project aiming to prevent rural drowning deaths, and injury-related deaths in general.

### Rescuing animals

Analysis of fatal drowning data indicates approximately 12% of those who drowned while performing a rescue, did so while attempting to rescue an animal (dogs=100%). Drowning while rescuing animals (commonly pets) is a little researched topic, although one such study examining the preparedness and evacuation behaviour of pet owners in emergencies or natural disasters (including flooding) found that having pets influenced people's evacuation behaviour, with those affected by floods, less likely to leave their pets behind.<sup>44</sup>

While the CATI survey didn't explore the rescue of animals, this is an area that warrants further exploration. The authors posit that for many people, the emotion that takes over when rescuing a family member or friend from drowning, likely also extends to pet

**Table 2: Demographics of rescue-related deaths, Australia, 2006-2015, chi square (p value) (N=51)**

	Total		Male		Female		Chi square analysis comparing males and females (p value)
	N	%	N	%	N	%	
<b>Total</b>	51	100.0	42	82.4	9	17.6	-
<b>Age group of those performing the rescue</b>							
18-24 years	8	15.7	8	19.0	0	0.0	3.88 (p=0.568)
25-34 years	14	27.5	11	26.2	3	33.3	
35-44 years	13	25.5	9	21.4	4	44.4	
45-54 years	9	17.6	8	19.0	1	11.1	
55-64 years	6	11.8	5	11.9	1	11.1	
65+ years	1	2.0	1	2.4	0	0.0	
<b>Location of drowning incident</b>							
Beach	28	54.9	22	52.4	6	66.7	1.76 (p=0.780)
Lake / Dam / Lagoon	3	5.9	2	4.8	1	11.1	
Ocean / Harbour	2	3.9	2	4.8	0	0.0	
River / Creek / Stream	10	19.6	9	21.4	1	11.1	
Rocks	8	15.7	7	16.7	1	11.1	
<b>Who rescued</b>							
Family member(s)	26	51.0	21	50.0	5	55.6	1.73 (p=0.631)
Friend(s)	10	19.6	9	21.4	1	11.1	
Unrelated person(s)	9	17.6	8	19.0	1	11.1	
Animal(s)	6	11.8	4	9.5	2	22.2	
<b>Time of day of drowning incident</b>							
Morning	14	27.5	12	28.6	2	22.2	0.18 (p=0.916)
Afternoon	31	60.8	25	59.5	6	66.7	
Evening	6	11.8	5	11.9	1	11.1	
<b>Season of drowning incident</b>							
Summer	23	45.1	19	45.2	4	44.4	1.20 (p=0.753)
Autumn	11	21.6	10	23.8	1	11.1	
Winter	3	5.9	2	4.8	1	11.1	
Spring	14	27.5	11	26.2	3	33.3	
<b>Remoteness classification of drowning incident location</b>							
Urban	15	29.4	13	31.0	2	22.2	0.27 (p=0.602)
Rural	36	70.6	29	69.0	7	77.8	
<b>Alcohol (≥0.05%)</b>							
Yes	3	5.9	2	4.8	1	11.1	0.09 (p=0.759)
No	20	39.2	15	35.7	5	55.6	
<b>Flooding</b>							
Yes	2	3.9	2	4.8	0	0.0	0.40 (p=0.529)
No	36	70.6	30	71.4	6	66.7	
Unknown	13	25.5	10	23.8	3	33.3	-
<b>Multiple Fatality Event (MFEs)</b>							
Yes	10	19.6	9	21.4	1	11.1	0.50 (p=0.479)
No	41	80.4	33	78.6	8	88.9	

**Note:**

The six unintentional drowning fatalities associated with rescuing an animal which were presented in Table 2, have been removed from this table (Table 3) as the survey questions asked did not cover rescues of animals.

owners and their animals.<sup>45</sup> Similarly pets, in particular dogs, have also played a role in rescue and retrieval in drowning cases<sup>46</sup> and may have a part to play in prevention.

### Implications for public health

The findings of this research provide support for the WHO recommendation

"train bystanders in safe rescue and resuscitation."<sup>12(p47)</sup> While the edict of many drowning prevention organisations when considering or conducting a rescue is 'self-preservation',<sup>47-49</sup> this study highlighted the altruistic nature of the rescues being performed with 53% of those rescued being family or friends and 46% aged under 10 years. We also note just 13.7% were lifesavers

or lifeguards, or had been in the past, when undertaking the rescue. However, the vast majority of those who had undertaken a rescue in the CATI survey (86.3%) and all of the rescue-related fatalities were bystanders. The authors posit a higher standard of skills and knowledge on safe rescues and effective resuscitation within the community, taught in secondary schools and regularly renewed through schemes such as being linked to motor vehicle licensing, may be an option for reducing the number of fatal incidents when performing a rescue. This is vital for all types of injury including road trauma and cardiac arrest, with bystander response shown to increase survival.<sup>50,51</sup>

Recognising that both the reason for, and the undertaking of, a rescue can be complex, further work is required to ensure that this improves the safety of all involved. As rescue and resuscitation are secondary and tertiary

prevention measures, work around primary prevention will be required to reduce the overall burden of drowning. Qualitative research should also be undertaken to explore motivations for undertaking rescues and any ongoing effects after performing the rescue as has been done with those who have rescued people who have driven through floodwaters.<sup>52</sup>

Although country of birth was not found to impact past experience of having undertaken a rescue, special consideration is required among culturally and linguistically diverse (CALD) communities. This includes ensuring awareness of the hazards and risks presented by different aquatic environments, as well as improving swimming and water safety skills among these communities. It is hoped that this will reduce the likelihood of someone getting into trouble and needing to be rescued. Importantly, CALD communities

should be encouraged, as should all swimmers, to choose a patrolled location to recreate at, be it a beach or lifeguarded public swimming pool.

### Limitations

This study used a triangulation approach with an analysis of rescue-related fatal drowning data nationally and CATI survey responses from the Australian State of Queensland. The authors have made the assumption that a representative sample in Queensland holds true for the experiences of those who have rescued someone across Australia. This may not be the case; however, this research still addresses a gap in current knowledge on bystander rescue and rescue-related drowning deaths in Australia.

The CATI survey is cross-sectional in nature, with a skew towards older participants and households with landline telephones, and collected self-reported data on rescues. This therefore relies on the respondent answering truthfully. With 84.7% of those who had performed a rescue stating it occurred more than five years ago, details provided about the rescue by this cohort may not be accurate, as recall of these events may have diminished over time.<sup>53</sup>

The survey did not collect data on respondents' perceived swimming ability or whether they held a current CPR qualification. These are areas that may impact likelihood of undertaking a rescue and are worthy of further exploration. The survey did not specifically clarify if the person who had conducted a rescue when they were a lifesaver or a lifeguard, did not capture if the rescue was undertaken in their capacity as a lifeguard or lifesaver or whether it was not while they were working but while they held employment as a lifesaver or lifeguard. The survey was conducted in a high-income country and therefore results may not be generalisable to other settings. Twenty-two per cent of the survey participants were born overseas, lower than the estimated 27.7% of the population born overseas in 2013 (when the survey was conducted).<sup>54</sup>

### Conclusion

There are risks associated with performing an aquatic rescue but it is evident from the results in this study that bystanders, alongside surf and pool lifeguards/lifesavers, play an important role in drowning prevention in waterways around the country. This study has

**Table 3: Comparison of rescue-related drowning deaths (2006-2015) and CATI survey responses (2013), chi squared (*p* value).**

	Rescue related drowning deaths		Had performed a rescue – CATI survey		X2 analysis comparing aquatic rescue related drowning deaths to those who had performed a rescue CATI survey ( <i>p</i> value)
	N	%	N	%	
<b>Total</b>	45	100.0	294	100.0	-
<b>Sex</b>					
Male	38	84.4	197	67.0	5.58 ( <i>p</i> =0.018)
Female	7	15.6	97	33.0	
<b>Age group of those performing the rescue</b>					
18-24 years	7	15.6	10	3.4	12.10 ( <i>p</i> =0.001)
25-34 years	13	28.9	14	4.8	30.99 ( <i>p</i> <0.001)*
35-44 years	11	24.4	41	13.9	3.31 ( <i>p</i> =0.069)
45-54 years	9	20.0	70	23.8	0.32 ( <i>p</i> =0.573)
55-64 years	5	11.1	70	23.8	3.65 ( <i>p</i> =0.056)
65+ years	0	0.0	87	29.6	UTBC
No response	0	0.0	2	0.7	-
<b>Remoteness classification of household of rescuer/respondent</b>					
Urban	25	55.6	205	69.7	2.43 ( <i>p</i> =0.119)
Rural	18	40.0	88	29.9	
Unknown/No response/Overseas	2	4.4	1	0.3	-
<b>Type of water</b>					
Beach/ocean/harbour	36	80.0	99	35.0	34.95 ( <i>p</i> <0.001)*
Lake/dam/lagoon	2	4.4	22	7.8	0.55 ( <i>p</i> =0.459)
River/creek/stream	7	15.6	56	19.8	0.31 ( <i>p</i> =0.575)
Bathtub	0	0.0	2	0.7	UTBC
Swimming Pool	0	0.0	99	35.0	UTBC
Other	0	0.0	4	1.4	UTBC
Unknown/No response	0	0.0	1	0.4	-
<b>Who rescued?</b>					
Family member(s)	26	57.8	95	32.3	11.03 ( <i>p</i> =0.001)
Friend(s)	10	22.2	62	21.1	0.03 ( <i>p</i> =0.863)
Unrelated person(s)	9	20.0	137	46.6	11.26 ( <i>p</i> =0.001)

Notes:

UTBC=Unable to be calculated

\*=Statistically significant

highlighted several key insights about rescues and rescue-related fatal drownings to guide future prevention efforts. Findings include: the relative young age of those performing a rescue, the difficulty of adhering to 'self-preservation' first when rescuing family, friends, pets and young children, and the high proportion of rescues being performed in rural areas. As recommended by the WHO, this study confirms the need to train bystanders in safe rescue and resuscitation, proposed to occur in secondary schools. It is hoped through these efforts, aquatic rescues will be made safer and result in less preventable loss of life.

### Funding

No direct funding was received for this project. James Cook University provided the funding for the CATI Survey. This research is supported by the Royal Life Saving Society - Australia. Research at the Royal Life Saving Society - Australia is supported by the Federal Government, to aid in the prevention of drowning.

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### Supporting Information

Additional supporting information may be found in the online version of this article:

**Supplementary Table 1:** CATI Survey Responses Rescue Performed Yes/No by demographic variables, chi square (p value), Queensland, 2013 (N=1,291).