Transportation Research Part F: Psychology and Behaviour 94 (2023) 492–503

Contents lists available at ScienceDirect

Transportation Research Part F: Psychology and Behaviour

journal homepage: www.elsevier.com/locate/trf

Beliefs and attitudes of Australian learner drivers toward driving and avoiding driving through floodwater

Kyra Hamilton[a,b,c,*], Jacob J. Keech[d,a], Amy E. Peden[e,f], Martin S. Hagger[g,c,a,h]

[a] School of Applied Psychology, Griffith University, Australia
[b] Menzies Health Institute Queensland, Griffith University, Australia
[c] Health Sciences Research Institute, University of California, Merced, USA
[d] School of Health, University of the Sunshine Coast, Australia
[e] School of Population Health, Faculty of Medicine and Health, University of New South Wales, Kensington, NSW, Australia
[f] College of Public Health, Medical and Veterinary Sciences, James Cook University, Townsville, Australia
[g] Department of Psychological Sciences, University of California, Merced, USA
[h] Faculty of Sport and Health Sciences, University of Jyväskylä, Finland

ARTICLE INFO

Keywords:
Drowning
Injury
Risk
Education
Road
Safety
Disaster
Driver
Learner permit
Theory of planned behaviour

ABSTRACT

Introduction: Driving through floodwater is a significant cause of flood-related injury and mortality, and opportunities exist to embed safe driving messages regarding floodwaters to novice drivers in graduated driver licensing schemes. To inform future educational efforts, we investigated the beliefs and attitudes of Australian learner drivers about driving and avoiding driving through floodwaters. Methods: The study adopted a cross-sectional correlational design with measures drawn from the theory of planned behaviour and administered within an online survey. Phase 1 ($N = 44$ learner drivers) aimed to identify the core beliefs associated with driving through floodwater. Phase 2 ($N = 250$ learner drivers) tested these beliefs predicting willingness to drive through floodwater as well as the social psychological factors that predict learner drivers' willingness to drive and avoid driving through floodwater using a pre-tested scenario. Analyses comprised descriptive statistics, linear regression, and structural equation models. Results: Ten key beliefs were identified as predicting willingness to drive through floodwater. These included perceived advantages and disadvantages, perceived social approval from important others, and perceived facilitators and barriers regarding driving through floodwater in the presented scenario. Structural equation models of social cognition constructs of the theory of planned behaviour revealed attitude, subjective norm, and perceived behavioural control predicted both willingness to drive and avoid driving through floodwater. Past experience as a passenger also predicted these social cognition constructs, although this differed across models. Discussion: Results highlight the importance of modelling safe driving behaviour for young passengers. The strong association between subjective norm and willingness to drive through floodwater further highlights the importance of those supervising learner drivers to establish expectations around avoiding driving through the floodwater if it is encountered on a driving route. Conclusion: Social cognition factors from the theory of planned behaviour predict willingness to drive and avoid driving though floodwater. Theory-based targets should be considered for the development of intervention programs for novice drivers, such as those holding learner licenses.

* Corresponding author at: Health and Psychology Innovations (HaPI) Research Lab, School of Applied Psychology, Griffith University, 176 Messines Ridge Road, Mt Gravatt, QLD 4122, Australia.
E-mail address: kyra.hamilton@griffith.edu.au (K. Hamilton).

https://doi.org/10.1016/j.trf.2023.02.014
Received 11 September 2022; Received in revised form 14 February 2023; Accepted 26 February 2023
Available online 21 March 2023

1. Introduction

Globally, floods are a significant cause of disaster-related mortality, morbidity, and property damage (Jonkman and Kelman, 2005). The United Nations Sendai Framework for Disaster Risk Reduction 2015–2030 estimated that in the decade between 2005 and 2015, 700,000 people lost their lives and 1.4 million people were injured due to flooding (United Nations, 2015). Flooding is predicted to occur more regularly and with greater severity due to the effects of climate change (Hirabayashi et al., 2013). Drowning is a leading cause of death during floods, with driving through floodwaters a leading mechanism of injury (Jonkman and Kelman, 2005; Hamilton et al., 2020).

In Australia, flood-related unintentional drowning claims the lives of an average of 13 people each year, with over half due to intentionally driving through floodwaters (Peden, Franklin, Leggat, & Aitken, 2017). Previous work has explored the motivations for driving through and avoiding driving through floodwaters (Hamilton et al., 2019; Hamilton et al., 2016; Hamilton et al., 2018; Pearson and Hamilton, 2014). This work identified a range of individual beliefs associated with an intent to drive or avoid driving through floodwater as well as various social and environmental factors that might facilitate or impede such decisions, such as social pressure and encouragement or increased confidence and self-efficacy (Hamilton et al., 2019). More recently, work has identified effective strategies to discourage driving through floodwaters, such as persuasive communication and implementation imagery, with males and those with a strong intention to drive through floodwater still challenging targets for behaviour change (Hamilton et al., 2018; Hamilton et al., 2019; Hamilton et al., 2021).

In Australia, and similar to other high-income countries, graduated driver licensing schemes are in place (Simpson, 2003). Although some regulations differ between Australian states and territories, in general this scheme requires adolescents (commonly aged 16–17 years) to pass knowledge and eyesight (reading aloud from a chart of letters of differing sizes) tests before being issued with a learner license (also known as a learner permit) (Walker et al., 2015). Under the conditions of this license, learner drivers are required to drive a motor vehicle under the supervision of a fully licensed driver. Learner drivers face numerous restrictions including maximum speed limits, a zero blood alcohol content limit, and must complete a designated number of supervised hours of driving before they can take a driving test and proceed to a provisional license and then an unrestricted license (Walker et al., 2015).

Currently in Australia there is no formal, standardised education provided to learner drivers about the risks of driving through floodwaters. Previously conducted research suggests some people had driven through floodwaters while learner drivers at the behest of their supervising parents (Hamilton et al., 2019), however no previous research has been conducted with this group regarding their driving behaviours during times of flood. Assessing the social psychological and behavioural factors underpinning flood safety for learner drivers is key to achieving life-long commitment to safe driving behaviours during floods. To date, there is no research, to the authors' knowledge, that has been published examining these potentially important factors underpinning learner drivers' willingness to drive through floodwater, and willingness to avoid driving through floodwater. It is important to examine both behavioural contexts (i.e., drive and avoid driving) as research suggests that engaging in, and not engaging in, a given behaviour are not conceptual opposites (Middlestadt et al., 2014; Richetin et al., 2011).

The theory of planned behaviour (Ajzen, 1991) provides a framework for understanding how social psychological factors such as beliefs and attitudes influence behaviour mediated by individuals' intentions to engage in the target behaviour. The theory of planned behaviour prescribes three factors that influence intentions and, in turn, behaviour (Ajzen, 1991): *Attitude* toward a behaviour is the degree to which an individual has a favourable or unfavourable appraisal of a particular behaviour; *Subjective norm* is the perceived social pressures from important others to engage or not engage in a behaviour; *Perceived behavioural control* refers to the perceived ease or difficulty of engaging in a particular behaviour. These global constructs of attitude, subjective norm, and perceived behavioural control are underpinned by a specific set of beliefs for each behaviour (Ajzen, 1991). Attitude is underpinned by behavioural beliefs (costs and benefits), subjective norm is underpinned by normative beliefs (important others' approval or disapproval), and perceived behavioural control is underpinned by control beliefs (barriers or facilitators). An advantage of identifying these specific sets of beliefs is that they can be embedded in interventions relevant to the target group and can suggest the use of behaviour change methods that map on to the targeted beliefs. These beliefs can be identified through qualitative research approaches such as open-ended surveys, and then their relative importance in explaining intentions to engage in a behaviour can be tested using a larger quantitative survey that serves to identify the most appropriate targets for future intervention work.

An important point to note when using rational decision making models, such as the theory of planned behaviour, to examine risky behaviours is that people, and in particular novice drivers in the context of the current study, might not hold an intention to do a behaviour that could comprise their health, such as driving through floodwater. However, this may not preclude them from being willing to perform the behaviour if the opportunity was presented. Empirical evidence has shown support for the conceptual distinction between intentions and willingness, with the latter being more concerned with a lack of planning and considered more reactive than deliberative and stronger in predicting more risk taking-type behaviours than intentions (Gibbons, Gerrard, Blanton, & Russell, 1998a; Gibbons, Gerrard, Ouellette, & Burzette, 1998b). Thus, due to the potential risks involved in driving through floodwater, which may be considered less planned and guided by reasoned decision making pathways, a measure of willingness was adopted in place of intention.

Building upon previous research exploring social psychological and behavioural motivations associated with driving through and avoiding driving through floodwater (Keech et al., 2019), this study explores the beliefs and attitudes of Australian learner drivers regarding driving behaviours in times of flood. This study has three overarching aims which were achieved in two phases. The aim of Phase 1 was to conduct formative research to identify the core beliefs of learner drivers regarding driving through floodwater so that individual characteristics and critical targets for subsequent safety messages can be identified. Phase 2 encompasses explanatory research. The first aim of Phase 2 was to examine the beliefs identified in Phase 1, which explain willingness to drive through floodwater. The second aim of Phase 2 was to test a theoretical model of behaviour to determine the social psychological factors that are associated with learner drivers' willingness to drive and avoid driving through floodwater.

2. Methods

The study adopted a cross-sectional correlational design with measures administered within an online survey hosted by Qualtrics. Measures were based on established guidelines (Ajzen, 2006) and have been used in prior research (Jonkman and Kelman, 2005).

2.1. Phase 1 belief elicitation: Participant recruitment and data collection

Participants were a convenience sample of 44 Australian residents who hold a learner driver's licence (those who require supervision to drive). Participants completed an online survey containing a range of open-ended questions. Participants were sourced from university advertisements and through advertisements posted on Facebook. Data were collected in March 2019.

2.1.1. Measures

2.1.1.1. Behavioural beliefs. Behavioural beliefs were measured with two open-ended questions about the advantages and disadvantages of driving through floodwater (e.g., "Please list what you believe are the advantages of driving through floodwater?").

2.1.1.2. Normative beliefs. Normative beliefs were measured with two open-ended questions about who would approve and disapprove of them driving through floodwater (e.g., "Please list any individuals or groups of people who would approve of you driving through floodwater?").

2.1.1.3. Control beliefs. Control beliefs were measured with two open-ended questions about the facilitators and barriers for them driving through floodwater (e.g., "Please list any circumstance or factors that might prevent or discourage you from driving through floodwater?").

2.2. Phase 2: Quantitative survey: Participant recruitment and data collection

Participants were 250 Australian residents who hold a learner driver's licence (those who require supervision to drive). Participants completed an online survey containing a range of multiple choice and Likert-style questions. Participants were sourced through an independent research panel company, recruited across 8 Australian states and territories, and comprised 66% female. Data were collected in August 2019.

2.2.1. Measures

Prior to completing the measures, participants were provided with the following information and an image (see Open Science Framework project site for item wording and image https://osf.io/rndxz/): "The following questions will ask about your knowledge and attitudes toward driving through floodwater. 'Floodwater' refers to a body of water covering land that is normally dry. For the next questions, please think about your driving through floodwater in the future. For example, think about the scenario where you now have your provisional or full driver's license and you are driving in your car immediately after a thunderstorm. You approach a section of the road that is completely covered in water such as in the image below. Now consider your future driving, if such a scenario occurred, how likely are you in the future to [drive/avoid driving] through the floodwater…?". The "drive through floodwater" wording was used for all measures. However, measures of attitude, subjective norm, and perceived behavioural control were administered a second time using the "avoid driving through floodwater wording". The image was pilot tested with 34 learner drivers prior to use in the main study to ensure that the image reflected a driving scenario where the depth of the water and the appraised likelihood of safely driving through were ambiguous.

2.2.1.1. Willingness. Willingness to drive through floodwater was measured using a single item ("In general, I would be willing to drive through the floodwater"). Similarly, willingness to avoid driving through floodwater was measured using a single item ("In general, I would be willing to avoid driving through the floodwater"). Responses were provided on a 7-point scale (1 = *strongly disagree* and 7 = *strongly agree*).

2.2.1.2. Attitude. Attitude toward driving through floodwater was assessed using five items preceded by the common stem: "If I were to drive through the floodwater, it would be…". Responses were provided on semantic differential scales (e.g., 1 = *bad* and 7 = *good*). Similarly, attitudes toward avoiding driving through floodwater were assessed using five items preceded by the common stem: "If I were to avoid driving through the floodwater, it would be…".

2.2.1.3. Subjective norm. Subjective norm was measured using four items prompting participants to rate the perceived agreement to which important others would want them to drive through floodwater and whether people similar to them would drive through (e.g., "Most people who are important to me would approve of me driving through the floodwater"). Similarly, subjective norm regarding avoiding driving through floodwater was also measured using four questions (e.g., "Most people who are important to me would approve of me avoiding driving through the floodwater"). Responses were provided on 7-point scales (1 = *strongly disagree* and 7 = *strongly agree*).

2.2.1.4. Perceived behavioural control. Perceived behavioural control was measured using two items assessing drivers' perceptions of their ability to control the behaviour (e.g., "I am confident I could drive through the floodwater"). Similarly, perceived behavioural control regarding avoiding driving through floodwater was also measured using two questions (e.g., "I am confident I could avoid driving through the floodwater"). Responses were provided on 7-point scales (1 = *strongly disagree* and 7 = *strongly agree*).

2.2.1.5. Behavioural beliefs. Behavioural beliefs were measured using nine items derived from Phase 1 (e.g., "If I drive through the floodwater, I would… damage or ruin my car"). Responses were provided on 7-point scales (1 = *extremely unlikely* and 7 = *extremely likely*).

2.2.1.6. Normative beliefs. Normative beliefs were measured using eight items derived from Phase 1 (e.g., "The following people are likely to think I should drive through the floodwater… friends"). Responses were provided on 7-point scales (1 = *extremely unlikely* and 7 = *extremely likely*).

2.2.1.7. Control beliefs. Control beliefs were measured using 10 items derived from Phase 1. Six items assessed facilitators for driving through floodwater (e.g., "How likely are the following to help or encourage you to drive through the floodwater… needing to get to my destination") and four items assessed barriers to driving through floodwater (e.g., "How likely are the following to prevent or discourage you to drive through the floodwater… not wanting to damage my vehicle"). Responses were provided on 7-point scales (1 = *extremely unlikely* and 7 = *extremely likely*).

2.2.1.8. Past experience of driving through floodwater. Prior research has identified that some drivers had previously driven into floodwater as a learner driver under the supervision of their parent (Hamilton et al., 2019). It was therefore thought important to measure and control for past experience, both as a driver and a passenger, in the current study. Past experience of driving through floodwater was measured using one item: "How often in the past 5 years have you driven through floodwater? 'Floodwater' refers to a body of water covering land that is normally dry". Past experience of being a passenger in a car driving through floodwater was also measured using one item: "How often in the past 5 years have you been a passenger in a car that has driven through floodwater? "Floodwater" refers to a body of water covering land that is normally dry." Responses were provided on a 7-point scale (1 = *never* and 7 = *very often*).

2.2.2. Data quality

Two questions were embedded within the quantitative survey in Study 2 to assess inattentive responding (Maniaci and Rogge, 2014). The questions instruct the choice of a particular answer so that it is not possible to answer the question incorrectly if the item is read carefully (e.g., "please choose option two to ensure you are paying attention"). Participants who did not answer both of the questions correctly were excluded ($n = 167$). Following these exclusions, the final sample size was $N = 250$.

2.3. Data analysis

Descriptive statistics for sample demographic characteristics in both phases were generated using SPSS V25. Phase 1 data were analysed using content analysis in NVivo. For the analyses of associations between beliefs and willingness to drive through floodwater in Phase 2, bivariate correlations and linear regression models were estimated using *R* (R Foundation for Statistical Computing, 2019). For the analyses of the theory of planned behaviour social cognition factors predicting willingness to drive through floodwater, and willingness to avoid driving through, partial least squares structural equation models (PLS-SEM) were estimated using the ***SEMinR*** package (Ray et al., 2021) in *R*. PLS-SEM was used to estimate the models because it is free of distributional assumptions and therefore well-suited to handling non-normal data (Hair et al., 2021). Two models were estimated. Model 1 examined theory of planned behaviour social cognition predictors of willingness to drive through floodwater in the presented scenario. Model 2 examined theory of planned behaviour social cognition predictors of willingness to avoid driving through floodwater in the presented scenario. In both models, multi-item latent variables were estimated for attitude, subjective norm, and perceived behavioural control; and single-indicator latent variables were estimated for past behaviour as a driver, past experience as a passenger, and willingness. Several criteria have been recommended for evaluating PLS-SEM models, including assessing convergent and discriminant validity. To support convergent validity, the average variance extracted (AVE) should exceed 0.50 for each factor (Hair et al., 2022). To support discriminant validity, heterotrait–monotrait (HTMT) ratio of correlations should be < 0.90 for structural models with conceptually similar constructs, and a more conservative < 0.85 when model constructs are more distinct (Henseler et al., 2015). Standardised path coefficients were bootstrapped (1000 samples) and considered statistically significant when 95% CIs did not encompass zero. Effect sizes for model paths were evaluated using Cohen's (Cohen, 1988) guidelines that $f^2 \geq 0.02$ is indicative of a small effect size, $f^2 \geq 0.15$ is indicative of a medium effect size, and $f^2 \geq 0.35$ is indicative of a large effect size.

2.4. Open science

All study data, analysis scripts, and materials are available at the Open Science Framework project site at: https://osf.io/rndxz/.

2.5. Ethics

This project received ethical approval from the University Human Research Ethics Committee (2017/895).

3. Results

3.1. Participants

Table 1 describes demographic characteristics of participants across Phase 1 and 2 of the research. A higher proportion of males (56.8%) participated in Phase 1, with a higher proportion of females participating in Phase 2 (65.6%). The median age of respondents was similar across both phases (Phase 1–18.36 years [SD = 2.18]; Phase 2–17.63 years [SD = 1.24]). All respondents across both phases reported being never married. The majority of respondents across both phases reported being full-time students (Phase 1–61.4%; Phase 2–68.8%). Across both research phases, the largest proportion of respondents reported a household income >$80,000 (Phase 1–34.1%; Phase 2–39.2%), likely indicating they reside at home with parents or caregivers. In Phase 1, the majority of respondents reported having completed senior schooling (Year 12–79.5%), while among Phase 2 respondents, 45.6% had completed senior schooling and 44.4% had completed junior school (i.e., Year 10). Almost all respondents in Phase 1 resided in the Australian state of Queensland (n = 43; 97.7%), while in Phase 2 the largest proportion of respondents reported residing in New South Wales (n = 91; 36.4%) the most populous state in Australia, followed by Victoria (n = 76; 30.4%), the second most populous Australian state (see Table 1).

Table 1
Participant demographic characteristics.

Demographic characteristic	Phase 1 (N = 44)	Phase 2 (N = 250)
Gender		
Male	25 (56.8%)	83 (33.2%)
Female	19 (43.2%)	164 (65.6%)
Marital status		
Married registered	0 (0.0%)	0 (0.0%)
Married de facto	0 (0.0%)	0 (0.0%)
Separated/Divorced	0 (0.0%)	0 (0.0%)
Widowed	0 (0.0%)	0 (0.0%)
Never married	44 (100.0%)	250 (100.0%)
Employment status		
Full-time work	0 (0.0%)	0 (0.0%)
Part-time work/casual work	12 (27.3%)	42 (16.8%)
Full-time student	27 (61.4%)	172 (68.8%)
Part-time student	2 (4.5%)	15 (6.0%)
Unemployed/home duties	3 (6.8%)	21 (8.4%)
Household income (annual AUD)		
Nil - $18,200	11 (25.0%)	37 (14.8%)
$18,201-$37,000	4 (9.1%)	32 (12.8%)
$37,001-$80,000	14 (31.8%)	83 (33.2%)
>$80,001	15 (34.1%)	98 (39.2%)
Highest educational attainment		
Completed junior school (yr 10)	0 (0.0%)	111 (44.4%)
Completed senior school (yr 12)	35 (79.5%)	114 (45.6%)
TAFE certificate/diploma	3 (6.8%)	13 (5.2%)
Undergraduate degree	5 (11.4%)	11 (4.4%)
Postgraduate degree	1 (2.3%)	1 (0.4%)
State of residence		
Australian Capital Territory (ACT)	0 (0.0%)	3 (1.2%)
New South Wales (NSW)	1 (2.3%)	91 (36.4%)
Northern Territory (NT)	0 (0.0%)	1 (0.4%)
Queensland (QLD)	43 (97.7%)	27 (10.8%)
South Australia (SA)	0 (0.0%)	10 (4.0%)
Tasmania (TAS)	0 (0.0%)	1 (0.4%)
Victoria (VIC)	0 (0.0%)	76 (30.4%)
Western Australia (WA)	0 (0.0%)	41 (16.4%)
Age		
Mean (SD)	18.36 (2.18)	17.63 (1.24)
Minimum	16	16
Maximum	25	21

3.2. Phase 1: Identification of key beliefs

Phase 1 identified learner drivers' key beliefs regarding driving through floodwater which are presented in Table 2. 'Getting to my destination' was identified as a key advantage regarding driving through floodwater for 63.6% of respondents. 'Get myself or my passengers injured or killed' was identified by 61.4% of respondents as being the leading disadvantage associated with driving through floodwater. While 22.7% ($n = 10$) respondents believed parents would approve of driving through floodwater, other family members ($n = 31$; 70.5%) and friends ($n = 27$; 61.4%) were the two groups identified as being most likely to approve of the behaviour by the highest proportion of respondents. Conversely, authorities such as the police ($n = 15$; 34.1%) and rescuers such as the State Emergency Service (SES) ($n = 10$; 22.7%) were identified as groups likely to disapprove of the behaviour. 'Water conditions seeming appropriate' ($n = 16$; 36.4%) and 'needing to get to my destination' ($n = 14$; 31.8%) were the most commonly identified advantages to driving through floodwater, while 'water conditions do not seem appropriate' ($n = 37$; 84.1%) and 'the risk of injury or death for myself or others' ($n = 21$; 47.7%) were the most commonly identified disadvantages (Table 2).

3.3. Phase 2: Testing key beliefs

Using a larger sample and quantitative questions, Study 2 examined the ability of each of the beliefs identified in Study 1 to predict learner drivers' willingness to drive through the floodwater in this scenario. To begin, bivariate correlations between the beliefs and learner drivers' willingness to drive through the floodwater in the presented scenario were examined and are presented in Table 3.

All behavioural beliefs, normative beliefs, and control beliefs – facilitators were found to be significantly ($p < 0.001$) associated with learner drivers' willingness to drive through floodwater. However, while several control beliefs – barriers were identified as being significantly associated with willingness to drive through floodwater at the $p < 0.001$ level (i.e., 'not wanting to damage my vehicle' and 'not being able to see what is beneath the water surface'), others were significantly correlated at the $p < 0.05$ level (i.e., 'the risk of injury or death for myself or others', 'not being in a large car', 'and another safe route to my destination is available') or not significantly correlated with willingness to drive through floodwater (i.e., 'Water conditions do not seem appropriate [e.g., deep water, water flowing]'). See Table 3.

Subsequently, four linear multiple regression analyses were conducted to examine the relative importance of each belief within behavioural beliefs, normative beliefs, and control beliefs – facilitators and barriers in predicting willingness to drive through floodwater. We found a range of beliefs explained willingness to drive through floodwater in the presented scenario. In terms of behavioural beliefs, 'getting to the destination' ($\beta = 0.30$; $p < 0.001$) and 'having fun' ($\beta = 0.22$; $p < 0.001$) explained higher willingness to drive through floodwater in the presented scenario. However, the belief that the learner driver would 'be in danger' ($\beta = -0.19$; $p = 0.026$) explained lower willingness to drive through floodwater in the presented scenario (Table 4).

In terms of normative beliefs, approval by family (based on a composite of 'parents' and 'other family members'; $\beta = 0.38$; $p <$

Table 2
Learner drivers' key beliefs regarding driving through floodwaters in Phase 1.

Beliefs	Theme	Frequency (n)	Percent (%)
Advantages	Get to my destination	28	63.6
	Have fun	2	4.5
Disadvantages	Damage or ruin my car	24	54.5
	Get myself or my passengers injured or killed	27	61.4
	Be in danger	14	31.8
	Lose control of my car	15	34.1
	Get stuck	14	31.8
	Encounter hidden hazards (e.g., trees, power lines, deep water)	10	22.7
	Use emergency services resources	3	6.8
People who would approve	Parents	10	22.7
	Other family members	31	70.5
	Friends	27	61.4
	People who drive large cars or trucks	6	13.6
	Thrill seekers	5	11.4
	Inexperienced drivers	3	6.8
People who would disapprove	Authorities such as the police	15	34.1
	Rescuers such as the State Emergency Service (SES)	10	22.7
Facilitators	If there is an emergency	12	27.3
	Water conditions seem appropriate (e.g., shallow water, water not flowing)	16	36.4
	Needing to get to my destination	14	31.8
	Needing to escape danger	6	13.6
	If there is no other route to my destination	5	11.4
	Support from other people	5	11.4
Barriers	The risk of injury or death for myself or others	21	47.7
	Water conditions do not seem appropriate (e.g., deep water, water flowing)	37	84.1
	Not wanting to damage my vehicle	9	20.5
	Not being able to see what is beneath the water surface	6	13.6
	Not being in a large car	5	11.4
	Another safe route to my destination is available	4	9.1

Table 3
Bivariate correlations between key beliefs and willingness to drive through floodwater in Phase 2.

	M (SD)	*r*	*p*
Behavioural beliefs: *If I drive through the floodwater, I would….*			
BB1. Get to my destination	4.48 (1.75)	0.59	<0.001*
BB2. Have fun	2.87 (1.74)	0.50	<0.001*
BB3. Damage or ruin my car	5.03 (1.54)	-0.41	<0.001*
BB4. Get myself or my passengers injured or killed	3.57 (1.70)	-0.55	<0.001*
BB5. Be in danger	4.72 (1.61)	-0.57	<0.001*
BB6. Lose control of my car	4.94 (1.52)	-0.55	<0.001*
BB7. Get stuck	5.08 (1.41)	-0.50	<0.001*
BB8. Encounter hidden hazards (e.g., trees, power lines, deep water)	5.23 (1.46)	-0.42	<0.001*
BB9. Use emergency services resources	4.47 (1.62)	-0.47	<0.001*
Normative beliefs: *The following people are likely to think I should drive through the floodwater…*			
NB1. Parents	2.58 (1.82)	0.58	<0.001*
NB2. Other family members	2.66 (1.75)	0.56	<0.001*
NB1&2. Family composite (mean of item 1 and 2)	2.62 (1.72)	0.59	<0.001*
NB3. Friends	3.53 (1.90)	0.57	<0.001*
NB4. People who drive large cars or trucks	3.81 (1.83)	0.45	<0.001*
NB5. Thrill seekers	5.29 (1.67)	0.31	<0.001*
NB6. Inexperienced drivers	3.52 (1.87)	0.25	0.001*
NB7. Authorities such as the police	2.14 (1.48)	0.37	<0.001*
NB8. Rescuers such as the State Emergency Service (SES)	2.27 (1.66)	0.26	<0.001*
NB7&8. Emergency services composite (mean of item 7 and 8)	2.20 (1.52)	0.33	<0.001*
Control Beliefs – Facilitators: *How likely are the following to help or encourage you to drive through the floodwater…*			
F1. If there is an emergency	5.05 (1.65)	0.48	<0.001*
F2. Water conditions seem appropriate (e.g., shallow water, water not flowing)	5.03 (1.66)	0.54	<0.001*
F3. Needing to get to my destination	4.32 (1.73)	0.64	<0.001*
F4. Needing to escape danger	5.44 (1.56)	0.42	<0.001*
F5. If there is no other route to my destination	4.85 (1.65)	0.56	<0.001*
F6. Support from other people	4.05 (1.79)	0.60	<0.001*
Control Beliefs – Barriers: *How likely are the following to prevent or discourage you from driving through the floodwater…*			
B1. The risk of injury or death for myself or others	6.21 (1.23)	-0.14	0.048*
B2. Water conditions do not seem appropriate (e.g., deep water, water flowing)	6.03 (1.30)	-0.05	0.473
B3. Not wanting to damage my vehicle	5.80 (1.25)	-0.27	<0.001*
B4. Not being able to see what is beneath the water surface	5.81 (1.30)	-0.34	<0.001*
B5. Not being in a large car	5.12 (1.48)	-0.15	0.048*
B6. Another safe route to my destination is available	6.14 (1.28)	-0.16	0.048*

Note: *$p < 0.05$ (statistically significant).

0.001) and friends ($\beta = 0.29$; $p < 0.001$) explained higher willingness to drive through floodwater in the presented scenario. However, normative beliefs regarding approval by none of the other groups or individuals significantly explained willingness to drive through floodwater in the presented scenario (see Table 4).

In terms of control beliefs – facilitators, 'needing to get to my destination' ($\beta = 0.30$; $p < 0.001$) and having 'support from other people' ($\beta = 0.26$; $p < 0.001$), explained higher willingness to drive through floodwater in the presented scenario, and 'needing to escape danger' ($\beta = -0.21$; $p = 0.017$) explained lower willingness to drive through floodwater in the presented scenario. Turning to control beliefs – barriers, 'not wanting to damage my vehicle' ($\beta = -0.16$; $p = 0.035$) and 'not being able to see what is beneath the water surface' ($\beta = -0.34$; $p < 0.001$), explained lower willingness to drive through floodwater in the presented scenario. 'The risk of injury or death for myself or others' ($\beta = 0.17$; $p = 0.041$) also explained higher willingness to drive through floodwater in the presented scenario. This positive, statistically significant effect was unexpected given the statistically significant and negative bivariate correlation between willingness and this belief (see Table 3). This is likely indicative of a suppressor effect and should be viewed with caution (see Table 4).

3.4. Model tests

We tested two structural equation models for explaining willingness to drive through (Fig. 1) and avoid driving through (Fig. 2) floodwater with theory of planned behaviour variables as predictors, and accounting for past behaviour as a driver and past experience as a passenger. Convergent validity (AVE > 0.50) and discriminant validity (HTMT < 0.90) were satisfied for both models. All multi-item measures exhibited adequate internal consistency and acceptable factor loadings (see Supplemental Material, Appendix A). See Supplemental Material, Appendix B for correlations between latent variables for the model constructs.

3.4.1. Willingness to drive through floodwater

The structural equation model presented in Fig. 1 explained 78.6% of the variance in willingness to drive through floodwater in the presented scenario. Past experience as a passenger but not as a driver predicted subjective norm and perceived behavioural control regarding driving through floodwater in the presented scenario. Attitude, subjective norm, and perceived behavioural control regarding driving through floodwater in the presented scenario predicted willingness to drive through floodwater. Neither past

Table 4
Regression results for key beliefs predicting willingness to drive through floodwater in Phase 2.

	β	*p*
Behavioural beliefs $R^2 = 0.51$		<0.001*
BB1. Get to my destination	0.30	<0.001*
BB2. Have fun	0.22	<0.001*
BB3. Damage or ruin my car	-0.05	0.454
BB4. Get myself or my passengers injured or killed	-0.02	0.794
BB5. Be in danger	-0.19	0.026*
BB6. Lose control of my car	-0.15	0.114
BB7. Get stuck	-0.06	0.467
BB8. Encounter hidden hazards (e.g., trees, power lines, deep water)	0.04	0.575
BB9. Use emergency services resources	0.03	0.695
Normative Beliefs $R^2 = 0.41$		<0.001*
NB1&2. Family (composite)	0.38	<0.001*
NB3. Friends	0.29	<0.001*
NB4. People who drive large cars or trucks	0.04	0.595
NB5. Thrill seekers	0.01	0.916
NB6. Inexperienced drivers	0.04	0.491
NB7&8. Emergency services (composite)	-0.04	0.612
Control Beliefs – Facilitators $R^2 = 0.46$		<0.001*
F1. If there is an emergency	0.13	0.090
F2. Water conditions seem appropriate (e.g., deep water, water flowing)	0.13	0.125
F3. Needing to get to my destination	0.30	<0.001*
F4. Needing to escape danger	-0.21	0.017*
F5. If there is no other route to my destination	0.13	0.144
F6. Support from other people	0.26	<0.001*
Control Beliefs – Barriers $R^2 = 0.14$		<0.001*
B1. The risk of injury or death for myself or others	0.17	0.041*
B3. Not wanting to damage my vehicle	-0.16	0.035*
B4. Not being able to see what is beneath the water surface	-0.34	<0.001*
B5. Not being in a large car	-0.02	0.763
B6. Another safe route to my destination is available	-0.02	0.831

Note: *$p < 0.05$ (statistically significant).

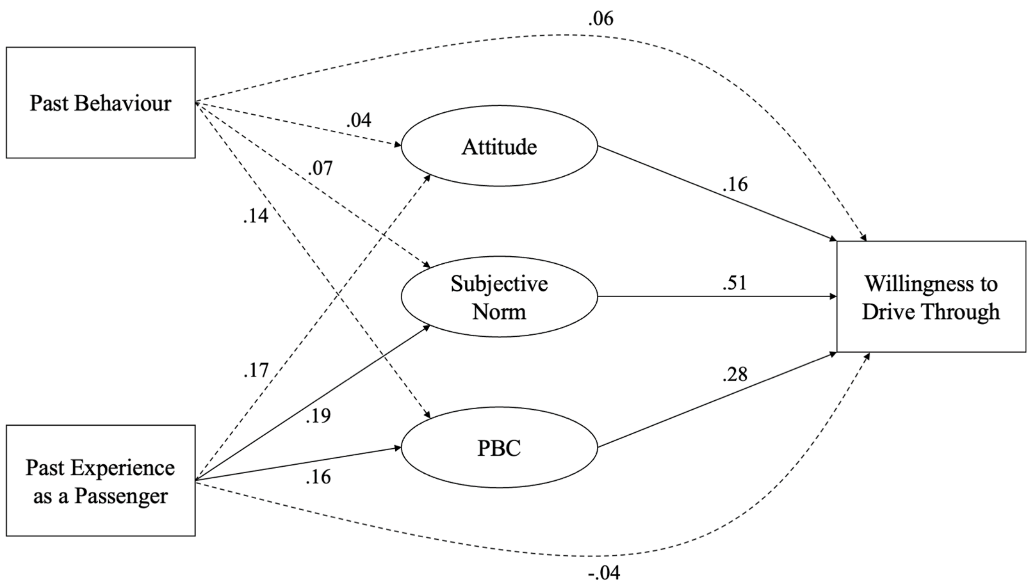

Fig. 1. Structural equation model predicting willingness to drive through floodwater.

experience as a passenger or driver directly predicted willingness to drive through floodwater in the presented scenario directly. Turning to indirect effects, past behaviour as a passenger indirectly predicted willingness to drive through floodwater, via subjective norm and perceived behavioural control, but not via attitude. No indirect effects of past experience as a driver on willingness were statistically significant. See Table 5.

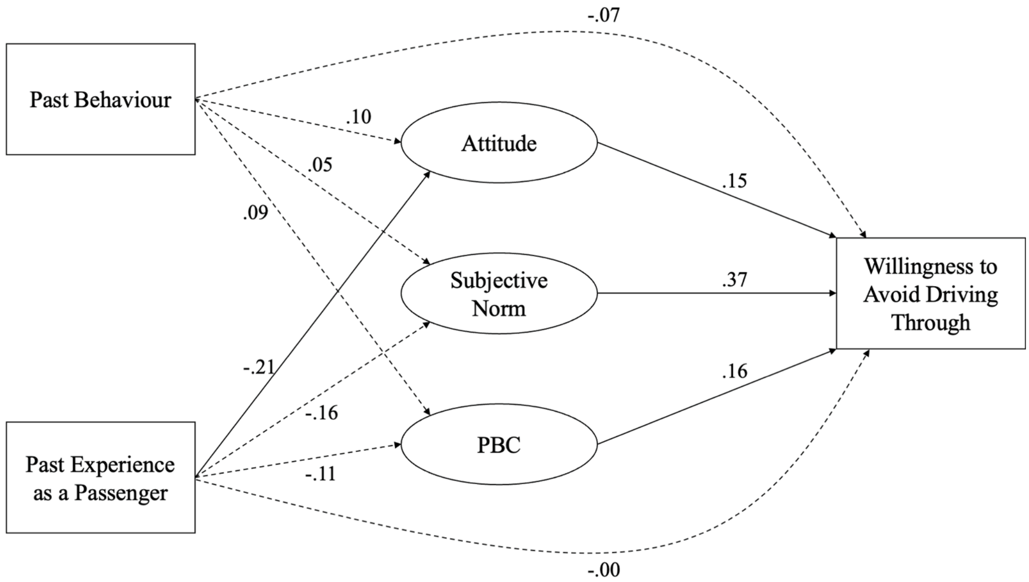

Fig. 2. Structural equation model predicting willingness to avoid driving through floodwater.

3.4.2. Willingness to avoid driving through floodwater

The structural equation model presented in Fig. 2 explained 30.8% of the variance in willingness to avoid driving through floodwater in the presented scenario. Past experience as a passenger but not as a driver predicted attitude regarding avoiding driving through floodwater in the presented scenario. Attitude, subjective norm, and perceived behavioural control regarding avoiding driving through floodwater in the presented scenario predicted willingness to avoid driving through floodwater. No indirect effects of past experience as a driver or passenger on willingness were statistically significant. See Table 5.

4. Discussion

Driving through floodwater is a significant cause of mortality and morbidity (Jonkman and Kelman, 2005; Hamilton et al., 2020). While a growing body of work has explored the social psychological factors guiding decisions to drive and avoid driving through floodwater among licensed drivers (Hamilton et al., 2019; Hamilton et al., 2016; Hamilton et al., 2018; Pearson and Hamilton, 2014), a knowledge gap exists among learner drivers (Hamilton et al., 2019). To address this gap, the current study conducted comprehensive formative research across two studies using a belief-based elicitation approach and predictive designs to investigate the beliefs, attitudes, and willingness of Australian learner drivers to drive through and avoid driving through floodwater. Results identified a number of key behavioural, normative, and control beliefs that predicted willingness to drive through floodwater. In the final models, attitude, subjective norm, and perceived behavioural control were associated with learner drivers' willingness to drive and avoid driving through floodwater. The inclusion of past behaviour did not extinguish effects of the predictors and, importantly, past experience as a passenger indirectly predicted higher willingness to drive through floodwater via subjective norm and perceived behavioural control.

This study has several important implications for both theory and practice. From a theoretical perspective, current findings support the efficacy of the theory of planned behaviour in explaining learner drivers' willingness to both drive through and avoid driving through floodwater, contributing to existing research in support of the models' utility for predicting drowning prevention behaviours (Jonkman and Kelman, 2005; Hamilton et al., 2019; Hamilton and Schmidt, 2013). The theory of planned behaviour has mostly been applied to understand individuals' decisions in times of flood among licenced drivers. Our findings make the first contribution that supports the utility of social cognition models in predicting novice drivers' flood-related driving decisions. From a practical perspective, current findings have implications for future graduated driver licensing schemes. For example, given attitude, subjective norm, and perceived behavioural control were shown to be important in this context, future licensing schemes for learner drivers could consider targeting these factors in education programs, government issued handbooks for learner drivers and learner driver tests, and school-based driving courses. Such interventions could adopt specific behaviour change techniques that map onto these theoretical constructs (Hagger et al., 2020),such as using persuasive communication (targeting attitude), highlighting support from important others (targeting subjective norm), and modelling safe driving behaviours in flood (targeting perceived behavioural control). This would ensure that the information and messaging developed is based on theory, thus providing a scientific base for effective intervention design and implementation.

Results further indicated that some of the social cognition factors from the theory of planned behaviour (Ajzen, 1991) — attitude toward driving through floodwater, and subjective norm and perceived behavioural control for avoiding driving through floodwater — were predicted by past experience as a passenger but not by past experience as a driver, most likely due to lack of driving experience

Table 5
Standardized parameter estimates for the structural equation models predicting willingness to drive through floodwater and willingness to avoid driving through floodwater.

Effect	β	95% CI LB	95% CI UB	f^2
Model 1 – Drive Through Floodwater				
Past behaviour (driver) → Attitude	0.037	-0.128	0.203	0.001
Past behaviour (driver) → Subjective norm	0.071	-0.082	0.237	0.003
Past behaviour (driver) → PBC	0.143	-0.025	0.295	0.012
Past behaviour (driver) → Willingness	0.061	-0.017	0.140	0.010
Past experience (passenger) → Attitude	0.171	-0.007	0.340	0.017
Past experience (passenger) → Subjective norm	0.190*	0.004	0.360	0.021
Past experience (passenger) → PBC	0.159*	0.006	0.322	0.015
Past experience (passenger) → Willingness	-0.040	-0.122	0.036	0.004
Attitude → Willingness	0.163*	0.058	0.280	0.052
Subjective norm → Willingness	0.513*	0.381	0.646	0.408
PBC → Willingness	0.283*	0.164	0.411	0.137
Indirect Effects				
Past behaviour (driver) → Attitude → Willingness	0.006	-0.023	0.038	–
Past behaviour (driver) → Subjective norm → Willingness	0.036	-0.044	0.120	–
Past behaviour (driver) → PBC → Willingness	0.040	-0.002	0.070	–
Past behaviour (passenger) → Attitude → Willingness	0.028	-0.002	0.070	–
Past behaviour (passenger) → Subjective norm → Willingness	0.097*	0.002	0.198	–
Past behaviour (passenger) → PBC → Willingness	0.045*	0.002	0.106	–
Model 2 – Avoid Driving Through Floodwater				
Past behaviour (driver) → Attitude	0.099	-0.078	0.264	0.005
Past behaviour (driver) → Subjective norm	0.053	-0.118	0.212	0.002
Past behaviour (driver) → PBC	0.093	-0.078	0.232	0.005
Past behaviour (driver) → Willingness	-0.066	-0.225	0.090	0.003
Past experience (passenger) → Attitude	-0.207*	-0.384	-0.029	0.025
Past experience (passenger) → Subjective norm	-0.157	-0.325	0.026	0.014
Past experience (passenger) → PBC	-0.112	-0.260	0.053	0.007
Past experience (passenger) → Willingness	-0.003	-0.134	0.128	0.000
Attitude → Willingness	0.153*	0.018	0.281	0.029
Subjective norm → Willingness	0.373*	0.229	0.527	0.140
PBC → Willingness	0.163*	0.020	0.308	0.030
Indirect Effects				
Past behaviour (driver) → Attitude → Willingness	0.015	-0.013	0.051	
Past behaviour (driver) → Subjective norm → Willingness	0.020	-0.045	0.083	
Past behaviour (driver) → PBC → Willingness	0.015	-0.012	0.051	
Past behaviour (passenger) → Attitude → Willingness	-0.032	-0.083	0.001	
Past behaviour (passenger) → Subjective norm → Willingness	-0.059	-0.014	0.009	
Past behaviour (passenger) → PBC → Willingness	-0.018	-0.061	0.007	

Note: PBC = perceived behavioural control. Model 1 $R^2 = 0.786$; Model 2 $R^2 = 0.308$. Cohen's (Cohen, 1988) guidelines outline that $f^2 \geq 0.02$ is indicative of a small effect size, $f^2 \geq 0.15$ is indicative of a medium effect size, and $f^2 \geq 0.35$ is indicative of a large effect size. * = statistically significant based on 95% CIs not encompassing zero.

(Rowe et al., 2016). Specifically, past experience as a passenger predicted less favourable attitudes toward avoiding driving through floodwater in the presented scenario. Past experience as a passenger also predicted higher subjective norm and perceived behavioural control regarding driving through floodwater. Further, past experience as a passenger indirectly predicted higher willingness to drive through floodwater, via subjective norm and perceived behavioural control. These findings point to the importance of modelling safe driving behaviour for young passengers (Scott-Parker et al., 2015). The strong association between subjective norm (i.e., social pressures) and willingness to drive through floodwater further highlights that it is important for those supervising learner drivers to set up expectations around avoiding driving through floodwater if it is encountered on a driving route (Hamilton et al., 2019). Public safety campaigns should therefore encourage drivers to consider the influence modelling risky driving behaviours may have on younger passengers' future willingness to drive through floodwater. Future research should seek to test safety messages aimed at reducing modelling of risky driving behaviours to younger passengers, with fully licensed drivers charged with supervision of learner drivers.

The current study also identified specific beliefs that were associated with learner drivers' willingness to drive through floodwater. These beliefs could be used to inform specific education material and persuasive messages that may help novice drivers to adopt safe flood-related driving intentions, and thus, safe driving behaviour in future. For example, learner drivers indicated that being willing to drive through floodwater would help them get to their destination and that it would be fun, yet also held the belief that it could put them in danger.

Drawing on behaviour change techniques such as weighing-up the pros and cons and addressing the salience of consequences may prove useful. Also, normative beliefs that predicted willingness to drive through floodwater included perceived approval of family and friends. The positive relationship between proximal groups (e.g., family, friends) indicates these close connections are potentially important influences on learner driver willingness to drive through floodwater, a finding consistent with previous studies with licenced drivers (Jonkman and Kelman, 2005). Finally, control beliefs – facilitators which significantly predicted willingness to drive through floodwater included learner drivers needing to get to their destination, needing to escape danger, and support from other people, while control beliefs – barriers included not wanting to damage their vehicle and not being able to see what is beneath the water surface. These beliefs could be used to inform messaging that challenges the ability and control learner drivers perceive they have over the decision to drive through floodwater.

While brief mentions of flooding (i.e., visual depictions of flood-related road signage and a very brief discussion of the dangers of driving through floodwater) are present in government issued handbooks for learner drivers (Queensland Government, 2021; New South Wales Government, 2021), the findings of this study show the importance of going beyond simple knowledge transmission to support learner drivers decision making in times of flood. Current findings provide an opportunity to embed, and test, behaviour change techniques on reducing willingness to drive through floodwater. It should also be acknowledged that learner drivers may not encounter a flooded road while undertaking their supervised driving hours required when learning to drive (Walker et al., 2015). The handbook may therefore encourage supervising drivers to discuss flood-related scenarios with learner drivers and to help them to develop an understanding of what the definition of a flooded road is and how to manage such a scenario if it is encountered in the future, maybe through developing if-then plans (Hamilton et al., 2022). Similarly, online interventions may also be able to be developed and deployed. Such interventions have been developed and found to be effective for licensed drivers when facing a flooded road (Jonkman and Kelman, 2005) and also for learner drivers in enhancing hazard perception (Horswill et al., 2021). Given such interventions can be taken to scale with relatively low resources (Horswill et al., 2021), consideration should be given to the development of such a resource for learner drivers.

While this study used a rigorous mixed-methods approach and is the first to investigate the beliefs and attitudes of learner drivers regarding willingness to drive and avoid driving through floodwater, the results should be considered in light of some limitations. Specifically, both studies used cross-sectional observational designs which means that causal inferences cannot be made. Further, due to ethical and practical implications associated with directly observing driving during flood events, self-report measures of willingness to drive through floodwater and avoid driving through floodwater in a hypothetical scenario were used. We sought to improve this measurement, however, by using a picture that was generated for the current study and rigorously pilot tested to aid the learner drivers in imagining and relating to the hypothetical scenario. Ultimately, future research should seek to examine the relationship between willingness to drive and avoid driving through floodwater on actual behaviour in "real-world" contexts, such as during flood events, although the somewhat unpredictable nature of flood events and ethical constraints make this challenging.

5. Conclusion

The current study has provided insight into the beliefs and attitudes of learner drivers regarding driving behaviour during flood events. The study further identified the specific beliefs associated with willingness to drive through floodwater and willingness to avoid driving through floodwater. Also, having experienced driving through floodwater as a passenger and perceived social pressure to drive through were most strongly positively associated with learner drivers' willingness to drive through floodwater and negatively associated with avoiding driving through floodwater. This highlights the importance of focusing on the modelling behaviour and social influences of significant others in intervention programs seeking to promote safe driving behaviour among novice drivers during flood events. Further work is needed to test safety messages and interventions based on the beliefs and the social psychological factors to ascertain their effectiveness in changing willingness to drive and avoid driving through floodwater and "real-world" driving behaviour during flood events.

Data availability statement: All study data, analysis scripts, and materials are available at the Open Science Framework project site at: https://osf.io/rndxz/

Funding statement: This research was funded by Royal Life Saving Society – Australia. Data collection, analysis, and interpretation of the findings were conducted independent of the funder.

Declarations of interest: The authors have declared that no competing interests exist.

CRediT authorship contribution statement

Kyra Hamilton: Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Visualization, Writing – original draft, Writing – review & editing. **Jacob J. Keech:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. **Amy E. Peden:** Conceptualization, Funding acquisition, Writing – original draft, Writing – review & editing. **Martin S. Hagger:** Conceptualization, Data curation, Investigation, Methodology, Resources, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

All study data, analysis scripts, and materials are available at the Open Science Framework project site at: https://osf.io/rndxz/

References

Ajzen, I. (1991). The theory of planned behavior. *Organisational Behavior and Human Decision Processes., 50*, 179–211.
Ajzen, I. (2006). Constructing a TPB questionnaire. *Conceptual and methodological considerations.*
Cohen J. Statistical power analysis for the behavioral sciences Lawrence Earlbaum Associates. 20th–. Lawrence Earlbaum Associates; 1988.
Gibbons, F. X., Gerrard, M., Blanton, H., & Russell, D. W. (1998a). Reasoned action and social reaction: Willingness and intention as independent predictors of health risk. *Journal of personality and social psychology., 74*(5), 1164.
Gibbons, F. X., Gerrard, M., Ouellette, J. A., & Burzette, R. (1998b). Cognitive antecedents to adolescent health risk: Discriminating between behavioral intention and behavioral willingness. *Psychology and Health., 13*(2), 319–339.
Hair, J. F., Jr, Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R: A Workbook.: Springer. *Nature.*
Hair, J. F., Hult, T., Ringle, C. M., & Sarstedt, M. (2022). *A primer on partial least squares structural equation modeling (PLS-SEM)* (3rd ed.). Thousand Oaks: Sage.
Hagger MS, Cameron LD, Hamilton K, Hankonen N, Lintunen T. Changing behavior: A theory-and evidence-based approach. In: M. S. Hagger LC, K. Hamilton, N. Hankonen, & T. Lintunen (Eds.), editor. The Handbook of Behaviour Change. New York, New York: Cambridge University Press,; 2020.
Hamilton, K., & Schmidt, H. J. (2013). Drinking and swimming: Investigating young Australian males' intentions to engage in recreational swimming while under the influence of alcohol. *Journal of Community Health., 39*(1), 139–147.
Hamilton, K., Peden, A. E., Pearson, M., & Hagger, M. S. (2016). Stop there's water on the road! Identifying key beliefs guiding people's willingness to drive through flooded waterways. *Safety Science., 86*, 308–314.
Hamilton, K., Peden, A. E., Keech, J. J., & Hagger, M. S. (2018). Changing people's attitudes and beliefs toward driving through floodwaters: Evaluation of a video infographic. *Transportation Research Part F., 53*, 50–60.
Hamilton, K., Price, S., Keech, J. J., Peden, A. E., & Hagger, M. S. (2018). Drivers' experiences during floods: Investigating the psychological influences underpinning decisions to avoid driving through floodwater. *International Journal of Disaster Risk Reduction., 28*, 507–518.
Hamilton, K., Peden, A. E., Smith, S., & Hagger, M. S. (2019). Predicting pool safety habits and intentions of Australian parents and carers for their young children. *Journal of Safety Research., 71*, 285–294.
Hamilton K, Keech JJ, Peden AE, Hagger MS. Protocol for developing a mental imagery intervention: a randomised controlled trial testing a novel implementation imagery e-health intervention to change driver behaviour during floods. BMJ Open. 2019;9(2):bmjopen-2018-025565.
Hamilton, K., Peden, A. E., Keech, J. J., & Hagger, M. S. (2019). Driving through floodwater: Exploring driver decisions through the lived experience. *International Journal of Disaster Risk Reduction., 34*, 346–355.
Hamilton, K., Demant, D., Peden, A. E., & Hagger, M. S. (2020). A systematic review of human behaviour in and around floodwater. *International Journal of Disaster Risk Reduction., 47*, Article 101561.
Hamilton, K., Keech, J. J., Peden, A. E., & Hagger, M. S. (2021). Changing driver behavior during floods: Testing a novel e-health intervention using implementation imagery. *Safety Science., 136*, Article 105141.
Hamilton, K., Smith, S. R., Wright, C., Buchhorn, Y. M., & Peden, A. E. (2022). Predicting and Changing Intentions to Avoid Driving into Urban Flash Flooding. *Water., 14*(21), 3477.
Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science., 43*(1), 115–135.
Hirabayashi, Y., Mahendran, R., Koirala, S., Konoshima, L., Yamazaki, D., Watanabe, S., et al. (2013). Global flood risk under climate change. *Nature Climate Change., 3*(9), 816–821.
Horswill, M. S., Hill, A., Rodwell, D., Larue, G. S., Bates, L., & Watson, B. (2021). A brief and unsupervised online intervention improves performance on a validated test of hazard perception skill used for driver licensing. *Transportation Research Part F: Traffic Psychology and Behaviour., 78*, 130–136.
Jonkman, S. N., & Kelman, I. (2005). An analysis of the causes and circumstances of flood disaster deaths. *Disasters., 29*(1), 75–97.
Keech, J. S., Peden, S. R., Hagger, A. E., Hamilton, M. S., & K.. (2019). The lived experience of rescuing people who have driven into floodwater: Understanding challenges and identifying areas for providing support. *Health Promotion Journal of Australia., 30*(2), 252–257.
Maniaci, M. R., & Rogge, R. D. (2014). Caring about carelessness: Participant inattention and its effects on research. *Journal of Research in Personality., 48*, 61–83.
Middlestadt, S. E., Macy, J. T., & Geshnizjani, A. (2014). To smoke or not to smoke: Is the risky behavior the opposite of the healthy behavior? *Health Behaviour and Policy Review., 1*(2), 143–149.
New South Wales Government. Road User Handbook 2021 [Available from: https://www.nsw.gov.au/sites/default/files/2021-05/road_users_handbook-english.pdf.
Pearson, M., & Hamilton, K. (2014). Investigating driver willingness to drive through flooded waterways. *Accident Analysis & Prevention., 72*, 382–390.
Peden, A., Franklin, R. C., Leggat, P. A., & Aitken, P. (2017). Causal Pathways of Flood Related River Drowning Deaths in Australia. PLOS Currents. *Disasters., 18 (Edition*, 1).
Queensland Government. Your keys to driving in Queensland 2021 [Available from: https://aussie-driver.com/queensland/queensland-drivers-handbook/.
Ray S, Danks, N., & Calero Valdez, A. . SEMinR: Domain-specific language for building, estimating, and visualizing structural equation models in R. Estimating, and Visualizing Structural Equation Models in R (August 6, 2021). 2021.
Richetin, J., Conner, M., & Perugini, M. (2011). Not doing is not the opposite of doing: Implications for attitudinal models of behavioral prediction. *Personality and social psychology Bulletin., 37*(1), 40–54.
R Foundation for Statistical Computing. R: A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing; 2019.
Rowe, R., Andrews, E., Harris, P. R., Armitage, C. J., McKenna, F. P., & Norman, P. (2016). Identifying beliefs underlying pre-drivers' intentions to take risks: An application of the Theory of Planned Behaviour. *Accident Analysis & Prevention., 89*, 49–56.
Scott-Parker, B., Watson, B., King, M. J., & Hyde, M. K. (2015). "I would have lost the respect of my friends and family if they knew I had bent the road rules": Parents, peers, and the perilous behaviour of young drivers. *Transportation Research Part F: Traffic Psychology and Behaviour., 28*, 1–13.
Simpson, H. M. (2003). The evolution and effectiveness of graduated licensing. *Journal of Safety Research., 34*(1), 25–34.
United Nations. (2015). *Sendai Framework for Disaster Risk Reduction 2015–2030*. Geneva: United Nations Office for Disaster Risk Reduction.
Walker E, Howard E, Harris A, Barnes B, Parnell H, Hinchcliff R, editors. Development of the Australian Graduated Licensing Scheme Policy Framework: a demonstration of jurisdictions taking action together to reduce road trauma. Proceedings of the 2015 Australasian Road Safety Conference (ARSC2015); 2015: Australasian College of Road Safety (ACRS).