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Author(s): Hamilton, Kyra; Peden, Amy E.; Keech, Jacob J.; Hagger, Martin

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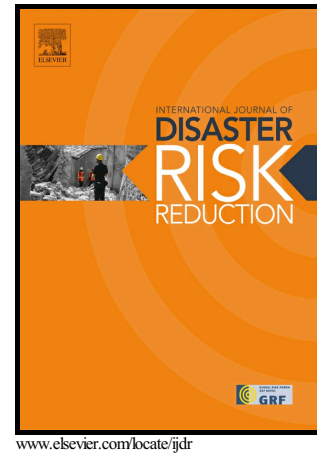
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Driving through floodwater: exploring driver decisions through the lived experience

Kyra Hamilton^{1,2*}, Amy E. Peden^{3,4}, Jacob J. Keech¹, & Martin S. Hagger^{1,2,5}

¹School of Applied Psychology, Menzies Health Institute Queensland, Griffith University, Brisbane, Australia

²Health Psychology and Behavioural Medicine Research Group, School of Psychology and Speech Pathology, Curtin University, Perth, Australia

³Royal Life Saving Society, Australia

⁴College of Public Health, Medical and Veterinary Sciences, James Cook University, Townsville

⁵Faculty of Sport and Health Sciences, University of Jyväskylä, Jyväskylä, Finland

*For correspondence contact: Dr. Kyra Hamilton, School of Applied Psychology, Griffith University, 176 Messines Ridge Road, Mt Gravatt, QLD 4122. Ph: +61 7 373 53334; Fax: +61 (7) 373 53388. Email: kyra.hamilton@griffith.edu.au

Abstract

More than half of unintentional flood-related drowning deaths in Australia are due to driving through floodwater, despite on-going public campaigns. Currently, there is a knowledge gap in understanding why individuals choose to drive through floodwater and the decisions that may lead to such actions. We propose that a more complete understanding of individuals' decisions to drive through floodwater needs to be considered in the context of the lived

experience. Australian drivers (N=20) who had intentionally driven through floodwater participated in semi-structured interviews. Data were analysed using a thematic analysis based in an interpretivist approach. Past experience, individual perceptions (e.g., situation perceived as different to warnings), and the social and environmental context (e.g., pressure and encouragement from others, seeing other motorists driving through) emerged as major themes. Most salient was that although there was a common awareness of the risk posed by driving through flooded waterways, the decision to take this risk emerged as being heavily reliant on one's ability to construct a sense of self-efficacy in the lead-up to the incident. This study is the first to explore the lived experience of drivers who intentionally decided to drive through floodwater. Future research and public campaigns can draw on these findings to develop evidence-based interventions aimed at combating this risky driving behaviour.

Keywords: Flooded waterways, Driving, Beliefs, Drowning, Qualitative research

1 Introduction

Drowning is a major public health issue that accounts for 7% of all injury-related deaths making it the third leading cause of unintentional death worldwide (World Health Organization, 2014). Drowning risk increases with floods, particularly in low and middle income countries (World Health Organization, 2014). Flood-related drowning deaths are also a concern in high income countries. For example, in Australia, they accounted for 17% of all unintentional fatal drowning in rivers, creeks, and streams between 2002 and 2012 (Peden, Franklin, Leggat, & Aitken, 2017). Many flood-related drowning fatalities are caused by individuals intentionally driving motor vehicles into flooded waterways or entering floodwaters on foot. In Australia, over half (53%) of all unintentional flood-related drowning deaths between 2004/05 and 2014/15 were as a result of driving into floodwaters (Australian Water Safety Council, 2016).

Driving into floodwaters is an activity that has been found to be associated with drowning (Peden et al., 2017) and is a leading cause of floodwater related drowning deaths (FitzGerald, Du, Jamal, Clark, & Hou, 2010). Research conducted in Australia in the period 1997-2008 inclusive has shown the use of a motor vehicle to be involved in flood-related drowning deaths 48.5% of the time and 39.7% of these incidents were attempting to negotiate flooded bridges, streams, and roads (FitzGerald et al., 2010). These facts make motor vehicle-related aquatic activities and drowning a serious public health issue. The World Health Organization's (2014) global report on drowning recommended that prevention is vital to combat drowning rates, given the often fatal outcome. The Australian Water Safety Council (2012) has established the goal of achieving a 50% reduction in drowning deaths by the year 2020 (Australian Water Safety Council, 2012). Consistent with this goal, the Australian Water Safety Strategy 2016-2020 has targeted reducing the impact of disaster and extreme weather on drowning deaths – with driving through floodwaters identified as a priority

behaviour. Key objectives in achieving these aims are to implement strategies that raise community resilience and awareness of water safety, and promote better education and skills to prevent drowning from motor vehicle-related aquatic activities (Australian Water Safety Council, 2016).

Although driving through floodwaters is considered a common type of flood experience (Franklin, King, Aitken, & Leggat, 2014) and some literature exists on the risk factors related to motor vehicle-related drowning (e.g., 45–60 centimetres of water will cause virtually all cars including four-wheel drives to float; Smith, Modra & Felder, 2017; NOAA, 2011), there is a dearth of research understanding individuals' decisions for this risky act (World Health Organization, 2014; Yale, Cole, Garrison, Runyan, & Ruback, 2003). In the scant literature available it is suggested that people who deliberately drive through floodwaters have a lack of knowledge about the risks and perceive flood warnings as not being a true evaluation of the real threat (Drobot, Benight, & Gruntfest, 2007; Drobot, Gruntfest, et al., 2007).

Government campaigns have aimed to raise awareness of the problem of motor vehicle-related drowning through campaigns such as “If it’s flooded, forget it” (a Queensland, Australia initiative aimed at reducing driving through floodwaters; Queensland Floods Commission of Inquiry, 2012) and “Turn Around, Don’t Drown” (an initiative released in the USA aimed at reminding people of the preventative nature of driving into floodwaters and discouraging people from driving past flood warning barriers; NOAA, 2011). Although these campaigns have been aimed at reducing the number of unintentional drowning deaths, very little research to date has evaluated the success of these campaigns on people’s attitudes and motives toward driving through floodwaters, and, critically, actual drowning rates.

While previous research and campaigns have focused their attention on the role of

driving behaviour in fatal drowning and raising awareness and knowledge about the dangers of negotiating flooded waterways, the limited evaluation of these strategies that exists, suggests that the safety messages are being ignored (Gissing, Haynes, Coates, & Keys, 2016). There is a paucity of research aimed at understanding why people engage in this risky behaviour, despite awareness of the risks and also when unaware of the risks. Given motor vehicle-related drownings are often preventable, decisions informing risky driving acts around water are likely to be psychological in nature, involving a range of social and motivational factors. Recent research has attempted to understand the psychological mechanisms that may guide individuals' decisions to engage in safety compromising behaviours around water (Hamilton, Peden, Pearson, & Hagger, 2016; Hamilton & Schmidt, 2013, 2014; Hamilton, White, Wihardjo, & Hyde, 2015; Keech, Smith, Peden, Hagger, & Hamilton, 2018; Pearson & Hamilton, 2014). Specifically, in two pioneering studies by Pearson and Hamilton (2014) and Hamilton et al. (2016), it was found that attitudes, social pressures, and self-efficacy beliefs play a role in influencing individuals' willingness to drive through floodwaters. Another recent mixed-methods study has explored motivations for avoiding driving through floodwater when encountered on a driver's route (Hamilton, Price, Keech, Peden, & Hagger, 2018). The study found that a range of behavioural, normative, and control beliefs underpinned decisions to avoid driving through floodwater.

Although this emerging research provides some useful insights into understanding why individuals may engage in risky driving acts around water, research indicates that performing and not performing a behaviour are not conceptual opposites and may be influenced by different processes (Middlestadt, Macy, & Geshnizjani, 2014; Richetin, Conner, & Perugini, 2011). Hence, there is a knowledge gap in understanding the experiences of individuals who have actually driven through floodwaters and the decisions that led to their actions. Continued efforts are therefore needed to build an understanding of this risky

driving behaviour, and thus, guide public health messages. We propose that a more complete understanding of individuals' decisions to drive through floodwaters needs to be considered in the context of 'lived experience' (Reid, Flowers, & Larkin, 2005) of having engaged in the behaviour. Our approach was, therefore, aimed at developing knowledge and understanding of the reasons for and influences on driving through floodwaters based on the perspectives and experiences of those who had previously engaged in this behaviour.

2 Method

2.1 Participants

Participants were community members from New South Wales and Queensland, Australia who held a current driver's licence and who had driven through a flooded road in the past three years (after the launch of the "If it's flooded, forget it" campaign; Queensland Floods Commission of Inquiry, 2012). Participants ($N = 20$, males = 10, females = 10; $M_{age} = 23.94$ years; $SD = 14.25$, range = 19 to 64 years) were recruited using social media and media releases in newspapers and online/websites. All drivers who expressed interest in participating were interviewed, except for one who did not provide a reason. Many of the drivers (65%) were employed full-time, 25% were studying full-time at university, one driver was working part-time alongside home duties, and one was unemployed. The majority of drivers (70%) reported having children, and three of those had their children in the vehicle at the time of the experience. A quarter of the drivers (25%) had completed senior high school, 35% had received a vocational/trade qualification, and 40% had received a university degree qualification. All but one of the drivers were from English-speaking backgrounds and all but two drivers (who held provisional licences) held an unrestricted drivers licence, with years of driving experience ranging from 1 to 47 years ($M = 21.10$). A quarter of the drivers (25%) drove large four-wheel drive vehicles (e.g., Toyota Landcruiser) and 35% drove dual-cab utility four-wheel drive vehicles (e.g., Toyota Hilux), while 20% drove small or medium

four-wheel drive vehicles (e.g., Honda CRV) and 20% drove small sedan or hatchback vehicles (e.g., Hyundai i30). Two of the large four-wheel drive vehicles and one of the dual-cab utility vehicles were fitted with snorkels (15% of the sample). Four of the drivers (20%) interviewed lost their vehicle in the incident they described; three of the vehicles were dual-cab utility vehicles and one was a small sedan. Drivers were provided with a \$50AUD department store gift card as an incentive for participation. The interviewer was not known to participants prior to the study, and the reasons for conducting the research were presented on the study information sheet (to develop an understanding of the experiences of people who have driven through floodwater).

2.2 Design and Procedure

The current study adopted an interpretivist inductive approach to understand the experiences of drivers who had driven through floodwaters (i.e., driven a vehicle through a road covered in flooded water to a depth of 60cm or greater). Results reported are part of a larger study investigating the experiences of individuals who had intentionally driven through floodwaters and emergency personnel who rescue them. This article focuses on drivers' experience both in the lead-up to and after the event. Questions were thus designed to stimulate discussion regarding their thoughts in the prelude to driving through the floodwater and their experiences of the actual event. Author JK conducted semi-structured interviews by telephone or in-person at the drivers' convenience. Only the researcher and interviewer were present for in-person interviews, and telephone participants did not disclose the presence of other people during the interview. Author JK is male and holds a BPsych(Hons), is trained in and has experience conducting research using qualitative methods, and was a Research Assistant, PhD Candidate, and Academic Teaching Assistant in Psychology at the time of the interviews. Author KH and MH hold PhDs and academic appointments in university psychology departments. Author AP holds an MPP, is a PhD Candidate and the National

Manager – Research and Policy at an Australian drowning prevention community organisation. The average length of the interviews was 30 minutes and drivers were free to speak at length with minimal interruption other than prompting for clarification. Semi-structured interviews were employed as they ensure coverage of predetermined questions, but allow flexibility for the participant to discuss experiences the researcher has not anticipated (Braun & Clarke, 2013). All interviews were audio-recorded and uploaded to a secure website for verbatim transcription. As Braun and Clarke (2006; 2013) note, it is good practice to reflect on researcher assumptions to maintain transparency in analysis. The researcher therefore kept a reflexive journal throughout the interview and data analysis process. No assumptions or biases were identified through reflexivity in the process of conducting the interviews or analysis. The current study received ethical approval from the Griffith University Human Research Ethics Committee (reference # PSY/A9/15/HREC).

2.3 Interview Guide

The interview was guided by a series of open ended questions common to each interview and designed to stimulate participants in providing a rich, detailed, self-directed narrative of their experiences. Formulation of questions was informed by prior research in drowning prevention behaviours (Franklin et al., 2014; Hamilton & Schmidt, 2014; Hamilton et al., 2015; Taylor, 2016) and, more specifically, in motor vehicle-related drowning behaviours (Drobot, Benight, et al., 2007; Gissing et al., 2016; Hamilton et al., 2016; Pearson & Hamilton, 2014) as well as the expertise of the research team, while being guided by several criteria of good practice in qualitative research (Tracy, 2010), including worthiness of the topic, sincerity (the interviewer practicing being self-reflective), as well as the research having rich rigour, credibility, and relational ethics. In order to lead in to the discussion surrounding drivers' experience of driving through floodwaters and to gain an understanding of their knowledge about the behaviour, the interviewer first asked, "Are you aware of any

information about driving through flooded waterways?” The second question focused on drivers’ thoughts in the prelude to driving through the flooded waterway, “If you are comfortable, can you tell me about the circumstances that led up to you driving through the floodwater?” Where descriptions had not already been provided, the interviewed probed for information regarding physical and social environment (e.g., situation, type of car, others in car), prior behaviour, attitudes regarding costs and benefits at the time of the situation, normative expectations, and self-efficacy beliefs. Probes were used to seek clarification and to allow for elaboration and were informed by prior research (Hamilton et al., 2016; Pearson & Hamilton, 2014). They were framed so that participants could easily indicate if the content of the probe was not relevant to their experience, and broad to minimise the risk of leading a specific response. The third question related to drivers’ experience of the actual event, “Again, if you are comfortable, can you tell me about your actual experience of driving through the flooded waterway?” At the conclusion of the interview, drivers were invited to share any additional thoughts on their experience or the behaviour in general; or, if they believed the interviewer had missed anything that they would like to share. To ensure the rigour of analyses, confirming summaries occurred throughout the interviews to validate drivers’ responses.

2.4 Interview Analysis

As the aim of the current research was to allow themes to form based on individuals’ descriptions of their experiences, a thematic analysis based in an inductive interpretivist approach was used to interpret the data (Braun & Clarke, 2006, 2013). Thematic analysis was chosen over more complex analytical techniques (e.g., interpretative phenomenological analysis) as the study was aimed more toward understanding the reasons for and influences on driving through floodwaters based on the subjective experience of those who had previously engaged in this behaviour rather than understanding the meanings which those

experiences hold for the participants. The approach was inductive as it allowed the researchers to provide subjective reasoning with the help of participants' real life experiences and develop data-driven themes rather than drawing implications from hypotheses for the purpose of verification (Strauss, 1987). The interpretivism philosophy compliments the inductive approach as it acknowledges that discourse regarding lived experiences are socially constructed and thus subjective, and that different individuals experience and understand the same objective reality in different ways and have individual reasons for their actions (Gergen, 1985, 1999). This differs from a positivist approach, which involves making objective observations and deductively testing predetermined hypotheses to verify predictions (Strauss, 1987). To ensure rigour and confidence in the findings, the interviewer used confirming summaries to validate drivers' responses, a code-recode procedure was used for 20% of the data, 10% of the data was co-coded, and themes were reviewed and refined by two authors.

In conducting the thematic analysis, we followed the six steps stipulated by Braun and Clarke (2006, 2013). First (step 1), transcripts were read and re-read to ensure familiarity with the data by author JK. Second (step 2), interesting features of the data were then identified and coded systematically in relation to the research question using NVivo 10 qualitative analysis software. Development of the coding-scheme was entirely data-driven, with no codes being specified *a priori*. To ensure stability of coding, a code-recode procedure was undertaken for 20% of the data and author KH co-coded 10% of the data. At the next step (step 3), codes were collated inductively into potential themes. Using an iterative process (Miles & Huberman, 1994; Strauss, 1987), themes were reviewed (step 4) with reference to the interview transcripts from which they were drawn in order to ensure they were reflective of their original contexts and to ensure theoretical saturation had been attained. Themes were then reviewed, refined, and named by authors KH and JK (step 5). As a final step, the list of themes were reported (step 6) and extracts were included to

demonstrate contextual significance.

3 Results and Discussion

Almost all drivers reported an awareness of information about the risks of driving through floodwaters. This included government messages and campaigns (e.g., “If its’ flooded, forget it”) that urge people not to drive through floodwaters, as well as media reports of fatalities, vehicle losses, and experiential awareness. Overall, drivers described that the information indicates that driving through floodwaters is risky and should not be undertaken yet, despite this awareness, all made the decision to attempt to drive through the floodwater. Four overarching themes emerged in driver’s descriptions about their decision to drive through the floodwater despite awareness of the risks; indicating that value placed on past experience, individual factors, social and environmental contexts, and self-efficacy judgements, are key influences on behavioural decision-making for driving through floodwaters. Themes that emerged from the data were similar across drivers. Thus, the most salient themes across all drivers are presented below. Extracts are classified by driver number (e.g., *P01*) and themes are visually mapped in Figure 1.

3.1 Past Experience

It was common among drivers with previous experience of driving through floodwaters to report they had the ability to make a reliable risk assessment which led to an informed decision regarding whether it was safe to drive through the floodwater. Accounts of past experiences varied, with some drivers reporting experience in a recreational four-wheel-driving setting, while others reported experience driving through urban roads covered in water or roads familiar to the driver that are known to flood. One driver described, “They say you know, don't go into the water, you know if there's water across the road don't go in, basically is what they say. But from my experience having lived in a flood prone area for 35 years, yeah we usually have had to make our own judgement.” - *P04*. The value of past

experience was particularly impactful for some drivers who described dissatisfaction with campaigns discouraging all driving through floodwater, “It just comes down to experience and also understanding with that particular crossing...I get annoyed that they paint the standard picture that no one can drive through floodwaters and that there are people that do stupid things, but there are also situations where it is safe to drive through floodwater and also that if you are living in a remote or regional area that there's going to be a lot of times where you actually do have to drive through floodwater, and I don't think that they take that into account.” - P08. In addition to the perceived ability to make an informed decision, it was also commonly described that having previously driven through floodwater afforded the experience necessary to safely drive through floodwater in the current situation. One driver described, “Look, I've driven four-wheel-drives for 10 years and I've driven through water crossings and different things plenty of times. So, for me, I feel I'm a very skilled four-wheel-drive water crossing sort of person... I'd driven through flood water earlier in the day, and quite comfortably.” - P19.

Despite the assessment at the time that the skills of driving through floodwater attained through past experience are transferable; following the incident, a number of drivers described that this is often not the case given the uncertainty of conditions and lack of safety precautions in place. For example, one driver described, “And I realise that it's not...when you're out four-wheel-driving and things like that you're more controlled on what's going on around you. And because of other people. There's a lot more other people that make different choices and you're not in control of them. So it made me a little bit, now that I've heard more of those ‘If it's flooded forget it’ you don't know what the road's like underneath, all that kind of stuff, it's made me think that's exactly right. You don't know. You're not in control. You don't have safety measures in place.” - P19.

3.1.1 Practical implications. Drivers described that they felt confidence in their

ability to make a reliable risk assessment, as well as their ability to navigate safely through the floodwater, and that this was afforded by their past experience. Efficacy derived from past experience is intuitive; however, paradoxical for this target behaviour, given the uncertain and unpredictable conditions. Beliefs of confidence and self-efficacy to engage in a particular behaviour rely on the similarity of situations or the transferability of skills; however, following their experience, many drivers reported that conditions were not as expected, and that the skills were not transferable. Hence, messages aiming to reduce engagement in this behaviour should draw attention to the lack of transfer of skills to judge the depth of flooded waterways across situations and past experience between situations of driving through water, through provision of information outlining uncertainty and unpredictability of conditions when driving through floodwaters.

3.2 Individual Perceptions

3.2.1 Pressure to arrive at destination. The theme emerged in driver descriptions that often there was a strong externally felt pressure to arrive at their destination. The pressure that was most commonly described was the pressure to get home to check on the welfare of their family, home, and pets given the severe weather events taking place. Two drivers described, “I wanted to get home to my family, and I had a young daughter at home, and my thoughts were I have to get home and make sure they are all okay.” - *P01*; and, “By that point I had been in the rain so much I was starting to worry about my house, if it was this wet, what was my house like, worried about my dog.” - *P11*. It was also described by another driver that given the rising water and adverse weather there was a desire to reach the safety of home, “The town was almost actually isolated with the, you know, the floods that were surrounding it and I just wanted to get home.” *P17*.

Another commonly reported pressure was the perceived need to get to work, which was described as compelling the driver to take substantial risks. One driver described, “I

saw...this is going to sound dreadful, I saw signs up saying the road was closed. But there were cars, four-wheel-drives coming towards me so I thought...and I thought 'oh I should turn around, I should turn around', but I was panicking about being late for work. I felt really panicky about not getting there. And when I saw four-wheel-drives coming towards me I thought okay I can do this." - P04. This pressure to get to work was described as deriving more from internal (i.e., the self) rather than external (i.e., a supervisor) influences, and perceived, once reflecting on the situation, that given the adverse weather any absence would likely have been excused or unimportant. For example, one driver described, "It was mainly the pressure... to get there and lecture. The silly thing is once I got through [the floodwater] that my phone went [phone message received], and the people were saying that [the workplace] was out of power and totally flooded in there and they were cancelling the lecture anyway." - P20.

3.2.2 Situation perceived as different to warnings. The theme also emerged that a number of drivers' perceived the circumstances through which they drove through the floodwater to be different to the government messages such as "If it's flooded, forget it" and media reports of incidents. One driver described, "So wherever you see the incidents on television where there is normally a drop to the side where the cars had been pushed off and my understanding was that due to the impact on the side of the car it probably got stuck. Or they were driving through water in excess of a metre high. Or in a normal car, two-wheel drive." - P15. Another driver reported a similar account, "Before that there was the Grantham flood [severe 2011 flash flooding event that occurred in rural Queensland, Australia where 12 people were killed; Grantham Floods Commission of Enquiry, 2015] and all that, yeah. I think, yeah [I was] more aware of people getting washed off bridges and things. But I mean I didn't feel this was a bridge, I know its double standards. I wouldn't have driven down and up a bridge but this was, I felt oh this is a long straight where the water has made like an ocean

like yeah.” - *P04*. A number of drivers also reported lack of agreement with, or lack of clarity regarding, what constitutes a flooded road as outlined by the safety message “If it’s flooded, forget it.” For example, one driver described, “Like you said if it's flooded forget it. But then really what is flooded? Is it 100mm over the road surface? You can still see the road from there. I don't know if too many people are going to heed to 100mm over the water.” - *P05*.

3.2.3 Avoiding the potential to become stranded. The theme also emerged that many drivers made the decision to take the risk of driving through the floodwater based on the perception that they were likely to become stranded for an extended period if they did not drive through, “I was concerned that I would be stuck on that side and then there was no way back either because the motorway was being cut [behind me] so I would have been stuck on the highway for however long.” - *P01*. Another driver described that although comfortable with the alternative option, it became less desirable due to the potential for it to become particularly enduring, “I didn’t feel unsafe pulling up and snoozing, but I knew it was going to get worse. It was going... the flood levels were going to get worse, and I thought if I don’t get through now, I won’t get through for three days, kind of thing.” - *P12*.

3.2.4 Lack of appeal of alternatives. A number of drivers also reported that taking alternate routes were not appealing due to a number of factors. One driver, for example, described their lack of willingness to take an alternate route, “I was definitely rushing... because it [the detour to take a friend home] made me a bit late [for work]... I'd say that potentially affected my position because I was so close... and the detour would have added a few more minutes. I reckon that would've definitely affected the decision.” - *P18*. Another driver reported that having already gone another way, which had also been flooded, led to an increased desire to make it home on the current route, “But at that point I think this served then to sort of made me, well not made me do it, but felt like I wanted to do it or could do it was that I had already gone another way, couldn’t get home.” - *P11*. Another driver described

that there was consideration and discussion of alternative options which resulted in the conclusion that going through the floodwater was the only way to avoid sleeping in the car for an extended period of time, “We did try to reverse up this track and try and turn around and back out again. Which wasn't really feasible at the time due to it was raining we could hardly see out the back while reversing. And I think we came through another creek so I think I made the educated judgment that if this creek was flooded then the one behind us would've been flooded as well. So if we got stuck at that stage we'd have to sleep in the car until whenever.” - *P15*.

While these descriptions indicate a deliberate consideration of alternatives (even if their appeal is minimised in this process), a small number of the drivers described a more impulsive and spontaneous decision making process. One driver described, “So I slowed, I didn't even come to a complete stop. If I'd have come to a complete stop, I might have been in a frame of mind to think about it more. But I slowed down to the point where I thought I had enough information about it, and then started to make my way through.” - *P13*.

3.2.5 Practical implications. It is clear that that a range of individual factors were influential in decisions to drive through the floodwater. First, a number of drivers described a strong internal pressure to arrive at their destination, particularly in reference to getting home or getting to work. This has been found to occur despite the availability of options such as phoning family to be assured of others safety, and despite many workplaces closing facilities and cancelling events during natural disasters. Prior research indicates that those physically exposed to flooding worry more about potential flooding, perceive themselves as being more vulnerable to flooding, and perceive the consequences of flooding to be more severe in comparison to those who have not experienced flooding in the past (Zaalberg, Midden, Meijnders, & McCalley, 2009). As the current research was conducted in flood-prone regions, and almost all drivers described having prior exposure to flooding, it is unsurprising

that the drivers described a strong motivation to arrive at their destination to ensure safety as a parent, a homeowner, or a pet owner in the face of potentially worsening conditions.

A recommendation arising from this finding is that it would be beneficial to reduce the internal pressures felt by drivers during adverse weather. Messages should encourage drivers to pre-emptively plan steps they need to take in order to feel comfortable with not reaching their destination. Both to encourage the forming of plans, and to provide scaffolding for how these plans should look, authorities responsible for promoting safe driving behaviours should develop readily available resources. This could include smartphone applications, websites, and car magnets where drivers can make a plan and then easily access their plan. In addition, it was observed that drivers may ignore road closure signs in order to reach their destination. Given the sometimes overwhelming pressure to arrive at a destination, which was appraised by some drivers to be more important than observing immediate warning signs, it is suggested that departments responsible for regulating road safety take steps to restructure the physical environment as a means of physically preventing drivers from entering floodwaters. For example, when road closed signs are installed at the location to also install barricades to close off both lanes or have police presence as a deterrent.

It is important, however, that any measures used to obstruct or deter use of a particular section of road can adapt to the changing conditions or that authorities can easily be alerted when a change of signage is required. Technological solutions such as cameras that can provide real-time monitoring of flood-prone sections of road, and tools such as barriers that are activated and deactivated based on water levels should be explored. Drowning prevention organisations and departments of transport should also be promoting awareness of the implications of driving through road closed signs. This may include advocating for new legislation where enforcement of penalties for deliberately driving into floodwater is not covered by existing legislation. An example of this kind of legislation is the “Stupid Motorist

Law” in Arizona, USA, which renders drivers liable for the costs associated with their rescue plus additional liability when they become stranded after driving around a road closed sign and into floodwater (Arizona State Legislature 28-910). While no published research has evaluated the effectiveness of this law, creating new fines or increasing the severity of fines has been found to provide a deterrence effect for other risky driving behaviours such as speeding (Brubacher et al., 2014; Meirambayeva et al., 2014). Meta-analytic evidence also supports the effectiveness of enforcement using clearly visible fixed speed cameras in reducing crashes in that vicinity (Høye, 2014; Wilson, Willis, Hendrikz, Le Brocque, & Bellamy, 2010). While this suggests legislating penalties for this behaviour is a worthwhile consideration, it is important that the effect of these penalties on behaviour is evaluated.

It further emerged that many drivers perceived the situation leading up to their experience as being different to situations they had been warned about regarding driving through floodwaters. A number of drivers, both those who lost their car during the experience and those who did not, described specific conditions in which they perceived driving through floodwaters to be risky, and how their experience was perceived to be different in the lead-up. These accounts align closely with the concept of optimism bias—where people think a particular behaviour is safer for them than for others—which has been shown to be influential in decision making regarding a range of risky behaviours including driving under the influence of alcohol and mobile phone use while driving (Nelson, Atchley, & Little, 2009). In addition, some drivers also indicated a lack of clarity regarding what constitutes a flooded road (e.g., should 10cm deep water in a four-wheel-drive not be entered into?). While associations are unable to be inferred using the current research methodology, prior research into risky driving behaviours has found that young males most often demonstrate optimism bias regarding driving skills, and accident risk perceptions and interventions that emphasise personal accountability should adverse consequences occur are particularly effective with this

group (White, Cunningham, & Titchener, 2011); though it should be noted this was not found to be effective with more experienced drivers. It is therefore recommended that messages focus on both emphasising personal accountability for adverse consequences and the risks posed by driving through floodwaters despite prior experience.

A number of drivers also described that they needed to drive through the floodwater to avoid becoming stranded or having to sleep in their vehicle for an unspecified amount of time. In addition, some drivers indicated that they found the option of taking an alternate route to be less appealing due to a range of factors such as time restraints or having already tried at least one alternative option. This indicates that drivers quickly form outcome expectancies regarding the possible decisions. It is therefore recommended that messages encourage consideration of alternative options to driving through floodwaters as well as a realistic consideration of possible outcomes attributed to each decision. This may include familiarisation with all possible routes home or to work or familiarisation with technology such as mobile applications that are able to facilitate alternate route options. It may also include preparation for the worst possible outcome such as situations where one may find themselves not able to proceed to their destination (e.g., storing water and food in the car during seasons where severe weather events are common).

It has been acknowledged that drivers were aware of the risks associated with driving through floodwaters yet proceeded to drive through. In many of the instances, this behaviour was planned, deliberate, and the result of a careful decision-making process. However, it was also observed that in the moment more spontaneous decisions transpired. Strack and Deutsch (2004) in their reflective impulsive model posit that in usual circumstances behaviour is driven by deliberate conscious processes (reflective route) but in circumstances where cognitive resources are stretched, like in a flooding situation, behaviour is often executed by more impulsive non-conscious processes. Given that both deliberative and automatic decision

making processes emerged we recommend that cues to action be made readily available in the environments in which this behaviour occurs in order to trigger enactment of plans (Michie, Atkins, & West, 2014). For example, cues could take the form of a reminder on a digital screen in the car, a small sticker people can place near the four-wheel drive activation button in their vehicle, or signs reinforced with barricading during flood events be placed in sections of roads prone to flooding. In addition, many regions now utilise emergency notification services which can provide messages to cellular mobile phones to warn of impending risks. This existing infrastructure could be used to deliver a cue to action in the form of a message, which can remind drivers to enact their plans. Prior research in the United States has found that drivers make judgements on whether to drive through floodwaters based on visual cues in the environment such as depth indicator signs (Balke, 2011; Higgins, Balke, & Chrysler, 2012). Thus, we anticipate that leveraging cues to encourage drivers to enact plans will be a useful intervention strategy in reducing the prevalence of driving through roads covered in water.

3.3 Social and Environmental Context

3.3.1 Social influences: pressure, encouragement, and sense of security. Another theme that emerged from drivers' descriptions was that there was a pressure placed on them from others, and in particular other motorists, to drive through the water. One driver explained, "I don't think there was ever an option where I wasn't going to do it because I couldn't turn around, or to stop I would have to stop all the traffic" - *P11*. It was also described that some drivers experienced pressure (sometimes including horn beeping) from vehicles behind which evoked unwanted pressure to keep moving and get through the water, "There was big bus on my tail and he [the driver] was just getting closer and closer and beeping and shaking his fist at me." - *P20*.

While many drivers reported pressure to drive through the floodwater, a number

reported experiencing a more positively framed 'encouragement' from significant others to drive through the floodwater. One driver explained, "He [father] was like, 'you know, you've done creek crossings before, you'll be fine, let's get you across quickly, we'll walk it through before the water rises any more' like, and he was just very much like, you know, 'You'll be fine, you can, you have to do it, this is how you're going to do it', like if it wasn't him there telling me what to do, I probably wouldn't have done it. Even if it was, you know, just another person like someone who was just there who I didn't know, I probably wouldn't have done it. So it was a lot of his encouragement I guess." - *P16*. Another driver described that following the incident they wished they were warned rather than encouraged, "Like I said I wasn't happy about it and I wish that they'd given me a call and said, 'Hey I don't know if you want to try it.' " - *P05*. It was also often described that the internal and environmental pressures were concurrently present in the situation, providing greater pressure to drive through the floodwater. One driver described, "So it was mainly the pressure from the people behind and the pressure to get there [arrive at their destination]." - *P20*.

A number of drivers also described the experience of a sense of security being felt due to the presence of other people who would have the potential to rescue them if something was to happen. One driver described that due to the presence of her father standing on the other side she felt comfortable that she could be rescued if the experience did not go as planned, "I felt more comfortable someone else being there if something went wrong, then you know, they'd call for someone to come help, or they could come in and help me." - *P16*. Another driver, who was travelling in a convoy of other families on a vacation, similarly described the presence of potential rescuers as a facilitator to drive through, "If anything would have happened then there's always someone to, you know, save us." - *P14*.

3.3.2 Other motorists driving through. A theme emerged in the descriptions of many drivers that their decision to drive through the floodwater was heavily influenced by

other motorists driving through the water before them. One driver stated, “Probably if I’d been the only person on the road I might have hesitated but I saw other people go through in similar cars and that was the catalyst for my decision to go through.” - *P01*. Based on driver accounts, it was clear that observing others’ success in driving through the floodwater was enough evidence for them to not weigh up the risks for themselves, “It’s not like I checked the depth. Whereas if he wasn’t there [another motorist who had driven through], I’d be looking at it and I think... I don’t know if I would’ve gone through it if he wasn’t there. It may have influenced my decision seeing... someone else go first. It certainly made it easier for me to go just go for it. He made it through, yes I can make it through.” - *P05*. It was also described that seeing others in front go through the water led to the appraisal that the behaviour was less risky than it otherwise would have been, “I’d just seen probably one or two cars make it through the water just before I went to go through. So that also added I guess to me thinking it wasn’t that risky.” - *P19*; and, “It’s a good indication of whether or not you are going to be able to get through if they [other motorists] go ahead in front of you and they get through in a car that is similar to what you are in, you are a bit more confident to take the risk.” - *P05*.

3.3.3 Perceived environmental conditions. Perceptions of the environmental context were also perceived as important in this context. The majority of drivers indicated that fast-flowing water should not be driven into and would likely prevent them making the decision to drive through. For example, one driver described, “The speed that the water is travelling at is always important. If the water is travelling really fast I would never go in, if the water is travelling at a slower pace then I’m more likely to consider it.” - *P04*; and, “So it’s tidal, and knowing that, that’s why I’m quite comfortable driving through it. Even when the level is quite high, because there is not a lot of flow, it’s quite calm conditions.” - *P09*. The depth of water was also perceived to be influential with some drivers reporting that they felt

comfortable driving through water up to a certain depth. One driver described, “For a four-wheel-drive, if its 200mm of water a four-wheel-drive can drive through that.” - *P19*. The type and length of crossing were also perceived to be important. One driver described that the risk was perceived as being lower due to there not being anywhere for the vehicle to be washed off the causeway, “So it's still flowing but it's wider and there's no drop-off anywhere. You know you're not going to run off the side of the road into a river.” - *P05*. Another driver described that the risk was perceived to be lower if the length of the crossing was not far and the other side was visible, “The creek was about a road length I would say...my theoretical calculation would say maybe 1.5m or less than that... So I thought the risk is only that much, you know.” - *P14*.

It was also often reported that drivers felt more confidence in their ability to perceive the depth and conditions and in their ability to make it through the water when it was a known location. One driver described, “You drive the road a lot and you obviously like knew that it was flooding and so you know, I just saw the water and then you're sort of like the house is just you know, literally 200m away which should be okay. And like, you know the road and all the rest of it and like ‘Oh yeah, it can't be that deep’. And it was deeper than I realised.” - *P17*. Further, it was often reported that drivers would not make the same decision to drive through had their kids been in the car at the time, or would have at least considered their need to drive through more carefully. Two drivers explained, “I don't believe I would have driven through if my child or any of our kids had been in the car” - *P01*; and, “Anytime my daughter is in the car and it's not just me. You know, if I take my own risk that's one thing and of course I'm not looking to die. But if my daughter is in the car I'll be a bit safer.” - *P12*. Some drivers, however, did have their kids with them at the time of their experience, and often expressed a sense of regret in the period following. One driver explains, “With kids in the car I felt very irresponsible. Not happy about it. So to the point where I told my work

partner and family and stuff. And it's sort of like, Jeez I won't tell too many people" - P05.

Another driver discussed their poor role modelling, "Now I reflect back and I think I haven't given my kids a good lesson. I just took the opinion that you know I had to make them happy [by arriving at destination], but it's not a good lesson for their life. Like you know it's a big risk." - P14.

3.3.4 Practical implications. Drivers described a range of social influences as influencing their decision to drive through the floodwater. This included the use of non-verbal persuasion from drivers behind through to behaviours such as horn beeping and tailgating, to other instances where positively-framed verbal encouragement was used. These present as normative social influences, which are defined as the influence of others leading a person to conform in order to be liked and accepted, resulting in compliance but not necessarily private acceptance of the behaviour (Nail, MacDonald, & Levy, 2000). This is further evident in the current study due to the regret described by drivers influenced in this way. The effect of these influences present as examples of conformity in order to maintain social approval. For example, not conforming to a gesture such as a horn being beeped, or encouragement from an authority figure (such as a father or other knowledge-empowered authority figure) is often perceived as leading to reduced social approval.

Messages should therefore focus on encouraging drivers to turn around and go the other way so as to remove themselves from the situation containing the normative social influence. This could involve providing information about steps drivers could take if it is not possible to turn their car around such as stopping and calling emergency or state rescue services for assistance. A goal of encouraging drivers to stop their vehicle in the face of pressure from others should be to encourage individuals to be the first in a line of cars to break the consensus and resist the normative social influences. This could be taught in learner driver education courses to instil a norm about this behaviour. Norm-based interventions may

be particularly useful in assisting drivers to resist any social pressure when faced with the decision to drive through floodwaters, and Van Der Linden (2013) found that the combination of providing descriptive norm information (information about what others would do) and also a persuasive message was effective in significantly reducing behavioural intentions. In applying this type of intervention to driving through floodwaters, the descriptive norm information could be that most people in fact do not drive through, and the persuasive message could be that breaking this consensus when presented with this social pressure to drive through the floodwater does not unnecessarily antagonise other drivers, but may actually prevent those drivers from being in the same situation of making a potentially life-threatening decision themselves.

A number of drivers also described their decision to drive through the floodwater was due to the presence of other individuals who they perceived would be useful in the provision of a rescue in the event of an incident occurring. The comfort derived from the presence of others relies on individuals' beliefs that these bystanders know how to swim, possess the necessary skills to conduct a swift-water rescue, and would be willing to put themselves at risk to provide assistance. These, however, are perhaps false beliefs held by the individual as the literature has shown that in emergency situations, bystanders often do not intervene to provide assistance (Fischer et al., 2011).

Messages should therefore encourage drivers to consider their moral obligations toward others and not exposing bystanders and emergency services personnel to unnecessary risks. Given that driving through floodwaters has the potential to place people other than just the driver at risk of harm, consideration of legislation and enforcement of specific offences related to the behaviour which carry financial penalties (fines) may be warranted. Implementation of fines or increases in the severity of fines have been demonstrated to provide a deterrent effect for other risky behaviours such as speeding (Meirambayeva et al.,

2014) and also decrease road incidents and fatalities (Brubacher et al., 2014). In Australia, no specific offences currently exist to penalise driving through floodwaters. Drivers can be fined if they ignore 'road closed' signs, and under negligent driving offences; however, these are rarely enforced and unlikely to exhibit a deterrent effect equal to public awareness of a specific offence. A legislative approach to reducing driving through floodwaters should therefore involve the implementation of specific driving offences attributed to this behaviour, public awareness campaigns regarding the associated penalties, and strict enforcement of regulations.

The majority of drivers reported that observing other motorists successfully driving through the flood water influenced their decision to drive through. A sense of competence and self-efficacy can be acquired through vicarious experience (Schwarzer, 2014). In crisis or disaster situations where options are often ambiguous and decisions need to be made quickly, it is also argued that people often look to see what other people are doing to manage the situation and then act accordingly (Aronson, Wilson, & Akert, 2010). Consider the scenario that it would be uncommon to follow a person who is jumping off a bridge, even in a crisis situation, as the risk is highly salient. This is often not the case when presented with the decision of whether or not to follow another driver through floodwaters given that depth of water and potential submerged or floating objects are difficult to observe. Hence, the use of interventions containing mental imagery tasks may be useful in making the non-visible risks associated with the conditions more salient. Interventions utilising mental imagery have been successful in reducing engagement in health-risk behaviours (Hagger, Lonsdale, & Chatzisarantis, 2011) and in increasing implicit positive attitudes toward health-promotion behaviours in prior research (Markland, Hall, Duncan, & Simatovic, 2015).

It also emerged in drivers' descriptions that a range of environmental conditions led to a perception of lower risk when driving through the floodwater. This included whether the

water was not flowing, the depth judgement, or whether it was a known location. Messages should therefore provide information that perceived water conditions are not reliable indicators of risk.

Consistent with the research regarding ethic of care, which refers to the culturally endorsed notion of a good parent whereby the child's wellbeing is placed above that of the parent (Hamilton & White, 2010; Lewis & Ridge, 2005; Miller & Brown, 2005), a number of drivers indicated that they would not drive through floodwaters with their child in the car. If they have done so, considerable regret was expressed. These descriptions of not driving through floodwaters so as not to place their child at risk highlights at least some level of understanding that the behaviour carries an inherent and substantial risk.

3.4 Self-efficacy Judgements

Given the common awareness of the risk posed by driving through floodwaters, the decision to take this risk was influenced by constructing a sense of self-efficacy in the lead-up to the incident. One driver exclaimed, "I'd be a dickhead to drive into it if I thought I wasn't going to make it, you know? Like, that's counterintuitive." - *P13*.

3.4.1 Skills and knowledge. Often described as a key component in deriving the efficacy to safely cross the floodwater were the skills and knowledge attained from past experience. One driver described, "It's common sense and experience, that's I guess what I was relying on, experience. From the age of like 10 onwards either driving on country or property roads in central Queensland, or being with family who were doing similar things." - *P12*. In addition, drivers often described the use of techniques for driving through floodwaters or for making an assessment of the conditions, which often came from trusted others, "Trying to keep the revs up. And the bow in the water as well, trying to minimise that. And then suddenly going through the water and applying more and more pressure, acceleration trying to push through it." - *P15*.

3.4.2 Perceived ability to assess and mitigate risk. It also emerged that in a deliberate attempt to construct self-efficacy, drivers often made an assessment of the risk based on the conditions (e.g., speed of current, depth of water, objects in water, degradation of road). Conditions were reported to be checked either by visual observation of objects in the water or by actually walking through the water. Water depth was commonly identified as a condition examined prior to driving through the floodwater. Diverse methods of depth perception were reported, with one driver describing making the assessment based on a car stranded in the water, “Look, there was the ute that was sort of stuck in the road. And I was looking at where he was at and I was thinking it was probably three-quarters my tyres...That's what I was using to gauge the ability to go through.” - *P02*. Getting out of the car and walking through the water also emerged as a common method of assessing the conditions. For example, one driver described, “But I really did assess it, I spent a good 20 minutes or so walking in this water, across this hundred odd stretch of deep water, and it was pooling but it wasn't flowing fast and there was no debris in it yet.” - *P12*. Following the experiences, however, a majority of drivers reported that they had misjudged either the depth of water and/or the conditions. For example, “It was very still water, and I just, it just dove deeper than I thought it was... and it was too late before, you know, before I'd realised. I was lucky enough to put the window down as soon as the car started, that I felt the car float, I pressed the down button on the electric windows, and that's how I had to get out of the car.” - *P13*.

In the lead-up to driving through the floodwater, a number of drivers also described behaviours executed in a deliberate attempt to mitigate the risk associated with the endeavour. One behaviour, as discussed in the previous paragraph, was walking through to assess the conditions in the actual water. Second, another driver described conducting an internet search to inform their decision-making, “I did go onto the website, did some research on, you know, what could be the danger and the things, so yes I did read through it but we

took up the challenge.” - *P14*. The driver described their decision as a “calculated risk” based on this information. Finally, another driver described that given the potential for the car to become inundated with water, she made all attempts that wake her daughter (who was asleep at the time) prior to entering the floodwater, “I did wake my daughter up to make sure that if anything bad happened we got out.” - *P12*.

3.4.3 Vehicle efficacy beliefs. Many drivers also perceived their vehicle to be capable of driving through the floodwater. The following driver, whose car was lost while driving through a flooded waterway, describes the self-efficacy that was constructed due to the perceived capability of his vehicle despite reported lack of relevant experience, “I’ve never encountered driving through water four-wheel-driving, but you’ve got a four-wheel-drive you think that that’s what you can do.” - *P02*. Another driver described that the assessed depth of the water entered was within the vehicle manufacturer’s approved wading depth (the maximum driving depth of water approved by the manufacturer for the specific vehicle); however, the problem arose when the water was deeper than anticipated, “Still would have been a depth that I would have been able to drive through based on the wading depth of that particular vehicle. The vehicle has a wading depth that’s approved at a certain point, but that doesn’t mean you should be driving through the water.” - *P13*. Vehicle characteristics other than driving a four-wheel-drive vehicle were also described as influencing decisions to drive through the floodwater, “I thought, well I’m in a diesel, I should be alright because that was always part of living in the country, you get a diesel car for floods.” - *P04*.

3.4.4 Practical implications. It emerged that through a range of sources, drivers made self-efficacy judgements of their capability to successfully drive through the floodwater. A number of drivers reported feeling confident, skilled, and sufficiently knowledgeable about their ability to drive through the floodwater due to influences such as past experience (previous experiences did not have adverse consequences), the perceived

ability to assess and mitigate risk, and also self-efficacy derived from one's vehicle.

Perceived self-efficacy, which refers to the extent to which one believes in their ability to achieve a particular goal (Bandura, 1997) has, in contexts such as health behaviour change (Hamilton, Bonham, Bishara, Kroon, & Schwarzer, 2017; Hamilton, Warner, & Schwarzer, 2017; Zhou, Gan, Hamilton, & Schwarzer, 2017; Zhou, Sun, Knoll, Hamilton, & Schwarzer, 2015), been associated with adaptive behaviours and more positive outcomes. In the context of driving through floodwater, however, these self-efficacy judgements may be maladaptive. This is because the unobserved risks make an accurate appraisal of efficacy difficult to obtain, and thus may lead to lower perceptions of susceptibility and likelihood of an adverse outcome occurring, which is suggested in the health belief model to be an important determinant of behaviour (Janz & Becker, 1984; Rosenstock, 1974). Given this limited utility, messages should provide information to drivers that risk and depth are often misjudged, even when the driver has experience in similar situations. Interventions should also utilise behaviour change techniques that are effective in increasing perceived susceptibility.

A majority of drivers also indicated strong efficacy beliefs derived from the perceived capability of their vehicle, factors such as size and type of the vehicle (e.g., four-wheel-drive, diesel vehicle). None of the drivers who perceived their vehicle as capable of driving through floodwaters indicated an awareness that 600mm of water is enough to make most four-wheel-drive vehicles float. This is particularly alarming because recent Australian research has found that even low levels of water and slow flow speeds can make large vehicles such as four-wheel-drives unstable (Smith et al., 2017). This suggests that dissemination of information about floodwater levels and its impact on all types of vehicles may be important. Further, a number of vehicle manufacturers advertise that certain vehicles have an approved wading depth of up to 700mm, and also run television commercials depicting a glorified

representation of their vehicles driving through water. Despite any guarantees that a vehicle will continue to operate mechanically in water of this depth, the inherent risk of doing so is well established (World Health Organization, 2014) and raises concern regarding advertising of this nature. Due to the health and social consequences of behaviours such as tobacco smoking and alcohol consumption, advertising restrictions have been implemented in many jurisdictions such as the Tobacco Plain Packaging Act 2011 (Cth). It is therefore recommended that experts concerned with promoting safe driver behaviour during times of flood advocate for the development of a code of conduct regarding this advertising that relates to vehicles having the capacity to deliberately drive through floodwater.

3.5 Strengths, Limitations, and Future Directions

While prior research has identified beliefs predicting willingness to drive through floodwaters using hypothetical scenarios (Hamilton et al., 2016; Pearson & Hamilton, 2014), the current study draws upon the lived experiences of individuals who had intentionally driven through floodwaters to gain a richer understanding of the reasons for and influences on this risky driving behaviour based on their subjective realities. The study therefore fills two key gaps in the scientific literature. First, it cannot be assumed that the beliefs predicting willingness to drive through floodwaters in situations that have not necessarily been experienced will be synonymous with actual influences on behaviour in a real scenario. A key strength of the lived experience approach is that it can provide insight into decision-making processes that took place in a real scenario. Second, while there are similarities in the overarching themes with the key influences reported in prior research (Hamilton et al., 2016; Pearson & Hamilton, 2014), the current study identified unique manifestations through which these influences operate in real scenarios. Through inductive analyses of interviews in which drivers provided rich in-depth descriptions of their lived experience, the current study was able to isolate a range of commonly occurring themes which will be instrumental in planning

future research and interventions aimed at reducing the number of fatal and non-fatal incidences as a result of engaging in this risky driving behaviour.

The results of the study should be considered in light of some limitations. While the lived experience approach is well suited to understanding this behaviour, it relies on participants accurately recalling their experience and the thought processes at the time of their experience. Individual differences in recall is unknown to the researcher and therefore difficult to consider in the analysis. Further, and limiting generalisability of current findings, a high proportion of drivers in the sample drove four-wheel-drive vehicles and participants were recruited from two Australian states, although these two states represent the highest drownings in Australia.

In moving this research forward, and based on current findings and those of another study that evaluated a mass media campaign aimed at promoting safe driver behaviour during floods which found no sustained effect on males' beliefs regarding the behaviour (Hamilton, Peden, Keech, & Hagger, 2018), it is recommended that sociodemographic and environmental factors are taken into consideration when designing messages to change peoples' beliefs and behaviour regarding driving through floodwater. Working toward an understanding of automatic cognitions both when exposed to prevention campaigns and when floodwater is encountered on the road in future research may also help to inform prevention efforts in future. Finally, the current study identified a range of factors that led to low perceptions of risk and high perceptions of self-efficacy regarding driving through the floodwater. Some of the drivers in the current study described a difficulty accepting blanket campaigns such as "If it's flooded, forget it" (Queensland Floods Commission of Enquiry, 2012) as they know that the actual risk when driving through floodwater is variable. However, while not all floodwater is equally dangerous, an accurate risk appraisal is not able to be made through a visual inspection, which was commonly described by the drivers. It

may therefore be useful to make this more salient to drivers by using messages that draw attention to the uncertainty regarding what is under the water and how even shallow water can pose risks.

4 Conclusions

In summary, it was identified that the overarching influences on driver decision making were successful past experiences, individual deliberative motivational and impulsive influences, social and environmental context, and judgements of self-efficacy. The findings provide important considerations for the development of future public health messages and behavioural interventions aimed at promoting safe driving behaviour during times of flood. This includes a careful consideration of sociodemographic and environmental factors when designing messages and also designing messages to make people aware that while the risk associated with a particular body of water over the road is variable, the ability to judge risk and understand what is under the water is consistently unreliable. Current findings also highlight the need to advocate for legislation to create a penalty for deliberately driving into floodwater, and to advocate for a code of conduct for advertising vehicles as being capable of driving through floodwater. The findings can also be used to develop public education materials and prevention programs aimed at road users.

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References

- Arizona State Legislature 28-910. *Statute 28-910: Liability for emergency responses in flood areas*. Retrieved from <https://www.azleg.gov/ars/28/00910.htm>.
- Aronson, E., Wilson, T. D., & Akert, R. M. (2010). *Social Psychology* (7th ed.). Saddle River, NJ: Pearson.
- Australian Water Safety Council. (2012). *Australian Water Safety Strategy 2012-2015*. Sydney, Australia: Australian Water Safety Council.
- Australian Water Safety Council. (2016). *Australian Water Safety Strategy 2016-2020*. Sydney, Australia: Australian Water Safety Council.
- Balke, K., Higgins, L., Chrysler, S., Pesti, G., Chaudhary, N., & Brydia, R. (2011). *Signing strategies for low-water and flood-prone highway crossings*. (No. FHWA/TX-12/0-6262-1). Retrieved from <http://tti.tamu.edu/documents/0-6262-1.pdf>.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: Freeman.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101. doi: 10.1191/1478088706qp063oa
- Braun, V., & Clarke, V. (2013). *Successful qualitative research: A practical guide for beginners*. London, UK: Sage.
- Brubacher, J. R., Chan, H., Brasher, P., Erdelyi, S., Desapriya, E., Asbridge, M., . . . Pike, I. (2014). Reduction in fatalities, ambulance calls, and hospital admissions for road trauma after implementation of new traffic laws. *American Journal of Public Health*, 104(10), e89-e97. doi: 10.2105/AJPH.2014.302068
- Drobot, S. D., Benight, C., & Gruntfest, E. (2007). Risk factors for driving into flooded roads. *Environmental Hazards*, 7(3), 227-234. doi: 10.1016/j.envhaz.2007.07.003

Drobot, S. D., Gruntfest, E., Barnes, L., Benight, C., Schultz, D., & Demuth, J. (2007).

Driving under the influence of weather: perceptions of flash floods and vehicle safety.

Paper presented at the 16th Conference on Applied Climatology.

Fischer, P., Krueger, J. I., Greitemeyer, T., Vogrincic, C., Kastenmüller, A., Frey, D., . . .

Kainbacher, M. (2011). The bystander-effect: a meta-analytic review on bystander intervention in dangerous and non-dangerous emergencies. *Psychological Bulletin*, 137(4), 517. doi: 10.1037/a0023304

FitzGerald, G., Du, W., Jamal, A., Clark, M., & Hou, X. Y. (2010). Flood fatalities in contemporary Australia (1997–2008). *Emergency Medicine Australasia*, 22(2), 180-186. doi: 10.1111/j.1742-6723.2010.01284.x

Franklin, R. C., King, J. C., Aitken, P. J., & Leggat, P. A. (2014). “Washed away”—assessing community perceptions of flooding and prevention strategies: a North Queensland example. *Natural Hazards*, 73(3), 1977-1998. doi: 10.1007/s11069-014-1180-x

Gergen, K. J. (1985). The social constructionist movement in modern psychology. *American Psychologist*, 40(3), 266-275. doi: 10.1037/0003-066X.40.3.266

Gergen, K. J. (1999). *An invitation to social construction*. London, UK: Sage.

Gissing, A., Haynes, K., Coates, L., & Keys, C. (2016). Motorist behaviour during the 2015 Shoalhaven floods. *The Australian Journal of Emergency Management*, 31(2), 25.

Grantham Floods Commission of Inquiry. (2015). *Grantham floods commission of inquiry: report*. Brisbane, Australia: Retrieved from

<http://granthaminquiry.qld.gov.au/assets/grantham-floods-report-october-2015.pdf>.

Hagger, M. S., Lonsdale, A., & Chatzisarantis, N. L. D. (2011). Effectiveness of a brief intervention using mental simulations in reducing alcohol consumption in corporate

employees. *Psychology, Health and Medicine*, 16(4), 375-392. doi:

10.1080/13548506.2011.554568

Hamilton, K., Bonham, M., Bishara, J., Kroon, J., & Schwarzer, R. (2017). Translating dental flossing intentions into behavior: A longitudinal investigation of the mediating effect of planning and self-efficacy on young adults. *International Journal of Behavioral Medicine*, 24(3), 420-427. doi: 10.1007/s12529-016-9605-4

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: Traffic Psychology and Behaviour*, 53, 50-60. doi: 10.1016/j.trf.2017.12.012

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*, 89, 308-314. doi: 10.1016/j.ssci.2016.07.004

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. doi: 10.1016/j.ijdrr.2017.12.013

Hamilton, K., & Schmidt, H. (2013). Critical beliefs underlying young Australian males' intentions to engage in drinking and swimming. *Sage Open*, 3(4), 1-7. doi: 10.1177/2158244013508959

Hamilton, K., & Schmidt, H. (2014). 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. doi: 10.1007/s10900-013-9751-4

- Hamilton, K., Warner, L. M., & Schwarzer, R. (2017). The role of self-efficacy and friend support on adolescent vigorous physical activity. *Health Education and Behavior, 44*(1), 175-181. doi: 10.1177/1090198116648266
- Hamilton, K., & White, K. M. (2010). Understanding parental physical activity: Meanings, habits, and social role influence. *Psychology of Sport and Exercise, 11*(4), 275-285. doi: 10.1016/j.psychsport.2010.02.006
- Hamilton, K., White, K. M., Wihardjo, K., & Hyde, M. K. (2015). Targets to promote swimming between the flags among Australian beachgoers. *Health Promotion International, 1*-7. doi: 10.1093/heapro/dav079
- Higgins, L., Balke, K., & Chrysler, S. T. (2012). Driver responses to signing treatments for flooded roads. *Transportation Research Record, 2321*, 98-107. doi: 10.3141/2321-13
- Høye, A. (2014). Speed cameras, section control, and kangaroo jumps—a meta-analysis. *Accident Analysis and Prevention, 73*, 200-208. doi: 10.1016/j.aap.2014.09.001
- Janz, N. K., & Becker, M. H. (1984). The health belief model: A decade later. *Health Education Quarterly, 11*(1), 1-47. doi: 10.1177/109019818401100101
- Keech, J. J., Smith, S. R., Peden, A. E., Hagger, M. S., & Hamilton, K. (2018). The lived experience of rescuing people who have driven into floodwater: Understanding challenges and identifying areas for providing support. *Health Promotion Journal of Australia*. doi: 10.1002/hpja.181
- Lewis, B., & Ridge, D. (2005). Mothers reframing physical activity: family oriented politicism, transgression and contested expertise in Australia. *Social Science and Medicine, 60*(10), 2295-2306. doi: 10.1016/j.socscimed.2004.10.011
- Markland, D., Hall, C. R., Duncan, L. R., & Simatovic, J. (2015). The effects of an imagery intervention on implicit and explicit exercise attitudes. *Psychology of Sport and Exercise, 17*, 24-31. doi: 10.1016/j.psychsport.2014.11.007

Meirambayeva, A., Vingilis, E., Zou, G., Elzohairy, Y., McLeod, A. I., & Xiao, J. (2014).

Evaluation of deterrent impact of Ontario's street racing and stunt driving law on extreme speeding convictions. *Traffic Injury Prevention*, 15(8), 786-793. doi:

10.1080/15389588.2014.890721

Michie, S., Atkins, L., & West, R. (2014). *The Behaviour Change Wheel: A Guide to Designing Interventions*. UK: Silverback Publishing.

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 Behavior and Policy Review*, 1(2), 143-149. doi: 10.14485/HBPR.1.2.6

Miles, M., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Thousand Oaks, California: Sage Production.

Miller, Y. D., & Brown, W. J. (2005). Determinants of active leisure for women with young children—an “ethic of care” prevails. *Leisure Sciences*, 27(5), 405-420. doi: 10.1080/01490400500227308

Nail, P. R., MacDonald, G., & Levy, D. A. (2000). Proposal of a four-dimensional model of social response. *Psychological Bulletin*, 126(3), 454-470. doi: 10.1037//0033-2909.126.3.454

National Oceanic and Atmospheric Administration (NOAA). (2011). Turn Around Don't Drown. from <http://www.nws.noaa.gov/os/water/tadd/>

Nelson, E., Atchley, P., & Little, T. D. (2009). The effects of perception of risk and importance of answering and initiating a cellular phone call while driving. *Accident Analysis and Prevention*, 41(3), 438-444. doi: 10.1016/j.aap.2009.01.006

Pearson, M., & Hamilton, K. (2014). Investigating driver willingness to drive through flooded waterways. *Accident Analysis and Prevention*, 72, 382-390. doi: 10.1016/j.aap.2014.07.018

Peden, A. E., Franklin, R. C., Leggat, P., & Aitken, P. (2017). Causal pathways of flood related river drowning deaths in Australia. *PLOS Currents Disasters*. doi:

10.1371/currents.dis.001072490b201118f0f689c0fbe7d437

Queensland Floods Commission of Inquiry. (2012). Queensland floods commission of inquiry: final report. Retrieved Apr 25, 2018, from http://www.floodcommission.qld.gov.au/__data/assets/pdf_file/0007/11698/QFCI-Final-Report-March-2012.pdf

Reid, K., Flowers, P., & Larkin, M. (2005). Exploring lived experience. *The Psychologist*, 18(1), 20-23.

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.

Rosenstock, I. M. (1974). Historical origins of the health belief model. *Health Education Monographs*, 2(4), 328-335. doi: 10.1177/109019817400200403

Schwarzer, R. (2014). *Self-efficacy: Thought control of action*. New York, NY: Routledge.

Smith, G., Modra, B., & Felder, S. (2017). *Experimental testing of flood hazard curves for a partially submerged vehicle*. Paper presented at the 13th Hydraulics in Water Engineering Conference, Sydney, Australia.

Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review*, 8(3), 220-247. doi: 10.1207/s15327957pspr0803_1

Strauss, A. (1987). *Qualitative analysis for social scientists*. Cambridge, UK: Cambridge University Press.

Taylor, F., Archer, F., Bird, D. & Paton, D. (2016). *Lessons from the floodsafe program: why people do and do not prepare for floods*. Paper presented at the Floodplain

Management Australia National Conference, Nowra, Australia.

<http://www.floodplainconference.com/papers2016/Frances%20Taylor%20Full%20paper.pdf>

Tobacco Plain Packaging Act 2011 (Cth) (Austl.). Australia: Retrieved from

http://www.austlii.edu.au/au/legis/cth/num_act/tppa2011180/.

Tracy, S. J. (2010). Qualitative quality: Eight “big-tent” criteria for excellent qualitative research. *Qualitative inquiry*, 16(10), 837-851. doi: 10.1177/1077800410383121

Van Der Linden, S. (2015). Exploring beliefs about bottled water and intentions to reduce consumption: The dual-effect of social norm activation and persuasive information.

Environment and Behavior, 47(5), 526-550. doi: 10.1177/0013916513515239

White, M. J., Cunningham, L. C., & Titchener, K. (2011). Young drivers’ optimism bias for accident risk and driving skill: Accountability and insight experience manipulations.

Accident Analysis and Prevention, 43(4), 1309-1315. doi: 10.1016/j.aap.2011.01.013

Wilson, C., Willis, C., Hendrikz, J. K., Le Brocque, R., & Bellamy, N. (2010). Speed

cameras for the prevention of road traffic injuries and deaths. *Cochrane Database of Systematic Reviews*(11). doi: 10.1002/14651858.CD004607.pub4

World Health Organization. (2014). Global report on drowning: Preventing a leading killer. from

http://www.who.int/violence_injury_prevention/publications/drowning_global_report/Final_report_full_web.pdf

Yale, J. D., Cole, T. B., Garrison, H. G., Runyan, C. W., & Ruback, J. K. R. (2003). Motor vehicle-related drowning deaths associated with inland flooding after Hurricane

Floyd: A field investigation. *Traffic Injury Prevention*, 4(4), 279-284. doi:

10.1080/714040485

- Zaalberg, R., Midden, C., Meijnders, A., & McCalley, T. (2009). Prevention, adaptation, and threat denial: Flooding experiences in the Netherlands. *Risk Analysis*, 29(12), 1759-1778. doi: 10.1111/j.1539-6924.2009.01316.x
- Zhou, G., Gan, Y., Hamilton, K., & Schwarzer, R. (2017). The role of social support and self-efficacy for planning fruit and vegetable intake. *Journal of Nutrition Education and Behavior*, 49(2), 100-106. e101. doi: 10.1016/j.jneb.2016.09.005
- Zhou, G., Sun, C., Knoll, N., Hamilton, K., & Schwarzer, R. (2015). Self-efficacy, planning and action control in an oral self-care intervention. *Health Education Research*, 30(4), 671-681. doi: 10.1093/her/cyv032

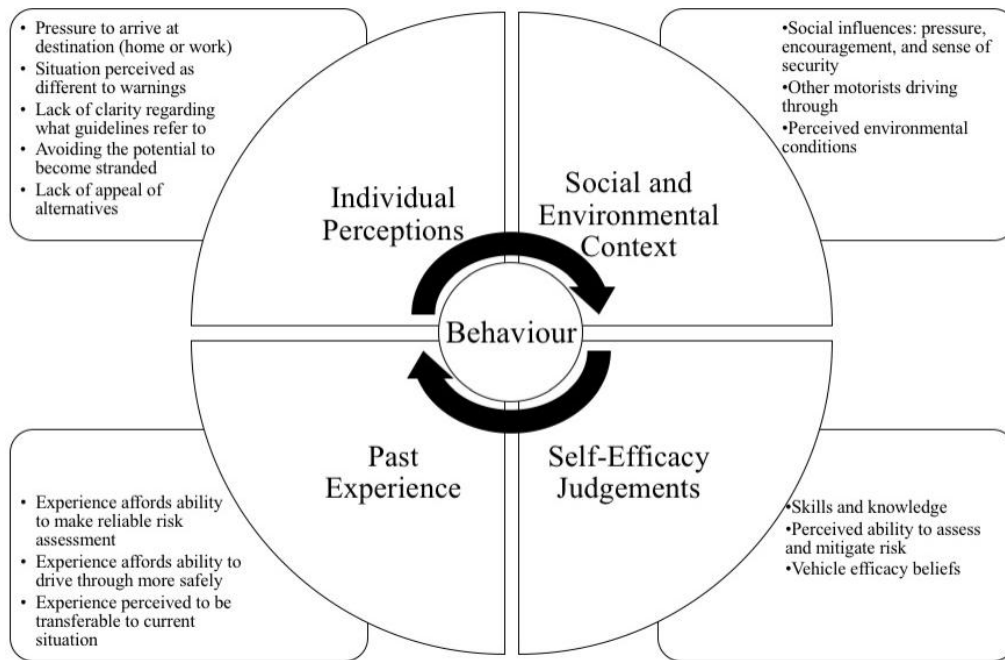


Figure 1. Thematic map of influences on decisions to drive through flooded waterways.