Establishing information seeking pathways in slow and flash floods

1. Abstract

The purpose of this paper is to investigate information seeking behaviour of people involved in slow and flash flood disasters, specifically how they received the first alert, where they then turned for more information, and what their main sources and forms were. An online and mailed survey based on models of problem-specific information seeking and risk information for natural hazards secured responses from Australians who had experienced flash flood (n=91) and slow flood (n=41). It found that information pathways taken by individuals are different for slow and flash floods, but the set of information forms and sources used are similar. 'Other people', television and news and weather websites were predominant sources and forms in flash flood, and online sources, television and radio predominant in slow flood. The importance of other people and mainstream media (including their online sites) in information behaviour means that mainstream media should remain an important component of information efforts by agencies. This study builds further evidence that disaster type and the media landscape should be taken into account when developing warning and response communication strategies, and allows public information officers to prioritise communication forms during response.

Highlights:

- Other people and environmental cues were the main alert sources and forms in flash flood.

- Slow flood information seekers tended to use formal sources and forms such as television, radio and news and weather websites.

- Mainstream media is still a major source of information and was the most predominant alert source for slow flood.

- The most important source/form for flash flood was television.

- Social media was not a significant source of information in the overall information environment.

Key words: flash flood, information-seeking, information behaviour, slow flood, communication, disaster.

2.   Background

The value of effective communication with the community during a disaster is well established as a central factor in successful disaster management. It has been attributed to saving lives and livelihoods [1-8], while communication done badly has contributed to failed response [9, 10] and even to deaths [11]. In Australia between 2003 and 2016, reviews of incidents and exercises, including the 2009 Black Saturday bushfires, found that between 19 and 21% of all recommendations for improvement related to communication with the community [12, 13]. While agency information delivery, particularly of warnings, has been well researched [14-18], receipt of this information by affected individuals and use of all information forms and sources during the response phase of disaster has been lightly studied. Exceptions include studies on tornado [19], earthquake [20, 21], wildfire [22-24], hurricane [25], terrorist attacks [26], storm [27, 28], flood [29], epidemic [30], crisis communication [31, 32], flood [33] and using scenarios [34-36]. A large number of broader studies have added to the field by including one or two information source or form questions that contribute to this picture [for instance, 8, 21, 37, 38-47]. Other studies have focused on one information form or cluster of forms (such as Twitter [48], social media generally [49], flood maps [50] or mass media [51]) or specific information such as health messages following a disaster impact [52].

How people find out about both slow and flash floods, their confirmation behaviour, and the forms and sources of information they subsequently use has

not been clearly illustrated. Human behaviour in flash floods, particularly, has not been well researched [53]. Knowledge of information-seeking is critical for agency public information officers to determine the most effective sources and forms for flood communication strategies. This study aims to document from the flood literature clear information seeking pathways for both types of flood from the point where people first become aware of the threat. It will contribute Australian research that builds on this picture of information seeking behaviour in slow and flash flood. In doing so, it will provide foundations for selection of sources and forms for agency flood communication in future. However, it will not consider the effect of information seeking on decision-making or evacuation, or the effect of message composition on behaviour.

3. The frameworks for this study

3.1 Foundation models

Understanding human behaviour and social systems during and after a disaster is stressed by Manoj and Hubenko-Baker [54] as critical in communication system design, and is therefore important to this study. The model of warning response presented by Mileti and colleagues [14, 17, 55-57] was one such attempt to understand human behaviour during disaster, and the protective action decision-making model (PADM) [58] was a second. The Mileti group's risk communication model for natural hazards attempted to generalise a task-oriented decision-making model based on information receipt, and the perceptions of individuals receiving the information. Lindell and Perry's PADM model, however, attempted to explain the decision-making that emerged as a consequence of information received during a disaster. It is the task-orientation of the Mileti group's model that makes it suitable for this study, as their risk information for natural hazards model was considered to have potential to explain behaviour that enabled decisions to be made, while the PADM model could be effectively used during the next step, which would be to explain decision-making arising from and resulting in, information behaviour in a disaster.

Mileti and O'Brien [14] described a behavioural process common when a disaster approaches or has occurred:

1.   Receiving an alert;

2.   Believing the alert is credible/confirming the threat;

3.   Personalising the threat;

4.   Determining whether protective action is needed;

5.   Determining whether protective action is feasible; and

6.   Deciding what action to take and taking action.

Firstly, a person receives a message about an imminent or occurring disaster from one or more environmental cues or from another person, a friend or acquaintance, or a someone via media. Secondly, people attempt to confirm, by a visual check, tuning in to mainstream media or talking to another person [14]. From this information, a meaning for what they have just heard or seen is processed, which then enables them determine the accuracy and salience of the information. Belief that the warning is serious is a significant obstacle to individuals taking action, particularly if the conditions are similar to other incidents in the past that had not developed into a disaster [59] or if the situation was outside their comprehension [60]. This is the third phase, personalisation of the process [14]. The fourth stage is deciding the disaster is relevant to them, what to do (fifth step) and to take that action (sixth). It is a looped process that can be repeated as new information is received that changes the personalisation perspective for the individual [14]. The sequence is not the same for everyone: some people may bypass one stage or more, and different people spend different amounts of time on each stage, as each stage can be affected by the characteristics of the individuals involved or the characteristics of the source or form [61]. Mileti and colleagues attempted to illustrate this using the following diagram (Figure 1).
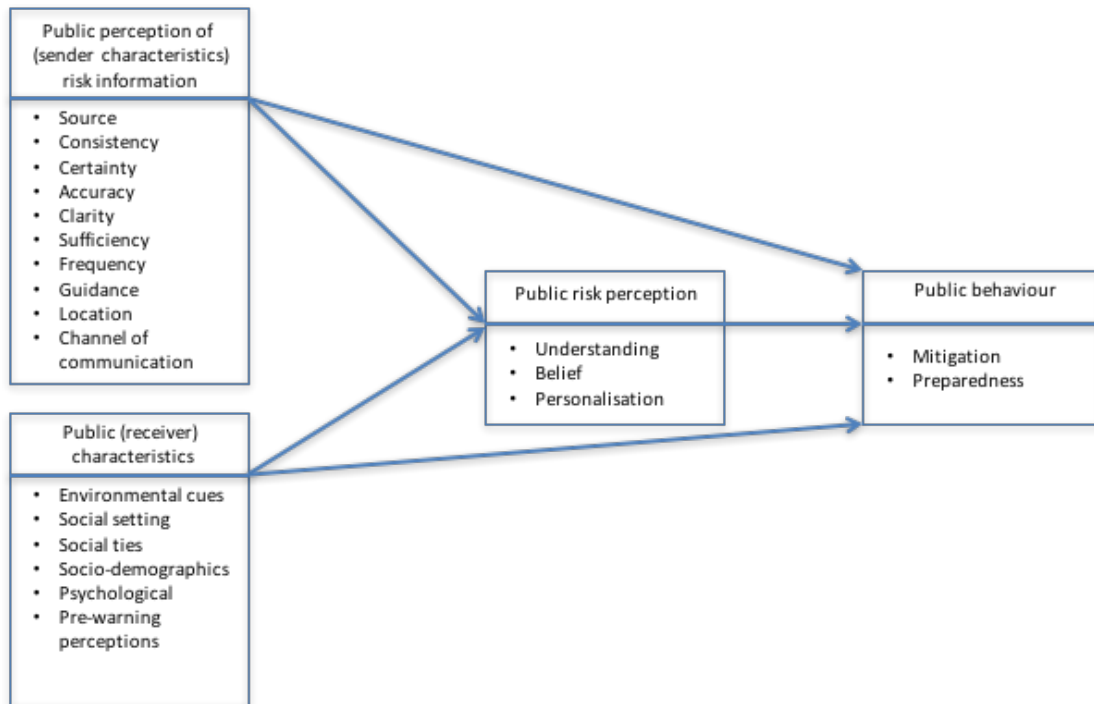
Figure 1 - A model for risk communication for natural hazards developed by Mileti, Sorensen and O'Brien [14, 17]

Within this framework, Mileti, Sorensen, Fitzpatrick and O'Brien [14, 17, 57, 61] proposed that once people have received notice of a disaster, they seek information to define the situation by confirming the contents of the message through another source, sometimes neighbours, friends, family or other media, including the internet [62-66].

The second model on which this study is based is problem-specific information-seeking proposed by Savolainen [67, 68]. This model considered information pathways as a sequence of sources and was one of the first attempts to describe information-seeking for a specific problem [69]. Savolainen incorporated into this model 'source preference criteria' and 'information source horizons' that incorporate three zones of importance – most important sources, secondary sources and marginal sources [68]. Savolainen classified sources into three groups – human sources, networked sources and others. These features are shown in Figure 2, along with a representation of the sequence of sources used. The process of information seeking in Savolainen's model included feedback loops that emphasised the most important sources and showed the information

seeker consistently returning to the first source of information and to reconsider the problem at hand.

Perceived information environment

Information source horizon

Most important sources
- Printed media
- Networked sources
- Others
(Zone 1)

Sources of secondary importance
- Printed media
- Networked sources
- Others
(Zone 2)

Sources of marginal importance
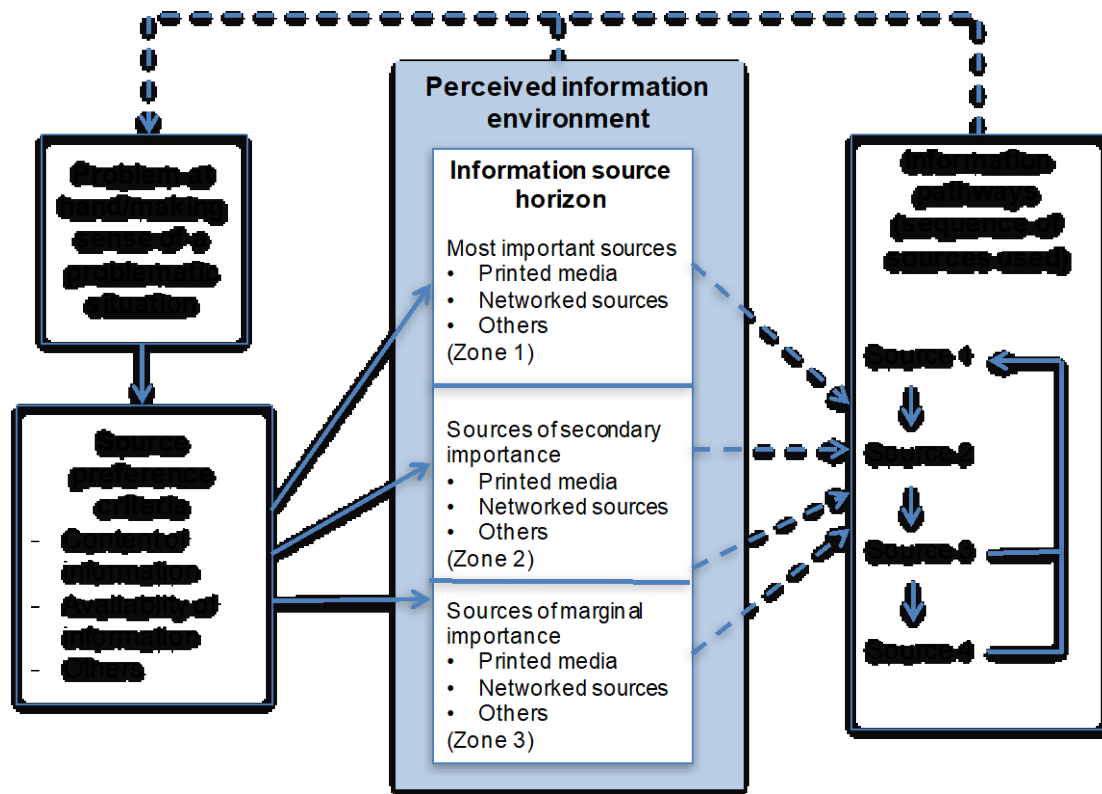- Printed media
- Networked sources
- Others
(Zone 3)

Figure 2 – Savolainen's information source horizon and information behaviour in the context of seeking problem-specific information [68]

Savolainen confirmed in subsequent interview research [68, 70] that the sequence of sources used will mostly progress through the zones, with a feedback loop sending the information-seeker back to already-used sources consistently through the process. The problem with Savolainen's classification of the importance of sources was that it made the source groups very general. With reference to the current study, information seeking in a flood, this puts at risk the usefulness of research as a decision-making tool for communicators. For instance, Savolainen's classification 'networked sources' could cover radio, television and internet, and it would not be evident to anyone but the researcher that the

preference in a particular case might be radio. For this reason sources will not be grouped as Savolainen outlined.

Savolainen's model also addressed source preference criteria. These were factors that might affect a person's selection of sources such as their background, existing knowledge, the type of media involved and access to this media, and demographic features [68]. While this data was collected, effects of source preference criteria will not be explored here as the focus of the study is to establish a range of possible information patterns undertaken in slow and flash flood.

3.2   Flood definitions

This study investigates information seeking behaviour in both slow and flash floods, so it is necessary to define each of these disaster types.   Using the National Weather Service of the USA definitions [71], a flash flood is "a flood which follows within a few hours (usually less than 6 hours) of heavy or excessive rainfall, dam or levee failure, or the sudden release of water impounded by an ice jam". A slow flood is defined as "The inundation of a normally dry area caused by high flow, or overflow of water in an established watercourse, such as a river, stream, or drainage ditch; or ponding of water at or near the point where the rain fell. This is a duration type event with a slower onset than flash flooding, normally greater than 6 hours".

4.   Literature review

The issue of communication is widely researched and discussed in relation to risk perception and preparedness for flood. Since a major review by Kellen, Terpstra and De Maeyer in 2013 [72], 320 articles have been published that respond to searches in Ebscohost for 'flood' and 'risk' and 'perceptions'. However, few of these explore activity by individuals once the risk is realized, a flood is imminent and people are alerted by way of official warning, news from others, or realisation

due to environmental factors that a flood is imminent. This section will review the literature on information behaviour triggered by a first alert. It will use components from the two models outlined in the previous section to order the literature review, starting with the alert. The two steps in Mileti at al's model that were overtly information behaviour were this 'first alert' (which leads to knowledge of Savolainen's 'problem at hand'), and 'confirmation' steps (which reflect the first two steps in Savolainen's information pathways, based on his 'sequence of sources' used). 'Most important sources' within the information horizons, and the full sequence of information seeking will be investigated using Savolainen's model.

4.1   The first alert

The first alert that the disaster is imminent or has arrived is important to consider because it is the trigger for established behavioural process [55, 56] and for behaviour described by Savolainen's model of information seeking. The first alert can not be confused with warnings, as warnings are linear communication systems in which an agency (the sender) identifies a hazard through validated detection and monitoring systems, and this news of this hazard is communicated to residents (the receivers) by that agency or another [15]. Warnings can be delivered more than once and by a variety of means. A first alert, however, is the means by which a person (the receiver) first becomes aware of a threat. subsequent information received about the threat can also be warnings, but these also form the information pathway that the person takes or encounters before making a protective action decision or starting a new information search.

4.1.1   Slow flood alert sources

Observation of environmental cues (such as constant/heavy rain, rising water) often provides the first alert in slow flood [73-75] followed by radio or community networks [73, 74] and television [74]. Also prevalent as an alert source are a formal/official warning from authorities [73, 75], although the form was not

specified in either of these studies. Another method of discovery reported by one study's respondents was becoming trapped at home by the flood [74]. In a study of flooding in Grafton, New South Wales in 2001, radio was the most prevalent evacuation warning source (63%) followed by other people (31%) and emergency agency staff undertaking a doorknock (25%) [76]. However, the question in this research was about evacuation warning sources specifically, and it is not clear whether the respondents already knew about the flood from some other alert source. Own observation was the most mentioned way to get initial information [38] in a flood in North Queensland. In another Australian study that set out to document source sequences in slow flood [33], the three most prevalent alert sources reflected other previous research for slow flood: other people, radio, and environmental cues.

4.1.2 Flash flood alert sources

Despite extensive literature to guide flood warning improvement from the disciplines of geography, sociology, psychology and hydro-meteorology, flood detection, prediction, message communication (that is, delivery by agencies) and protective action response are investigated [77], but not the source or form by which warnings are received in flash flood by individuals under threat. The literature also gives few clues on which non-official or formal information sources or forms are most likely to alert people to a flash flood.

In a hypothetical flash flood in Denver, Colorado and Austin, Texas [36], Denver respondents preferred a siren at each of the three times of day tested in the study, while Austin interviewees preferred sirens, local radio and local television [36]. In testing information sources for potential flash flooding in Boulder, Colorado, the most often mentioned alert sources were sirens (77%), television (85%), radio (58% and internet (54%) [78], although the Boulder study's question seemed to ask what range of alert sources were available to respondents, not which alert people thought they would receive.

One of few studies that recorded actual flash flood alert sources was from an Australian event in 2011 that used qualitative interviews with a small number of people [33], in which the alerts came mainly from other people and environmental cues, with local radio making up the small remainder. Work that reinforced the role of personal observation of environmental cues came from Puerto Rico, where most interview respondents found out that about the flood when water entered their properties [79]. One person heard a warning on radio. Televisions were on, but stations did not issue warnings. This identification of other people as a first alert source supports findings that other people are more likely to feature as a key source of information in disasters that were high impact or more urgent [80, p. 518, 81]. It reflects substantial numbers of general human information behaviour studies that show that people consistently choose other people as important or preferred sources of information [69, 82].

4.1.3   First alert summary and research question

It seems that alert forms and sources for slow flood are environmental cues, social and local networks including other people, and television. In some places, government weather forecast websites and information and radio are important. For flash flood, other people and environmental cues are the most prevalent alert sources, followed by radio. The small number of studies means these concepts require more testing. For this reason, the research question on alert forms and sources will be:

1. What is the first alert source or form of information for people experiencing slow and flash floods?

4.2   Confirmation source and form

Confirmation facilitates understanding, belief, personalisation and decision making that helps to fill an information void when rare or unexpected events are expected to occur [64]. "This void typically creates public demand for more information than is being disseminated in the warning message" [64, p. 74].

Confirmation often involves discussion with others and interpretation of information received via traditional media [25, 83], particularly when individuals feel there is a void in the information provided by official and media sources [25, 84]. Confirmation sources have been barely investigated in flood research, but have been researched in other disaster types such as bushfire, tornado and hurricane [see the body of work presented by the Australian Bushfire and Natural Hazards Co-operative Research Centre, 83, 85, 86] and confirmation behaviour was particularly evident during 9/11 [81, 87].

4.2.1 Slow flood confirmation sources

One of the earliest flood studies to test confirmation sources was by Perry and Lindell [88], who considered differences between ethnic groups in two cities. They found more than half of African-Americans in the city of Abilene confirmed a flood warning using their social networks, while whites' confirmation sources in Abilene and Mt Vernon were spread across mass media or their social network. Mexican Americans also used either of these two to confirm - mass media and social networks. While this is useful, the media landscape has changed significantly since 1991, and a gap in the research in the timing and purpose of information sources is evident. Ryan [33] discovered that the most prevalent confirmation sources in slow flood were checking the river levels, talking to other people about what flood heights might mean for their own property, and contacting people they knew in the agencies managing the response.

4.2.2 Flash flood confirmation sources

Confirmation sources for flash flood seem to have been investigated in only one Australian study [33] with the most prevalent forms and sources found to be other people, television, and the government weather website, the Bureau of Meteorology (the BoM).

4.2.3 Confirmation sources summary and research question

Social networks and environmental cues might be key information sources during the confirmation stage for both slow and flash floods, and television and weather websites are an additional confirmation source for flash flood. However, this stage of the information-seeking process is so little researched that no conclusions can be reached. The research question emerging from this section is:

2. What is the confirmation source for people in slow and flash floods?

4.3   The main source and/or form

Most important, most valuable or most helpful information sources are the best researched of all aspects of information seeking in disaster research, with a wide range of studies across many different types of disasters asking questions about this aspect of information seeking [such as 22, 27, 28, 40, 41, 47, 89-93].

4.3.1   Slow flood main sources and forms

Research into key information sources in slow flood comes mostly from Australia. In a slow flood, businesses in western Queensland in 2008 found that the most helpful sources or forms for updates on the progress of the flood were radio (24%), the Bureau of Meteorology (BoM - Australia's weather forecaster) website (19%), messages from the local council (19%), and face to face with State Emergency Service staff (16%) [94]. The BoM was "relied on" by 73% of surveyed local people leading up to the water's arrival in the Callide Creek flood in Queensland in 2015, followed by family, friends or neighbours (67%) [95]. ABC news (the government radio station) was the next most relied-upon source for this stage of the flood for 46% of the group. The local council and Local Disaster Management Group were a key source for 43% of the group. However, this reliance changed after the flood arrived – other people became more important (71%), while those who referred to the BoM dropped to 46%. Reliance on ABC news was relatively stable at 40% [95] and reliance on agencies dropped to 26%. Contact with other people was made by phone (46% after the alert and before the flood arriver, then 50% after the water arrived), Facebook (36% then 28%) and face to face (32% then 37%) [95].

In the 2012 Victorian floods, neighbours were by far the most used sources (40.5%) followed by emergency agencies, television and ABC local radio [74]. Main sources in a 2009 North Queensland flood were radio and television, neighbours or people in the community, friends and family, and the internet [45]. Other people were most important in St George, Queensland in 2011 [33], with 46% of the sample relying on this source during the flood, followed by news and weather websites - including the BoM website (23%), radio 15.4% and then agencies and environmental cues (7.7% each). In other floods in Queensland in 2011, people followed advice they received from radio, internet and television [96], but this study did not give details on which sources were used most and what other sources and forms were used. SMS and landline flood warning information messages were reported as useful in this study, but the extent of use was not quantified.

4.3.2   Flash flood main sources and forms

In flood, the Denver and Austin hypothetical study [36] shows local television was considered the most important source for residents to get weather information. Denver residents also believed radio and environmental cues would be very important leading up to and during a flood, while Austin residents were "more likely to favor the Weather Channel and NOAA Weather Radio" [36p. 213]. In an Australian flash flood [33], the main sources for most were television (42.9%), radio (14.3%) and then a wide spread of sources such as environmental cues, other people, police/agencies via Facebook, and internet sites.

4.4   *Main sources and forms summary and research question*

The key sources and forms for information during a slow flood seem to be mainly other people, along with environmental cues, weather websites, television and radio.   For flash flood this is television and radio, tending to more formal information than could be obtained in personal networks.

The research question used to investigate main sources and forms of information will be:

3. Which source of information becomes the most used in slow and flash floods?

4.5   Information pathways

Research that identifies and quantifies information seeking pathways, that is, the sequence of forms and sources used by people affected in some way by a disaster, is hard to find. Palen and Liu [97] were the first to identify communication pathways in a disaster, but used the term in a general way to explain use of specific sources. Their pathway typologies, rather than being specific in terms of first alert, confirmation source and then other sources, explained the information seeking process in terms of the groups of communicators involved. For example, they drew attention to three information pathways that were made possible or greatly enhanced by the use of information communication technology: firstly, communication within the public affected by the crisis; second, between members of the public who are affected by the crisis and those outside it; and third, between the official public information officer function and members of the public [97].

In floods specifically, one study could be found that detailed information seeking pathways from the first alert for both slow and flash flood [33]. In slow flood, the most predominant pathway was observing persistent heavy rain or the river rising, then referring to other people. The main source of information from that point was other people. In flash flood, the most used information pathway was hearing about the flash flood from other people and then referring to other people or television, with television emerging as the main source in the aftermath of the impact of the flood.

4.6   The role of other people

Other people were a recurring and important source at the alert and confirmation stages, and also in ongoing information seeking in the literature review. Friends, neighbours, family and community members were named as a primary source in each of the flood studies reviewed for this research [including 33, 38, 45, 73, 74]. The survey presented an opportunity to find out how people accessed information from other people, so a fourth question was added:

4. If other people are a significant source, what were the forms of media used to communicate with them?

5.   Methodology

The findings from the flood and other disaster information-seeking literature provided a list of sources/forms and other information that was used to develop a survey instrument that could be used to further explore information seeking behaviour. This was administered in 2012, online and by mail delivery, following 18 months of major flooding across eastern Australia, when a La Niña event caused Queensland's wettest December in 2010 and Victoria's wettest January in 2011 [96]. The subsequent Queensland floods affected 23 of the 75 local government areas in that state [98]. The Wollongong and southern tablelands area of New South Wales were also affected by floods in March that year [99]. In 2012, also before the survey was published and distributed, Victoria's north east was inundated, including slow and flash floods [74], and Queensland's southern interior [100] and northern NSW experienced flooding [101].

Questions were developed for the survey that reflected the components of the models of Savolainen and Mileti and colleagues: the problem at hand (disaster type), factors influencing source preference criteria, important sources and information pathways (alert, confirmation and most relied upon sources). The survey was divided into three sections. The first included demographic questions about country of residence, age, gender, partnership status, size of the household, number of dependents, level of education, household income, the

type of community they live in (urban, regional, rural). This section could be used to analyse source selection criteria [102] and Mileti's receiver characteristics at a later date.

The second section established the disaster context for each individual – whether the respondent had experienced a disaster in the past two years, what type it was and whether the respondent had been directed to evacuate from work or home during that incident.

The third section included information behaviour questions on how people first became aware of the disaster (one source/form nominated from 11 possibilities), where they then turned for more information (one source/form nominated), which information sources they relied on most (Likert scale rating of each of 11 possible sources/forms in terms of importance), and how they mostly communicated with other people if this was a source they relied on in the previous question (one source/form nominated). The Likert scale questions were rated from, 1-5, with 1 being 'not important' and 5 being 'most important'. The approach in the third section of the survey followed Mileti and colleagues' idea that an important part of an individual's disaster behaviour was receiving an alert, then confirming that alert through an information seeking process. The most relied-upon source was considered separately because of limitations of SPSS in tracking a sequence of more than two steps.

In each case, the closed-ended answer options were developed from the range of possibilities that emerged from the literature review. It is analysis of the third section about information seeking sources, forms and pathways that will answer the research questions asked in this study.

The resulting exploratory survey was developed online and the link published on the author's university's website. Details of the survey were publicised through Queensland media and via the Facebook account of the author. It opened on August 16, 2012 and closed on October 30, 2012. Online responses numbered 277. To ensure participation by lower income and older people and others less likely to be connected to the internet (and therefore to eliminate inherent bias of

the online survey toward internet-connected, younger and better educated respondents) the survey was also printed. The 1,800 copies of this printed survey were delivered directly to mailboxes in two Queensland suburbs that reflected the demographics of those harder to reach online, Gailes and Wilsonton (n=71). The online and mailed survey combined secured 348 respondents, with 101 identifying flash flood as the most recent disaster experienced, 42 experienced with a slow flood, and the remainder with either no experience, or experience in some other type of disaster. These non-flood responses were discarded. Five of the flood participants came from outside Australia, four with experience in flash flood and one in slow flood, so these were cleaned from the sub-samples. However, six of the flash flood respondents did not answer either or both of the alert and confirmation questions, bringing the number of respondents to 91.

The survey data was loaded on to SPSSv19, and descriptive tables used to track the first two steps of the source sequence. The most relied-upon sources for each flood type were analysed using charts that listed all 11 information sources/forms, and with each compared to the other forms and sources.

6. Results

The two flood samples will be the subject of analysis here, with their demographic features reported in Table 1. They featured a gender bias toward females and a skew toward better education people. However, as the purpose of this study was to establish a range of possible information seeking pathways rather than a definitive range, the data was considered workable.

		Flash flood % (n=91)	Slow flood % (n=41)
Age	Younger than 25	7.1	4.9
	25-39	23.5	29.3
	40-55	48.0	39.0
	56-70	16.3	22.0
	71+	5.1	4.9

Gender	Female	72.4	73.2
	Male	27.6	26.8
Partner status	Married or in a partnership	64.3	75.6
	Single or divorced	35.7	24.4
People in household	1	16.3	14.6
	2	34.7	48.8
	3-4	32.7	31.7
	5 or more	16.3	4.9
Dependents	None	55.7	59.0
	1-2	29.9	38.5
	3-4	13.4	2.6
	5 or more	1.0	0.0
Education levels	Primary school	8.2	4.9
	High/secondary school	19.4	19.5
	Vocational or trade college	16.3	4.9
	College/university	56.1	70.7
Household income	$0-$30,000	11.5	10.5
	$31,000 - $80,000	26.0	31.6
	$80,000 - $100,000	28.1	15.8
	More than $100,000	34.4	42.1
Type of community	City or suburb	50.0	63.4
	Regional town/semi-rural area	39.8	24.4
	Rural area	10.2	12.2

Table 1. Demographic features of flood-affected respondents to the survey

6.1   Slow flood

6.1.1   Alert and confirmation sources

The information patterns revealed by the slow flood participants showed that mainstream media was the primary alert form, with 12 of the 41 respondents (29.2%) alerted by television and 10 alerted by radio (24.4%). Other people directly and indirectly were also a prominent alert source for slow flood (n=8, 19.5%). From this point, the range of sources diverged. The most used confirmation sources were news and weather websites (24.3%), television (19.5%) and radio (12.2%), and agency websites (16.6%). While other people were an

important alert source, they did not seem to be a reliable confirmation source for participants (9.7%).

The range of source sequences for the first two steps in information seeking in a flood are more clearly illustrated in Table 2. The literature review had pointed to radio and social networks, and television as key alert sources, which was confirmed. However, other studies showed that environmental cues (seeing water levels, rain) were an important alert source, which was not reflected in the results presented here. Instead, radio was more important. Interestingly, 31.7% of the slow flood sub-sample identified pathways that would not provide pictures or footage, or had the potential not to (such as agency websites or agency social media).

First alert received from:	Confirmation source:	Numbers using this pathway:
Television (n = 12)	News/weather website/s	3
	Television	2
	Agency social media	2
	Agency website	1
	Newspaper	1
	Direct contact with family/friends/neighbours	1
	Agency message	1
Radio (n = 10)	Radio	4
	Television	2
	News/weather website/s	2
	Agency website	2
Other people directly (n = 7)	News/weather website/s	3
	Television	3
	Agency website	1
Agency contacts/staff (n = 5)	Personal contacts in emergency agencies or council	3
	Direct contact with family/friends/neighbours	2
Environmental cues (n = 3)	Radio	1

	Television	1
	Direct contact with family/friends/neighbours	1
News/weather website/s (n = 2)	News/weather website/s	1
	Agency website	1
Other people indirectly (n = 1)	News/weather website/s	1
Agency social media (n = 1)	Agency website	1
Agency phone or text message (n = 1)	Agency social media	1

Table 2. Information pathways enacted during a slow flood

6.1.2   Most important sources

The slow flood respondents were more committed to a larger range of most important sources than flash flood, with six nominated as most, very or of somewhat importance by more than 85% of slow flood experienced respondents. Figure 3 shows that television was important or most important for 82%, followed by agency websites and radio (74%), then news or weather websites (72%). Direct contact with others remained important (67%). Even newspapers was of some level of importance to more than 50% of the slow floor respondents. However, while a number of the most important sources recorded in the survey were consistent with the important sources reported in the literature review, environmental cues, which featured highly in the literature review, was hardly mentioned in the survey.
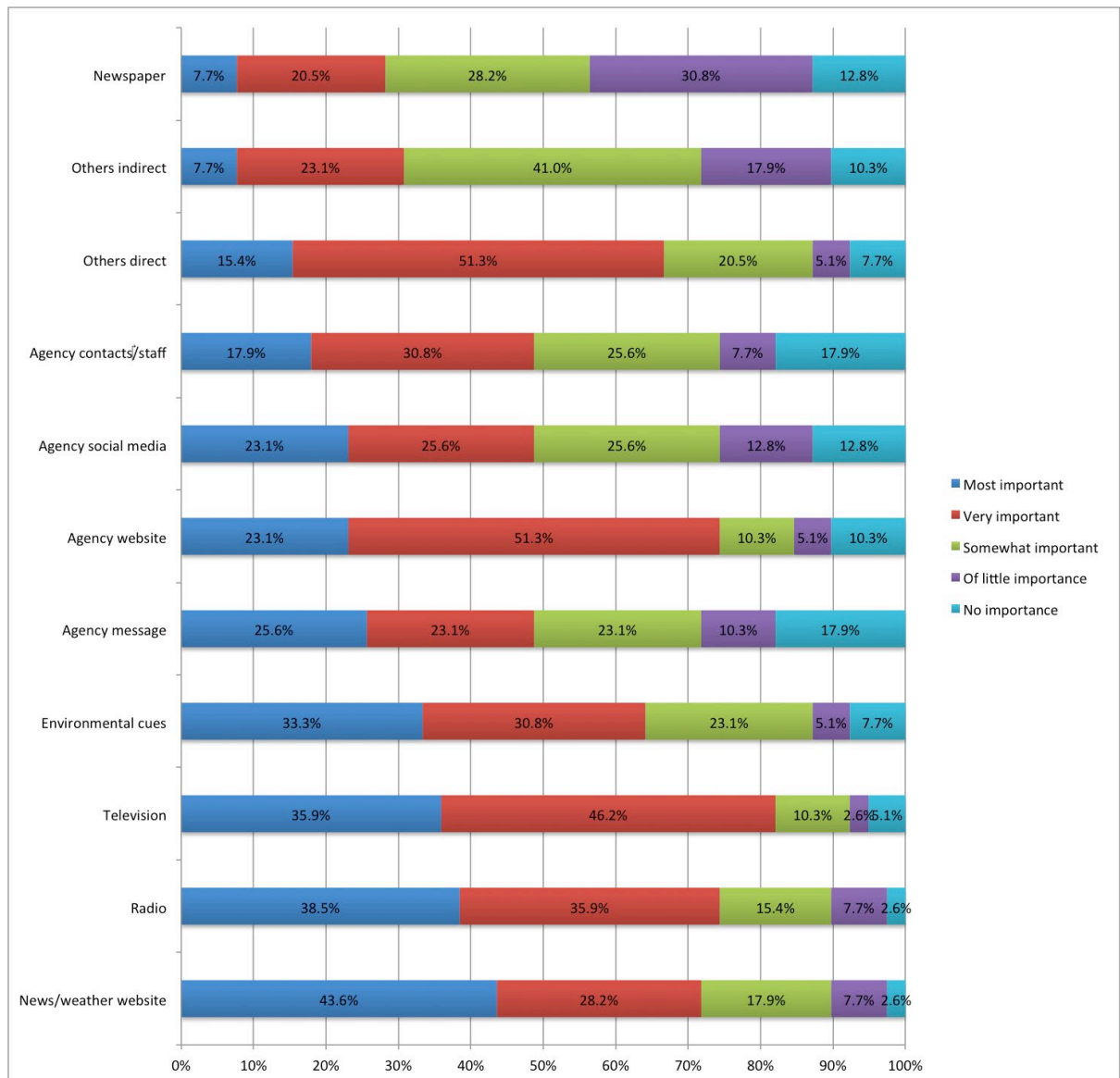
Figure 3.   Most important sources during a slow flood

6.2   *Flash flood*

Flash flood was the disaster type with the greatest number of responses (n=91) and therefore the largest number of information pathways.

6.2.1   Alert and confirmation sources

The alerts and confirmation sources for the flash flood-experienced survey respondents were more concentrated for flash flood, with 35 of the respondents learning of the disaster from friends, relatives or neighbours, by talking to them (direct contact) or corresponding by email, text or social media (indirect contact). This slightly differed from the literature review where radio played a larger role

than television. Whether they learned of the flash flood directly or indirectly from others, their confirmation sources were mostly news or weather websites, television or radio. News and weather websites were the most used confirmation source across all forms of alert (34.1% of respondents used this form). From here, confirmation sources tended to spread out: radio was used by 19.7% of flash flood respondents, television by 17.6%, and other people (directly and indirectly) by 14.3%. This mostly reflected the literature review for confirmation sources, although other people played a much larger role in the literature.

These are tabulated for clarity in Table 3. For almost every pathway, at least one form of information provided some visual platform. The exceptions were six respondents (6.5%) who were alerted by radio and then confirmed using radio or direct contact with other people. In the slow flood data, 31.7% of the sub-sample identified pathways that would not provide pictures or footage, or had the potential not to (such as agency websites or agency social media).

First alert received from:	Confirmation source:	Numbers using this pathway:
Other people directly (n = 24)	News or weather websites	8
	Television	7
	Radio	5
	Direct contact with family/friends/neighbours	2
	Agency social media	1
	Agency website	1
Environmental cues (n=20)	Radio	6
	News/ weather website/s	5
	Television	3
	Direct contact with friends/family/neighbours	3
	Environmental cues	1
	Personal contacts in an agency/council	1
	Agency website	1
Television (n=13)	News and weather website	5

	Radio	2
	Direct contact with family/friends/neighbours	2
	Television	1
	Indirect contact with family/friends/neighbours	1
	Agency social media	1
	Agency website	1
Other people indirectly (n = 11)	News/weather website/s	5
	Television	3
	Agency social media	1
	Agency website	1
	Direct contact with family/friends/neighbours	1
Radio (n = 11)	Radio	4
	News/weather website/s	3
	Television	2
	Direct contact with family/friends/neighbours	2
News/weather website/s (n = 5)	News/weather website/s	2
	Personal contacts within an agency or council	1
	Radio	1
	Direct contact with family/friends/neighbours	1
Agency contacts/staff (n =3)	News/weather website/s	2
	Newspaper	1
Agency social media (n = 2)	Agency or council website	2
Agency website (n = 1)	News/weather website/s	1
Newspaper (n = 1)	Indirect contact with friends/family/neighbours (eg email, social media)	1

Table 3.   Information pathways enacted during flash flood

6.3   *Most important sources*

The most important sources for people who were involved in a flash flood were television, others directly, news and weather websites, environmental cues and then radio – which reflected the sources that appeared as first alerts and

confirmation sources in the survey, but also as key sources in the literature review for flash flood. The most useful source was television for a full picture of the event. This was considered 'most' or 'very' important by 82.1% of the respondents. However, the range of important sources was wide, with six of the 11 possible sources or forms considered important or most important by more than 50% of respondents. All forms had some level of importance in flash flood. The importance of the full range of sources and forms is recorded in Figure 4.
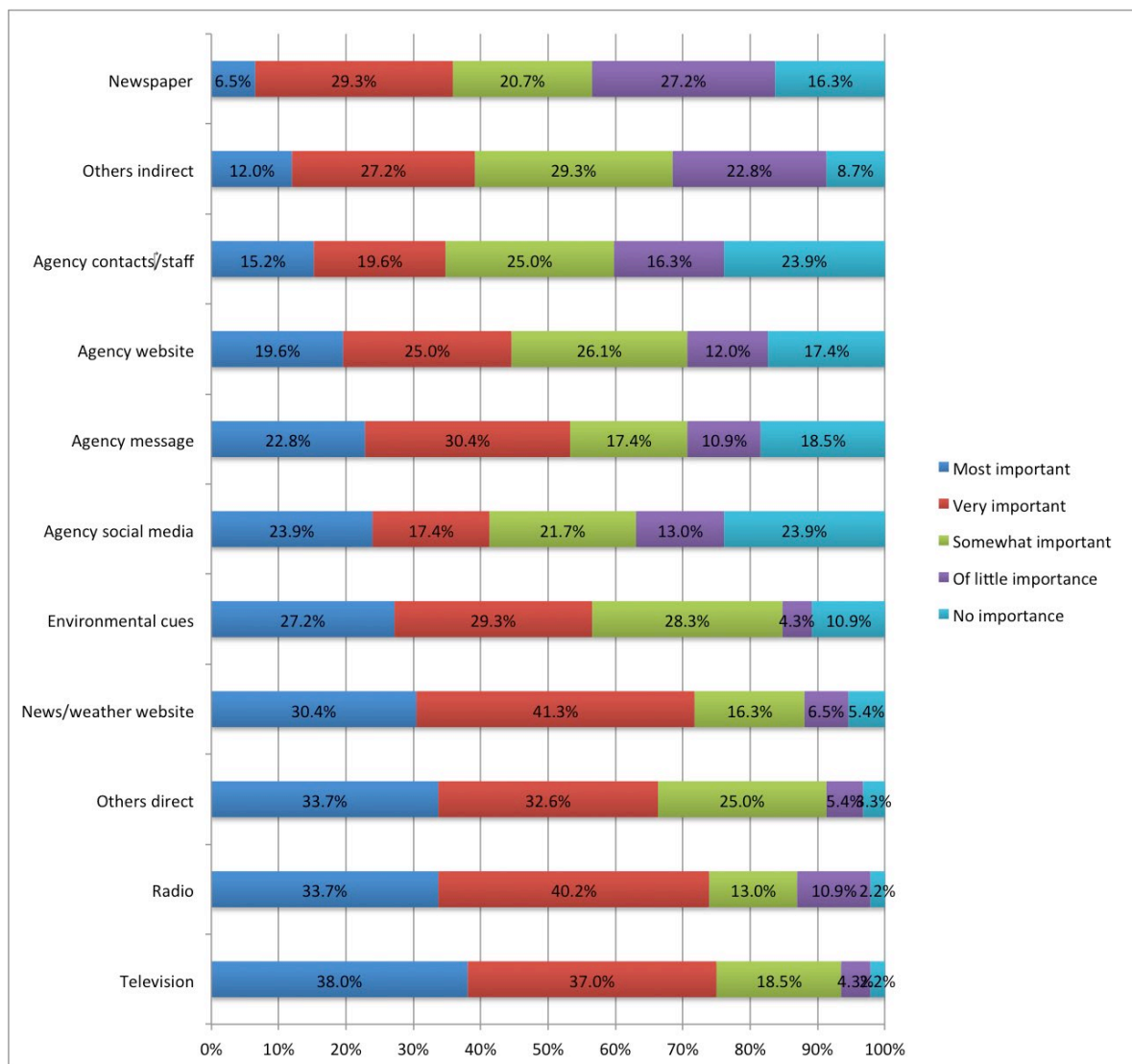

Figure 4.   Most important sources during a flash flood

The information pathways that emerged from the survey for flash flood did not reflect the pathways shown in the literature review: television featured more

highly in the alert and confirmation sources in literature than in the survey, and news and weather websites and radio appeared as the most predominant confirmation sources and also as more widely identified main sources than in the interviews.

6.4   Sourcing information from other people

The literature review showed that many people relied on information from others in both slow floods (87% directly, 72% indirectly) and flash floods (92% directly, 69% indirectly), so the survey questionnaire was structured to include questions about how this communication was undertaken. Those who indicated that other people were 'most important', 'very important' or 'somewhat important' were asked to indicate how they communicated with these other people. The choices were: mobile phone voice, mobile phone text, face to face, landline telephone, social media, email or VOIP system such as Skype. Mobile phones proved the most popular form of contact, used for both voice calls and text. In a flash flood, 47.7% of respondents to this question called or were called by others on their mobile, and this was 38.5% for slow flood respondents. Those who used their mobile to send or receive texts during the disaster made up 19.3% of flash flood and 12.8% of slow flood respondents. Landline telephone also featured highly, with 18.2% of flash flood and 20.5% of slow flood respondents using this to communicate with other people during the event.   Social media, face to face and email were little used, and VOIP services not at all. Table 4 provides details of the different sources for each.

	Flash flood		Slow flood	
	n	%	n	%
Mobile phone - voice	42	47.7	15	38.5
Mobile phone - text	17	19.3	5	12.8
Landline telephone	16	18.2	8	20.5

Social media	7	8.0	4	10.3
Face to face	5	5.7	6	15.4
Email	1	1.1	1	2.6
Skype or similar	0	0.0	0	0.0
	88	100.0	39	100.1

Table 4. How people communicated with others during a disaster

7. Conclusions

The questions asked by this research were:

1. What is the first source of information for people experiencing slow and flash floods?

2. What is the confirmation source for people in slow and flash floods?

3. Which source of information becomes the most used in slow and flash floods?

4. If other people are an important source, what is the communication form?

Answering RQs 1-3, the most common information pathways per disaster type, from first alert source through confirmation source to the main source are more clearly shown in Table 5.

Disaster type	Alert form	Confirmation form/source	Most relied-upon form/source
Slow flood	Television Radio	• News and weather websites • Television • Radio	• News and weather websites • Radio • Television
Flash flood	Other people	• News or weather websites • Radio • Television	• Television • Others directly • Radio • News and weather websites

Table 5. Most common information pathways

For agencies keen to maximise limited resources during a flood event, this table gives some guidance on where people are most likely to be looking for information.

These pathways diverged from those that emerged from the literature in many cases. For instance, in flash and slow flood, environmental cues featured highly in the literature review as an alert source, and as a confirmation source for flash flood, but was not so well used by respondents in this survey. For slow flood, other people featured highly as alert sources in the literature review, but this source was not so prominent in this study – and was still considered an important source in the ongoing information seeking process. In both disaster types, television was an important form of information, possibly because of the impact of visuals in allowing individuals to make sense of the effect of the disaster on themselves and their community, but was not as highly rated in the literature review for slow flood.

The reasons for these differences could be found in the background characteristics of the respondents, which could be a subject for further analysis. Differences in information seeking behaviour based on location [36] and ethnicity [88] emerged from the literature review, so location or another background factor might explain differences that emerged from the survey data. For instance, only one recent article on slow flood confirmation sources could be found during the literature review stage [33], and it reported that the confirmation forms of a rural community in a slow flood were social networks and environmental cues. The more urban sample in this survey revealed confirmation sources to be mainly news and weather websites, and television.

The difference between the alert sources for the two types of flood within this survey was also shown in the literature review and could reflect the different types of disaster – one a rapid onset event, and the other predicted for days in advance. If this was the case, it points to agencies needing to develop different

communication strategies for different types of disasters and in different communities based on the features of the community.

Regarding most important sources, conventional or mainstream media, including online versions, were identified prominently in both types of flood. This shows that despite the ease of use of social media for both agencies and individuals, and the preference of agencies for social media as a factual and instant source of information, mainstream media should be kept current with as much information as possible. In some disasters, online access is restricted for communities, so mainstream media and other people remain pivotal to a successful communication effort.

This importance of other people as a source of information in all stages of information seeking is a double-edged sword for agencies: other people as a source presents a potential problem in that the information imparted could be incorrect or based on rumour; but these other people could also be a potential facilitator of information if the accuracy and timeliness of the knowledge imparted could be improved by access to up-to-date sources. The challenge is to connect key people in the community with sources such as social media so the correct and timely information can cross social and communication networks. Research on the quality and form of social networks in a disaster would inform these efforts.

There were a number of limitations to this study. The samples for each disaster type were sub-samples of a larger study, but small within their own right. The data was acceptable for exploration given the lack of investigation of information-seeking in flood, especially for source sequences and for flash flood. However, future studies should secure larger and randomly selected samples to make firm conclusions about information seeking behaviour in flood. In addition, at the time of this survey, the media landscape was changing, particularly in the area of social media and online news. Social media use by affected communities in disasters will almost certainly have changed since this study was undertaken in amount of use, nature of use and type of social media

used. In addition, many agencies have since incorporated many forms of social media into their communication tool kits and now use social media more comprehensively. This study might provide some background in attempts to measure change in the media landscape and related information seeking since 2012.

8. References

1.	Renckstorf, K. and D. McQuail, *Social Action perspectives in mass communication research: an introduction*, in *Media Use in Social Action*, K. Renckstorf, D. McQuail, and N. Jankowski, Editors. 1996, John Libbey and Company: London, UK. p. 1-17.
2.	Gilbert, C., *Studying Disaster: Changes in the Main Conceptual Tools*, in *What is a Disaster? Perspectives on the Question*, E.L. Quarantelli, Editor. 1998, Routledge: London.
3.	Haddow, G.D. and J.A. Bullock, *Introduction to Emergency Management*. 2nd ed. 2006, Burlington, Masschussetts: Elsevier Butterworth Heineman. 408.
4.	Quarantelli, E.L., *Disaster Crisis Management*, in *Preliminary Papers*, Disaster Research Centre, Editor. 1986, University of Delaware: Disaster Research Center website. p. 11.
5.	Quarantelli, E.L., *Social Science Study of Disasters and Mass Communication - an Historical Account of the Field*, in *Bad Tidings: Communications and Catastrophe*, L. Masel Walters, L. Wilkins, and T. Walters, Editors. 1988, Lawrence Erlbaum and Associates: Hillsdale, New Jersey. p. 1-19.
6.	Quarantelli, E.L., *How Individuals and Groups React During Disasters: Planning and Managing Implications for EMS Delivery*, in *Preliminary Papers*, Disaster Research Centre, Editor. 1989, University of Delaware: Disaster Research Center website. p. 38.
7.	Young Landesman, L., *Public Health Management of Disasters: The Practice Guide*. 2nd ed. 2005, Washington DC: American Public Health Association. 466.
8.	McLennan, J., *Capturing community members' bushfire experience: interviews with residents following the 12 January 2014 Parkerville (WA) fire*, B.a.N.H.C.-o.R. Centre, Editor. 2014, Bushfire and Natural Hazards Co-operative Research Centre: Bushfire and Natural Hazards Co-operative Research Centre website.
9.	O'Sullivan, J., et al. *Enhancing flood resilience through improved risk communications*. Natural Hazards and Earth System Sciences, 2012. **12**, 2271-82.
10.	Lutoff, C., et al. *Anticipating flash-floods: Multi-scale aspects of the social response*. Journal of Hydrology, 2016. **541**, 626-635 DOI: https://doi.org/10.1016/j.jhydrol.2016.01.005.

11. Teague, B., R. McLeod, and S. Pascoe, *2009 Victorian Bushfires Royal Commission Final Report*, Parliament of Victoria, Editor. 2010, Victorian Government: Melbourne.

12. Ryan, B. and A. Matheson *Significance of communication in emergency management*. Australian Journal of Emergency Management, 2010. **25**, 54-57.

13. Ryan, B. *What's changed since 2009? The significance of communication in emergency management*. Australian Journal of Emergency Management, 2017. **32**, 24-31.

14. Mileti, D.S. and P.W. O'Brien *Warnings during disaster: normalizing communicated risk*. Social Problems, 1992. **39**, 13 DOI: 10.2307/3096912.

15. Sorensen, J.H. and B. Vogt Sorensen, *Community processes: warning and evacuation*, in *Handbook of Disaster Research*, H. Rodriguez, E. Quarantelli, and R. Dynes, Editors. 2007, Springer: New York. p. 606.

16. Sorensen, J.H. *Hazard Warning Systems: A review of 20 years of progress*. Natural Hazards Review, 2000. **1**, 119-125.

17. Mileti, D.S. and J.H. Sorensen, *Communication of emergency public warnings*, in *Landslides*. 1990, Colorado State University: Centre for International Research on Education Systems website. p. 52-70.

18. Jibiki, Y., et al. *Analysis of early warning systems: The case of super-typhoon Haiyan*. International Journal of Disaster Risk Reduction, 2016. **15**, 24-28 DOI: https://doi.org/10.1016/j.ijdrr.2015.12.002.

19. Paul, B.K. and M. Stimers, *Tornado warnings and tornado fatalaties: the case of May 22, 2011 tornado in Joplin, Missouri*, in *Quick Response Report*, N.H. Center, Editor. 2011, University of Colorado: Natural Hazards Center website. p. 1-33.

20. Fu, K.-w., et al. *Enabling the disabled: media use and communication needs of people with disabilities during and after the Sichuan Earthquake in China*. International Journal of Emergency Management, 2010. **7**, 75-88 DOI: 10.1504/IJEM.2010.032046.

21. Sommerfeldt, E.J. *Disasters and Information Source Repertoires: Information Seeking and Information Sufficiency in Postearthquake Haiti*. Journal of Applied Communication Research, 2015. **43**, 1-22 DOI: 10.1080/00909882.2014.982682.

22. Steelman, T.A., et al. *What information do people use, trust, and find useful during a disaster? Evidence from five large wildfires*. Natural Hazards, 2015. **76**, 615-634 DOI: 10.1007/s11069-014-1512-x.

23. Choo, C.W. and I. Nadarajah *Early warning information seeking in the 2009 Victorian Bushfires*. Journal of the Association for Information Science and Technology, 2014. **65**, 84-97.

24. Cohen, E., P. Hughes, and P.B. White *Media and bushfires: A community perspective of the media during the Grampians Fires 2006*. Environmental Hazards, 2007. **7**, 88-96 DOI: 10.1016/j.envhaz.2007.07.007.

25. Taylor, K., et al. *Reading Hurricane Katrina: Information Sources and Decision-making in Response to a Natural Disaster*. Social Epistemology: A Journal of Knowledge, Culture and Policy, 2009. **23**, 361-380 DOI: 10.1080/02691720903374034.

26.   Boyle, M.P., et al. *Information Seeking and Emotional Reactions to the September 11 Terrorist Attacks*. Journalism & Mass Communication Quarterly, 2004. **81**, 155-167.

27.   Burger, J., et al. *Trusted Information Sources Used During and After Superstorm Sandy: TV and Radio were Used More Often than Social Media*. Journal of Toxicology and Environmental Health, Part A, 2013. **76**, 1138-1150 DOI: 10.1080/15287394.2013.844087.

28.   Drobot, S., C. Schmidt, and J. Demuth, *The January 5-6, 2008 California winter storm: assessing information sources, actions and damages*, in *Quick Response Report*, N.H. Center, Editor. 2008, University of Colorado: Natural Hazards Center. p. 1-27.

29.   Griffin, R.J., et al. *After the Flood: Anger, Attribution, and the Seeking of Information*. Science Communication, 2008. **29**, 285-315 DOI: 10.1177/1075547007312309.

30.   Hagar, C. *Whom do you trust? Information seeking during the UK foot and mouth crisis*. Library and Archival Security, 2010. **23**, 16.

31.   Liu, B.F., L. Austin, and Y. Jin *How publics respond to crisis communication strategies: the interplay of information form and source*. Public Relations Review, 2011. **37**, 8.

32.   Liu, B.F., J.D. Fraustino, and Y. Jin *How Disaster Information Form, Source, Type, and Prior Disaster Exposure Affect Public Outcomes: Jumping on the Social Media Bandwagon?* Journal of Applied Communication Research, 2015. **43**, 44-65 DOI: 10.1080/00909882.2014.982685.

33.   Ryan, B. *Information seeking in a flood*. Disaster Prevention and Management, 2013. **22**, 229-242.

34.   Lachlan, K.A., D.K. Westerman, and P.R. Spence *Disaster News and Subsequent Information Seeking*. Electronic News, 2010. **4**, 203-217 DOI: 10.1177/1931243110387092.

35.   Becker, S.M. *Emergency Communication and Information Issues in Terrorist Events Involving Radioactive Materials*. Biosecurity and Bioterrorism: BioDefense Strategy, Practice and Science, 2004. **2**, 195-207.

36.   Hayden, M.H., et al. *Information sources for flash flood warnings in Denver, CO and Austin, TX*. Environmental Hazards, 2007. **7**, 211-29 DOI: 10.1016/j.envhaz.2007.07.001.

37.   Hughes, P., E. Cohen, and P.B. White *Bushfires and the Media: a cultural perspective*. Australian Journal of Emergency Management, 2007. **22**, 14-20.

38.   Goudie, D. and D. King *Breaking Through the Disbelief - The March 1997 Cloncurry flood: Even the ducks swam away*. Australian Journal of Emergency Management, 1997. **12**, 29-33.

39.   Trigg, J., et al., *Capturing community experiences South Australian bushfires January 2014*, in *Capturing Community Experiences*, Bushfire and Natural Hazards Co-operative Research Centre, Editor. 2015, Bushfire and Natural Hazards Co-operative Research Centre: Melbourne, Australia.

40.   Mackie, B., J. McLennan, and L. Wright, *Community understanding and awareness of bushfire safety: January 2013 bushfires - Research for the New South Wales Rural Fire Service*, Bushfire and Natural Hazards Co-operative Research Centre, Editor. 2013, Bushfire and Natural Hazards Co-operative

Research Centre: Bushfire and Natural Hazards Co-operative Research Centre website.

41. McLennan, J., et al., *Lake Clifton Fire 10 January 2011 - Field interview taskforce report Community Bushfire Safety*, Bushfire and Natural Hazards Co-operative Research Centre, Editor. 2011, Bushfire and Natural Hazards Co-operative Research Centre: Melbourne, Australia.

42. McLennan, J., G. Elliott, and M. Omodei, *Issues in Community Bushfire Safety: Analyses of Interviews Conducted by the 2009 Victorian Bushfires Research Task Force*, in *Communicating Risk - Human Behaviour Under Stress*, B.a.N.H.C.-o.R. Centre, Editor. 2012, La Trobe University and the Bushfire and Natural Hazards CRC: Bushfire and Natural Hazards Co-operative Research Centre website.

43. McLennan, J., D. Paton, and L. Wright *At-risk householders' responses to potential and actual bushfire threat: An analysis of findings from seven Australian post-bushfire interview studies 2009–2014*. International Journal of Disaster Risk Reduction, 2015. **12**, 319-327.

44. McLennan, J., L. Wright, and A. Birch, *Community understanding and awareness of bushfire safety: October 2013 bushfires: Part 1 - Residents' experiences in three areas - resarch for the New South Wales Rural Fire Service*. 2013, Bushfire and Natural Hazards Co-operative Research Centre: East Melbourne.

45. Boon, H. *Investigating rural community communication for flood and bushfire preparedness*. Australian Journal of Emergency Management, 2014. **29**.

46. Childs, I.R., et al. *Bushfire preparedness of rural-residents in selected Southeast Queensland Shires*. in *Social Change in the 21st Century Conference*. 2006. Brisbane.

47. Marketing and Communications Research, *Review of the Effectiveness of Disaster Management Arrangements Arising from Tropical Cyclone Debbie - quantitative research with community members*, The Office of the Inspector General of Emergency Management Queensland, Editor. 2017, IGEM Queensland: Brisbane, Queensland.

48. Palen, L., et al. *Twitter-based information distribution during the 2009 Red River Valley flood threat*. Bulletin of the Association for Information Science and Technology, 2010. **36**, 13-17.

49. Jin, Y., B.F. Liu, and L.L. Austin *Examining the role of social media in effective crisis management: The effects of crisis origin, information form, and source on publics' crisis responses*. Communication Research, 2014. **41**, 74-94.

50. Hagemeier-Klose, M. and K. Wagner *Evaluation of flood hazard maps in print and web mapping services as information tools in flood risk communication*. Natural hazards and earth system sciences, 2009. **9**, 563-574.

51. Perez-Lugo, M. *Media Uses in Disaster Situations: A New Focus on the Impact Phase*. Sociological Inquiry, 2004. **74**, 210-225 DOI: 10.1111/j.1475-682X.2004.00087.x.

52. Murphy, M.W., et al. *Postdisaster Health Communication and Information Sources: The Iowa Flood Scenario*. Disaster Medicine and Public Health Preparedness, 2013. **4**, 129-134 DOI: 10.1001/dmp.2010-v4n2-hre10009.

53. Terti, G., et al. *Dynamic vulnerability factors for impact-based flash flood prediction*. Natural Hazards, 2015. **79**, 1481-1497.

54.   Manoj, B.S. and A. Hubenko Baker *Communication Challenges in Emergency Response*. Communications of the Association for Computing Machinery, 2007. **50**, 3.

55.   Mileti, D.S., *Disasters by Design: A reassessment of natural hazards in the United States*. 1999, Washington DC: Joseph Henry Press.

56.   Mileti, D.S. and L. Peek *The social psychology of public response to warnings of a nuclear power plant accident*. Journal of Hazardous Materials, 2000. **75**, 181-194 DOI: http://dx.doi.org/10.1016/S0304-3894(00)00179-5.

57.   Mileti, D.S. *Factors related to flood warning response*. in *United States-Italy Research Workshop on the Hydrometeorology, Impacts, and Management of Extreme Floods*. 1995. Perugia, Italy: Colorado State University.

58.   Lindell, M.K. and R.W. Perry *The protective action decision model: theoretical modifications and additional evidence*. Risk Analysis, 2012. **32**, 616-632.

59.   Eisenman, D.P., et al. *Disaster Planning and Risk Communication With Vulnerable Communities: Lessons From Hurricane Katrina*. American Journal of Public Health, 2007. **97**, S109-115 DOI: 10.2105/AJPH.2005.084335.

60.   Kuligowski, E.D., *Terror defeated: occupant sensemaking, decision-making and protective action in the 2001 World Trade Center disaster*. 2011, University of Colorado at Boulder: Boulder, Colorado.

61.   Mileti, D.S. and C. Fitzpatrick *The Causal Sequence of Risk Communication in the Parkfield Earthquake Prediction Experiment*. Risk Analysis, 1992. **12**, 393-400 DOI: 10.1111/j.1539-6924.1992.tb00691.x.

62.   Leik, R.K., et al., *Community Response to Natural Hazard Warnings*, D.T.I. Center, Editor. 1981, Defense Technical Information Center at the University of Minnesota: Mineapolis, Minnesota. p. 89.

63.   Kreps, G.A. *Sociological Inquiry and Disaster Research*. Annual Review of Sociology, 1984. **10**, 309-330 DOI: 0360-0572/84/0815-0309

.

64.   Fitzpatrick, C. and D.S. Mileti, *Public Risk Communication*, in *Disasters, Collective Behaviour and Social Organization*, R. Dynes and K. Tierney, Editors. 1994, University of Delaware Press: Newark.

65.   Fritz, C.E., *Disaster*, in *Contemporary Social Problems: An Introduction to the Sociology of Deviant Behaviour and Social Disorganization*, R.K. Merton and R.A. Nisbet, Editors. 1961, Harcourt, Brace and World: New York. p. 651-94.

66.   Crowe, A. *The Elephant in the JIC: The Fundamental Flaw of Emergency Public Information within the NIMS Framework*. Journal of Homeland Security and Emergency Management, 2010. **7**, 1662 DOI: 10.2202/1547-7355.1662.

67.   Savolainen, R., *Everyday life information seeking: Approaching information seeking in the context of "way of life"*. Library & Information Science Research, 1995. **17**(3): p. 259-294.

68.   Savolainen, R. *Source preferences in the context of seeking problem-specific information*. Information Processing & Management, 2008. **44**, 274-293 DOI: http://dx.doi.org/10.1016/j.ipm.2007.02.008.

69.   Case, D.O., *Looking for Information: A Survey of Research on Information Seeking, Needs, and Behaviour*. 2nd ed. Library and Information Science, ed. B.R. Boyce. 2008, Bingley, England: Emerald. 423.

70.   Savolainen, R. *Source preference criteria in the context of everyday projects: Relevance judgments made by prospective home buyers*. Journal of

Documentation, 2010. **66**, 70 - 92 DOI: http://dx.doi.org/10.1108/00220411011016371.

71.   National Weather Service. *National Weather Service Glossary*. 2009 [cited 2018 22 March]; Available from: http://w1.weather.gov/glossary/.

72.   Kellens, W., T. Terpstra, and P. De Maeyer *Perception and communication of flood risks: a systematic review of empirical research*. Risk Analysis, 2013. **33**, 24-49.

73.   Parker, D.J., S.J. Priest, and S.M. Tapsell *Understanding and enhancing the public's behavioural response to flood warning information*. Meteorological Applications, 2009. **16**, 103-114 DOI: 10.1002/met.119.

74.   Molino Stewart, *Report of the 2012 North East Victoria Flood Review*. 2012, Office of the Emergency Services Commissioner: Melbourne, Victoria.

75.   Kreibich, H., et al. *New insights into flood warning reception and emergency response by affected parties*. Natural Hazards and Earth System Sciences, 2017. **17**, 2075-2092 DOI: 10.5194/nhess-17-2075-2017.

76.   Pfister, N. *Community response to flood warnings: the case of an evacuation from Grafton, March 2001*. Australian Journal of Emergency Management, 2002. **17**, 19.

77.   Handmer, J., C. Keys, and J. Elliott *Achieving lasting change in multi-organizational tasks: the case of flood warnings in Australia*. Applied Geography, 1999. **19**, 179-197 DOI: https://doi.org/10.1016/S0143-6228(99)00001-6.

78.   Lazrus, H., et al. *"Know what to do if you encounter a flash flood": Mental models analysis for improving flash flood risk communication and public decision making*. Risk Analysis, 2016. **36**, 411-427.

79.   Perez-Lugo, M. *The Mass Media and Disaster Awareness in Puerto Rico: A Case Study of the Floods in Barrio Tortugo*. Organization & Environment, 2001. **14**, 55-73 DOI: 10.1177/1086026601141003.

80.   Drabek, T.E. *Understanding disaster warning responses*. The Social Science Journal, 1999. **36**, 515-523 DOI: 10.1016/S0362-3319(99)00021-X.

81.   Greenberg, B.S., B. Hofschire, and K. Lachlan, *Diffusion, Media Use and Interpersonal Communication Behaviours*, in *Communication and Terrorism: Public and Media Responses to 9/11*, B.S. Greenberg, Editor. 2002, Hampton Press: Cresskill, New Jersey. p. 3-16.

82.   Johnson, J.D., et al. *Fields and pathways: Contrasting or complementary views of information seeking*. Information Processing & Management, 2006. **42**, 569-582.

83.   Sharma, U., A. Patwardhan, and D. Parthasarathy *Assessing adaptive capacity to tropical cyclones in the East coast of India: a pilot study of public response to cyclone warning information*. Climatic Change, 2009. **94**, 189-209.

84.   Aguirre, B.E. and K. Tierney, *Testing Shibutani's Prediction of Information Seeking Behaviour in Rumor*, in *Preliminary Papers*, Disaster Research Center, Editor. 2001, University of Delaware: Newark, Delaware. p. 25.

85.   Legates, D.R. and M.D. Biddle *Warning response and risk behaviour in the Oak Grove - Brimingham, Alabama, Tornado of 08 April 1998*. Quick Response Research Report, 1999. 1-34.

86.   National Weather Service Central Region, *Joplin, Missouri, Tornado - May 22, 2011*, National Oceanic and Atmospheric Administration, Editor. 2011, US Department of Commerce: Kansas City, Missouri. p. 34.

87.   Ripley, A., *The Unthinkable: Who survives when disaster strikes - and why*. 2009, New York: Three Rivers Press. 266.

88.   Perry, R.W. and M.K. Lindell, *The effects of ethnicity on evacuation decision-making.* International journal of mass emergencies and disasters, 1991. **9**(1): p. 47-68.

89.   Cretikos, M., et al. *Household disaster preparedness and information sources: Rapid cluster survey after a storm in New South Wales, Australia*. BMC Public Health, 2008. **8**, 195-203.

90.   McLennan, J., G. Elliott, and L. Wright *Bushfire survival preparations by householders in at-risk areas of south-eastern Australia*. Australian Journal of Emergency Management, 2014. **29**, 11.

91.   Smith, B., M. Taylor, and K. Thompson *Risk perception, preparedness and response of livestock producers to bushfires: a South Australian case study*. Australian Journal of Emergency Management, 2015. **30**, 38.

92.   Chaney, P.L. and G.S. Weaver, *The Super Tuesday tornado disaster at Lafayette, Tennessee: preparedness, response and previous experience*, in *Quick Response Report*. 2008, University of Colorado: Google Books. p. 1-3.

93.   Nogami, T. and F. Yoshida *Disaster myths after the Great East Japan Disaster and the effects of information sources on belief in such myths*. Disasters, 2014. **38**, s190-s205 DOI: 10.1111/disa.12073.

94.   Apan, A., et al., *The 2008 floods in Queensland: a case study of vulnerability, resilience and adaptive capacity* National Climate Change Adaptation Research Facility, Editor. 2010, University of Southern Queensland, James Cook University and Bureau of Meteorology.

95.   Inspector-General for Emergency Management, *2015 Callide Creek Flood Review*. 2015, Office of the Inspector-General for Emergency Management: Brisbane, Queensland.

96.   Bird, D.K., et al., *Sink or Swim? Response, recovery and adaptation in communities impacted by the 2010/11 Australian floods*, in *Applied Studies in Climate Adaptation*, J.P. Palutikof, et al., Editors. 2014, Wiley: Sunset, United Kingdom.

97.   Palen, L. and S.B. Liu, *Citizen communications in crisis: anticipating a future of ICT-supported public participation*, in *SIGCHI Conference on Human Factors in Computing Systems*. 2007, ACM: San Jose, California, USA. p. 727-736.

98.   Bureau of Meteorology, *Detailed Reports on Notable Queensland Floods*. 2018, Bureau of Meteorology: Brisbane, Queensland.

99.   Bureau of Meteorology. *NSW in Summer 2010-11: Wettest summer in 29 years*. The Recent Climate - Regular statements 2011 [cited 2018 28 March 2018]; Season summary]. Available from: http://www.bom.gov.au/climate/current/season/nsw/archive/201102.summary.shtml.

100.   Bureau of Meteorology, *2011/2012 Queensland Flood Season*, Bureau of Meteorology, Editor. 2013, Bureau of Meteorology: Brisbane, Queensland.

101.	Bureau of Meteorology, *Exceptional heavy rainfall across southeast Australia*, in *Special Climate Statement*, Climate Information Services, Editor. 2012, Bureau of Meteorology: Sydney, NSW.

102.	Savolainen, R., *Everyday Information Practices: a Social Phenomenological Perspective*. 2008, Plymouth, UK: Scarecrow Press Inc. 233.