A model of household preparedness for earthquakes: how individuals make meaning of earthquake information and how this influences preparedness

Julia S. Becker, Douglas Paton, David M. Johnston & Kevin R. Ronan

Springer

Springer

ORIGINAL PAPER

A model of household preparedness for earthquakes: how individuals make meaning of earthquake information and how this influences preparedness
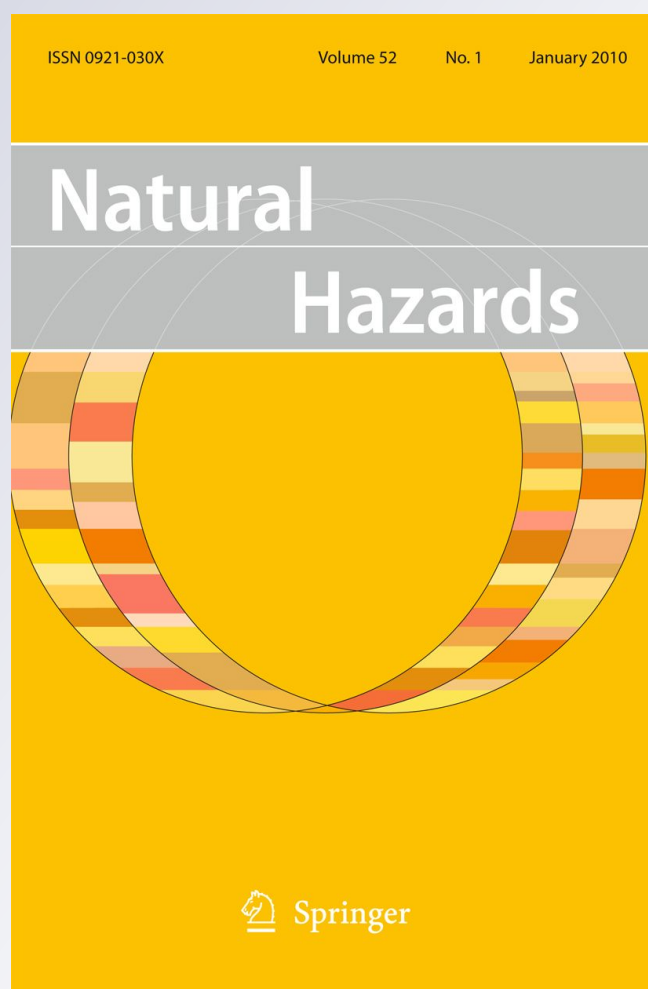
Julia S. Becker · Douglas Paton · David M. Johnston · Kevin R. Ronan

Abstract One way to reduce the risk from earthquakes is for individuals to undertake preparations for earthquakes at home. Common preparation measures include gathering together survival items, undertaking mitigation actions, developing a household emergency plan, gaining survival skills or participating in wider social preparedness actions. While current earthquake education programmes advocate that people undertake a variety of these activities, actual household preparedness remains at modest levels. Effective earthquake education is inhibited by an incomplete understanding of how the preparedness process works. Previous research has focused on understanding the influence individual cognitive processes have on the earthquake preparedness process but has been limited in identifying other influences posed by the wider social contextual environment. This project used a symbolic interactionism perspective to explore the earthquake preparedness process through a series of qualitative interviews with householders in three New Zealand urban locations. It investigated earthquake information that individuals are exposed to, how people make meaning of this information and how this relates to undertaking actual preparedness measures. During the study, the relative influence of cognitive, emotive and societal factors on the preparedness process was explored and the interactions between these identified. A model of the preparedness process based on the interviews was developed and is presented in this paper.

J. S. Becker · D. M. Johnston
School of Psychology, Massey University, P.O. Box 756, Wellington 6140, New Zealand

J. S. Becker (✉) · D. M. Johnston
GNS Science, P.O. Box 30368, Lower Hutt 5040, New Zealand
e-mail: j.becker@gns.cri.nz; jcdr.enquiry@massey.ac.nz

D. Paton
School of Psychology, University of Tasmania, Launceston, TAS 7250, Australia

K. R. Ronan
Institute for Health and Social Science Research, Central Queensland University,
Rockhampton, QLD 4701, Australia

1 Introduction

Around the world, earthquakes continue to be a significant cause for death, injury and
disruption. Contributions to death and injury include rising populations, poverty, building
collapse, poor construction methods, collateral hazards such as landslides or tsunami,
individual demographics, people's behaviour at the time of the earthquake and the
effectiveness of emergency response (Petal 2011; Spence et al. 2011). In developing
countries, death from earthquake can be extremely high, with 220,000 fatalities in the 2010
Haiti earthquake and 88,289 in the Wenchuan earthquake in China (Spence et al. 2011). In
developed countries, death and injury from earthquakes are often less, primarily due to
better construction methods; however, people can still be seriously affected. For example,
the recent magnitude 6.3 earthquake in Christchurch, New Zealand, on 22 February 2011
caused 185 deaths (New Zealand Police 2012), mostly related to the collapse of two multi-
storey office buildings, many unreinforced masonry buildings and being hit by other falling
objects. As well as death and injury, damage and disruption after an earthquake can be
widespread, with important services cut-off. For example, water and food may be difficult
to obtain for days to months afterwards, and sewerage and transport systems may be
disrupted for years. The Christchurch example illustrates the significant, sudden and
enduring impacts earthquakes have on people's lives, their effects on people's life and
work, short- and long-term financial hardship, and disruption to normal social processes
within the wider community. The sudden and persistent nature of such problems highlights
the need for preparation.

There are many ways to reduce the risks posed by earthquakes, including land-use
planning to avoid earthquake-prone areas (Kerr et al. 2004); engineering solutions (e.g.
building earthquake-resilient buildings; engineering soils to reduce risk); warning systems
that can give a number of seconds of warning before ground shaking is felt (Gasparini et al.
2011; Satriano et al. 2011); and earthquake preparedness. In terms of preparedness,
solutions may be administered at a societal, community or individual level. At an indi-
vidual level, household preparedness is often advocated, particularly in developed coun-
tries, as one component of risk management for earthquakes. For many decades,
earthquake-prone countries such as the United States, Japan, New Zealand and Turkey
have promoted the idea that individual households should prepare in ways that facilitate
people's ability to cope with, adapt to and recover from earthquake consequences. Pre-
paredness actions include collecting together essential survival items (e.g. food, water,
torch, radio and medication), creating a plan for what householders will do if an earthquake
occurs, undertaking earthquake mitigation actions (e.g. retrofitting buildings and securing
objects within a residence), developing survival skills in individuals and undertaking social
action related to earthquake preparedness (Kirschenbaum 2002, 2004; Lindell et al. 2009;
Mulilis et al. 1990; Russell et al. 1995; Spittal et al. 2008).

Despite many years of information dissemination and education about the importance of
preparing for earthquakes, household preparedness remains at only modest levels. Ronan
and Johnston (2005) analysed the outcomes of a number of international studies and found
that overall levels of preparation are universally low, including in risk-prone areas. There
have been some modest improvements in certain geographic areas over time (e.g.

earthquakes in California, Lindell and Perry 2000) but not to exceedingly high standards. In New Zealand, for example, despite many preparedness campaigns being run over the past decade, over half of residents report not having done a single thing to prepare for earthquakes (Earthquake Commission 2011). This suggests that alternative approaches are needed to understand what motivates sustained preparedness.

Research during the last 40 years has identified several factors that influence adjustment adoption for earthquakes, including individual perceptions, beliefs and attitudes; emotions and feelings; previous experience of earthquakes; demographics; resource constraints; and social influences. The emphasis of most previous studies has clearly been on the individual, however, and a review by Solberg et al. (2010, p. 1673) notes that many social psychology studies have had a narrow focus: "inter-individual[1] influences on intra-individual[2] cognitive processes". While studies of intra-individual cognitive processes provide valuable insight into particular influences of preparedness, such an emphasis has meant that researchers have fallen prey to a fundamental attribution error (Ross 1977) called context minimisation error (Shinn and Toohey 2003). This occurs when casual influences are attributed primarily to individuals, and less regard is given to contextual factors such as how the influence of the wider society (e.g. neighbourhoods and communities) affects how people interpret information and act to confront risk (Paton et al. 2010b). Shinn and Toohey (2003) maintain that contextual factors are important, as these factors interact with individual and sociocultural characteristics and may cause psychological processes to play out differently in different contexts. From an earthquake preparedness perspective, this suggests that people's deliberations about whether or not to prepare cannot be solely attributed to individual cognitive processes but are likely also influenced by their interactions within wider society. In addition, the eventual outcome of people's deliberations may play out in ways that reflect the diversity of the social contexts people inhabit, with this diversity shedding some light on why existing 'one size fits all' earthquake education programmes fail to motivate large numbers of people to prepare.

The current emphasis on intra-individual cognitive processes is evident in the models that have been constructed so far. For example, early models by researchers such as Turner et al. (1986), Dooley et al. (1992) and Farley (1998) focused on using quantitative survey data to undertake causal path analyses of earthquake preparedness. A number of models are based on the Theories of Reasoned Action (TRA) and Planned Behaviour (TPB) (Ajzen 1985; Fishbein and Ajzen 1975). These include Protection Motivation Theory (PMT) (Rogers 1983) and Person Relative to Event theory (PrE) (Duval and Mulilis 1999; Mulilis 1996; Mulilis and Duval 1995, 1997, 2003; Mulilis et al. 2000, 2003), both primarily cognitive models that focus on aspects such as likelihood, severity, self-efficacy, outcome expectancy and responsibility for protection. Some studies have explored wider aspects of context, including the influence that social interactions have on preparedness, but have not done so in any detail. For example, Mileti and Darlington (1997) identified that societal interaction was an important part of earthquake information use in a risk communication context, but did not explore this further. Recent research by Wood et al. (2011) has identified that societal activity such as observing others undertaking preparedness and talking with others about preparedness (described as "milling" by the authors) influences the undertaking of preparedness actions. Work by Lindell and Perry (1992, 2000, 2011) introduces the importance of the social context in their Protective Action Decision Model (PADM) but does not talk in explicit detail about the nature of its influence. Paton and

---

[1] Involving or taking place between individuals.

[2] Being or occurring within the individual.

colleagues (e.g. Paton et al. 2000, 2001a, b, 2006b, 2008, 2010a; Paton 2005, 2006, 2007) have developed a more comprehensive model that incorporates social influences into the preparedness process, in particular identifying important societal attributes that an individual must be exposed to, such as trust, community participation, articulation of problems and empowerment. Again, however, the model does not explain how the individual interacts within their wider context; it simply identifies that such social contextual elements are important to the process.

Consequently, there remains a gap in understanding the influence that the wider societal context has on the preparedness process. This is acknowledged by many earthquake researchers and has resulted in recommendations to explore this area further (e.g. Tierney et al. 2001; Solberg et al. 2010; Rohrmann 2000; Mileti and Darlington 1997; Lindell and Perry 2000).

The argument that society plays an important part in people's decisions to take action is supported by the symbolic interactionist perspective. Symbolic interactionism is a theoretical perspective framed by Blumer (1969) that argues that human behaviour is influenced by how people interact with and make meaning of their social environment. Decisions about action are part of a process, whereby people interact with others and within themselves to come to decisions. Studies in other fields (e.g. health) confirm that symbolic interactionism is a valid theoretical framework and that interactions with others (and within a person's own self) play an important part in helping people interpret the world and make decisions on how to act. People's use of earthquake information and its relationship to earthquake preparedness has not been explored from a symbolic interactionist perspective, resulting in a lack of knowledge about how social interaction affects earthquake preparedness. Consequently, a new research project was developed to identify and describe the social interactions that take place with respect to earthquake information and adjustment adoption, and devise a model to explain the process.

2 Outline, design and methodology of research

Applying the symbolic interactionist perspective calls for a qualitative approach (Flick 2006; Herman-Kinney and Verschaeve 2003) to understand the social construction of reality and how people's social constructions are enacted in preparedness activities. Compared with its quantitative counterparts, qualitative research affords greater opportunities to explore social diversity and provides more flexibility for elucidation of risk interpretation and action processes. To allow for the greatest possible flexibility in data collection and analysis, grounded theory methodology was used (Glaser and Strauss 1967; Strauss and Corbin 1990). Grounded theory is an often used qualitative approach that allows core categories and theory to emerge from the data, rather than forcing data into preconceived categories.

To investigate how people construct the meanings attributed to earthquake information and how this related to preparedness, research was conducted in three communities in New Zealand: Napier, Wanganui and Timaru. The towns were selected by method of comparison, and similar towns were chosen with respect to population size (i.e. between 25,000 and 55,000 based on the 2001 census data), relative potential geographic isolation, types of facilities present (e.g. port, airport, hospital, educational institutions), civic institutions and legislative environment so that preparedness could not be influenced by major environmental and institutional differences. Physical earthquake risk varies between the three
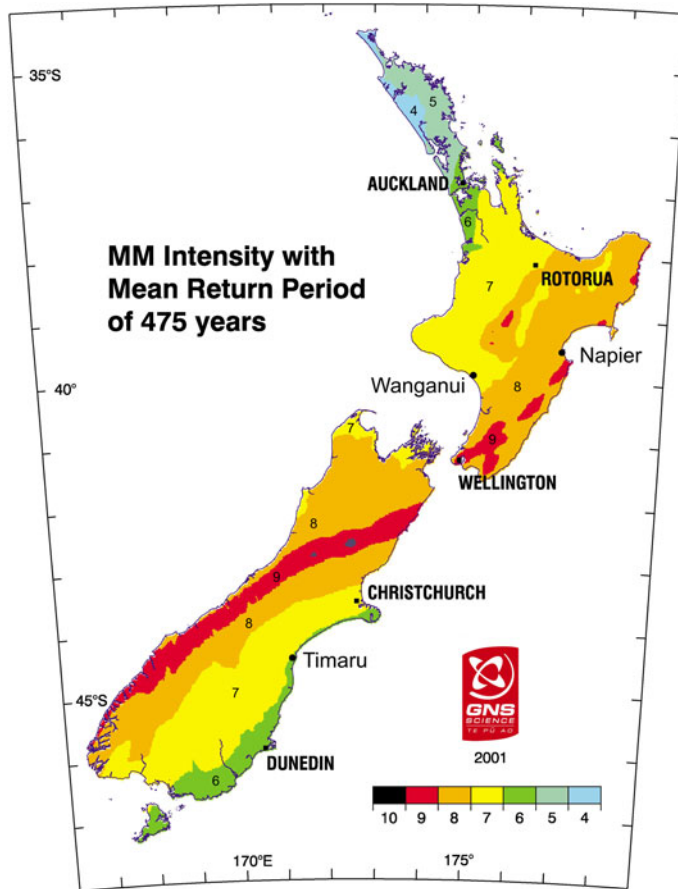
Fig. 1 Location of the study areas within areas of earthquake risk. The *map* shows the distribution of Modified Mercalli (MM) intensity with a current Annual Exceedance Probability of 1/475, derived from the National Probabilistic Seismic Hazard Model. Timaru is situated within MM6 (i.e. falling items, slight damage, e.g. cracked plaster), Wanganui within MM7 (i.e. buildings cracked, bricks and chimneys falling) and Napier within MM8 (i.e. damaged and partially or fully collapsed buildings) (personal communication, Smith 2001; based on data from Stirling et al. 2000)

locations, with Napier located in the highest area of risk, followed by Wanganui and Timaru (Fig. 1).

The research focused on asking household residents about their perspectives on earthquake hazards, earthquake information and preparedness for earthquakes. Data were collected by means of semi-structured interviews with residents. Forty-eight interviews were undertaken from April to June 2008, with 16 interviews in Napier, 14 in Wanganui and 18 in Timaru. Participants were self-selected volunteers, recruited by sending invitations to community groups and advertising in local publications.

At the time of the study, the last major earthquake disaster that had occurred was the magnitude 7.8 Hawke's Bay earthquake near Napier in 1931; with the September 2010 Darfield earthquake (magnitude 7.1) and February 2011 Christchurch earthquake (magnitude 6.3) occurring after data collection had taken place. Therefore, the study was

undertaken during a relative period of earthquake quiescence. Timaru had experienced a major snowstorm in 2006 (Hendrikx 2007), which many interviewees referred to in their interviews. Wanganui's most frequently occurring hazard is flooding, with the last major flood causing property damage occurring in 1990.

Interviews were taped and transcribed into a word-processing package with the interviewees' consent. The interview data were then entered into the qualitative research software package "Atlas.Ti", and codes identified and memos written. The codes were then assembled into core categories. Analysis followed the approach of Strauss and Corbin (1990), who suggest that several core categories may emerge from the analysis, rather than just one (Glaser and Strauss 1967). In fact, a range of core categories were eventually identified, in a similar manner to work undertaken by Richardson (2005) in mapping the phases of individuals' meaning-making following an explosion in Texas City in 1947. It was felt important not to condense the codes into too few categories, as to do so would prevent accurate identification of the range of factors that influence the earthquake information meaning-making process (Corbin and Strauss 2008). Theory was then developed from the identified codes and categories, and a process of earthquake information meaning-making and action identified.

3 Results

Figure 2 shows the process model derived from the interviews. The model describes cognitive, emotive and social influences on the information meaning-making process. The model represents a linear process, starting with people receiving information, interpreting it and making decisions about whether to prepare or not. While a linear process may accurately describe the journey for some individuals, this is not the case for all, as the data revealed. Some may start from a different point in the diagram, for example, those with strong existing beliefs about personal safety may start from the "Beliefs" point in the diagram and interpret hazards and preparedness information in the context of this belief. In addition, feedback loops also exist, but not all of these are documented or described in this diagram. There is also a time element to the process, but it is not captured on Fig. 2. For example, awareness of hazards or preparedness may be triggered by certain information, but as time passes this awareness may dissipate. Likewise, levels of actual preparedness may also wax and wane over time. For example, Interviewee 28 suggested that after she arrived in New Zealand to live, she got highly prepared; however, this preparedness had diminished over time. She attributed the change in her physical preparedness to an evolution in her beliefs that reflect New Zealand's societal norms more (i.e. from thinking preparedness is very important to being blasé about preparing for disasters). Therefore, while the diagram presents an accurate as possible picture of the information meaning-making and preparedness process, it should be interpreted within the complexity noted here.

In analysing interviews from the three locations of Napier, Wanganui and Timaru, there appeared to be few differences between the communities in terms of the overall process of information meaning-making and how this contributes to preparedness. The only major differences noted were with respect to perceptions of earthquake risk in the three different communities (with Timaru interviewees thinking they were exposed to the least earthquake risk and Napier interviewees the most risk). The variation in risk perceptions had an effect on levels of awareness and understanding but did not significantly alter the overall process itself. As a consequence, the model is an accurate representation of information meaning-making for all three locations and is likely to be applicable in a wider New Zealand context.
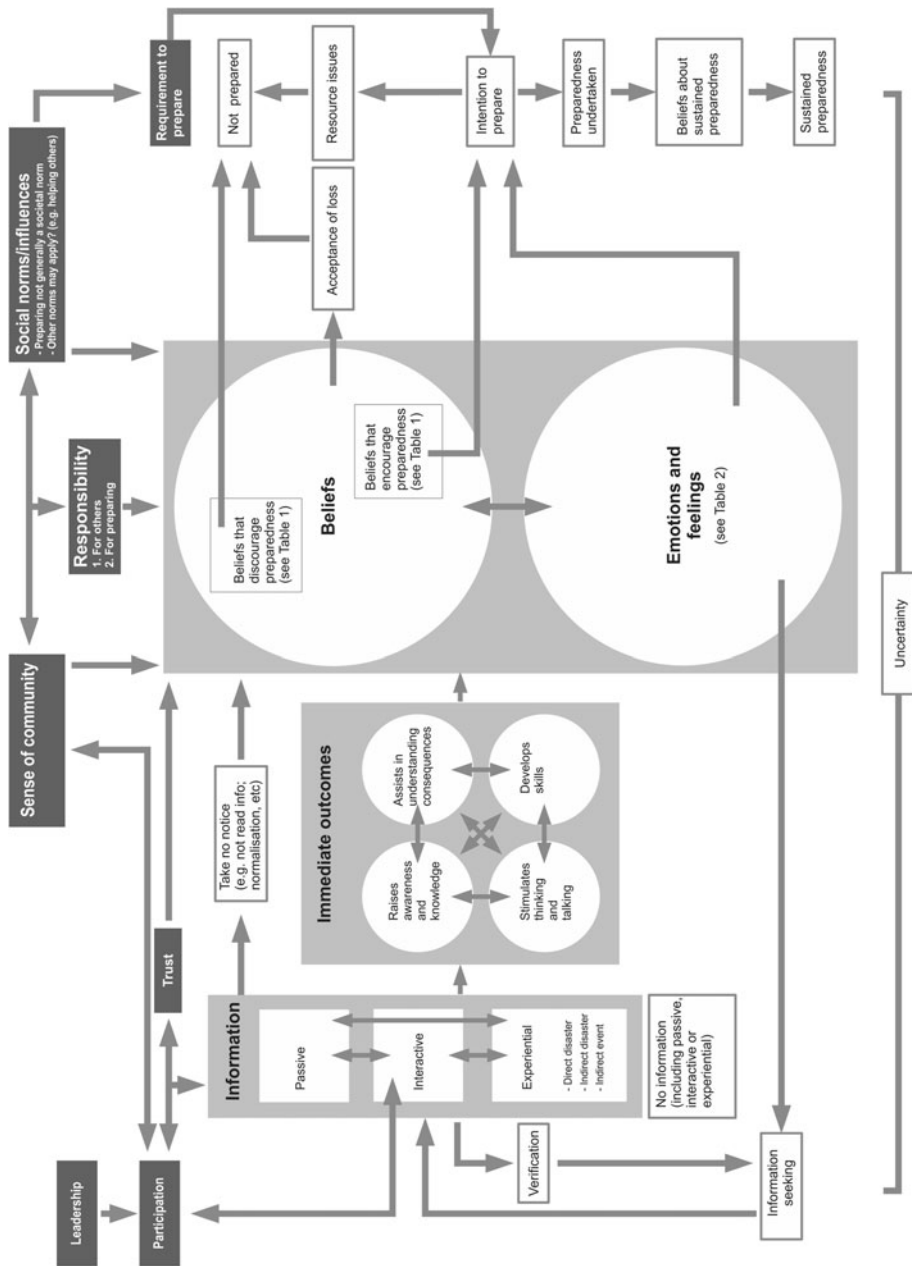
Fig. 2 Model of information meaning-making and preparedness for earthquakes and other disasters

3.1 Types of information

The interviews revealed that people are exposed to three main types of information: passive information, interactive information and experiential information (see Fig. 2—

"Information" box). Passive information reflects the type of information that is traditionally used for hazards and preparedness education such as brochures, television or websites. Interactive information pertains to information that involves interactions with other people, such as school activities, community activities, workplace activities and training. Experiential information is information that individuals glean from their own personal life experiences. Such experiences can be directly related (e.g. a person directly experiences a disaster) or indirect. Indirect experience can be broken into two main types: indirect disaster experience, whereby a person observes or is involved in responding to a disaster event; or indirect event experience with other hazards (e.g. experiencing an accident, personal health issues, being engaged in an occupation that involves elements of hazards or preparedness). The analysis revealed that both interactive and experiential information are important sources of information, which supports the notion that interaction within social and worldly contexts is important for how people make meaning of hazard information. Interviewee 42 provided a good overview of the three types of information that people use, including the media, magazines and videos (passive), workplace influences and discussion with others (interactive) and local hazard events (experience or in this case reference to lack of experience).

> *Where have you picked up that sort of [information]?*
> Probably just, I mean, if we have for example a flood and you'll hear someone say that was a one in a 100 year event or a one in 50 year event. So just nothing formal. Just what you've heard […] So heard through other people, or the media […] Probably magazines, things like that. And we don't have a lot of things happening in our area so I don't hear anything specific really about events in Hawke's Bay. We have, at work here we get, obviously we're involved in emergency management so we do see a fair few videos and things like that.

Each type of information has a different influence on people's understanding, interpretation and actions (Fig. 2—"Immediate outcomes"). Passive information was more likely to raise awareness and knowledge about hazards or preparing and would sometimes prompt people to think about hazard issues or talk about them with others. Passive information, particularly media-based information, also contributed to forming people's beliefs. Some beliefs were useful to understanding and personalising disasters (e.g. "A disaster like the one overseas could happen here"), and some were unhelpful, as they contributed to aspects such as fatalism (e.g. "The disaster overseas was so destructive; there's nothing I could do if it happened here"). Because media information is often visual, it also provided a good way for people to understand what the impacts of disaster events were really like, even if it did contribute to some unhelpful beliefs. In addition, passive information could influence people's feelings. For example, a common feeling was horror and fear at seeing information and images about overseas disasters. As Interviewee 9 describes, "… having seen the highways collapsing in the States when there was that last big earthquake in Los Angeles, San Francisco or wherever it was, it was (pause)—the pictures were just horrifying—you know people disappearing off the ends of bridges and getting crushed and those sorts of things—absolutely horrifying". Thus, passive information could induce anxiety in individuals.

Interactive information raised awareness and was an essential type of information for stimulating thought and discussion. Such information was useful, as it took people a step beyond just 'raising awareness' about hazards and actually helped people understand the consequences of a potential event through interactive discussion. Interactive information helped build people's skills for preparing and responding (e.g. show what practical tasks

need to be done to prepare; or train people about how to respond to earthquakes). Beliefs could also be shaped and formed by interactive information, and important beliefs such as "I can prepare" and "I can respond" were often shaped by such information. In many cases, where experts were involved in the interactions, there was a higher likelihood of beliefs being accurate, as people could discuss, evolve and correct assumptions during the course of the interaction. People tended not to discuss their feelings at length with respect to interactive information, but it did have some impact on feelings, particularly as people built knowledge and skills around preparedness and response, effectively reducing their level of concern.

Experiential information had a significant impact on the preparedness process. First, it raised awareness and stimulated thought and discussion. It was also essential in helping people understand the consequences of disasters, as experience often provided first-hand information about the types of conditions that could be experienced in a disaster, and what might be needed to overcome any adverse impacts. Direct experience helped build skills for preparedness and response, through practicing a real event. Experiential information was a key contributor to developing beliefs about a disaster, in particular beliefs related to: understanding of hazard and risk; the importance of preparation; a disaster can happen anytime; you could be on your own; safety and survival are important; and preparedness is a "way of life". Like the other types of information, disaster experience also had an impact on people's feelings, with most feelings being related to feeling shocked or scared by an event they had experienced. Some were directly motivated as a result of their experience to prepare for future disasters, while others were normalised and felt because they had got through the event they would survive a future one okay. Another common related belief was that such an event would not happen again. Among the interviewees, very few participants had had direct experience of a disaster, and none had experienced a large earthquake within their lifetime. Most people's experiential information was based on small events (e.g. minor earthquakes), indirect disaster experience and experience of other types of hazardous events.

Interview data revealed that people draw upon multiple types and sources of information in forming beliefs and making decisions about preparedness. Some people may also be motivated to seek further information in order to verify what they have seen or heard. The findings reinforce the fact that no single information format will encourage individuals to prepare and that a variety of resources must be used.

Some people may take no notice of information at all or are not influenced by it, meaning that they will rely on their existing beliefs in deciding whether hazards are an issue and whether they need to prepare for them. Others may not come into contact with any information at all, and again rely on existing hazards and preparedness beliefs.

A realisation that an individual had a lack of information (whether it be passive, interactive or experiential) often led to worry or concern, which could then prompt a search for further information about hazards or preparedness in an effort to reduce that concern. This aspect was most evident in new immigrants to New Zealand who, on arrival, became aware of the hazards posed by New Zealand's environment, were concerned by their lack of knowledge of them and went about seeking further information in an effort to reduce their worry.

3.2 Immediate outcomes

3.2.1 Raising awareness and knowledge

One of the first impacts of information is that it can raise people's awareness and knowledge (Fig. 2—"Immediate outcomes: Raises awareness and knowledge"). As

outlined previously, awareness was raised by all types of information—passive, interactive and experiential. Two main types of awareness were described by interviewees, including a raised awareness of hazards and awareness of the need for preparedness. Raised knowledge was closely linked with awareness so is considered as one category for this model.

Awareness seemed to be quite a superficial concept, relating mostly to the idea that the existence of hazards, and importance of preparedness, had been highlighted to individuals by certain sources of information. People mentioned specifically that people should be aware of the possibility that hazards can occur; the risk posed by hazards; the impacts or consequences such hazards might have; and how they might need to prepare or respond. For example, Interviewee 6 stated, "I think you just have to be aware that [an event is] a possibility and to know what you're going to do if it does happen", while Interviewee 10 said, "[People] should just be aware of what the consequences of a major event can be, and the best way to prepare themselves and their immediate family". When asked by the researcher what Interviewee 26 thought "awareness" meant, he related a similar theme, "Awareness of the possibility [of hazard events]. People living here should be aware that this is always a possibility. There's always a risk".

Awareness did not imply any detailed thinking around the topic—this was more accurately represented by another category entitled "Understanding consequences". Being "aware" simply meant that people realised there was a risk or danger, and they understood that having a degree of either mental or physical preparedness was advisable. Awareness alone was unlikely to motivate people into action, as many felt that simply being aware of the potential issues was enough to enable them to be mentally prepared for or respond appropriately to a disaster. For example, Interviewee 33 reflects on the need to be aware of hazards but not necessarily go to the extreme of physically preparing by saying, "I think whatever dangers you have, whether its tsunami, I think one has to be aware of tsunami, but you do not leave a car with its engine going polluting the atmosphere just so you can make a quick dash for the hills".

3.2.2 Thinking and talking

Once information had reached a point where it had entered people's consciousness (as opposed to simply raising awareness), it could prompt people to begin thinking and talking about hazards and preparedness (Fig. 2—"Immediate outcomes: Stimulates thinking and talking"). Thoughts and discussions generally began after information of some sort had acted as a trigger. People who had undergone an experience or who had been exposed to interactive information were more likely to talk about hazards and preparedness with others in their community. In some instances, passive information also triggered conversations as well, but this was typically related to something individuals had seen about a particular event in the media, rather than other traditional types of passive information such as receiving a brochure or looking at a website.

Individuals predominantly talked about hazards and preparedness with people they already knew, such as family members, friends, workmates and other community acquaintances (e.g. neighbours) in informal contexts (e.g. at home and at a friend's house). Some discussions were initiated in more formal contexts and sometimes with strangers as well (e.g. conversations during an organised community event and workplace training). Opinions about hazards and preparing were more readily listened to from those who were trusted or respected, with family and friends predominantly falling into those categories.

Common topics of thought and conversation were related to:

- Specific hazards (e.g. earthquakes, snowstorms and flooding);
- Specific events that had occurred in local, national or overseas locations, with discussion around what happened in the event;
- What would happen if a disaster were to happen "here"? (impacts and consequences of a potential event);
- What should we do if a disaster happens "here"? (preparedness and response);
- Preparedness already undertaken or preparedness that should be undertaken in future.

While people had an interest in discussing hazards and specific events, action was most likely to be initially prompted by conversations that were focused on understanding the impacts and consequences of an event (i.e. "What would happen if a disaster were to happen here?"). Following these conversations, thought and discussion would then naturally lead on to what one might do to prepare for a disaster, and how they might go about doing it. The evolution of people's thoughts was highlighted by Interviewee 40, who called the researcher back several times after the initial interview to talk about how discussion during the interview had prompted him to think a little more about hazards and his preparedness, and helped him realise that he was not as prepared as he originally stated. Thus, while this particular instance relates specifically to the evolution of thought as a result of the interview process, it also is applicable to discussions held about hazards and preparedness within communities.

People's interactions (reflected in thinking and talking) also contributed to the formation of social norms regarding hazards and preparedness. Informal networks, such as family and friends, would share ideas and come to an agreement on aspects of hazards and preparedness. This was also evident in more formal contexts, where groups of people followed a similar, if not more managed, process. For example, Interviewee 35 provided a forum at a dinner club to discuss hazards and preparedness and found following those discussions that a norm of "preparedness is important" had evolved among the attendees and that people had actually got prepared.

While people prefer to interact with friends and family, such informal networks may not necessarily provide accurate opinions about hazard and preparedness issues, resulting in unhelpful social norms developing. Formal group structures, mediated appropriately, can be useful for developing appropriate social norms and securing commitment for action. Ideas generated within these groups can then be taken back to family and friends in an attempt to influence the wider community.

3.2.3 Understanding consequences

An important part of the process was that people actually needed to understand the consequences of an event occurring and the consequences of preparing or not (Fig. 2— "Immediate outcomes: Assists in understanding consequences"). This appeared to be a trigger for people forming important beliefs around hazards and preparedness and in motivating preparedness. For example, Interviewee 24 directly links thinking about outcomes or consequences with preparedness:

> …there was one other bloke who was well prepared [during the Canterbury snowstorm], and when I think about it I'm sure he would be in every other respect as well be well prepared because he's that sort of person.
> *So when you say he's 'that sort of a person', what do you sort of mean by that?*
> Well, he (pause)… thinks about outcomes and that sort of thing.

Awareness and understanding consequences were identified as quite different concepts, with awareness being more of a "flag" of the presence of hazards or preparedness, and understanding the consequences implying that people had undertaken some serious and detailed thought about issues. Understanding the consequences implied a realisation of what the impacts would be, a reflection on their own vulnerability and a realisation of "why" individuals needed to prepare. People often used the term "making it real". Understanding of consequences was reflected in detailed descriptions of what people thought the consequences might be. For example, raised awareness of the impacts of an earthquake might be "power failure". Understanding the consequences included thinking through aspects such as "If there is power failure there will be no lighting available. If it's winter it will be cold and there will be no heating. I won't be able to cook and feed my family". Understanding of consequences best occurred from exposure to experiential information, whether it was direct or indirect experience. While providing slightly less impact, interactive information was also better than passive information at helping people to understand consequences. This was often due to the fact that interactive information enables discussion with others and allows people to explore potential scenarios surrounding an event, thus expanding people's understanding of the potential impacts.

3.2.4 Developing skills

Information provides an opportunity to build skills related to hazards and preparedness within individuals (Fig. 2—"Immediate outcomes: Develops skills"). Information that is more likely to do this includes interactive and experiential information. Interactive activities can directly assist people to upskill with respect to practically preparing for and responding to an event, through group discussion, physical demonstrations or training. Encouraging the development of such skills can be a form of empowerment for people. Interviewee 45 from Wanganui describes how interactive information from school, combined with interaction in the home helped empower his children to develop a fire escape plan themselves.

> And why did you decide to [develop a fire escape plan with your children]? What was the prompt for that?
> The prompt came more from them, because they knew I was doing this work on disaster recovery and they had the fire—'drop, roll' and that—lessons at school, and they were saying, "Well, what's our evacuation plan? They didn't call it evacuation plan", they said, "How do we get out?" (laughter).
> So then when you developed your plan, how did you go about doing that?
> Well, we just […] asked them to do it for themselves, and tell us what they thought was the best way to do it. That was the most logical way—they made it …

Experience provides a similar type of upskilling as people are able to practice how to respond during an event and consequently will have a better idea of what items and skills they will need for future events.

3.3 Formation of beliefs

People's beliefs are an important part in the preparedness process (Fig. 2—"Beliefs"). People may hold existing beliefs (often related to prior experience) around which they interpret information or may form completely new beliefs through being exposed to information. For example, people may believe that safety is important, and interpret any

hazards and preparedness information they are exposed to in the context of this belief. Alternatively, people's experiential information about disasters would often prompt them to form the belief that disasters "Can happen anytime".

Three main types of belief were found: hazard beliefs (most of which relate to risk perception), preparedness beliefs and personal beliefs. Table 1 shows the different important beliefs that were identified and whether these beliefs were more likely to encourage or discourage preparedness.

Various studies have identified select beliefs that influence preparedness (as discussed in the literature review at the beginning of this paper), many of which have also been identified as part of this study. However, while many of the previous studies have touched on only a limited number of important beliefs, this study, being qualitative in nature, has enabled an entire cross-section of beliefs to be identified, as well as the relationship between those beliefs. As this paper cannot discuss the relationships in detail, more information about the nature and relationships between beliefs can be found in Becker et al. (submitted-b).

3.4 Emotions and feelings

The symbolic interactionist perspective emphasises the importance of emotion on actions, as emotions help people engage with and understand the world, and contribute to decision-making and behaviour (Franks 2003). Thus, in a hazards and preparedness context, emotion is important, as individuals have feelings about hazards themselves, as well as

Table 1 Key beliefs important to encouraging and discouraging preparedness (Becker et al. submitted-a)

	Encourages preparedness	Discourages preparedness
Hazard beliefs	There is a risk Can/will/does happen (inevitability) Anytime (imminence)	Would not happen at all Would not happen to me (lack of personalisation) Low risk Not imminent There will be warning Cannot do anything about hazards (lack of control, external locus of control)
Preparedness beliefs	Preparing is important Safety Survival Basics On your own Recognise limitations of preparing Preparing is a "way of life" Preparing will help me in a disaster (positive outcome expectancy)	Preparing would not work/make a difference (negative outcome expectancy) Preparing is "over the top"
Personal beliefs	I can prepare (self-efficacy) I can respond/resourcefulness (only if this is linked with the "I can prepare" belief) I have a personal responsibility to prepare I have a responsibility for others (e.g. children, family, the community)	I can respond/resourcefulness (when not linked with the "I can prepare" belief) I will fare okay I was okay in a previous event, therefore I will be okay in future (normalisation bias) Other people or places are more vulnerable than me (optimistic bias) Others will help in a disaster (e.g. agencies, other community members) It is not my responsibility to prepare

Table 2 Emotions and feelings about hazards as expressed by interviewees

Excitement
Excited by the thought of hazards or a hazardous event occurring
Interest
Two aspects of interest
General interest in hazards
Fascination with hazards
"Negative" emotions and feelings towards hazards
Frightening
Terrifying
Scary
Horrific
Dreadful
Fearful
Anxious
Nervous
Concerned
Unpleasant
Disconcerted
Uneasy
Dislike
Worry

feelings about the information they come into contact with (Fig. 2—"Emotions and feelings"). Several key emotions and feelings were noted during the course of the interviews (Table 2), mostly related to hazards themselves.

Some participants reported finding hazards exciting. These people were more likely to become involved in volunteering in the community with the intention of helping with emergency response during a disaster (e.g. become civil defence volunteers). There were others who expressed that they were interested in or fascinated by disasters, and some of these were also the people who thought hazards were exciting. Such an interest in hazards often led individuals to seek information about hazards and preparedness.

People expressed a number of "negative" emotions and feelings about hazards and earthquakes. At one end of the scale, people thought earthquakes were "frightening", "terrifying", "scary", "horrific", "dreadful" or "fearful". Such feelings were often prompted by seeing an earthquake disaster in the media. Sometimes these emotions may also be prompted by other earthquake information they had come into contact with. People who had experienced serious floods often described the experience as "horrific". In contrast to flood events, the 2006 snowstorm in Timaru was not described as a "horrific" event, likely due to its fairly benign impacts. Flooding was often described as horrific because it caused so much devastation to property and had a traumatic impact on people. If people had experienced a moderate earthquake (rather than a minor one), they might describe the earthquake they had experienced as "scary", or describe a potentially large future earthquake as "scary".

The frightening nature of potential future events caused people to worry. Perceived risk from a hazard caused people to worry, as articulated by Interviewee 47 who said, "I don't think I'm as concerned about earthquakes in my head as I am about flooding. Maybe because I perceive the danger of flooding [to be] higher than the danger of an earthquake". People also admitted to worrying because they felt that hazards were out of their control, although conversely there were some individuals who stated that because they felt hazards were uncontrollable they had made a conscious decision not to worry about them. Worry

might also arise if people had limited knowledge of what an event might be like, either because they had not been exposed to passive or interactive information or had no experience of such an event. A lack of information could also act to reduce some people's worry, as people said that if they had not seen any information about a hazard, then it was possible there was no risk to their community from that hazard (and thus no point worrying about it). People also stated a number of other reasons why they might not worry about hazards, including not perceiving they were at risk, surviving a previous event, thinking an event was unlikely to happen again, not being responsible for others' safety and a belief in their ability to respond should an event occur. People generally did not seem to express worry about not being prepared—most worry was directed towards hazard events.

Worry manifested itself in four main ways: it could prompt individuals to seek further information about hazards and preparedness; it could directly motivate people to get prepared for a disaster to reduce their worry; it could indirectly contribute to helping form people's beliefs that "preparing is important"; or it could cause people to deny the problem. Interviewee 28 describes how her worry prompted her to seek information, contributed to belief formation and was a motivator to getting prepared:

> … when I came to New Zealand, I was gathering together water and canned food and candles. [My husband] didn't have the slightest idea what I was doing and why I [was] worried about this stuff. And I said, "Well, you have earthquakes and things here", and at the time he had never heard of or even thought of doing anything just in case there was a problem. We lived in Auckland at that time and of course they don't think about earthquakes up there, but that is where I felt my first one. But I did study about, you know, what was around me and I knew there were volcanoes, and if there were volcanoes there could be earthquakes, and so I wanted to prepare for that …

In terms of the latter issue of denial, if people were very worried or anxious they often would try not to think or talk about disasters or preparedness (thus denying the issue), or they might form denial-related beliefs, such as "A disaster won't happen here" or "A disaster won't happen to me". Interestingly, there was at least one person (Interviewee 19) who had been concerned and got prepared to avert her anxiety but did not talk about it with anyone else because of the anxiety it caused if she raised the subject. So there may be very prepared people in the community who do not interact with or "recruit" new people into preparedness because discussing preparedness makes them feel anxious.

Overall, when analysing the interviews, it was found that those with higher levels of worry (expressed in ways such as calling earthquakes "frightening", "terrifying", "scary", "horrific" or "dreadful") were more likely to follow a process towards getting prepared, than those who were simply concerned or uneasy.

3.5 Societal factors

A number of societal factors were identified as important influences on the interpretive, meaning-making and preparedness process (Fig. 2—Dark coloured boxes). Community participation helped the preparedness process in several ways. First, it could act as a form of interactive information. For example, several interviewees spoke about their involvement with Neighbourhood Watch (a community-led crime prevention group) and how they had used meetings of this group as a forum for discussing hazard and preparedness issues. If people participated in their community in a general sense, they were also more likely to feel a sense of community and a sense of responsibility for other community members. This often led to a heightened awareness of the need to prepare, as they felt a social

responsibility to look after themselves in a disaster and be available to help others in the community.

Community groups often had a role in assisting with preparedness and relief. In particular, a Rotary Group scheme put together disaster kits, primarily to be sent overseas to assist in disaster situations. Community groups also often helped with raising funds for disaster-stricken areas both within New Zealand and overseas. People within the community groups felt a sense of responsibility to help other people less fortunate than themselves but had not considered undertaking disaster-related activities to assist their own communities, perhaps due to optimistic bias. Interviewee 37 gave another reason for why groups were more likely to help others affected by a disaster but less likely to encourage preparedness within their own communities. He suggested that funding was available to groups to carry out preparedness and relief activities in other locations, whereas this funding was not available within local communities for preparedness activities. Linked with the issue of lack of funding is the strong perception in New Zealand that getting prepared is seen primarily as an individual responsibility rather than a collective responsibility, and therefore, collective action is rarely undertaken to boost preparedness.

Linked with participation was the concept of leadership. Some interviewees were very proactive in their communities and showed leadership in trying to disseminate information and encouraging others to prepare. For example, Interviewee 17 in Timaru delivered information to his neighbourhood in an effort to raise awareness about hazards and preparedness and encourage others to prepare. Interviewee 35, from Napier, took the initiative of raising the topic of hazards and preparedness at a social dinner she had organised. So the interviews showed that key leaders in the community can be proactive in providing information, raising the subject of hazards and preparedness for discussion, and promoting preparedness within their communities.

Trust emerged as a theme during the interviews. The relationship between trust and other factors was complex. If people trusted the information, they were exposed to (usually also related to trust in the information source), then they were more likely to believe or take the advice presented in the information and be motivated to prepare. However, too much trust in a particular agency may lead a person to think that the agency will look after them in a disaster, and therefore, they do not need to prepare (also known as "transfer of responsibility"). Distrust in information (or the information source) resulted in the information seeming less credible, and therefore, they might not take any notice of it or prepare. However, distrust in an agency could boost personal motivation to prepare, because if a person does not think an agency will be able to look after them in a disaster, then they need to make sure they can look after themselves. Therefore, the interviews revealed that there is a difficulty in managing trust relationships. It is critical that people trust information, and the source (agency) it comes from; however, too much trust in the agency may prevent some people from preparing. A delicate balance needs to be struck between trust in an agency and individuals having a realistic belief that they will be "On their own" in a disaster.

Community participation can help build trust, as Interviewee 32 articulated when he suggested that if the community had been involved more in making decisions about flood risk in Wanganui, then the local authority might have had greater support for their flood mitigation proposals.

Trust can be difficult to build, and damaged fairly easily (Slovic 1993). The interviews revealed that people's experiences of disaster can have a profound impact on how they view authorities. If an agency performed well in a disaster, then individuals may be more likely to trust an agency; if not, then trust may be lost. For example, Interviewee 32 from

Wanganui describes his feelings about the council who he believes did not perform adequately in a disaster:

> Now some places should have a portable generator—and the council is one of them. The council lost power in that flood [in 2004] and their cell phones ran flat, so they had no […] communication. For a council that is just […] stupid! I don't know why they didn't have a donkey down in the basement to keep their computers running and their phones running. That is just negligence, I reckon.

Given that disasters are fairly infrequent, many gains and losses in trust also happen during times of quiescence, and over fairly everyday matters. For example, Interviewee 18 phoned the police to try and help them apprehend some local hooligans but they did not take any notice of her, leading her to think she would not bother calling the police again in future. Interviewees mentioned that financial matters could be a key issue over which trust is gained or lost. For example, councils who chose to spend large amounts of money on hazard mitigation that was not perceived as necessary often lost the trust of their citizens. Several participants from Timaru mentioned that the local council had invested significant funds into earthquake-proofing the council buildings. To the participants, the buildings looked new and structurally sound already, and they could not understand why so much money had been spent on earthquake improvements. In a similar vein, when people's own experiences of hazards do not match the information an agency is purveying, distrust can arise. For example, in Wanganui, people had experienced only moderate floods, and distrust arose when they could not understand why the regional council was insisting that it spend a large amount of money upgrading flood protection to a height that they had never seen a flood occur at before.

There were two main themes that arose with respect to responsibility. First, if individuals felt that they had personal responsibility to deal with hazards (rather than it be the responsibility of others such as the local council), then they were more likely to get prepared. Second, if individuals felt some sort of responsibility for others, such as children, older adults, other dependents, the community or animals, then they were more likely to prepare. Interviewee 46 suggests that having a responsibility for others raises worry or anxiety and prompts a desire to prepare: "I mean when you've got children, and young children, or even well, put it this way, dependent children, your fear factor or your consciousness of looking after other people is raised or heightened".

Interview data revealed that that preparing for disasters was not generally considered a social norm. Some participants directly stated this fact, while others alluded to it. Interviewee 34 provided the most direct statement that described how preparedness was not considered a social norm.

> *And so why, for example, you mentioned buying […] life insurance or house insurance, why would you go ahead and do that?*
> Because everybody does it, whereas not everybody prepares for hazards. If you tell somebody you didn't have any life insurance or you didn't have any house insurance, then you would be up to, shall we say, social vilification. Because if your house actually burned down and you had no insurance, and you had to start again, then people would say, 'What an idiot'. You would lose a lot of friends, even, on that basis. But if you lost your house in, say, a flood or an earthquake you'd have plenty of company, and so you're not really acting against the social norm; whereas having life insurance and house insurance is a social norm, where you tend to respond to

social norms. Maybe in the future proper natural hazards preparation will become a norm but I don't think it's a norm yet.

The concept that preparing is not a social norm was reflected in people's beliefs, particularly the suggestion that many people thought, "Preparing is over the top". Such norms hindered people's desire to prepare for earthquakes. Other norms were at play, however, for example, the norm that you should help other people in your community motivated some interviewees to prepare. The influence of social norms is discussed more fully in Becker et al. (submitted-c).

Finally, some respondents suggested that government regulation for preparedness would motivate them to prepare. One interviewee stated that in order to get insurance for certain items (i.e. Interviewee 12 mentioned getting insurance for a set of stamps), a degree of preparedness was required by her insurance company (i.e. a storage unit which was anchored to the floor). The requirements of certain legislation also prompted a degree of preparedness, for example, the Building Act 2004 and associated Building Code require that buildings are constructed or brought up to certain standards to protect life safety for earthquakes; the Health and Safety in Employment Act 1992 requires that certain safety and emergency preparations are undertaken in the workplace. Unfortunately there is little regulation in New Zealand that specifically targets household earthquake preparedness (e.g. the Building Act does not legislate for the retrofitting of residential buildings less than two storeys high and containing less than three household units), so evidence of the effectiveness of regulation on preparedness was only seen anecdotally though the parallel examples presented here.

3.6 Uncertainty

In the model, uncertainty is placed across all aspects of the process, as uncertainty is a major player in terms of information itself, people's interpretation of that information, their beliefs and feelings, societal influences and even to the point where they create an intention to prepare (Fig. 2—"Uncertainty"). Some aspects of the influence of uncertainty have already been discussed previously.

Individuals discussed a range of uncertainties they had, most of which were related either to uncertainty about hazards, or uncertainty about how to prepare. In particular, people often described how the outcome of a hazard event was very uncertain: no one knows exactly what will happen in an event, what the impacts will be, and what you might need to do to mitigate those impacts (either before or after the event). The timing of the next big event, particularly in relation to earthquakes, also provided an element of uncertainty for most. People were not likely to prepare if they were uncertain about whether an event might actually happen or not. Interviewee 31 summed this up by saying, "… there's no point in planning for something that may not happen. You know, you've got all your plans in place, and it's something else. You can do all your planning for fire, and you've left earthquake out of it". Interviewee 22 described how uncertainty about the nature of an event itself could hinder preparedness: "Well a disaster is something that strikes suddenly and without warning. And how can you prepare for it, because you don't really know what form it will take, or what you will have to do to overcome things". A complex task like making a family plan for what to do after an earthquake was complicated by uncertainty surrounding what effects could be expected during a potential event and as consequence was often a task not tackled by the interviewees. People often stated they did not know what scenario to make a plan for. The interviews reflect that uncertainty has an

impact on preparedness through influencing beliefs such as negative outcome expectancy, fatalism, denial and enhancing the belief that people will simply be able to respond at the time when they find out exactly what the disaster is. Uncertainty can reduce worry and concern about hazards and reduces short-term motivation to act and get prepared.

Uncertainty can also lead to anticipatory anxiety, whereby people are anxious about facing something they have feared in the past such as earthquakes. Interviewee 13 describes how uncertainty about the timing and impacts of earthquakes leads to fear and anticipatory anxiety about how she could deal with and respond to an earthquake. This then prevents her from thinking about how to practically prepare for an earthquake, and as a consequence, she is not prepared.

> Well, the thought of an earthquake scares me. […] I think about how we would all cope. And the likes of the tsunami. Because they come so quickly those things, whereas snow I have dealt with a lot more, that doesn't frighten me quite the same. […] And the other thing […is that …] you're not in such a big populated area that you don't see great big two storey buildings falling down on top of you. Like you would if you were in a bigger city. […] You still see your buildings falling down on top of you and whatever, but, […] I think an earthquake here wouldn't be the same as a big earthquake in Christchurch. So I guess in that respect I haven't really let myself consider it. Other than yes, it would scare me. How you deal with it and how you fare.

Other interviewees reported that uncertainty was a motivator of preparedness. For the most part despite their uncertainty about the nature of a future earthquake event, these individuals still thought that an event "Can happen anytime". These people tended to have positive outcome expectancy and believe that preparedness would be useful in an event. They also seemed to have a realistic understanding of the limitations of preparedness, in that preparedness might not address every problem they encountered during a disaster, but would go a fair way towards helping them survive and prosper after an event. Some people were worried by the uncertainty surrounding the potential impacts of a hazard event and so were motivated to directly get prepared because of this worry. For these people, such preparedness reduced the worry and the uncertainty of how to respond.

Uncertainty about hazards or preparedness could also motivate an individual to seek further information in an attempt to become better informed. Uncertainty about information could also encourage information seeking in an attempt to verify the information through different sources. Individuals were more likely to seek information due to uncertainty because of lack of experience, uncertainty regarding hazards and preparedness from what they saw (e.g. information seen from passive sources) or heard (e.g. a speaker at a community group), or from uncertainty about how to respond in an event. Information seeking tended to be interactive (for example, people would talk to civil defence, join a group, talk to their local school) or they may draw upon limited passive information sources (for example, the Internet and telephone book were the most often cited sources of passive information).

Links between uncertainty and trust were evident. People's uncertainty about information could lead to reduced trust. For example, as discussed in the section on "Societal factors", where information was contradictory, uncertainty and distrust arose (e.g. if people's perceived understanding of risk differed to an organisation's perception of risk and ways of dealing with it). In addition, trust issues arose when people had uncertainty over whether mitigation measures advocated or managed by an organisation would

actually reduce risk in an event (e.g. whether stopbanks or pumps would actually reduce flood risk in an event).

3.7 Acceptance of loss

Some individuals appear to undertake a "rational" assessment of the information available to them about hazards and preparedness in making a decision whether to prepare or not (Fig. 2—"Acceptance of loss"), similar to the process suggested by Kunreuther (1992). In doing so, they also draw upon their existing beliefs and feelings (and the influence that societal factors have on these beliefs). As a consequence, some may choose to make an "informed decision" about whether to accept a potential loss or not. If they choose to accept the loss, they may decide that it is not worth preparing. A decision may be based on what the individual believes to be good or adequate information or may be based on only limited information. Most decisions about acceptance of loss are related to accepting loss of money or property, rather than loss of more social aspects such as loss of life or community. For example, Interviewee 1 discussed monetary costs versus consequences in making decisions about whether to accept loss or not: " … you are always going to be balancing the cost, if you like, against the consequences. You can accept some losses, in some cases you accept them, whereas rather than pay the price of eliminating the risks …"

3.8 Formation of intentions to prepare

The interviews revealed that a distinct category of "Intention to prepare" could be identified (Fig. 2—"Intention to prepare"). People drew upon information, societal influences, beliefs and feelings before deciding whether to prepare or not.

3.9 Resource issues

Several interviewees indicated that while preparing was important, it could be impeded by what are described as "Resource issues" (Fig. 2—"Resource issues"). People identified a lack of knowledge as a barrier to getting prepared, particularly a lack of knowledge about what preparedness items to gather, how this should be done and how to make their buildings safer. Linked with this lack of knowledge was that fact that people often did not feel capable of preparing, usually because they lacked the knowledge, skills or tools to undertake preparedness. Lack of knowledge about hazards was important at earlier stages of the process, in particular with respect to assisting with the formation of beliefs and feelings.

A major barrier to preparing was time, with interviewees suggesting that they just did not have time to undertake preparedness, as their lives were already full with undertaking other daily tasks. People suggested that they had other priorities that were far more pressing, such as work, looking after families or just living their lives.

Getting prepared was also seen as expensive by a number of participants, and consequently, many had not undertaken preparedness for this reason. Of those that had prepared, often the cheapest and easiest measures had been undertaken, such as storing food or water. More costly measures such as retrofitting buildings had only been undertaken by a very few participants in the study and often had been done as a part of general house maintenance or renovation, rather than specific retrofitting.

A major barrier to preparedness for many interviewees was that they had a problem of knowing where to store preparedness items. Some simply suggested they had no storage space in which they could store any items and therefore had not prepared because of this. Others were confused about where the best place was to store items. People had a myriad of questions on this topic: Should they store items together in one place or should they be scattered around the house? Should they store items inside the house or outside in a separate space such as the garage? Where was the safest place? What if they could not get to the items in an emergency, for example, if the garage collapsed in an earthquake?

Another issue that emerged was that sometimes people did not prepare because they did not want to see items go unused during times of quiescence (either because they thought it was a waste or they thought that the item would not work in an emergency if it had not been kept updated or in regular use).

Finally, although most people interviewed were home owners, there were a few that did not own their own home (e.g. they rented). These people admitted that they were either less willing or unable to make changes to their residences due to the fact that they did not have jurisdiction over the building they lived in.

3.10 Preparedness

In general, participants were more likely to have undertaken simple preparedness actions related to collecting survival items (Fig. 2—"Preparedness undertaken"). Water and food were the two most common collated preparedness items. Other common items included alternative cooking and heating devices, torches, radios, candles, batteries and smoke alarms. People's understanding of preparedness reflected their belief that they thought preparing was primarily related to having the "basics" required for safety or survival. While many admitted to having prepared survival items specifically for an emergency, there was an equal number of others who were using "just what they had in the house already" for an emergency. Undertaking exercises, drills and training for emergencies were also mentioned as important aspects of preparedness by interviewees.

Few respondents had actually undertaken more complex tasks, such as preparing an emergency plan or retrofitting their home for earthquakes. That few had undertaken such complex tasks appeared to be related to a number of factors, such as their focus on "basics" and "survival", a lack of knowledge of the consequences of a catastrophic event (also related to hazard uncertainty), a lack of knowledge about how to undertake more complex tasks (also related to preparedness uncertainty), fatalism, being overly optimistic about the outcome of a large event and resource difficulties in carrying out complex preparedness actions.

While survival items were most commonly mentioned in relation to the concept of preparedness, participants did discuss other aspects that they considered preparedness to be. For example, interviewees noted that preparedness was also necessary for wider society—for example, workplaces should be prepared for disasters, local authorities should ensure that community mitigation measures are in place, and buildings should be safely constructed. Also many people referred to preparedness more philosophically, saying it was about "forward thinking" or that preparedness should be "a way of life".

Few people discussed the additional benefits of preparing. Of those that did, most referred to the fact that being prepared meant they had additional items in the house they could use if they need to (e.g. could break into food supplies, use a gas cooker); that preparedness increased general safety (e.g. items were secured so small children would not be injured, acquired first aid or fire safety skills through training); and two people mentioned that

freezing bottled water in their freezer made the freezer more efficient. People did not really connect preparing with broader benefits, such as saving money in the long term.

3.11 Sustained preparedness

Getting people to commence preparing is not the only issue. A significant challenge is getting them to sustain and update their preparedness over time (e.g. replenish food and water, ensure that fresh batteries are available) (Fig. 2—"Sustained preparedness"). A number of interviewees did undertake sustained preparedness, while many others thought it was important but just did not get around to it.

People suggested they kept their preparedness items updated for two main reasons. The first was related to dispositional characteristics, whereby "organised" people were more likely to report keeping their supplies updated. They used a variety of methods to organise this. One interviewee wrote in her diary to update her supplies every 6 months. Others used the change from "normal" time to "daylight savings" time (and vice versa) as a cue to replenish or update their supplies. This approach is advocated in some passive information preparedness campaigns (e.g. by the Fire Service regarding changing batteries in smoke alarms), so it is clear that some individuals have taken these messages on board in this context.

Another reason for undertaking sustained preparedness was that people desired to keep their supplies fresh and/or in working order in case they had to use them. In particular people wanted to ensure they had safe drinking water and food, and this desire for safety encouraged people to replenish these items as part of sustained preparedness. Many beliefs about the necessity for safe water in particular were formed by exposure to passive information (i.e. seeing water issues occurring in a disaster elsewhere) or by experience (e.g. visiting a country with poor water quality, needing to ensure drinking water is safe for outdoor recreation).

Respondents also noted that constant informational reminders were needed to ensure that they remembered to undertake sustained preparedness.

4 Discussion

This research used a symbolic interactionism perspective to identify the personal and social processes that interact to inform the social construction of risk beliefs and how they are enacted as preparedness actions. Such an approach allowed information use, interpretation and the relationship with household preparedness to be identified and mapped into a model (Fig. 2). This model is depicted linearly. However, the process itself is not strictly linear as feedback also occurs during the process. This is supported by other models such as the PrE theory, which suggests that people's appraisal of a threat, coping and evaluation of responsibility for the threat does not occur in a linear fashion (i.e. primary appraisal followed by a secondary appraisal) but rather can happen as part of a parallel simultaneous process (Mulilis and Duval 1997, 2003).

Important aspects identified for the model are summarised as follows.

4.1 Type of information (passive, interactive and experiential)

Analyses revealed that people utilised passive, interactive and experiential information. These serve functions ranging from raising awareness through to directly motivating

preparedness. Traditional education programmes about hazards and preparedness tend to focus on providing passive information, and the relationship between this type of information and cognitively low level awareness-raising provides insights into why traditional risk communication is relatively ineffective in motivating preparedness. Consequently, programme effectiveness will be enhanced by providing the interactive and experiential information identified in the analyses as stimulating not only understanding but also action. For example, providing school children with interactive homework assignments around household preparedness would offer a means to move beyond more passive forms of preparedness education.

4.2 Immediate outcomes

A number of immediate outcomes from exposure to hazard and preparedness information were identified as part of the model. Information raised awareness and knowledge and prompted thinking and talking about hazard issues, which is consistent with previous research identifying critical awareness as a key part of the preparedness process (McIvor and Paton 2007; Paton 2003, 2007; Paton et al. 2003, 2005, 2006a, b; Lindell and Perry 2011; Lindell and Prater 2000; Mileti and Darlington 1995, 1997; Mileti and Fitzpatrick 1992, 1993; Wood et al. 2011). Information, particularly interactive and experiential information, contributes to the positive social construction of risk and the development of competencies that underpin preparedness. A category of influence not previously identified in the literature was "Understanding consequences". This construct embodied more detailed systematic thinking and comprehension about hazard impacts. People with a better understanding of consequences develop more complex causal models of earthquakes and were more likely to be motivated to get prepared (McClure et al. 1999; Hurnen and McClure (1997) The present study reinforced the importance of having a complex causal model and adds to previous work by identifying how it is partially socially constructed. Thus, education strategies should promote learning in social contexts to stimulate critical awareness in which risk beliefs that assist people to understand the consequences of an earthquake event are forged and to develop the skills that allow them to enact these beliefs as preparedness actions.

4.3 Formation of beliefs

The beliefs that underpin preparedness can be divided into hazard beliefs, preparedness beliefs and personal beliefs. With respect to hazard beliefs, the literature identifies two main issues regarding risk perception. The first is that risk perception appears to be only weakly correlated with household seismic adjustment adoption (Solberg et al. 2010). The second is that prior studies have identified only a few important aspects of risk perception and other salient beliefs, but not the full range that exist and how these interact within the preparedness process (Lindell and Perry 2000; Lindell et al. 2009). This research has been able to map the most important perceptions and beliefs that influence preparedness and the interactions between these. Further details of such beliefs are described in Becker et al. (submitted-b).

With regard to preparedness and personal beliefs, this paper reiterates some of those identified earlier. This includes, for example, self-efficacy (Cowan et al. 2002; Duval and Mulilis 1999; Lindell and Prater 2002; Lindell and Whitney 2000; McClure et al. 1999, 2001; McClure et al. 2007a, b; Mulilis and Duval 1995; Rüstemli and Karanci 1999; Şakioroğlu and Karanci 2008); outcome expectancy (Davis 1989; Farley et al. 1993;

Garcia 1989; Lindell and Whitney 2000; Mulilis and Duval 1995; Mulilis and Lippa 1990; Şakioroğlu and Karanci 2008; McIvor and Paton 2007; Paton 2003; Paton et al. 2003, 2005, 2010a, b; McIvor et al. 2009; Paton and Johnston 2008); personal responsibility (Garcia 1989; Jackson 1977, 1981; Mulilis and Duval 1995, 1997; Perry and Lindell 2008); normalisation bias (Johnston et al. 1999; Mileti and O'Brien 1992; Nguyen et al. 2006; Russell et al. 1995) and optimistic bias (Burger and Palmer 1992; Helweg-Larsen 1999; McClure 1998; Spittal et al. 2005). However, the findings of the present study also identified new beliefs. Prominent here were those describing people's views that "Preparedness is a way of life" and the belief that "Preparing is over the top". Emergency managers undertaking earthquake education should ensure that any educational programmes attempt to develop the helpful beliefs identified in this paper, and work to reduce negative beliefs through the use of interactive programmes.

4.4 Emotion and feelings

The analyses identified how important emotions and feelings, such as excitement, interest and those related to anxiety, fear and worry, must be accommodated in risk communication and outreach programs. Emotions and feelings affect the quality of several processes, including information seeking, belief formation and direct preparedness. Overall, those with higher levels of anxiety or worry (expressed in ways such as earthquakes are "frightening", "terrifying", "scary", "horrific" or "dreadful") were more likely follow a process towards getting prepared, than those who were simply concerned or uneasy. These findings are consistent with the Yerkes-Dodson law, and with other research that supports the concept of high arousal leading to action (Hanoch and Vitouch 2004; Dooley et al. 1992). Some previous earthquake research has found that anxiety can both facilitate and inhibit preparedness (Paton et al. 2005). Paton et al. (2005) found that anxiety could have positive or negative effects on preparing depending on whether people knew what to do to prepare. For those who did not know what to do, anxiety would prevent preparing. It is also likely that other contextual factors, such as experience or exposure to other specific types of information, or self-efficacy, play a part in determining whether anxiety will lead to action (Dutton and Carroll 2001). For example, Hanoch and Vitouch (2004) suggest that restricting information (i.e. focussing on essential or goal-relevant information rather than providing too much information) can lead to an improvement in performance during states of high arousal. This is consistent with the findings of Paton et al. (2005). This may well be the case with the interviewees, as many who got prepared as a consequence of feeling worried did so after either being exposed to or seeking specific goal-relevant information on how to prepare. Thus, despite the interviews showing that emotions such as "fear" are important in motivating preparedness, it is not just "fear" that gets people prepared; specific information about preparedness is also required to ensure people develop positive outcome expectancy. This supports previous findings that earthquake education programmes should provide a realistic perspective of the impacts of earthquakes to help people acquire a level of hazard concern that promotes action (vs. fear; e.g. Mileti 1999), as well as practical advice about the effectiveness of preparedness measures (McClure et al. 1999; Paton 2006; Wood et al. 2011).

4.5 Societal factors

Several key societal factors were identified as interacting with the information and preparedness process, including sense of community, community participation, leadership,

trust, responsibility, social norms and a requirement to prepare. While many of these attributes have been highlighted from prior quantitative work (e.g. Paton and colleagues highlight many of these aspects in their resilience model, Paton et al. 2000, 2001a, b, 2006b; 2008, 2010a; Paton 2005, 2006, 2007), the present study contributed a deeper understanding of how these elements interact. For example, it was found that trust can be difficult to build, and damaged fairly easily, in line with Slovic's (1993) findings regarding trust asymmetry. The interviews revealed that experiential information, both in times of quiescence and disaster, play a key role in influencing trust relationships, and in forming beliefs about whether preparedness was important or not, or whether it would be effective (outcome expectancy). Societal norms had a strong influence on formation of beliefs such as "Preparing is over the top", or that it was important to help other people in your community during a disaster. It is evident that the influence of society has diverse influences on the preparedness process and cannot be ignored when developing earthquake education programmes.

4.6 Uncertainty

Uncertainty was found to be influential across many aspects of the model: individuals were uncertain about information, about the hazard itself, about the outcome of a hazard event or about how they could deal with a hazard. Uncertainty could act to derail the preparedness process (e.g. through the formation of unhelpful beliefs or reducing worry) or could be a motivator of preparedness (e.g. by increasing worry). Uncertainty could also lead to a person seeking further information. Uncertainty can be difficult to address, as many aspects of earthquake hazard in particular are not easily quantified or communicated to the lay public. Some elements of uncertainty can be tackled, for example, people's uncertainty about the presence of an earthquake hazard due to a lack of knowledge. In this case, the use of interactive information in combination with passive information is potentially the best way to raise knowledge. Other aspects will likely always be unknown (e.g. when the next earthquake will occur) and will need to be addressed slightly differently. For example, the focus of the information might need to be on assisting people to believe that it "Can happen anytime" and letting them know how to deal with it. Information needs to be tailored to the specific type of uncertainty that is intended to be addressed.

4.7 Other aspects of preparedness

After forming core beliefs, some (but not all) people undertook a rational cognitive assessment of whether they could accept the losses imposed by an earthquake or not, and if they were willing to accept the loss, often did not prepare (similar to the process suggested by Kunreuther 1992).

Resource issues such as lack of knowledge, lack of time, lack of capability, other priorities, cost, knowing where to store items and renting a property (rather than owning a home) were barriers to getting prepared. Such resource issues have also been highlighted in previous research (e.g. Blessman et al. 2007; Kunreuther et al. 1978; Mileti and Darlington 1995; Palm et al. 1990; Carter-Pokras et al. 2007; Lindell et al. 2009), and ways of addressing these issues need to be factored into education and empowerment programmes, particularly, given that factors such as financial resources or competing demands on people's time are difficult to influence, with regard to developing residual risk assessments at the community level.
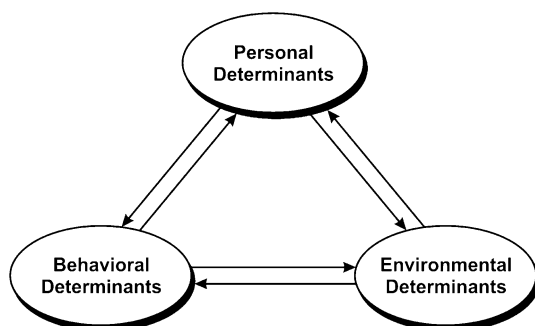
Recognition of the role of resource issues reiterates the importance of finding a role for intentions. The existence of resource constraints can result in people forging intent but not following through as they cannot afford to act or lack time and so on. Intentions should thus continue to play a role in the empirical analysis of preparedness.

An interesting finding arose in relation to people's actual preparedness. This tended to be focused on gathering together simple survival items, rather than undertaking more complex tasks such as developing an earthquake response plan or undertaking mitigation actions. This reiterates the tendency that people are most likely to do things that are deemed easier to undertake (Farley et al. 1993; Russell et al. 1995), have been recommended for a long time (Mileti and Darlington 1995) or are associated with general emergency preparedness (Heller et al. 2005). In addition, people are not likely to sustain their preparedness for any length of time. It is obvious there still remains a problem with people focussing on survival items for preparedness and this needs to be a focus of on-going educational efforts.

4.8 Fit with previous models of earthquake adjustment adoption

When reflecting on previous models it can be said that the model developed for this research fits aspects of previous work. For example, it fits with previous TRA and TPB models in that attitudes towards behaviours, subjective norms and control are influential on behavioural intentions. Consistent with the PMT seen in Mulilis and Lippa's research (1990) and the PrE model (Duval and Mulilis 1999; Mulilis 1996; Mulilis and Duval 1995, 1997, 2003; Mulilis et al. 2000, 2003), people do assess the likelihood and severity of the consequences of the threatening event, their self-efficacy, and the response efficacy of protective actions in coming to decisions about whether to prepare or not. Personal responsibility for protection is also another important aspect, as identified in the PrE model. The model fits more closely with Lindell and Perry's (1992, 2000, 2011) Protective Action Decision Model as it maps out a variety of situational, personal and social characteristics that influence the preparedness process. Paton's (2006) model also provides a good fit, as many of the community and societal indicators found in Paton and colleagues' research are also confirmed by this research (e.g. that self-efficacy, outcome expectancy, critical awareness, community participation, empowerment and trust) are important in motivating preparedness. The new model, however, advances thought by identifying additional predictors of preparedness (whether they be directly influential of preparedness or mediating factors) and helping to understand the interactions between different variables.

Fig. 3 Bandura's model of Social Cognitive Theory representing the triangular relationship between the three main factors of human behaviour (Bandura 2001)

In attempting to place it in context with other current theories, it perhaps best resembles a model developed according to Bandura's (1986) Social Cognitive Theory (Fig. 3). This is perhaps not surprising, as Bandura's focus fits well within a symbolic interactionist perspective. As well as identifying that cognition plays an important role, the theory also considers the importance of context, interaction and meaning-making in people's decisions about behaviour. In his model, Bandura suggests that human behaviour is influenced by three main factors: personal determinants (also described as cognitive factors, e.g. knowledge, expectations, attitudes); behavioural determinants (e.g. skills, practice, self-efficacy); and environmental determinants (e.g. social norms, access in the community, influence on others). Some of these factors have a direct influence on behaviour, while others interact with other factors or serve as mediators (for example, the influence of socio-environmental factors is mediated by cognitions). The three main factors are certainly seen in the model developed from this research (Fig. 3), with the cognitive factors represented by "Beliefs" and "Uncertainty"; the behavioural determinants primarily represented by "Immediate outcomes", "Intention to prepare" and "Preparedness"; and environmental determinants represented by "Information" and a variety of societal influences. Perhaps, the theory's one weakness is a lack of focus on emotions as an influence on behaviour (Breinbauer et al. 2005); this research has highlighted that in the earthquake preparedness context "Emotion and feelings" are a key factor in developing beliefs and directly driving behaviour. While Social Cognitive Theory has been used before to explain certain aspects of disasters (e.g. Benight and Bandura 2004), it has not been specifically applied in an earthquake preparedness context, and with some adaptation could well be a better fit than previous models.

5 Limitations and future research opportunities

This research undertaken for this project has several limitations. First, as the study was qualitative in nature it does not measure representativeness of the model across the wider population. A quantitative study is required to test and confirm the model findings for the general New Zealand population as a whole. Further research could also confirm whether it is also applicable in an international context. Second, due to the self-selection of interviewees there is likely some bias present in the interview sample, namely: an over-representation of "community-minded people" (as the majority of invitations were sent to community groups); an over-representation of people interested in earthquakes and preparedness; and an over-representation of older people in the sample (i.e. over half the sample were 60 years or over). Third, this model did not consider the influence of personality on preparedness, as the primary focus of the research was to identify aspects that could be useful for developing new directions for earthquake education and resilience strategies, rather than focus on something that is impossible to change such as personality. Future research could focus on identifying aspects of personality that contribute to getting prepared and how this relates to the overall model.

References

Ajzen I (1985) From intentions to actions: a theory of planned behaviour. In: Kuhl J, Beckmann J (eds) Action control: from cognition to behaviour. Springer, Berlin, pp 11–40

Bandura A (1986) Social foundations of thought and action: a social cognitive theory. Prentice Hall, Englewood Cliffs

Bandura A (2001) Social cognitive theory of mass communication. Mediapsychology 3:265–299

Becker JS, Johnston DM, Paton D, Ronan KR (submitted-a) How people use earthquake information and its influence on household preparedness in New Zealand. J Civil Eng Archit

Becker JS, Paton D, Johnston DM, Ronan KR (submitted-b) Salient beliefs about earthquake hazards and household preparedness. Risk Anal

Becker JS, Paton D, Johnston DM, Ronan KR (submitted-c) Societal factors of earthquake information meaning-making and preparedness. Int J Mass Emerg Disasters

Benight CC, Bandura A (2004) Social cognitive theory of posttraumatic recovery: the role of perceived self-efficacy. Behav Res Ther 42(10):1129–1148

Blessman J, Skupski J, Jamil M, Jamil H, Bassett D, Wabeke R, Arnetz B (2007) Barriers to at-home-preparedness in public health employees: implications for disaster preparedness training. J Occup Environ Med 49(3):318–326

Blumer H (1969) Symbolic interactionism: perspective and method. University of California Press, Los Angeles

Breinbauer C, Maddaleno M, Maddaleno H (2005) Youth: choices and change, promoting healthy behaviours in adolescents. Pan American Health Organisation, Washington DC

Burger JM, Palmer ML (1992) Changes in and generalization of unrealistic optimism following experiences with stressful events: reactions to the 1989 California Earthquake. Pers Soc Psychol Bull 18(1):39–43

Carter-Pokras O, Zambrana RE, Mora SE, Aaby KA (2007) Emergency preparedness: knowledge and perceptions of Latin American immigrants. J Health Care Poor Underserved 18(2):465–481

Corbin J, Strauss A (2008) Basics of qualitative research, 3rd edn. Sage, Thousand Oaks

Cowan J, McClure J, Wilson M (2002) What a difference a year makes: how immediate and anniversary media reports influence judgements about earthquakes. Asian J Soc Psychol 5:169–185

Davis MS (1989) Living along the fault line: an update on earthquake awareness and preparedness in Southern California. Urban Resour 5(4):8–14

Dooley D, Catalano R, Mishra S, Serxner S (1992) Earthquake preparedness - predictors in a community survey. J Appl Soc Psychol 22(6):451–470

Dutton A, Carroll M (2001) Eyewitness testimony: effects of source of arousal on memory, source monitoring, and metamemory judgements. Aust J Psychol 53(2):83–91

Duval TS, Mulilis J-P (1999) A person-relative-to-event (PrE) approach to negative threat appeals and earthquake preparedness: a field study. J Appl Soc Psychol 29(3):495–516

Earthquake Commission (2011) Monitoring the effectiveness of the Earthquake Commission's communication programme: quarter 2 2011. Earthquake Commission, Wellington

Farley JE (1998) Earthquake fears, predictions, and preparations in Mid-America. Southern Illinois University Press, Carbondale

Farley JE, Barlow HD, Finkelstein MS, Riley L (1993) Earthquake hysteria, before and after: a survey and follow-up on public response to the browning forecast. Int J Mass Emerg Disasters 11(3):305–321

Fishbein M, Ajzen I (1975) Belief, attitude, intention and behavior: an introduction to theory and research. Addison-Wesley, Reading

Flick U (2006) An introduction to qualitative research, 3rd edn. Sage, London

Franks DD (2003) Emotions. In: Reynolds LT, Herman-Kinney NJ (eds) Handbook of symbolic interactionism. Rowman & Littlefield, Lanham, pp 787–809

Garcia EM (1989) Earthquake preparedness in California: a survey of Irvine residents. Urban Resources 5(4):15–19

Gasparini P, Manfredi G, Zschau J (2011) Earthquake early warning as a tool for improving society's resilience and crisis response. Soil Dyn Earthq Eng 31(2):267–270

Glaser BG, Strauss AL (1967) The discovery of grounded theory: strategies for qualitative research. Aldine de Gruyter, New York

Hanoch Y, Vitouch O (2004) When less is more. Information, emotional arousal and the ecological re-framing of the Yerkes–Dodson Law. Theory Psychol 14(4):427–452

Heller K, Alexander DB, Gatz M, Knight BG, Rose T (2005) Social and personal factors as predictors of earthquake preparation: the role of support provision, network discussion, negative affect, age, and education. J Appl Soc Psychol 35(2):399–422

Helweg-Larsen M (1999) (The lack of) optimistic biases in response to the 1994 Northridge Earthquake: the role of personal experience. Basic Appl Soc Psychol 21(2):119–129

Hendrikx J (2007) The June 2006 Canterbury snowstorm. J Hydrol NZ 46(1):33–49

Herman-Kinney NJ, Verschaeve JM (2003) Methods of symbolic interactionism. In: Reynolds LT, Herman-Kinney NJ (eds) Handbook of symbolic interactionism. Rowman & Littlefield, Lanham, pp 213–252

Hurnen F, McClure J (1997) The effect of increased earthquake knowledge on perceived preventability of earthquake damage. Australas J Disaster Trauma Stud 3:11

Jackson EL (1977) Public response to earthquake hazard. Calif Geol 30:278–280

Jackson EL (1981) Response to earthquake hazard—the west coast of North America. Environ Behav 13(4):387–416

Johnston D, Bebbington MS, Lai C-D, Houghton BF, Paton D (1999) Volcanic hazards perceptions: comparative shifts in knowledge and risk. Disaster Prev Manag 8(2):118–126

Kerr J, Nathan S, Van Dissen R, Webb P, Brunsdon D, King A (2004) Planning for development of land on or close to active faults: a guideline to assist resource management planners in New Zealand. Ministry for the Environment, Wellington

Kirschenbaum A (2002) Disaster preparedness: a conceptual and empirical reevaluation. Int J Mass Emerg Disasters 20(1):5–28

Kirschenbaum A (2004) Generic sources of disaster communities: a social network approach. Int J Sociol Soc Policy 24(10–11):94–129

Kunreuther H (1992) Earthquake insurance as a hazard reduction strategy: the case of the homeowner. Paper prepared for a USGS monograph on the socio-economic impacts of earthquakes. Centre for Risk Management and Decision Processes, University of Pennsylvania, Philadelphia

Kunreuther H, Ginsberg R, Miller L, Sagi P, Slovic P, Borkan B, Katz N (1978) Disaster insurance protection: public policy lessons. Wiley, New York

Lindell MK, Perry RW (1992) Behavioural foundations of community emergency planning. Hemisphere Press, Washington

Lindell MK, Perry RW (2000) Household adjustment to earthquake hazard: a review of research. Environ Behav 32(4):461–501

Lindell MK, Perry RW (2011) The protective action decision model: theoretical modifications and additional evidence. Risk Anal. doi:10.1111/j.1539-6924.2011.01647.x

Lindell MK, Prater CS (2000) Household adoption of seismic hazard adjustments: a comparison of residents in two states. Int J Mass Emerg Disasters 18(2):317–338

Lindell MK, Prater CS (2002) Risk area residents' perceptions and adoption of seismic hazard adjustments. J Appl Soc Psychol 32(11):2377–2392

Lindell MK, Whitney DJ (2000) Correlates of household seismic hazard adjustment adoption. Risk Anal 20(1):13–25

Lindell MK, Arlikatti S, Prater CS (2009) Why people do what they do to protect against earthquake risk: perceptions of hazard adjustment attributes. Risk Anal 29(8):1072–1088

McClure J (1998) Psychology of perception of risk. NZ Sci Rev 55(1–2):20–24

McClure J, Walkey F, Allen M (1999) When earthquake damage is seen as preventable: attributions, locus of control and attitudes to risk. Appl Psychol 48(2):239–256

McClure J, Allen MW, Walkey F (2001) Countering fatalism: causal information in news reports affects judgments about earthquake damage. Basic Appl Soc Psychol 23(2):109–121

McClure J, Sutton RM, Sibley CG (2007a) Listening to reporters or engineers? How instance-based messages about building design affect earthquake fatalism. J Appl Soc Psychol 37(9):1956–1973

McClure J, Sutton RM, Wilson M (2007b) How information about building design influences causal attributions for earthquake damage. Asian J Soc Psychol 10(4):233–242

McIvor D, Paton D (2007) Preparing for natural hazards: normative and attitudinal influences. Disaster Prev Manag 16(1):79–88

McIvor D, Paton D, Johnston D (2009) Modelling community preparation for natural hazards: understanding hazard cognitions. J Pac Rim Psychol 3(2):39–46

Mileti DS (1999) Disasters by design: a reassessment of natural hazards in the United States. Joseph Henry Press, Washington

Mileti DS, Darlington JD (1995) Societal response to revised earthquake probabilities in the San Francisco Bay area. Int J Mass Emerg Disasters 13(2):119–145

Mileti DS, Darlington JD (1997) The role of searching in shaping reactions to earthquake risk information. Soc Probl 44(1):89–103

Mileti DS, Fitzpatrick C (1992) The causal sequence of risk communication in the Parkfield Earthquake prediction experiment. Risk Anal 12(3):393–400

Mileti DS, Fitzpatrick C (1993) The great earthquake experiment: risk communication and public action. Westview Press, Boulder

Mileti DS, O'Brien PW (1992) Warnings during disaster: normalizing communicated risk. Soc Probl 39(1):40–57

Mulilis J-P (1996) Social considerations of disaster-resistant technology: the person-relative-to-event (PrE) model of coping with threat. J Urban Technol 3(3):59–70

Mulilis J-P, Duval TS (1995) Negative threat appeals and earthquake preparedness: a person-relative-to-event (PrE) model of coping with threat. J Appl Soc Psychol 25(15):1319–1339

Mulilis J-P, Duval TS (1997) The PrE model of coping and tornado preparedness: moderating effects of responsibility. J Appl Soc Psychol 27(19):1750–1765

Mulilis J-P, Duval TS (2003) Activating effects of resources relative to threat and responsibility in person-relative-to-event theory of coping with threat: an educational application. J Appl Soc Psychol 33(7):1437–1456

Mulilis J-P, Lippa R (1990) Behavioral change in earthquake preparedness due to negative threat appeals: a test of protection motivation theory. J Appl Soc Psychol 20(8, Pt 1):619–638

Mulilis J-P, Duval TS, Lippa R (1990) The effects of a large destructive local earthquake on earthquake preparedness as assessed by an earthquake preparedness scale. Nat Hazards 3(4):357–371

Mulilis J-P, Duval TS, Bovalino K (2000) Tornado preparedness of students, nonstudent renters, and nonstudent owners: issues of PrE theory. J Appl Soc Psychol 30(6):1310–1329

Mulilis J-P, Duval TS, Rogers R (2003) The effect of a swarm of local tornados on tornado preparedness: a quasi-comparable cohort investigation. J Appl Soc Psychol 33(8):1716–1725

New Zealand Police (2012) List of deceased, as at 9 Feb 2012. New Zealand Police. http://www.police.govt.nz/list-deceased. Accessed 23 Feb 2012

Nguyen LH, Shen HK, Ershoff D, Afifi AA, Bourque LB (2006) Exploring the causal relationship between exposure to the 1994 Northridge earthquake and pre- and post-earthquake preparedness activities. Earthq Spectra 22(3):569–587

Palm R, Hodgson ME, Blanchard RD, Lyons D (1990) Earthquake insurance in California. Westview, Boulder

Paton D (2003) Disaster preparedness: a social-cognitive perspective. Disaster Prev Manag 12(3):210–216

Paton D (2005) Community resilience: integrating hazard management and community engagement. Paper presented at the Proceedings of the international conference on engaging communities, Brisbane, 14–17 Aug 2005

Paton D (2006) Disaster resilience: integrating individual, community, institutional and environment perspectives. In: Paton D, Johnston D (eds) Disaster resilience. An integrated approach. Charles C. Thomas, Springfield, pp 305–319

Paton D (2007) Measuring and monitoring resilience in Auckland. GNS Science report 2007/18. GNS Science, Lower Hutt

Paton D, Johnston DM (2008) A means-end chain theory analysis of hazard cognitions and preparedness. GNS Science report 2008/19. GNS Science, Lower Hutt

Paton D, Smith L, Johnston DM (2000) Volcanic hazards: risk perception and preparedness. N Z J Psychol 29(2):86–91

Paton D, Johnston D, Smith L, Millar M (2001a) Responding to hazard effects: promoting resilience and adjustment adoption. Aust J Emerg Manag 16(1):47–52

Paton D, Millar M, Johnston D (2001b) Community resilience to volcanic hazard consequences. Nat Hazards 24:157–169

Paton D, Smith L, Johnston D, Johnston M, Ronan K (2003) Developing a model to predict the adoption of natural hazard risk reduction and preparatory adjustments: EQC Research Project No. 01-479

Paton D, Smith L, Johnston D (2005) When good intentions turn bad: promoting natural hazard preparedness. Aust J Emerg Manag 20(1):25–30

Paton D, Kelly G, Bürgelt PT, Doherty M (2006a) Preparing for bushfires: understanding intentions. Disaster Prev Manag 15(4):566–575

Paton D, McClure J, Bürgelt PT (2006b) Natural hazard resilience: the role of individual and household preparedness. In: Paton D, Johnston D (eds) Disaster resilience: an integrated approach. Charles C. Thomas, Springfield, pp 105–124

Paton D, Parkes B, Daly M, Smith L (2008) Fighting the flu: developing sustained community resilience and preparedness. Health Promot practice 9(4 Suppl):45S–53S

Paton D, Bajek R, Okada N, McIvor D (2010a) Predicting community earthquake preparedness: a cross-cultural comparison of Japan and New Zealand. Nat Hazards 54(3):765–781

Paton D, Sagala S, Okada N, Jang L-J, Bürgelt PT, Gregg CE (2010b) Making sense of natural hazard mitigation: personal, social and cultural influences. Environ Hazards 9:183–196

socia

Perry RW, Lindell MK (2008) Volcanic risk perception and adjustment in a multi-hazard environment. J Volcanol Geotherm Res 172(3–4):170–178

Petal M (2011) Earthquake casualties research and public education. In: Spence R, So E, Scawthorn C (eds) Human casualties in earthquakes: progress in modelling and mitigation. Springer, London, pp 25–50

Richardson B (2005) The phases of disaster as a relationship between structure and meaning. Int J Mass Emerg Disasters 23(3):27–54

Rogers RW (1983) Cognitive and physiological processes in fear appeals and attitude change: a revised theory of protection motivation. In: Cacioppa J, Petty R (eds) Social psychophysiology. Guildford Press, New York

Rohrmann B (2000) A socio-psychological model for analyzing risk communication processes. Australas J Disaster Trauma Stud 2000:2. http://www.massey.ac.nz/~trauma/issues/2000-2002/rohrmann.htm

Ronan KR, Johnston DM (2005) Promoting community resilience in disasters. Springer, New York

Ross L (1977) The intuitive psychologist and his shortcomings: distortions in the attribution process. In: Berkowitz L (ed) Advances in experimental social psychology, vol 10. Academic, New York, pp 173–220

Russell LA, Goltz JD, Bourque LB (1995) Preparedness and hazard mitigation actions before and after two earthquakes. Environ Behav 27(6):744–770

Rüstemli A, Karanci AN (1999) Correlates of earthquake cognitions and preparedness behavior in a victimized population. J Soc Psychol 139(1):91–101

Şakioroğlu M, Karanci AN (2008) Positive outcomes of 1999 Duzce earthquake. A thesis proposal submitted to the graduate school of social sciences of Middle East Technical University. Department of Psychology, Middle East Technical University

Satriano C, Wu YM, Zollo A, Kanamori H (2011) Earthquake early warning: concepts, methods and physical grounds. Soil Dyn Earthq Eng 31(2):106–118

Shinn M, Toohey SM (2003) Community contexts of human welfare. Annu Rev Sociol 54:427–459

Slovic P (1993) Perceived risk, trust, and democracy. Risk Anal 13(6):675–682

Smith W (2001) MM intensity with mean return period of 475 years. GNS Science diagram. GNS Science, Lower Hutt

Solberg C, Rossetto T, Joffe H (2010) The social psychology of seismic hazard adjustment: re-evaluating the international literature. Nat Hazards Earth Syst Sci 10(8):1663–1677

Spence R, So E, Scawthorn C (2011) Introduction. In: Spence R, So E, Scawthorn C (eds) Human casualties in earthquakes: progress in modelling and mitigation. Springer, London, pp 1–9

Spittal MJ, McClure J, Siegert RJ, Walkey FH (2005) Optimistic bias in relation to preparedness for earthquakes. Australas J Disaster Trauma Stud 2005:1.

Spittal MJ, McClure J, Siegert RJ, Walkey FH (2008) Predictors of two types of earthquake preparation: survival activities and mitigation activities. Environ Behav 40(6):798–817

Stirling M, McVerry G, Berryman K, McGinty P, Villamor P, Van Dissen R, Dowrick D, Cousins J, Sutherland R (2000) Probabilistic seismic hazard assessment of New Zealand: new active fault data, seismicity data, attenuation relationships and methods. Institute of Geological & Nuclear Sciences Client Report 2000/53. Institute of Geological & Nuclear Sciences Ltd, Lower Hutt

Strauss AL, Corbin J (1990) Basics of qualitative research: grounded theory procedures and techniques. Sage, Newberry Park

Tierney KJ, Lindell MK, Perry RW (2001) Facing the unexpected: disaster preparedness and response in the United States. Joseph Henry Press, Washington

Turner RH, Nigg JM, Heller-Paz D (1986) Waiting for disaster: earthquake watch in California. University of California Press, Berkeley

Wood MM, Mileti DS, Kano M, Kelley MM, Regan R, Bourque LB (2011) Communicating actionable risk for terrorism and other hazards. Risk Anal. doi:10.1111/j.1539-6924.2011.01645.x