Communities' understanding of earthquake risk in the Hawke's Bay and Manawatu-Wanganui regions, New Zealand[1]

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ABSTRACT: This paper reviews the major findings from two recent studies that surveyed residents in the (a) Manawatu-Wanganui and (b) Hawkes Bay regions on levels of risk perception, preparedness and other human factors related to a future large magnitude earthquake. The overall findings indicated that the majority of respondents in Manawatu Wanganui and over one third in Hawkes Bay reported not hearing any general or specific information related to the next large magnitude earthquake in the region. These studies was also found that levels of risk perception were generally lower than expected though Hawkes Bay residents appear to have more realistic views. It therefore comes as no surprise that low levels of preparedness were generally indicated with some exceptions in Hawkes Bay. Those exceptions notwithstanding, the vast majority of residents in both regions reported not being prepared with regard to some major hazard adjustments (e.g., structural changes to homes). A number of factors were identified in those studies that predicted increased levels of preparedness. These factors are discussed in the context of community education programmes.

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1 INTRODUCTION

The Manawatu-Wanganui and Hawkes Bay regions of New Zealand encompass some of the most seismically active parts of New Zealand (e.g., Stirling et al., 1998). Given that risk perceptions do not correlate all that well with the level of hazard, two recent studies (Ronan, Johnston, & Hull, 1999; Ronan, Johnston, & Paton, 2001) were designed to establish the levels of perception and preparedness relating to the earthquake risk in these two regions. The purpose of the current paper is to provide an overview of the literature on risk perceptions and related behaviours followed by a summary of the findings of these two studies. Thus far, no systematic research has assessed people's perceptions of risk and levels of preparedness in light of the recent assessment of earthquake hazard in these two areas. Thus, the initial purpose of the two studies was to assess levels of awareness, risk perceptions, access to multiple sources of risk-related information, and levels of preparedness across adjacent regions, one of which had a devastating earthquake in the previous century (1931 in Hawkes Bay).

2 SUMMARY OF PREVIOUS RESEARCH RELATING TO RISK PERCEPTIONS

Perceptions influence behaviour. An individual's perceptions are simply intuitive judgements

about a subject. Researchers over the past three decades have attempted to explain the differences in individual perceptions of earthquake-related (and other) risk and to develop techniques of assessing the complex opinions that individuals have about risk (Drabek, 1986; Lindell, 1994). There are often subtle variations in perceptions found between individuals and groups in society. The public's perception of risk is often found to be biased with people often overestimating small probability events and underestimating large ones (Slovic, 1987). Typically, individuals do not reason about risk by weighing and combining available evidence in a rational and logical way but employ a number of mental strategies (heuristics) which sometimes yield reasonable judgements and sometimes lead to severe systematic errors (Kahnemen & Tversky, 1973). People appear not always to be motivated solely to be accurate or correct. Accuracy may be sacrificed to some extent in favour of other motivations (e.g., decrease feeling of being at risk) (Higgins & Bargh, 1987). It is thought that these perceptions, whether based on fact or not, will then have a moderating effect on the types of protective or preparedness behaviours that people choose to undertake (Slovic, 1987).

In fact, the ways in which individuals and communities perceive natural hazards has been shown to affect a variety of hazard-relevant behaviours; for example, their response to warning and hazard preparedness (e.g., Lindell 1994; Lindell & Perry 1992; Mileti & O'Brien 1993; Mileti & Sorensen 1990). However, while hazard awareness is certainly one factor that influences preparedness activity (Mileti & O'Brien, 1993), awareness alone is rarely sufficient in influencing protective behaviours for the reasons outlined in the previous paragraph. Research by Mileti and colleagues (e.g., Mileti & Fitzpatrick, 1992, 1993; Mileti & Darlington, 1997; Ward & Mileti, 1993) have found that in addition to awareness, the following appear instrumental to influencing behaviour: multiple messages, delivered by multiple agencies, delivered via multiple channels, but carrying a consistent theme appear to stimulate a personal search for more information. From this "personal information searching" may emerge a personal definition of risk which in turn leads to protective behaviour:

"People discount risk..., until new information, such as prediction, creates uncertainty...(and) searching is characteristic of people caught up in uncertainty which blocks meaningful action. Searching results in "milling" with others, which leads to new definitions of risks. Milling allows time for interpreting symbols and substitutes meaning for ambiguity. Consequently, inquiry often addresses the processes and conditions that lead to interpretations of threat information, and how interpretations relate to behavior." (Mileti & Darlington, 1997, p. 89).

Stimulating personal information searching is likened to creating a hazard-related "conversation" which then increases the likelihood of people confirming risk and subsequently engaging in specific actions designed to mitigate risk and increase preparedness. The model associated with this perspective has been labelled "interactionist" (Mileti & Fitzpatrick, 1992; Turner & Killian, 1987). In particular, consistent, multiple messages providing specific guidance have been found to enhance public readiness. However, intervening variables may counter this including a lack of perceived efficacy (e.g., "there is nothing I can do that will help"), influence about the effectiveness of safety devices (e.g., it may be wrongly assumed by some that they may eliminate threat from the hazards), and other factors (e.g., money, time, the discounting of risk for a variety of reasons).

3 REVIEW OF THE TWO STUDIES: OVERVIEW

Taking into account the issues outlined above, these survey-based studies were designed to assess residents' baseline levels of awareness and risk perceptions as well as preparedness and risk mitigation behaviour undertaken in these two regions. In addition, assessing the relationships between survey variables was undertaken to identify those factors that stimulate (i.e., predict) earthquake preparedness activity in the Manawatu-Wanganui as well as Hawkes Bay.

In each region, four separate communities, a total of 2000 households (1000 in each region; 250 in each of the eight communities), were surveyed (Table 1). Households were randomly selected from census mesh blocks within the urban boundaries of the chosen locations. In

Manawatu-Wanganui (MW), 410 households returned surveys; in Hawkes Bay (HB), 334. The survey itself included questions on awareness, risk perceptions, and the extent to which people have engaged in preparedness activities.

4 SUMMARY OF MAJOR FINDINGS: AWARENESS AND RISK PERCEPTIONS

The majority of respondents in both regions endorsed earthquakes as the most threatening form a list of natural (cyclones, floods, severe storms, volcanic eruptions) and man-made (chemical spill, toxic waste spill, scrub or forest fires, water contamination or pollution) hazards (HB, 77%; MW, 54%). However, in both regions, a relatively large percentage of respondents also reported hearing no information from anywhere concerning various factors (e.g., magnitude, damage locales) related to the next large earthquake in MW (57%) and in HB (39%). In addition, just over half in HB (58%) agreed that a large magnitude earthquake causing personal injury or home damage was a possibility sometime in the future; in MW, it was less than half (42%).

   Thus, the overall finding here was that the majority of respondents across regions acknowledged earthquakes to be a threat to their area but that (a) just under half had not received any information concerning such a threat and (b) around one half believed that even if a major earthquake occurred, it would not have any real personal consequences. Hawkes Bay residents appear to have more realistic risk perceptions overall.

5 SUMMARY OF MAJOR FINDINGS: INFORMATION RECEIVED ABOUT PREPARATION FOR EARTHQUAKES

The major sources of information across regions were as follows: telephone book (HB, 62%; MW, 55%), television and radio (58% and 30%, respectively), newspapers or magazines (50% and 22%), local councils (49% and 20%), the Earthquake Commission (EQC) (48% and 24%), insurance companies (29% and 17%), Regional Councils (26% and 13%), and police/fire services (14% and 9%). Information was received less from other sources including central government, schools, places of work, meetings/seminars/workshops, neighbourhood groups, and others. In terms of the sources deemed most credible across the regions, those that are considered most trustworthy also tended to be the sources where more participants received information (i.e., those endorsed by approximately 70% of respondents across regions): the telephone book (c. 25%), local government (c. 20%), EQC (c. 15%),and broadcast media (c. 10%).

5.1 *Summary of Major Findings: Information Searching*

Consistent with relatively low levels of risk perceptions, it was not a surprise that there were similarly no large percentages of respondents who sought out information from formal sources on preparing for earthquakes. Over the past year, the primary sources of information sought were informal (family, friends) (HB, 46%; MW, 14%) followed by schools (13% and 4%, respectively) and insurance companies (13% and 3%). As can be discerned from the comparative percentages, HB residents reported more information searching compared to MW residents. However, overall, low levels of seeking out information were apparent across both regions.

5.2 *Summary of Major Findings: Preparedness and Readiness Behaviours*

More preparedness activity was apparent in HB versus MW. For example, when looking at activity undertaken over the past year, around a half of HB residents reported storing emergency equipment (54%) and stockpiling food and water (48%). These percentages were much lower in MW (22% and 18%, respectively). Inspection of Tables 2 and 3 indicate increased activity in HB versus MW. Thus, HB has developed more of a culture focused on preparation. However,

overall, both regions have low levels of activity related to some major areas of readiness and risk mitigation (e.g., structural changes to homes, see tables).

Why people don't prepare vary but reasons reported by respondents include: financial, time limitations, perception of preparation as not helping, and other reasons (e.g., fatalistic perceptions). About 20% reported no recent preparedness activity because they feel fully prepared (HB, 22%; MW, 19%).

5.3 *Summary of Major Findings: Predictors of Preparedness*

A number of significant correlates of preparedness activity for a major earthquake were found across both studies including past preparedness activity, information searching, specific guidance, multiple messages offering guidance, the receiving of information specifically related to an earthquake in the region, seeing others prepare, and planned future readiness activities.

The upshot here is that helping provoke people to prepare for a future earthquake involves multiple messages that offer specific guidance and informing them about specific aspects of a future, regional earthquake.

6 OVERALL SUMMARY

The main findings from these two studies related to risk perceptions and preparedness for a large magnitude earthquake are that despite the fact that Hawkes Bay residents appear to have developed a more advanced "earthquake culture" compared to those in the Manawatu Wanganui region, and despite the fact that the majority of respondents acknowledge earthquakes to be a concern, it is also the case that the majority of respondents in Manawatu-Wanganui communities and a well over a third in Hawkes Bay communities were simply unaware about even the most general information related to a future large magnitude earthquake in the region. This includes relatively low levels of risk perceptions. That is, just over half of Hawkes Bay residents felt any personal risk from a future earthquake while under half of Manawatu Wanganui residents perceived such a risk. Given a generalised lack of awareness combined with the majority of respondents generally perceiving lower levels of risk, it comes as no surprise that large percentages of respondents reported not engaging in most activities aimed at risk mitigation and preparedness. The exception here was the finding that Hawkes Bay residents did report fairly high levels of preparation in a few areas (e.g., storing emergency equipment, stockpiling food and water). In fact, less than half--in most cases, much less than half--of respondents reported undertaking any specific protective action, particularly with regard to major activities (e.g., structural adjustments to home).

A number of factors were endorsed that related to people's reasons for not preparing (e.g., financial, time, lack of efficacy (i.e., preparation won't help), external locus of control/fatalism). Future community education efforts need to take these factors into account. In fact, community education efforts continue to be necessary – in both settings but particularly in Manawatu-Wanganui - to raise both awareness as well as begin the process of assisting people to take more action. Such efforts may well assist the forging of an "earthquake culture" (see Mileti & Darlington, 1997; Mileti & Fitzpatrick, 1993).

In terms of intervention efforts, the two studies identified a number of factors that predicted increased levels of preparedness. In general, these factors are consistent with those found in previous research (e.g., Mileti & Darlington, 1997; Mileti & Fitzpatrick, 1992). First, and consistent with previous large scale studies, preparedness was highly correlated with information searching. That is, people appear to respond to risk information first by engaging in earthquake-related "conversations"--a personal search for information--designed to resolve any ambiguity introduced by the new risk-related information. As our studies indicated, the primary source of information respondents actively sought was informal--relatives, friends, and neighbours. This is consistent with much of the hazard research from overseas studies (e.g., Mileti & Fitzpatrick, 1993; Perry & Lindell, 1990) which shows the public often relies on social networks rather than official agencies, particularly as a stimulant to engaging in actual preparedness behaviours (e.g., Kartez & Lindell, 1987; Perry, 1990). For example, the media is

often only used by the public as a surveillance tool and the public then seek advice and suggestions from friends and relatives before deciding what specific actions to take (Vogt & Sorenson, 1994). Current findings support "interactionist" models (Turner & Killian, 1987) and associated research on the public's response to both earthquake predictions (e.g., Mileti & Darlington, 1997; Turner et al., 1986) and warnings in general (Drabek, 1969; Leik et al., 1981; Perry & Lindell, 1990; Rogers, 1987).

Other correlates of preparedness were: past preparedness activity, specific guidance, the planning of future preparedness activities, multiple sources of information, seeing others prepare, and receiving information related specifically to the earthquake hazard in the region.

A maxim in the field of disaster psychology--and psychology in general-- is that "past behaviour is often the best predictor of future behaviour" (Johnston & Ronan, 1998; Long, Ronan, & Perreira-Laird, 1998). It therefore comes as no surprise that both past information searching and preparedness behaviour correlated strongly with current levels of both searching or preparedness-related activities. Regarding the power of past searching and preparedness in predicting future preparedness behaviour, one implication for public education is that the more it can help the public engage in--or remind them that they may have already engaged in--initially simple readiness activities, the more these initial behaviours may serve as momentum for future, more complex, time-consuming, or costly activities.

A strong correlate of both searching and action was receiving specific guidance information about what to do to be prepared for an earthquake. Thus, as Mileti and Darlington (1997) also found in their study in the Bay Area (San Francisco), the most important information that people receive looks not to be information solely related to risk. What appears crucial is giving the public specific information about what actually to do to reduce risk and increase preparedness. In these studies' case, that information was specific guidance about how to prepare for earthquakes. Thus, while raising awareness about risk does have value, and indeed may be a first step, in promoting search--and to a lesser extent, actual preparedness--behaviour (see also Drabek, 1986; Perry et al., 1981; Perry & Lindell, 1990), telling people specifically what they need to do should be incorporated into future community intervention efforts (see also Mileti & Darlington, 1997; Mileti & Fitzpatrick, 1993).

Related, the finding that multiple sources of information also correlated significantly with preparedness behaviour underscores the idea that the more that various agencies can coordinate with each other to put out specific, consistent messages, the more the public will benefit (Mileti & Darlington, 1997). The studies demonstrated that no one particular source of information is the best method to disseminate information. Different people rely on different sources they deem as reliable and credible for information, and this should be acknowledged when releasing public information. Similar results were found following the 1995-96 Ruapehu eruptions with respect to volcanic hazard information (Johnston, 1997) as well in Dennis Mileti's research overseas (Mileti & Fitzpatrick, 1992, 1993). These general findings notwithstanding, current findings did indicate that respondents reported receiving more information from the following sources: the telephone book, television and radio, the Earthquake Commission, print media, local councils, regional councils, insurance companies and police/fire services. In addition, the sources considered most credible by respondents were the following: telephone book, local government, EQC, and broadcast media.

However, here again, the studies showed that although some sources of information and agencies are perceived as more credible than others for earthquake hazard information, no single agency or source has a monopoly on perceived credibility. In other words, different people recognise different agencies or sources as the best source of information on earthquake hazard information. This has important implications for disseminating public information and supports the idea of using multiple agencies carrying a consistent message to enhance public response. This conclusion also supports the need for integrated planning, coordination of information collection and dissemination, inter-organisation communication, and coordinated communication with the community. Perry and Lindell (1990) found that two principal dimensions attributed to credibility are past reliability (trustworthiness) and access to skills and information (expertise). Thus, the more that already credible sources of information can access expertise in disseminating information, the more the public may listen and respond. Of course, this includes linking with other credible sources. It must also be recognised that there is no such thing as the "average person" and material may need to be written to accommodate the needs of

various groups.

   As indicated earlier, stimulating preparatory action may also be accomplished by people seeing others preparing for earthquakes. Thus, while it is clear from this study that while no one source is the best method for disseminating information, it did find that increased perceptions that others are preparing for a large earthquake was significantly correlated with undertaking readiness actions. Thus, both local councils and the Regional Council may be particularly important sources of information for at least two reasons. First, as discussed earlier, they appear to be a credible source of information on preparedness. Second, and importantly, they also may be an important model for action. Consequently, while the disseminating of consistent, specific messages appears crucial, it may also be important to demonstrate to the public that the local and Regional Council have their "own houses in order". If they are able to demonstrate their own readiness in coordinated fashion, this may have a stimulating effect on the public.

   The current study is limited to people's self-reports. Out of the 2000 who were requested over 700 chose to participate. Thus, while an approximately 35% return rate is very acceptable (Dillman, 1978) and we had a range of demographics represented, the fact remains that self-selection may tend to reveal a certain level of motivation on the part of participants. Thus, it is our opinion that the current results may actually reveal a more optimistic picture than there actually is when considering all residents of both of these regions. This underscores the primary recommendation of this study that community education is necessary to raise levels of awareness and to help the public gain a better idea about specific things they can do to reduce risk to themselves and to their families.

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Table 1. Surveyed communities.

Region	Communities	Date
Manawatu-Wanganui	Pahiatua Palmerston North Wanganui Taumarunui	May 1998
Hawke's Bay	Waipawa Hastings Napier Wairoa	November 1999

Table 2. Readiness Activities Undertaken in Manawatu-Wanganui

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	Readiness Activity Undertaken	
	Over 1 Year	Last Year
Store emergency equipment	24%	22%
Stockpile food and water	20%	18%
Buy earthquake insurance	24%	13%
Learn to provide first aid	22%	11%
Store hazardous materials safely	11%	10%
Rearrange breakable items	11%	9%
Develop earthquake plan	9%	7%
Learn how to put out fires	10%	5%
Learn to assist elderly/immobile	5%	5%
Pick emergency contact	2%	4%
Learn to rescue trapped people	4%	2%
Put latches on cabinet doors	3%	2%
Add lips to shelves	3%	2%
Strap water heater	3%	2%
Install flexible piping	3%	2%
Bolt house to foundation	4%	1%
Put spanner by valve	2%	2%
Brace house walls	2%	1%
Arrange bracing for pile foundation	2%	1%

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n = 410; respondents could report multiple actions.
Adapted from Ronan, Johnston, & Hull (1999) by permission.

Table 3. Readiness Activities Undertaken in Hawkes Bay

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	Readiness Activity Undertaken	
	Over 1 Year	Last Year
Store emergency equipment	44%	55%
Stockpile food and water	31%	48%
Buy earthquake insurance	45%	29%
Learn to provide first aid	37%	25%
Store hazardous materials safely	25%	24%
Rearrange breakable items	25%	25%
Develop earthquake plan	18%	17%
Learn how to put out fires	20%	13%
Learn to assist elderly/immobile	13%	11%
Pick emergency contact	8%	8%
Learn to rescue trapped people	6%	4%
Put strong latches on cabinet doors	9%	7%
Add lips to shelves	9%	4%
Strap hot water cylinder	9%	3%
Install flexible piping	2%	1%
Bolt house to foundation	4%	2%
Put spanner by gas turn-off valve	3%	3%
Brace house walls	3%	2%
Arrange bracing for pile foundation	4%	1%
Have emergency light	23%	21%

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n = 334; respondents could report multiple actions.
Adapted from Ronan, Johnston, & Paton (2001).

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