A means-end chain theory analysis of hazard cognitions and preparedness

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ABSTRACT

Recognition of the importance of proactively developing people's capacity to cope with, adapt to, and recover from natural hazard consequences has stimulated a need to understand the factors that influence household and community hazard preparedness. Building on the findings of EQC Project 01-479 (Paton, Smith & Johnston, 2005) in which three issues requiring additional research were identified, the overall objectives of this project were to:

a) Examine how people interpret preparedness scale items;
b) Clarify the relationships between predictor variables and decisions whether to prepare or to not prepare; and
c) Conduct an exploratory investigation of the cognitions that underpin people's preparedness decisions.

Factor analysis of preparation scale items revealed that people do not perceive items as forming an homogenous list. People classified items according to function. While some consistency was evident between people's classification (of items into six factors) and those of experts, several significant differences were noted. The implications of these differences, particularly with regard to the possible conflation of routine and emergency actions and the need for additional investigation of the predictors of each functional category, was discussed, as were the consequent implications for research and for the development of effective public education and risk communication.

With respect to the second major issue identified in EQC Project 01-479, this project developed a model that clarified the earlier finding that the same variable (Critical Awareness) predicted both preparing and not preparing outcomes. The current project identified how differences in people's beliefs regarding the amenability of hazard consequences to mitigation through personal efforts could account for this difference. Clarification of the mechanisms that predict "preparing" versus "not preparing" outcomes provides clearer guidelines for developing public education programmes.

An earthquake scenario was selected to test a generic model that comprised individual, community and institutional indicators. A generic model was selected to accommodate the social and hazard diversity that underpins New Zealand's complex natural hazardscape. Structural equation modelling analysis produced a model that that comprised two individual-level (positive outcome expectancy, negative outcome expectancy), two community-level (community participation, ability to articulate community problems), and two community-agency relationship factors (empowerment, trust). At a practical level, this work demonstrated that, if they are to be effective, public education programmes must accommodate the interdependence between individual, community and agency factors.

The development of a reliable model means that it can be used to assess current levels of preparedness and its predictors, assist the formulation, planning and delivery of strategies to facilitate household preparedness, and provide a framework for evaluating intervention. A generic model facilitates the performance of these tasks irrespective of the hazard or community of interest. Prevailing levels of predictor factors were generally present at moderate levels, indicating considerable scope for their development. These data can serve as baseline data for community monitoring and programme development and evaluation.

The final issue addressed involved an exploratory analysis of people's accounts of their preparedness decisions. This was accomplished using an interview protocol developed using means-end chain theory principles. This analysis identified the attribute, consequence and value cognitions that underpin people's preparation decision making. The implications of these findings for understanding preparedness decisions are discussed.

KEYWORDS

hazard cognitions, preparedness, earthquakes

1.0 INTRODUCTION

1.1 Objectives of research

Building on the findings of EQC Project 01-479 (Paton, Smith & Johnston, 2005) in which three issues requiring additional research were identified, the overall objectives of this project were to:

1. Examine how people interpret preparedness scale items;
2. Develop an empirically-validated model that can guide the development and delivery of risk communication and public education strategies intended to encourage the sustained adoption of natural hazard preparedness measures, and identify a set of predictors of individual/household preparedness capable of being applied across communities and hazards.
3. Develop cognitive maps of reasons for evaluating preparedness in positive or negative ways and identify their implications for public education and community-based risk management strategies.

2.0 BACKGROUND

When disaster strikes, people may be isolated from external assistance and have limited, if any, access to normal societal resources and functions for at least several days and possibly considerably longer. Under these circumstances, their capacity to adapt will reflect their level of preparedness (e.g., securing fixtures and furniture, storing food & water, developing a household emergency plan) and their capacity for self-reliance (Paton, 2003; Smith, 1993). Given that disaster can strike with no or very little warning, it is imperative that people are prepared in advance of any hazard activity. However, despite the attention devoted to public hazard education, many people fail to develop adequate levels of hazard preparedness (Duvall & Mulilis, 1999; Gregg et al., 2004; Lasker, 2004; Lindell & Perry, 2000; Lindell & Whitney 2000; Mulilis & Duvall, 1995; Paton et al., 2000). This calls for more research into the factors that influence the sustained adoption of preparedness measures.

This report examines the question of facilitating sustained household preparedness from the perspective of how individual, community and societal factors interact to guide how people interpret information and use it to make choices regarding how they manage the risk posed by natural hazards (Paton, 2008 a,b; Paton & Bishop, 1996; Paton et al., 2005). It also takes the view that, when conceptualising preparedness, it is important to accommodate the fact that while some people decide to prepare, others decide not to do so.

A significant outcome of EQC Research Project 01-479 was the finding that deciding to ‘prepare’ and deciding ‘not to prepare’ represent separate reasoning processes (Paton et al., 2005). This has important implications for risk management. Specifically, it means that risk management programmes must accommodate strategies to reduce or eliminate reasons for not preparing and develop a separate set of strategies designed to facilitate the sustained adoption of preparedness measures. To develop the means to achieve these outcomes, it is first necessary to identify the predictors of each outcome.

Research Project 01-479 revealed that one predictor, critical awareness (the degree to which people think about and discuss hazard issues), predicted both 'preparing' and 'not preparing' (Paton et al., 2005). When linked to opposing outcomes in this way the variable itself ceases to have any value as a guide to intervention planning. Consequently, this study sought to conduct a more searching analysis of this relationship and to identify specific predictors of each outcome to provide clearer guidelines for intervention. In addition to refining the set of predictor variables, this project also sought to examine the cognitions that underlie people's preparedness decision making using Means-End Chain Theory. Examining people's own beliefs provides an additional means of testing the validity of any model of hazard preparedness. If the model is valid, we would expect to see evidence of its components in people's own accounts of the reasons that underpin their deciding whether or not to prepare.

Means-End Chain Theory posits that cognitions about abstract concepts (e.g., hazard preparedness) are organized in a hierarchy with concrete activities (e.g., preparing) linked to progressively deeper levels of cognitions regarding the relationship between the person, the hazards in their environment, and the sources and content of information available to inform their decision making. Cognitive maps constructed from these data could provide additional insights into the beliefs that underpin people's preparedness decision making. In doing so, the outcomes of this work can be used to provide additional guidelines for the development of public education content. The model analysis will provide a framework for programme development, and a better understanding of the beliefs that influence model variables can be used to assist defining the content of education programmes.

Given the fundamental objective of developing a model capable of predicting preparedness, it is crucial to have an accurate measure of the outcome – the nature and level of peoples' preparedness. The latter is essential not only for research, but also for assessing prevailing levels of preparedness in a manner capable of supporting the planning, development, delivery, and evaluation of public education programmes. EQC Research Project 01-479 also raised issues regarding how people conceptualise and interpret preparedness measures. Consequently, the final objective of this project involved the analysis of how people conceptualise preparedness items. However, given the central role that preparation items play within the process of researching preparedness, the issue of how people organise their understanding of preparedness items is considered first.

3.0 ANALYSIS OF PREPARATION SCALE ITEMS

One of the central goals of preparedness research is to identify predictors that can help explain why people differ in the nature and number of preparedness items they adopt. Once articulated, this knowledge can be used to guide the development of risk communication and public education programmes. When conducting such analyses, the dependent variable, the preparedness measure, describes those actions, measures and resources required to enhance the safety of household inhabitants during and after (possibly for several days or weeks) a hazard event. The content of these scales have, to date, been treated as homogenous within the research process. That is, preparedness scores represent the sum of items adopted (with the assumption that all items make comparable and substitutable contributions to safety), with little attention being directed to the implications of the specific set of items adopted for survival and coping (see below). This occurs even though functional

differences have been recognised within the content of scales. For example, scale items can be categorised as mitigation actions, preparedness actions, and planning actions.

Mitigation actions include, for example, securing water heaters, tall furniture, and mirrors, and installing latches on cupboards to prevent their contents from injuring people. Preparedness actions describe those that facilitate self reliance during periods of disruption and include, for example, ensuring a supply of water for several days, having a supply of dehydrated or canned food, a radio with spare batteries, a first aid kit, a fire extinguisher, and wrenches to operate utility valves. Finally, planning activities cover, for example, developing a household earthquake emergency plan and attending meetings to learn about hazards and how to deal with hazard consequences. In this way, preparedness items are subdivided according to their function. This functional classification generally reflects objective, expert analysis. Recognition of these functional differences raises a number of issues.

One issue concerns whether an expert classification (irrespective of the objective logic that underpins it) is mirrored by the people whose behaviour public education seeks to change. This issue has not been examined systematically. A related issue is whether it is legitimate to sum all items to compile a composite preparedness score if functional differences exist, particularly as these functional differences can be weighted differentially with regard to the overall assessment of people's ability to survive initial (e.g., protect against the consequences of ground shaking) and subsequent (e.g., self-reliance to cope with the disruption associated with the consequences of hazard activity. A corollary of this position is that functionally different aspects of preparing could be influenced by different predictors.

Other issues have been identified. For example, it has been argued that the recorded presence of some preparedness scale items may say more about people's day-to-day behaviour than about their risk management decision making. Paton et al (2005) argued that people may equate the performance of routine activities (e.g., shopping habits) or the presence of widely used items (e.g., a portable radio) with a level of hazard preparedness. If so, response based on conflating these different aspects of functioning could result in people overestimating their preparedness, introducing bias into the analysis of preparedness. Similarly, it can be argued that if people equate routine actions with hazard readiness, their consequent over-estimation of their preparedness could result in their being less likely to attend to public education information.

In this report, the issue of the relationship between expert and citizen classification of preparedness items is examined. That is, it asks how people organise their understanding of the various preparedness items and activities. It was originally intended to examine this using Rasch Scaling. However, because the sample size fell short of what was required (as a result of a reduction in budget allocation), factor analysis was used to provided a preliminary analysis of how peoples understanding of preparedness items is structured. The preparedness items comprised 22 items derived from Spittal's (2003) scale and 8 items derived from an earlier study of earthquake preparedness (Paton et al., 2005). Items were scored as 'have adopted (3), may adopt (2), and will not adopt (1). Data were collected from 255 respondents in Napier.

The data were analysed using principal components analysis (PCA) after determining the suitability of the data for factors analysis. The ratio of cases to variables was close to 10

participants per variable. The correlation matrix revealed several correlations over r=.3. The Kaiser-Meyer-Olkin value was .840, exceeding the recommended value of .6. All sampling adequacy values exceeded .5. Bartletts Test of Sphericity was statistically significant. These tests justified conducting the analysis. The PCA produced six factors with eigenvalues greater than 1 and that accounted for 65.34% of the variance. These are summarised in Table 1. Items loading on each factor are highlighted.

The convention of labelling factors according to the item with the highest loading was followed. In Table 1, items are presented in the order that they appeared in the questionnaire. This approach allows cursory examination of whether the factor content was biased by the order in which items appeared in the questionnaire. Analysis of the factor content suggests that the order of presentation did not bias the perceived structure of the items.

4.0 FINDINGS

Stevens (1992) recommends that, with a sample of 200-300 (in this case, 255), loadings of .364 and over can be regarded as significant. This convention was applied to the present data. However, Stevens also argues that a more exacting test of the importance of a variable to a factor involves including only factor loadings with an absolute value of .4. When the latter criterion is applied, one item 'I have fastened tall furniture to the wall' becomes marginal. However, as this analysis is exploratory in nature, this item was retained to provide a more comprehensive picture of how people organise or impose meaning on items.

Several complex items (i.e., those loading on more than one factor) were found. These were "fastening furniture to the wall" and "objects containing water are not placed on electrical equipment." Both items had comparable loadings on three factors. While ordinarily grounds for the removal of an item, for this preliminary analysis, these items were retained and were placed in the factor corresponding to their highest loading.

The analysis identified 6 factors: emergency kit items, physical security of the home, household emergency planning, securing household fittings and fixtures, fire extinguishing, and response resources (Table 1). Each of these factors is discussed in turn.

4.1 Factor 1: Emergency Kit items

Items loading on this factor were (predominantly) those traditionally identified as emergency kit items. The exception was the exclusion of "storing 2 litres of water/person/day" (water) from this factor. All these items, including "water" are presented in public education programmes and in expert classifications as emergency kit items.

Table 1 Results of factor analysis of preparedness scale items. The highlighted numbers identify hose items loading on each factor.

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Considered earthquake risk when deciding to live in this house	.083	.606	.338	-.082	.100	.210
I have fastened tall furniture to the wall	.334	.357	.222	.386	.207	-.257
I have fastened my hot water cylinder	.109	.587	.055	.263	-.057	.009
Have strengthened chimney/satisfied self it will not fall in a major earthquake	.113	.710	.166	.067	.126	.076
Have strengthened house/satisfied myself that it will not fall down in an earthquake	.088	.820	.129	.163	-.072	.075
Have ensured roof will probably not collapse in a major earthquake	.186	.755	.010	.188	.092	.018
I have arranged the cupboards so that heavy objects are stored at ground level	.012	.315	.253	.522	-.116	.297
Have securely fastened cupboards w. latches	.100	.145	-.124	.580	.125	.358
Have ensured objects containing water are not been stored on electrical equipment	.091	.384	.159	.393	.008	.411
I have ensured that heavy objects are stored on the floor	.181	.105	.142	.764	-.076	.207
Have put aside spare plastic bags/toilet paper for use as an emergency toilet	.272	.214	.551	.234	.003	.027
Have accumulated tools to make minor repairs to house following earthquake	.269	.106	.228	.116	.218	.654
I have a supply of essential medicines for illness or allergies	.332	.048	.264	.214	.009	.488
I have secured moveable objects in my home (e.g., TV, computer)	.195	.253	.253	.459	.301	-.053
Have household earthquake emergency plan	.093	.177	.824	.138	-.036	.120
Plan covers where family should meet if an earthquake occurs during the day	.027	.184	.793	.070	.041	.170
Have an emergency kit containing: Flashlight/torch	.818	.121	.170	-.047	.124	.170
Batteries for flashlight/torch	.846	.184	.135	-.002	.066	.203
Transistor radio	.829	.042	.099	.121	.074	-.152
Batteries for transistor radio	.869	.054	.118	.176	.033	-.043
Spare batteries	.841	.141	.045	.122	-.019	.159
First aid kit	.624	.036	.029	.211	.140	.288
2 litres water (in plastic containers) per person, per day for three days	.364	.116	.500	.113	.198	.069
3 days supply of dehydrated/canned food	.566	.253	.097	.183	-.052	.338
A portable stove/barbecue for cooking	.307	.194	.348	.019	-.058	.445
I check the contents/operation of my emergency kit every month	.226	.006	.498	.303	.172	.150
I have a fire extinguisher	.037	.015	.080	.084	.857	-.029
Know how to operate a fire extinguisher	.158	.055	-.002	.082	.858	.166
Have checked property to minimise fire risk (e.g. garden rubbish near fences)	.110	.122	.181	.717	.197	-.114

The fact that people excluded “water” from their classification of emergency kit items is interesting. All the items loading on this factor are items with common (non-emergency) household functions (Table 1) or uses, or could reflect the performance of household activities such as grocery shopping habits. Thus, the common denominator between those items that comprise Factor 1 is that they are all items that people use everyday. The exception is “water” which represents an activity that people only adopt if they specifically decide to prepare for earthquakes. This pattern of classification of emergency kit items is consistent with the earlier observation (Paton et al., 2005) that people may conflate routine activities with emergency preparedness.

While people could, for example, state that they have three days of tinned food because they buy groceries in bulk (i.e., their response reflects their shopping habits), they are only likely to, for example, develop a household emergency plan if they specifically decide to prepare for hazard consequences. Paton et al. (2005) argued that conflation of routine actions with emergency preparedness could result in people overestimating their readiness to respond to and adapt to hazard consequences. This position was supported by Paton’s (2007) analysis of hazard preparedness.

Paton first asked people if they had 3 days supply of tinned food. Some 67% of respondents answered in the affirmative. However, rephrasing the question and asking whether people had “changed their shopping habits to gradually increase their emergency food supplies” revealed a very different outcome. The latter question represents a measure that provides clearer insights into whether people are adopting actions that reflect their specifically preparing for the consequences of hazard activity. For the second measure, only 16% stated that they were building their food supply gradually. The discrepancy between these scores (67% versus 16%) illustrates how measures that tap into routine behaviours (e.g., people shopping in bulk to meet their immediate needs or storing several days food in a freezer to meet short term needs) could result in people overestimating their capacity to cope with the lack of food availability following a period of hazard activity. If shopping habits have not changed, the potential for people to accumulate supplies when a warning is issued may be non-existent (for hazards with short warning periods, rapid depletion of supermarket supplies will severely limit opportunities) will place significant constraints on people’s capacity to adapt. For example, coping efficacy will be influenced more by the temporal proximity between the hazard event and the last shopping trip than by people’s own risk management decisions.

The second measure (which controls for the conflation of routine and emergency preparedness thinking) taps into whether people are changing their shopping habits specifically to accumulate emergency supplies and so increase their level of preparedness for unpredictable emergency events. As such, it provides a more representative measure against which the role of the predictors preparedness can be established. It would also provide a more accurate measure for agencies that need to assess people’s level of readiness. It may have other practical ramifications. If people estimate their level of preparedness on everyday life activities, they are more likely to overestimate their preparedness. They may be less likely, as a consequence, to think about their level of preparedness or attend to public education messages about preparedness or to regularly consider their preparedness needs.

This possibility also calls for more attention to be paid to the wording of questions to ensure they effectively tap into actions specifically indicative of hazard preparedness. While this conclusion should be regarded as tentative for now, it does identify a need for more searching analysis of the reasoning that underpins people's classification or organisation of preparedness scale items.

Issues associated with how questions were worded were identified with several other items in the preparedness scale. In particular, the three questions associated with the physical integrity of the home (e.g., have strengthened house or satisfied myself that it will not fall down in an earthquake). All three questions contain two response options (i.e., have strengthened versus satisfied self). Questions should contain only one option. In the case of these questions, asking people if they have specifically taken actions to ensure the physical integrity of the house, roof and chimney would represent a more appropriate and exacting test (particularly if it involved engaging the services of someone to provide an objective test) of the degree to which they have undertaken preparedness measures. In contrast, unless the person happened to be a structural engineer, the question of what is meant by "satisfied myself" would remain open to speculation (decreasing reliability) and would cover a range of actions from the superficial assessment (e.g., it looks ok) to a full survey (e.g., by an engineer).

The possibility of people classifying some items (Factor 1) according to their daily utility is reinforced by the finding that "water" loaded on Factor 3 (see below). Because the "water" question appeared in the questionnaire in the midst of the list of items that are normally classified, functionally, as emergency kit items it is possible to argue that people were relatively objective in their deliberations and did not automatically respond to this item according to its position in the scale (surrounded by other kit items). Furthermore, the item "monthly checking of emergency kit items" ("checking" - another item with specific emergency connotations) did not load on Factor 1 (see below). That is, factors analysis may be tapping into the fact that people differentiate between commonly-present items and those that specifically reflect their deciding to prepare for hazards.

In other words, the way in which people impose meaning on or classify the "water" and "checking" items suggests that they think about them in ways that differ from how they think about the other items that comprise the "emergency kit" (i.e., those in Factor 1) items (and thus differently from the typical expert classification of these items). Experts would classify the "water" and "checking" items as emergency kit items (which reflects the objective and legitimate belief that they are items designed to assist people to cope with and survive the disruption accompanying a hazard event). However, it appears that people structure their understanding of, or the way they impose meaning on, these items in a way that differs from their expert counterparts. Understanding the reasons for these differences will require additional research.

4.2 Factor 2: Physical Security of House

The items loading on this factor relate to the location (considered risk in deciding to live in this house) and the physical integrity of the house (e.g., strengthened house to increase its earthquake resistance). One surprising item was the loading of "fastening hot water cylinder" on this factor. What makes this interesting was the fact that other items associated with

securing household fittings were represented by a separate factor (Factor 4). Again, this raises issues about the reasoning behind people's classification of items and identifies another area that should be included in future research agenda.

4.3 Factor 3: Household Emergency Planning

Items loading on this factor cover planning (e.g., having a household emergency plan, planning where the family should meet). Interestingly, it also includes "storing 2 litres of water/person/day", "putting aside plastic bags/toilet paper for an emergency toilet", and "monthly checking of emergency kit items". While typically listed as emergency kit items, these data indicate that people separate the latter three items from the other emergency kit items. This observation reinforces the possibility the items that comprise Factor 1 reflect routine activities rather than their being interpreted as items that need to be specifically set aside for emergency work (see also Paton, 2007).

4.4 Factor 4: Securing Household Fittings and Fixtures

Items loading on this factor generally describe those actions undertaken to secure household fittings (e.g., "fasten tall furniture to walls", "store heavy items at floor level", "secure cupboard doors with latches"). An interesting finding, in the sense that it bears more functional similarity with the physical security of the property (Factor 2), was that "checking property to minimise fire risk" also loaded well on this factor.

4.5 Factor 5: Fire Extinguishing

Items loading on this factor described having and knowing how to use a fire extinguisher. A potentially interesting issue to arise from this, in the context of minimising fire risk (Factor 4), is the emergence of these items as a separate factor. One interpretation of this factor can be framed in terms of it being indicative of people differentiating routine actions from than specific hazard preparedness (e.g., if it were seen as a hazard preparedness item, it could be hypothesised that it would load on Factor 3). These items loaded strongly on this factor and did not show any indication of being perceived as hazard preparedness items. This issue remains tentative until additional work is undertaken. As above, this has implications for researching preparedness and the identification of predictors.

4.6 Factor 6: Repair Tools (Response Resources)

The items loading on this factor represent an interesting mixture. This factor comprises "tools to make minor repairs", "having a supply of essential medicines", having a portable stove/barbecue" (another item commonly assumed to fall into the category of emergency kit item), and "ensuring that objects containing water are not stored on electrical equipment (though comparable loadings on Factors 2 and 4 make this item more difficult to interpret). With the exception of the latter item, the content of this factor would suggest that the label "Response Resources" would be more appropriate as a means of capturing the nature of its content. Again, the mix of items that comprise this factor, and the fact that it included items that could be hypothesised to load onto Factor 1 or Factor 3, identifies a need for additional research into how people interpret and organize this item in relation to other preparedness items.

4.6.1 Discussion

The factor analysis raises some interesting issues regarding the relationship between expert categorization (based on the objective classification of function) and how people (based on their interpretation) impose meaning on and organize preparedness items. It is, however, clear that neither experts nor citizens treat items as forming an homogenous scale. While there appeared to be broad agreement between experts and citizens, several discrepancies were also evident. This was most noticeable with regard to the emergency kit items. People did not perceive "storing water" and "checking emergency kit items" in the same way as the other items that might normally be considered to be representative of emergency kit items. Nor was another common emergency kit item, "having a portable stove/barbecue" perceived as such by respondents. Taken together, the latter observations and the possibility for the conflation of routine and emergency activities highlight a need for a more searching analysis of how people make sense of and organise preparedness scale items. The potential conflation of routine actions and emergency preparedness has other implications.

Although the items that comprise Factor 1 will influence how well people can adapt to the disruption associated with hazard activity, care must be taken in assuming that recording their presence on an inventory reflects their genuine availability for emergency use or that it reflects any underlying belief in the importance of being prepared. While it must remain tentative until a more systematic analysis is undertaken, these data provide support for the contention that people can conflate routine activities and emergency preparedness.

While the content of factors 1 and 6 remain important contributors to peoples' ability to cope with hazard consequences, these data post a warning for both research and the assessment of people's adaptive capacity. When testing predictors of preparedness, it is essential for the rigour and validity of the analyses of the relationships that the dependent variable reflects the behaviour being examined. In this case, the measure should capture the outcome of decisions to specifically prepare for hazard activity. The present analysis provides support for other work (Paton, 2007; Paton et al., 2005) that raises the possibility that this may not always be the case, at least with respect to those items that can also serve more common domestic functions.

Caution in regard to the interpretation of self-report data is warranted on other grounds. Lopes (2000) found that people would overestimate their preparedness. This resulted from their inferring a level of current preparedness based on their prior levels of preparedness rather than from checking their preparedness objectively. On asking people to physically check their preparedness responses, Lopes found discrepancies between peoples' expectations and their actual levels of preparedness. For most people, their actual levels were lower than expected. For example, over time, items such as tinned food and batteries had been removed but not regularly replenished. However, people's estimates of their preparedness was still based on the fact that they had, at some point in the past, compiled an emergency kit.

This is an important issue for agencies and researchers who are interested in knowing about and attempting to facilitate emergency preparedness. Lopes' findings suggest that, particularly for high availability items (e.g., food, torch, batteries etc) it would be prudent for emergency management agencies to conduct periodic audits of preparedness in order to

assess the reliability of self-report data. This point reiterates the need for further consideration to be given to the choice of items used to assess preparedness. In the absence of independent audits to provide estimates of reliability, it may be prudent to focus on items (e.g., securing furniture, preparing a household emergency plan for earthquakes) those whose adoption can be more clearly aligned to decisions to prepare for earthquakes (Paton et al., 2005). This is an important issue for researchers. If their goal is to identify factors that predict hazard preparedness, the items that comprise the preparedness scale must reflect the outcome of decision processes that relate specifically to adopting hazard preparedness measures. If there is any doubt that an item of items do not specifically reflect the outcome of a hazard preparedness decisions process, then these items cannot be used in research.

While a case for the use of preparedness items to assess overall levels of preparedness is not being questioned, caution in their collective use in the process of identifying predictors of their adoption is warranted. With regard to the assessment of levels of preparedness, these data highlight the potential for community assessment to overestimate preparedness (e.g., from conflation of routine and emergency actions). If people conflate routine and emergency behaviours in this way, the possibility that people may discount or ignore future public information cannot be discounted.

Confirmation not only of functional differences but also of people classifying items in ways not entirely consistent with the objective analysis of function calls into question the practice of treating preparedness items as an homogenous, equally-weighted set of items that can be scored by summing the number of items present. Further complexity is injected by the possibility that response to the Factor 1 items could reflect routine household activities and practices rather than specific emergency actions. This means that their inclusion in a scale could introduce the presence of different reasoning processes, introducing a confounding influence into the analysis process. While the meaning imposed on items differs from that expected, it remains to be seen whether there exist corresponding differences in their predictors.

A further issue concerns the potential hierarchical inter-dependence between some items. Typically all items in preparedness scales are assigned equal values irrespective of differences in, for example, the ease of their adoption (e.g., storing water versus securing a hot water cylinder versus ensuring the physical integrity of the house), their permanence once adopted, and/or their relative contribution to survival. The latter issue relates to the fact that items can be differentiated with regard to their respective contribution to peoples safety, or their function in the adjustment process (e.g., securing furniture reduces loss of property, whereas storing food and having a household plan reduces reliance on external agencies during periods of disruption).

It can be argued that these items should not be weighted equally. For example, if effective mitigation measures are not in place, the consequent increase in risk of serious injuries or death to household occupants may render preparation or planning actions redundant. Similarly, it can be the case that some behaviours are hierarchically dependent on others. For example, if you do not have a torch (and usable batteries – neither of which can be assumed even when self-report items suggest their availability [Lopes, 2000]) and an earthquake leads to a total power failure at night there may be protective behaviours you

cannot initiate for want of a light. Existing inventories assume equality between items. A more searching, systematic analysis of preparedness from the perspective should be included in future research agenda.

This problem may be compounded by the way in which people's estimate the number of items they need to adopt in order to be "prepared." While comprehensive preparedness effectively requires the adoption of all items on a scale, people need not necessarily perceive things in this way. For example, Paton, Bürgelt, & Prior, (in press) found that some people believed themselves prepared if they had adopted one item from a list of recommended actions, while others did not believe themselves prepared unless they had adopted all the recommended actions. If people believe themselves prepared after adoption of one item, this could reduce their future attentiveness to public education content.

In addition to identifying a need for further systematic analysis of the functional organisation of preparedness scale items, future work will also need to investigate the implications of the hierarchical organisation of items (e.g., first mitigation, then survival, then recovery) and the interdependence between items. Analysis of these relationships will be required before it will be possible to identify how preparedness items should be scored in order to arrive at an accurate assessment of functional preparedness. The finding of functional differences also highlights a need to examine whether each factor is influenced by the same or a different set of predictors. The identification of the complexity of preparedness also calls for caution in the use of the scale for researching the analysis of predictor variables. Consequently, model analysis progressed using Behavioural Intentions (Paton et al., 2005) as the dependent variable.

5.0 MODELLING PREPAREDNESS

The theoretical underpinning of the model proposed here (Paton, 2008a; Paton et al., 2005) argues that actions are preceded by the formation of intentions to act. Consequently, a measure of intentions that comprised items that assessed people's intention to acquire hazard knowledge, increase actual preparedness, and to work with other people/civic agencies to develop knowledge and capability was included.

Intention has proven to be a good indicator of actual behaviour (Paton et al., 2005) and represents an appropriate dependent variable for several other reasons.

Firstly, several factors that are difficult to change through public education initiatives moderate the relationship between intention formation and the conversion of intentions into actions (Paton et al., 2005). Significant issues here include people's beliefs regarding when the next hazard event will occur. If this exceeds 12 months, the likelihood that people will act declines significantly. Another moderator concerns whether people possess the resources (e.g., time, money, physical resources, expertise) required to turn their intentions into reality. If they do not, actions are unlikely to follow. The assessment of intentions can thus provide an indication of people's potential to act. It also represents a more stable indicator since it is less susceptible to bias or moderation by factors such as beliefs regarding the timing of the next hazard event or resource availability. Furthermore, because it is not concerned with the specific content of preparedness measures that vary form hazard to hazard (e.g., earthquake

versus volcanic), intention provides a more accurate basis for assessing the all-hazards and all-community validity of the model.

The approach adopted here was driven by the goal of developing a generic model of hazard preparedness. The rationale for this is outlined in the next section.

5.1 Generic Multi-Level Model

The objective when developing a generic model is to construct a device whose reliability and validity will transcend the boundaries of any specific hazard or community and thus accommodate the hazard and community diversity that characterises New Zealand's highly complex risk environment. This reflects the diversity implicit in its hazard-scape (e.g., volcanic, storms, and earthquake hazards etc), the pattern of distribution of hazards (e.g., different regions/areas face different hazards), the need for all-hazards planning in areas susceptible to multiple hazards, and the diverse and changing characteristics of its citizens (e.g., age, gender, ethnicity).

Taken together, interaction between hazard, geographic and social (community diversity) characteristics creates a complex risk management and emergency planning environment. A valid and reliable generic model that can operate independently of the specific combination of risk characteristics can provide a cost effective means of assessing preparedness under these circumstances. It can also be used to guide intervention development and evaluation.

This report discusses the development and testing of a model predicting preparedness. While the constituent components of the model have proven useful as a guide for understanding volcanic hazard preparedness (Paton, 2007; Paton, 2008a), confirmatory analysis for another hazard and in a different community is required in order to assess the all-hazards and all-community capability of the model. The model is based on identifying the respective contributions that people, communities and civic agencies make to the process of actively managing natural hazard risk.

5.1.1 Modelling Preparedness

Earlier work (Paton et al., 2005) identified a need for any model designed to predict preparedness to accommodate the fact that while some people decide to prepare, others decide <u>not</u> to do so. It is also important to conceptualise preparing as a decision process that revolves around how people deal with the uncertainty associated with infrequent, complex hazard events. To deal with their uncertainty, people consult both community and expert sources. If a model is to be used to predict preparedness, it must accommodate the influence of individual, community and expert (civic agency) factors on people's preparedness decision making (Paton, 2008 a,b).

5.2 Identifying Predictor Variables

At the individual-level, decision making commences with peoples' beliefs about the relationship between the hazard and the efficacy of measures proposed to mitigate their consequences. The construct of outcome expectancy was selected to examine this component of the process.

5.3 Outcome Expectancy

Two outcome expectancy variables (Paton, 2008a) were used. Negative outcome expectancy reflects beliefs that hazard consequences are too catastrophic for personal action to make any difference to peoples' safety. If people adopt this belief, no further action is likely (i.e., this construct is proposed to explain why some people decide not to prepare). In contrast, positive outcome expectancy (the belief that preparation can reduce risk and increase personal safety), it is argued, will motivate people to prepare. If people have the necessary information and resources, positive outcome expectancy will predict the development of adaptive capacity. If people do not have all the information they require, the model proposes that people look first to other community members and subsequently to civic emergency management agencies. With regard to the former, two community variables, community participation and articulating problems, were selected on the grounds of their relationship with how people deal with risk (Paton, 2008a).

5.4 Community Characteristics

Because participating in community activities provides access to information from people that share one's interests, values and expectations, a measure of 'community participation' (Eng and Parker, 1994) was included in the model. While other members of the communities of which one is a member can provide the necessary information, this need not always be the case. Faced with infrequent events, community members may first have to identify what issues they could have to deal with. Eng and Parker's (1994) measure of 'articulating problems' was used to assess this aspect of community functioning. Once these needs have been articulated, whether people can act will be a function of the degree to which information meets people needs. That is, the degree to which information from civic sources empowers them to act by providing the information that meets their needs, reduces their uncertainty, and provides direction for their preparedness efforts. A measure developed by Speer and Peterson (2000) was used to assess empowerment.

5.5 Hypotheses

The model proposes that people's decision to prepare reflects the outcome of a sequence of activities. The process commences with peoples' outcome expectancy beliefs. If people hold negative outcome expectancy beliefs, it is hypothesised that they will not act. If people hold positive outcome expectancy beliefs, they will either proceed to develop their adaptive capacity, or, if lacking the information they require, proceed to work with others to articulate their needs and expectations. If these needs cannot be met within the community, it is hypothesised that whether people then prepare is a function of the degree to which community groups perceive themselves being empowered by these sources of information. This predicts levels of levels of trust (assessed with a measure of trust used in an earlier

study of earthquake preparedness (Paton et al., 2005)) which, in turn, predicts intentions. For reasons outlined earlier, the measure of intentions (Paton et al., 2005) was used as the dependent variable in this research.

5.6 Data collection

This questionnaire was administered to a random sample of 1980 households in Napier (New Zealand) in October/November 2006. A total of 255 responses were obtained. This provided a rate of return of 13%. This sample size was sufficient to proceed with a structural equation modelling analysis.

5.6.1 Results

The means and standard deviations of all variables are described in Table 2. Intentions (i.e., prevailing levels of adaptive capacity) were present at low-moderate levels (Table 2). All the remaining variables were present at low or low-to moderate levels. This indicates considerable scope for the development of predictor variables.

The analysis (Figure 1; Table 3) describes how whether or not people decide to develop their adaptive capacity is a process which comprises variables linked in a causal sequence. The sequence commences with people assessing their outcome expectancy beliefs, with the remaining variables in the model being dependent on (i.e., 'caused by') those preceding them (from left to right). The arrows, and the number adjacent to them, indicate the direction of causality and strength (from 0 (no relationship) to 1) of the relationships between variables respectively. A minus sign indicates an inverse relationship between variables. All paths shown are significant. The Goodness-of-Fit statistics for the model are described in Table 3.

Table 2 Means and standard deviations of model variables (N =255).

Scale	Range	Mean Napier Oregon	SD
Negative Outcome Expectancy	4-20	9.21	2.78
Positive Outcome Expectancy	4-20	13.23	2.59
Community Participation	5-20	13.52	3.61
Articulate Problems	6-20	14.21	2.18
Empowerment	4-20	10.29	2.66
Trust	5-25	16.42	3.44
Intentions	5-20	10.53	3.53

Because it can estimate multiple and inter-related dependence relationships simultaneously, structural equation modelling allows statistics to be calculated to test the model as a whole and to show how well the data fit the hypothesised model (Goodness-of Fit). The hypothesised relationships were analysed using the AMOS 6 structural equation modelling programme. The results are summarised in Figure 1 and in Table 3.

In structural equation modelling, the objective is to find non-significant differences between the predicted and actual model. This is measured by the Chi Squared (χ^2) statistic. The non-significant values obtained here (Table 3) indicate that the actual model is a close fit to the hypothesised model. This is supported by the levels of the other fit indices (Table 3).

Values of 0.90 and over for the Goodness-of-Fit Index (GFI) indicate a good fit. Values of the Normed (NFI) and Comparative (CFI) Fit Indices above 0.95 are indicative of a good fit. RMSEA values of less than 0.05 are also indicative of a very good fit. By suggesting an upper level of 0.069, the 90% confidence limits of the RMSEA are indicative of a good fit.

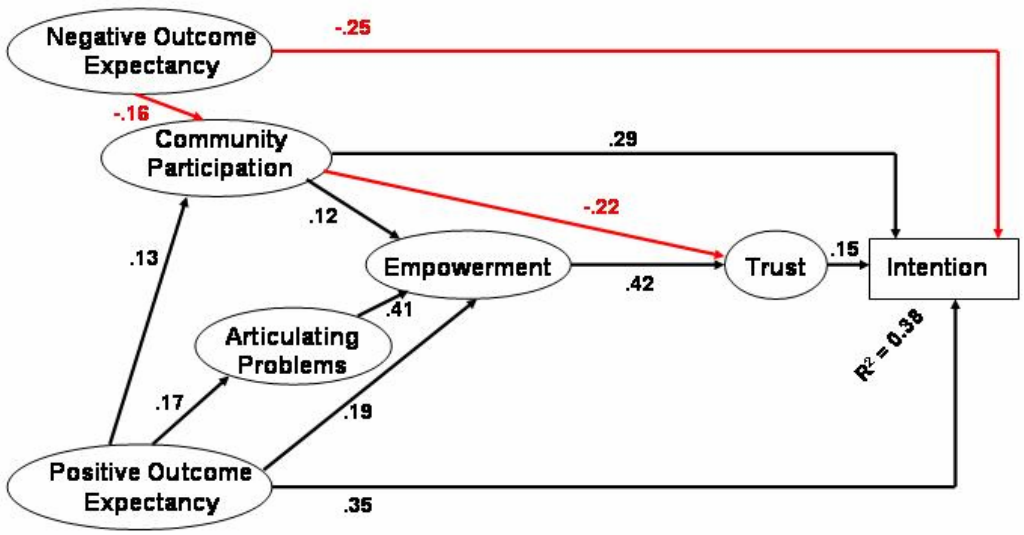

Figure 1 A summary of the structural equation analysis of the earthquake scenario data illustrating the direction, sign (positive relationships in black, negative relationships in red) and strength of relationships (the numbers adjacent to arrows illustrating the path relationships) between variables.

The goodness of fit statistics and indices indicate that the data are a good fit for the hypothesised model (Arbuckle, 2006) and that the model can account for differences in intention to prepare. The model accounted for 38% of the variance (R^2) in levels of intentions (Figure 1; Table 3).

5.6.2 Discussion

Overall, the fit indices indicate that the model is a good fit to the data. The data support the use of the model as a means to assist understanding how people make decisions regarding their intentions to prepare or not. In this section, attention turns to discussing the components of the model and how they influence decision making.

Table 3 Goodness of fit statistics and indices (N =255).

Fit Indices	Napier
$\chi 2$	5.919
df	7
p	0.549
RMSEA (90%)	0.001 (0.00 - 0.069)
NFI	0.983
CFI	0.994
GFI/AGFI	0.994/0.974
R^2	38%

As hypothesised, as negative outcome expectancy (NOE) beliefs increase (people believe that hazard consequences would be so severe as to render personal actions futile), the more likely it is that people will decide not to prepare. This finding reiterates the fact that some people are deciding not to act (cf. Paton et al., 2005). Furthermore, people who hold NOE beliefs are less likely to engage with others (the negative NOE-Community Participation link), reducing the likelihood that they will act to develop their capacity to respond (Figure 1).

The division of outcome expectancy into its positive and negative components helps explain why Paton et al. (2005) found a relationship between critical awareness (the frequency with which people think about and discuss hazards) and both preparing and not preparing. While critical awareness assesses the frequency with which people think about hazards, it does not differentiate between the positive and negative hazard beliefs that people could hold and that would inform how they are thinking. If the critical awareness variable captured both positive and negative outcome expectancy beliefs, this would explain the relationships found by Paton et al. By differentiating between these beliefs, the present model provides clearer guidelines for the development of intervention programmes.

As hypothesised, positive outcome expectancy (i.e., people believe that the benefits of preparing for hazards outweigh the costs and perceive the desired outcomes as achievable through personal effort) had a direct influence on intentions (Figure 1). This indicates that, for some people, a belief in both the efficacy of acting and their personal capability to act (i.e., they have sufficient knowledge, resources etc) predicts the development of adaptive capacity. Others, however, need more information, and for this they first turn to members of their community. This is indicated by the relationship between positive outcome expectancy and both community participation and articulating problems (Figure 1).

Confirmation of the role of community participation in the model reflects the important contribution that social interaction with those that share similar beliefs and values has in facilitating preparedness (Paton, 2008a). The significant, direct relationship between participation and intentions and between articulating problems and empowerment (Figure 1) indicates that, in some cases, information from members of one's community can motivate people to prepare. However, the relationship between participation and empowerment (Figure 1) also supports the contention that the necessary guidance may not always be forthcoming from community sources. Under this circumstance, people turn to expert sources. In doing so, an ability to formulate pertinent questions (articulating problems) can make an additional contribution to predicting preparedness. As predicted, empowerment mediated the relationship between community characteristics (participation and articulating problems) and trust (Figure 1). The importance of empowerment in the process was reinforced by finding a direct negative relationship between community participation and trust (Figure 1). This indicates that when people do not perceive themselves as being empowered, they are less likely to trust agency sources, and this reduces the likelihood that they will prepare. The final prediction, that trust mediated the relationship between empowerment and intentions, was supported (Figure 1).

In summary, a generic model was selected to accommodate the social and hazard diversity that underpins New Zealand's complex natural hazardscape. The structural equation modelling analysis produced a model that that comprised two individual-level (positive outcome expectancy, negative outcome expectancy), two community-level (community

participation, ability to articulate community problems), and two community-agency relationship factors (empowerment, trust). If they are to be effective, these data suggest that public education programmes must accommodate the interdependence between person, community and agency factors.

The development of a reliable model means that it can be used to assess current levels of preparedness and its predictors, assist the formulation, planning and delivery of strategies to facilitate household preparedness, and provide a framework for evaluating intervention. A generic model facilitates the performance of these tasks irrespective of the hazard or community of interest. However, this analysis involved a prescriptive approach to the analysis of preparing. The validity of the model can be enhanced if this can be demonstrated from other data. This is the topic that is addressed in the next section.

6.0 QUALITATIVE ANALYSIS

While the theoretical and empirical rigour brought to the model analysis contributes to its validity, this project sought to provide an additional test of this. The second test of the validity of the model involved eliciting people's own accounts of the reasons why they decided to prepare or not prepare for hazard consequences. The outcomes of this analysis are discussed in this section. If the model provides a valid set of indicators, it can be hypothesised that there would be comparability between the model variables and people's accounts of why they prepare or don't prepare.

It is important to note the results of the quantitative (i.e., that depicted in Figure 1) and the results of the qualitative analysis presented in this section of the report are not directly comparable. The quantitative analysis examined the relationships between the behaviours that people engage in or perform. The qualitative analysis examines people's beliefs.

This work was undertaken using means-end chain theory (Gutman, 1982, 1997) to provide a theoretical framework for eliciting people's reasons for their actions. This approach taps into the fact that people's decisions reflect hierarchically-ordered beliefs or cognitions, with the higher level beliefs representing their enduring, long term values. While these values represent the proximate reason for performing a particular behaviour, they derive from deeper-level beliefs. It is these deeper level beliefs that support (and influence) values. Means-end chain theory is based on the premise that the reasons that underpin our actions are mental constructions made within the context of the person's experience, norms and expectations. This renders it an approach capable of accommodating the influence of the social context.

This approach provides a structured, theoretically-rigorous framework for eliciting participants hierarchically-ordered beliefs regarding their decision making process about whether to adopt, or not adopt, actions that could influence their hazard preparedness.

The interview protocol invited participants to indicate their overall evaluation of hazard preparedness (e.g., to define the degree of positivity or negativity towards hazard preparation). This approach is not based on any a priori categorization of behaviour, but rather elicits people's reasons for wanting, or not wanting to pursue a goal. When one is

asked to defend or justify one's evaluative position, more reasons are generated when the extremity of the evaluation is greater. Because, under these circumstances, more dimensions of justification are produced, more detailed and comprehensive cognitive maps can be generated (Bagozzi & Dabholar, 2000). Next people are asked to provide personal reasons for their expressed views on preparedness (e.g., their response might be "I think that preparing increases my chances of survival" or "I think that preparing provides me with protection"). Respondents are then asked to justify the explanation in terms of its personal relevance (e.g., for each reason, the interviewee is asked why they think that).

Participants are then invited to identify salient attributes that differentiate between different options (e.g., preparing or not preparing, or, for those predisposed to prepare, to account for high versus low levels of preparing). This procedure is repeated for each stated reasons (e.g., survival, protection etc) elicited originally in defence of the respondent's evaluations of hazard preparedness until the respondent can give no further justification. At this point, the fundamental attributes or cognitions are identified. These data are then compiled into a matrix of hierarchically ordered reasons and justifications for supporting or not supporting hazard preparedness that can be summarised in a cognitive map.

Data were collected from telephone interviews with 15 participants from Napier. These individuals had signalled their willingness to be interviewed when they returned the questionnaire. In-depth interviews were conducted with all participants during April and May, 2007.

The analysis followed the procedure recommended Reynolds and Gutman (1988) and involved placing the identified elements into a matrix with the position of items being determined by the number of times an element led to another element. Two types of relationships emerge from this process. These are direct and indirect relations. Direct relationships are identified from people identifying direct relationships in their accounts. For example, "I think that preparing can make a positive difference influences my belief people taking action is important" illustrates a direct link between "Belief in Preparing" and "Active Preparing." In contrast, "I think that as a result of my involvement with others taking action can also affect the safety of others," illustrates how "Community Involvement" mediates the link between "Active Preparing" and "Responsibility to Others." This depicts an indirect relationship between "Active Preparing" and "Responsibility to Others." The direct and indirect relationships are summarised in Table 4.

The relationships shown in Table 4 are in fractional form with direct relations expressed on the left of the colon and indirect relations on the right. For example, relevance leads directly to an adjacent element 21 times and indirectly leads to other elements 43 times. Responses were grouped into attributes, consequences and values.

Attributes (A) represent the deeper-level beliefs and interpretations that motivate action and thus provide the cognitive foundation for people's decision making. The next level, the consequences Cognitions (C), describes the outcome (consequences) of the interaction between attributes and hazard-related and public education issues. This, in turn, influences the Values (V) that determine the degree to which people adopt specific behaviours).

While the values underpin the content of people's accounts of their actions (as well as the discourse that occurs with other community members and with the interviewer), changing behaviour requires that strategies are directed to changing the attributes and consequences that underpin and sustain people's values. The data in Table 4 provides an indication of the relative influence or importance of Attributes, Consequences and Values (i.e., the number of direct and indirect links) in people's mental deliberations about whether or not to prepare for natural hazard consequences.

Table 4 Summary of direct (numbers to the left of the colon) and indirect (numbers to the right of the colon) relations for each element

Name	To another element	From another element
(A) Previous experience	21:61	0:0
(A) Hazard awareness (Knowledge)	42:79	2:0
(A) Belief in preparing (makes a positive difference)	10:17	9:02
(A) Relevance	21:43	1:0
(A) Salience	27:24	7:04
(A) Sources of information	22:38	19:02
(A) Fatalism	4:02	4:0
(A) Inconvenience	2:03	2:01
(A) Influence of others	8:15	2:02
(A) Reticence	3:0	5:0
(A) Awareness of preparing (benefits)	8:06	5:04
(A) Active preparing	23:21	29:27
(C) Thinking about issues	7:07	17:11
(C) Discussing issues	6:06	15:17
(C) Community Involvement	10:05	5:13
(C) Lack of motivation	2:0	7:08
(C) No discussion	1:02	12:09
(C) Non-preparedness	3:01	4:04
(C) Physical protection	4:04	14:23
(C) Self sustaining	4:0	14:2
(C) Shelter	5:0	7:12
(C) Transferring responsibility	0:0	3:1
(C) Distrust	1:0	5:02
(C) Trust	1:0	8:08
(V) Protection	1:0	9:36
(V) Return to normal	0:0	3:11
(V) Responsibility to others	1:0	10:15
(V) Survival	1:0	9:32

Note :
(A) = Attributes (C) = Consequences (V) = Values

By capturing people's accounts of their reasons for their actions (or lack of action), the qualitative data examine how people actually think about hazard issues. It identifies the beliefs and cognitions that influence people's perceptions, choices and actions. As such, these data can be used to determine the degree of coherence between people's personal beliefs and the variables in the model. That is, if the model is a valid depiction of preparedness decision making, we would expect to see elements of the model represented in people's accounts of their beliefs and cognitions. Consequently, a comparison of the data from both analyses provides the means for checking the validity of the model. If this consistency is present, the interview data will provide support for the validity of the model

and thus it's utility as a mechanism for informing the development and delivery of public education strategies. In reviewing the data, evidence to support the model is sought at each level. The analysis of attribute data is discussed first.

6.1 Attributes

6.1.1 Negative Outcome Expectancy

Several elements represented constituents of negative outcome expectancy (NOE) beliefs (Paton et al., 2006). These were Fatalism, Inconvenience, and Reticence (uncertainty about the effectiveness of acting).

6.1.2 Positive Outcome Expectancy

Several cognitions consistent with positive outcome expectancy (POE) beliefs were evident in the interview data. These were the attributes of Belief in Preparing, Awareness of Preparing (Benefits), and Active Preparing.

6.2 Community Characteristics

The item "influence of others" is representative of cognitions that support a role for interaction with other community members influencing people's hazard mitigation decision making.

6.3 Empowerment

The element of Relevance represents a cognition that underpins the role of empowerment. It reflects the degree to which people believe that information from formal sources meets, or fails to meet, peoples' needs and expectations.

6.4 Consequences

Evidence supporting the model can also be discerned in the analysis of the higher-order Consequences cognitions elicited in the interviews. The potential for 'Not Preparing' outcomes (the NOE – Intention path in Figure 1) to have arisen from a specific reasoning process was strongly supported by several respondents describing Non Preparedness (Table 4) as a legitimate belief. Secondary support for not preparing representing the outcome of a discrete reasoning process was evident in 'lack of motivation' and 'no discussion' of hazard beliefs (which reflects the negative NOE – community participation pathway – Figure 1) featuring prominently in the accounts of their preparedness reasoning offered by those interviewed.

POE beliefs were reflected in Thinking About (hazard) Issues (Paton et al., 2005). The Discussing Issues and Community Involvement consequence cognitions are consistent with the role of community participation (Figure 1). Furthermore, their presence as consequence cognitions indicates that they result from (i.e., arise as a consequence of) people's personal beliefs (e.g., that preparing is beneficial). This supports the validity of the POE-community (participation, problem-solving) links in the model (Figure 1). The importance of community involvement is evident in the number of direct links emanating from this cognition (Table 4).

The significance people afforded the constructs of Trust and Distrust in their accounts (as higher-order consequence cognitions) provides support for the postulated role of the community-agency relationship (community-empowerment-trust) in the model (Figure 1). The relationship between relevance and trust provides additional evidence for the importance of these relationships in the model.

6.5 Values

With regard to the higher-order cognitions that underpin preparing, the values of 'Protection,' 'Survival,' and 'Responsibility to Others' were significant proximate beliefs about preparing that emerged from people's accounts of their decision making process. Valuing protection and survival are consistent with the general philosophy that underpins hazard education programmes. However, 'Responsibility to Others' has not previously been identified as a significant, proximal determinant of people's preparedness decisions. Nor has it been reflected in the way in which public education and risk communication have been framed. This finding is, however, consistent with the social justice tenets that underlie the development of the model (Paton, 2008b) and with findings emerging from research into preparedness for other hazards (Paton, Bürgelt, & Prior, in press). This finding provides support for the contention that people's risk management choices are embedded in the social context in which they live and not based solely on self-interest.

The interviews elicited several attributes and consequences that are consistent with the actions of the variables postulated for and supported in the model (Figure 1). In particular, these data identified how previous experience, hazard awareness (people's knowledge of hazard effects and their interpretation of hazard consequences for themselves), belief in preparing (that it can make a positive difference), salience (relative importance of hazard issues compared with other demands on people's lives), and the relevance of information (consistency between people's needs and the information made available) are important fundamental determinants of people's actions (Table 4). Because they emerged from people's accounts of their relationship with hazard issues, these data underscore the ecological validity of the model content.

The emergence of important roles for Salience (the relative importance of hazard issues compared with other prevailing issues) and Relevance (degree to which information from civic sources met people's needs) indicates that a) public education has to compete for people's attention and b) people actively evaluate the information available to them in relation to their needs rather than against any objective assessment of risk. These factors then influence people's actions.

For example, some respondents were reticent to initiate preparedness activities, even if they knew what to do. This lack of motivation was attributed largely to the salience that people attached to hazard events. Where people hold low hazard salience beliefs (i.e., hazard issues are less important than other issues), their motivation to prepare is lessened and they are less likely to discuss hazard issues with others. Hazard salience was influenced by the infrequent nature of earthquakes. This increased the likelihood that people believed that their attention, resources and efforts would be more effectively used if they directed them to other, more immediate concerns.

When confronted with a need to act to mitigate the consequences of infrequent events, salience is influenced by the degree to which people believe that the actions associated with earthquake preparedness will result in some immediate benefit. This finding is consistent with the role of POE in the model. This identified people's belief in preparedness activities leading to immediate benefits as a predictor (direct and indirect) of preparedness (Figure 1). If, however, this expectation is not met then it is unlikely that an individual will be motivated to act. So while earthquake preparation is seen as important, it is its relative position in the range of issues impinging on the person/community that influences motivation to prepare. Low relative importance (with the infrequent nature of earthquakes making an important contribution here) means that other issues take precedence.

A complex pattern of relationships between Relevance and Beliefs about the Sources of Information helped understand the distinction between preparing and not preparing outcomes. In particular, analysis of these relationships indicated how the quality of people's engagement with a source (e.g., telephone book, EQC, advertisements in the media, and the local council) was influenced by the degree to which people perceived the information provided as being meaningful for them (e.g., that helps them resolve issues, clarifies their uncertainty, provides direction for future actions). That is, Relevance (meaningfulness) was a function of the degree to which the information available addressed the specific concerns people had in relation to understanding earthquake hazards and the measures proposed to mitigate their adverse consequences.

A lack of relevance increased the likelihood that people would distrust the source. In contrast, when it was perceived as relevant, the consequence was a stronger sense of trust in a source. The trust that people had in particular sources of information led them to actively prepare for earthquakes. This involved specific preparations that enabled people to protect themselves from hazard consequences.

The qualitative analysis reiterated the important role that trust (in sources of information) had in people's preparation decision making. It also identified a need to distinguish between trust and distrust. These data indicate that trust and distrust play different roles. Future iterations of the model must accommodate measures of both.

On the basis of the qualitative findings, it can be hypothesised that trust will influence the level of preparedness adopted. However, it is possible that the inclusion of distrust could assist understanding why some people decide not to prepare (i.e., inform understanding of the NOE-intentions link).

6.6 Mapping People's Accounts of Hazard Preparedness

In order to provide a graphic illustration of the hierarchical nature of people's hazard preparedness cognitions, a preliminary cognitive map was constructed from the interview data (Table 4). For inclusion in the model an element needed to lead directly to another element at least three times.

People's prior experience, hazard knowledge and beliefs about preparing provide the motivating force for people to acquire the information they need. It is at this point that the reasoning process diverges according to decisions to prepare or not to prepare. Low

relevance is linked to distrust, and low salience to a lack of motivation and low level of belief in the value of discussing hazard issues with others. These cognitions represent key elements in the reasoning process that leads to people deciding not to prepare. This work reiterates the importance of conceptualising preparing and not preparing as discrete decision processes rather than as their representing opposite ends of a continuum.

The interview data reiterate the finding in the model analysis (Figure 1) that the social context (the quality of community discourse, the level of engagement between community members, the quality of the relationship with civic agencies) exercises an important influence on how people think about hazard issues and in their decision making about how to manage their risk. This is represented in how people's belief in taking steps to prepare (active preparing) is supported by recognition of the importance of discussing issues and involvement with others (Figure 2). These cognitions sustain the "Responsibility to Others" value that people identified as one of the factors supporting their decision to prepare. A belief in "Active Preparing" also held direct and indirect relationships with the other core values of "Protection" and "Survival".

In summary, people's accounts of the beliefs that support their preparedness reveals that their interpretation of their previous experience, recognition that preparedness can have positive consequences, knowledge of the benefits that accrue from being prepared, the salience of hazard issues, and the relevance of information influence whether or not an individual will initiate preparation activities and, for those that do decide to prepare, they influence the level of preparedness undertaken. It was not possible to examine whether these beliefs influenced the type and number of preparedness measures undertaken. Finding answers to this question will require additional work. Those persons who choose to actively prepare are likely to believe that they will be protected from the consequences of an earthquake and will able to survive in the aftermath of an earthquake. The Salience and Relevance cognitions illustrate the existence of evaluative processes that can lead to preparation. However, a lack of perceived salience and/or relevance may result in people deciding not to prepare.

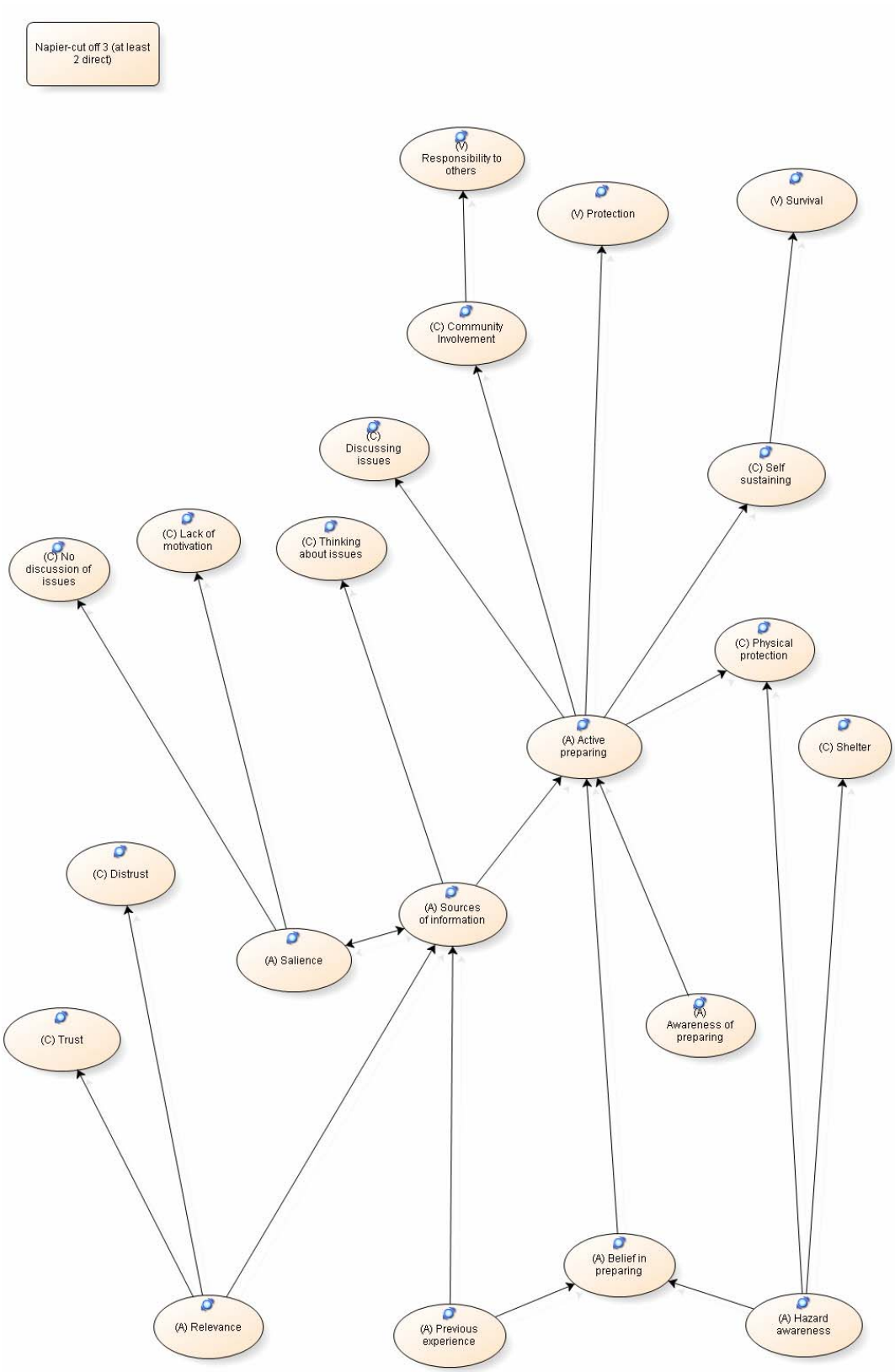

Figure 2 Preliminary social cognitive model of earthquake preparedness derived from interviews with 15 residents on Napier.

7.0 CONCLUSIONS AND IMPLICATIONS

If significant levels of hazard activity (e.g., a destructive earthquake) occur, people could have to cope with the consequences for several weeks without recourse to normal societal resources and functions. Given that hazard events could be preceded by little or no warning, it is imperative that people prepare in advance.

The model used here suggests that strategies designed to facilitate preparedness must accommodate the interaction between individual (e.g., outcome expectancy), social context (community participation, problem solving), and agency (empowerment, trust) factors. The validity of the model was supported by the qualitative analysis, with people's accounts of their preparedness reasoning reflecting the content of the model. This supports the utility of the model as a guide to public education planning. General guidelines (based on the model content) for developing strategies are available from several recent sources (Paton, 2008b; Paton et al., 2006; Paton & Wright, 2008).

The qualitative analysis identified several issues that can inform the development of hazard education strategies. With regard to the general framing of messages, emphasis on protection, safety and responsibility to others are likely to be more effective.

However, analysis points to a need to direct the content to changing and developing the underlying attributes (Figure 2). The analysis also identified several attributes and consequence cognitions that underpin these values and that can inform the development of information content (which should be delivered in the context defined by the model parameters of social interaction within community contexts and the relationship between community and agency sources). The content should be aligned to a need to promote change in hazard knowledge, hazard salience, and relevance (all of which are influenced by delivering information in community (social) contexts and in empowering contexts). Additional work is required to examine how these beliefs are formed and to account for differences in the degree to which they are represented in people's own accounts of how they arrive at the decisions of whether or not to prepare.

While the qualitative analysis provided some additional insights into the factors that influence overall levels of preparing, it did not further understanding of whether functionally different types of preparing (e.g., Table 1) reflect the influence of different beliefs. However, the fact that the social (responsibility) and personal (e.g., protection) values that underpin preparedness decisions are influenced by different belief pathways (Figure 2) suggests that this issue is one that should be placed on future research agenda.

The interview data also identified a need for the further development of the model variables to ensure that they accurately tap into the reasoning and social processes that influence preparedness. The model analysis also revealed considerable scope for increasing the variance in the predictor variables (particularly community participation and articulating problems) it can account for. While the overall level of fit was acceptable, the limited capacity of the analysis to account for variance in social context variables highlights a need for more systematic model development to be included in future research agenda.

It is worth reiterating that the variables being modelled here (particularly the social process variables of participation, problem solving, empowerment, trust) are tapping into peoples' mainstream community experience of relationships and competencies (i.e., respondents were not members of groups established specifically to consider or resolve problems about hazard issues). Consequently, it is not surprising that there exists considerable scope to investigate how to increase levels of variance in these variables. This fact is also mirrored in the importance that salience and relevance had for people's decision making.

From a practical perspective, these issues reflect the fact that risk management programmes are rarely geared to actively facilitating community discussion of hazard issues, developing community members' ability to define and resolve their risk management problems, or engaging (i.e., working with them over prolonged periods of time) with communities to develop collaborative approaches to confront the threat posed by natural hazards.

However, the data discussed here indicate that people do discuss hazard issues with others in the communities in which they are members (note that it is not possible to identify these communities – just that people report a role for interaction with others in the communities of which they are members in forging their risk beliefs and management choices), and that these discussions are causally related to their subsequent decisions to prepare. The fact that pre-existing community sources and capabilities influence preparedness decision making for non-routine earthquake hazards indicates the benefits that could accrue from making more use of community processes (e.g., encouraging community discussion of hazard issues and disseminating information through community forums) in future risk management strategies (Paton, 2000; Paton, 2008b). This suggests that integrating risk management and community development activities in ways that specifically encourage discussion of hazard issues, develop problem solving competencies, and involve agencies engaging with communities in ways that empower communities and their members will increase the likelihood of people acting in ways that enhance their adaptive capacity (Paton, 2000; Paton, 2008b; Paton & Bishop, 1996).

In this context, the effectiveness of public education and risk communication then becomes a function of two factors (Paton, 2008a). The first is the degree to which strategies encourage community members to discuss hazard issues and identify the resources and information they need to deal with the consequences hazards would pose for them. The second concerns the degree to which the relationship between community members and agencies is complementary and empowering.

The feasibility of adopting this approach was demonstrated by a community engagement project (Paton, 2002) undertaken for Auckland City Council in 2000-2001. This process involved using community board representatives in a leadership role, providing them with training in hazard mitigation issues, and developing their capacity to provide feedback regarding salient hazard issues within their respective jurisdictions. This project demonstrated not only the feasibility of this approach, but also its potential as a cost-effective means of both disseminating information (that could be tailored to the specific needs of its recipients) and obtaining information on community needs. This issue is of particular importance when working in highly complex urban contexts (in which diversity on all social parameters is high) about infrequently-occurring, complex hazards and mitigation options. This suggests that emergency management planning may profit from being actively

integrated with community development planning (Paton, 2000; Paton, 2008b). Sustainable risk management solutions are more likely to emerge when they are developed in ways that complement existing activities and relationships.

7.1 Implications for Risk Management Programmes

A generic model possesses the flexibility to assess levels of preparedness within an all-hazards environment in ways that accommodate demographic and regional differences. The model and qualitative analyses emphasized the inter-relationships that exist between the factors that comprise the model. Consequently, risk management strategies designed to facilitate sustained preparedness must develop interventions that are correspondingly comprehensive.

It is important to acknowledge that whether or not people prepare is a process that occurs over time as a result of interaction between people within community contexts and between community members and civic and scientific agencies (and that includes the consequences of previous intervention with community groups). Risk management programmes should accommodate these inter-relationships and include strategies that facilitate that acquisition of progressively more complex and/or new information (e.g., building understanding of hazards and their link to mitigation options), competencies (e.g., applying preparedness measures, working with others to identify salient issues) and relationships (e.g., community participation) over time. Risk management programmes also need to accommodate the fact that people will be at different stages in their development. A key issue here is the quality of engagement. (Note: the community participation measure used in the model analysis describes the degree to which people interact with other community members and does not reflect the actions of external groups or agencies in any way.)

Community engagement can occur at different levels. At the lowest level, it simply involves making information available to the community. At the next level, some measure of directive or autocratic consultation is involved, usually in the form of seeking input to specific questions. The third level covers the involvement of people in defining and resolving problems, with the actual resolution remaining with the agency. The fourth level involves collaboration, which complements involvement with both parties working on solutions. The final level, empowerment, is concerned with devolving responsibility for all aspects of the process to the community. Agency involvement is concerned with making information and resources requested by the community available to the community and providing any training (e.g., problem solving, leadership) required by the community. From the perspective of facilitating sustained preparedness, the fifth level, true empowerment, is the most effective. The importance of the latter is heightened by its implications for developing and maintaining trust in a source of information. When emergency management agencies engage community members about hazards, satisfaction with communication, risk acceptance, levels of trust, people's willingness to take responsibility for their own safety, and their collective commitment to prepare for hazard consequences will increase.

The final issue concerns how levels of preparedness are assessed. The analysis of how people organised or characterised preparedness items identified that people did not treat items in an homogenous manner (which is how they are typically dealt with in research). This work raised several issues. One concerned whether the process by which people organised

items means that different facets of preparing are influenced by different predictors. Another concerned the need for additional work on how items are weighted and sequentially organised. The issues discussed in this context include temporal course of demands that people have to contend with (e.g., mitigation items such as securing a house to its foundations become important before preparedness items such as having stored water), the hierarchical relationships between items and activities (e.g., the lack of a torch/batteries could preclude acting on other strategies if an earthquake occurred at night), and conflation (e.g., response to some items based on shopping rather than preparedness decisions) issues.

Additional research is required to examine how people impose meaning on or classify preparedness items. Given both anecdotal and empirical evidence for the perception of functional differences in the classification of items, future work needs to examine whether these factors are influenced by different predictors and processes.

In conclusion, confirmation of the validity of the model, from both survey data and people's own account of their preparedness decisions, reinforces its utility for the evidence-based development of public education programmes. The development of a reliable model means that it can be used to assess current levels of preparedness and its predictors, assist the formulation, planning and delivery of strategies to facilitate household preparedness, and provide a framework for evaluating intervention. A generic model facilitates the performance of these tasks irrespective of the hazard or community of interest.

A generic model designed to accommodate the social and hazard diversity that underpins New Zealand's complex natural hazardscape was developed and tested. It comprises two person-level (positive outcome expectancy, negative outcome expectancy), two community-level (community participation, ability to articulate community problems), and two community-agency relationship factors (empowerment, trust). Qualitative and quantitative analyses demonstrated that, if they are to be effective, public education programmes must accommodate the interdependence between these person, community and agency factors.

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