



Responding to earthquake hazards: promoting household resilience and preparedness

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ABSTRACT: Central to contemporary emergency planning is the development of individual/ household resilience to hazard effects. Drawing upon work conducted in New Zealand on risk perception and preparedness for volcanic hazards, this paper outlines a model, derived from Protection Motivation Theory and the Theory of Planned Behaviour to predict the causal relationship between certain social cognitive variables and individual preparation for natural hazard effects. Core elements in the model include outcome expectancy, risk perception, self-efficacy and action coping. The role of earthquake anxiety was also examined. From this a tentative model of individual risk reduction behaviour is proposed. Data from the members of four communities in New Zealand were collected to test the model. Structural equation modelling was used to fit the data to the model in regard to preparedness for earthquake hazards. The implications of this model for developing key performance indicators for personal resilience and for intervention planning is discussed. In regard to the latter, by linking these findings to earlier work the opportunities for developing intervention strategies by incorporating them within a community empowerment process is discussed, as is the capability of the model to operate within an all-hazards management framework.

1 INTRODUCTION

Substantial funds are expended annually on risk communication programmes to promote natural hazard preparedness (e.g., storing food & water, fixing high furniture and hot water cylinders to walls, preparing a household evacuation plan). The adoption of these measures facilitates a capability for coping with the temporary disruption associated with hazard activity and with minimising damage and insurance costs. Risk communication initiatives typically assume that hazard awareness represents a substantive antecedent of protective behaviour and, consequently, that presenting information on hazard threat will encourage protective behaviour (Smith 1993). This assumption is unfounded (Lindell & Whitney 2000; Paton et al. 2000).

While effective in raising hazard awareness, the success of these programmes in translating awareness into preparedness has fallen below expectations (Lindell & Whitney 2000; Paton et al. 2000). In this

paper, we explore the proposition that this lack of effectiveness relates to a failure to accommodate the cognitive processes that influence the relationship between risk beliefs and protective behaviour. Developing a theoretically robust model of hazard preparedness is an essential precursor to constructing effective risk reduction interventions strategies, developing key performance indicators for assessing intervention and risk communication effectiveness, and providing a framework for promoting individual and community resilience to hazard effects.

Irrespective of the quality of hazard and risk information, the likelihood of people adopting preparedness measures is influenced by several cognitive variables (Abraham et al., 1998; Ajzen, 1991). In this context, intentions are a key indicator of the adoption of preventative behaviour (Abraham et al. 1998; Godin & Kok 1996). The Theory of Planned Behaviour (Ajzen, 1991) proposes that outcome expectancies (perceptions of whether personal actions will effectively reduce a problem) and self-efficacy (beliefs regarding personal capacity to act effectively) are prominent precursors of intention formation (Abraham et al. 1998; Bagozzi & Edwards 1998; Bennett & Murphy 1997). In addition to its role in intention formation, self-efficacy influences the effort and perseverance expended on achieving outcomes (Abraham et al. 1998; Bennett & Murphy 1997).

2 THE PROPOSED MODEL

This theoretical framework provides a basis for examining natural hazard adjustment adoption for several reasons. Firstly, the variables *outcome expectancy* and *self-efficacy* have been implicated as precursors of resilience in natural hazards contexts (Bishop et al. 2000; Duval & Mulilis 1999; Lindell & Whitney 2000; Paton et al. 2001). Secondly, outcome expectancy will be an important precursor because natural hazard reduction initiatives are typically undertaken during periods of hazard quiescence (i.e., when a lack of hazard activity renders them less salient to the public) and focus on attempting to motivate people to deal with infrequently occurring and destructive or disruptive hazards (e.g., earthquakes, volcanic eruptions) whose nature and intensity tend not to be perceived as lending themselves to mitigation by individual action (Spedden 1998). Thirdly, natural hazard effects are often perceived as uncontrollable. Self-efficacy has been identified as a significant influence on behaviour when dealing with issues perceived as less controllable (Godin & Kok 1996). Finally, the incorporation of intention formation, describing a point where individuals will make decisions regarding execution or not, emphasises the need to differentiate between factors that influence intentions to adopt and those that may moderate their implementation. The latter may be particularly important in natural hazard contexts as a consequence of, for example, the rarity of hazard activity, attenuation effects on risk perception over time, and the need for hazard issues to compete with other more important personal goals or needs (Karoly 1998; Paton et al. 2001). This conceptualisation also highlights the need for risk communication strategies to be designed to achieve these different functions (i.e., the factors that drive intention formation are not the same as those that influence the conversion of intentions into actions).

Variables have been selected on the grounds of their predictive validity and the fact that they are amenable to change through intervention strategies at individual and community levels. In addition, the model reflects the development of processes that affect outcome responses. The objective is thus to produce an instrumental model capable of assisting both future research and the formulation of practical risk communication strategies.

In the proposed model, motivation to act is triggered by the perception of a threat, but intentions are driven by outcome expectancy and self-efficacy judgements. For this research, risk perception will be measured in terms of perceived threat and hazard intrusiveness (Lindell & Prater 1999). It is proposed that outcome expectancy precedes efficacy judgements. People make assumptions about whether successful outcomes are possible before forming an intention to adopt a preparatory measure. Individuals are more likely to engage in behaviours when the outcome is valued and perceived as achievable. If favourable, the individual moves to the action phase; a phase strongly influenced by self-efficacy expectations. The number and quality of action plans and the amount of effort and perseverance invested in risk reduction behaviours is strongly dependent on one's perceived competence and experience (Bennett & Murphy 1997).

Outcome expectancies could also be influenced by earthquake anxiety. While low levels of anxiety can stimulate learning and action, high levels can have the opposite effect, increasing the likelihood of people avoiding literature or media coverage of earthquake issues, including those relating to preparation and the reduction of their effects. Preliminary work suggests that earthquake anxiety may be present in some 20% of the New Zealand population. Consequently, a measure of earthquake anxiety was developed for this study.

Even if intentions are formed, they may not be acted upon. Several variables capable of moderating the intention-action relationship are proposed. Intentions may not be translated into action if people lack resources for implementation (low response efficacy) (Abraham et al. 1998; Lindell & Whitney 2000). This variable describes the personal capabilities and resources (e.g., time, skill, financial) available for realising strategies, the benefits associated with adoption (the greater the uses or benefits associated with a specific strategy, the more likely its adoption), and the degree of conflict between recommended actions and other important personal goals or needs (Lindell & Whitney 2000; Karoly 1998; Paton et al. 2001). The intention-action link can also be disrupted if people transfer responsibility for their safety (low perceived responsibility) from themselves to others. Ballantyne et al., (2000) observed that the provision of hazard information resulted in respondents becoming less concerned about volcanic hazards as a consequence of attributing responsibility for their safety to others, compromising adjustment adoption in the process (Duval & Mulilis 1999; Lindell & Whitney 2000). Prior experience influences interpretation of subsequent risk (Johnston et al. 1999; Lindell & Whitney 2000; Paton et al. 2000). Finally, Bishop et al. (2000) observed a relationship between sense of community and risk reduction.

The relationship between these variables and adjustment adoption is modelled in figure 1. For reasons of space, the model also depicts the research process and its longitudinal approach. The central focus of this study is the development of an intention to act in respect of preparation for earthquake hazards and mapping the progression to the adoption of appropriate behaviours. For this reason the study is divided into two phases of linked data collection. The first phase covers the development of the intention to act and the second phase covers the behavioural changes. The separation of the two phases mirrors the causal sequence proposed is methodologically necessary to draw such inferences, and requires that participants responses are examined on several occasions, to adequately examine this process, and thus to test the model.

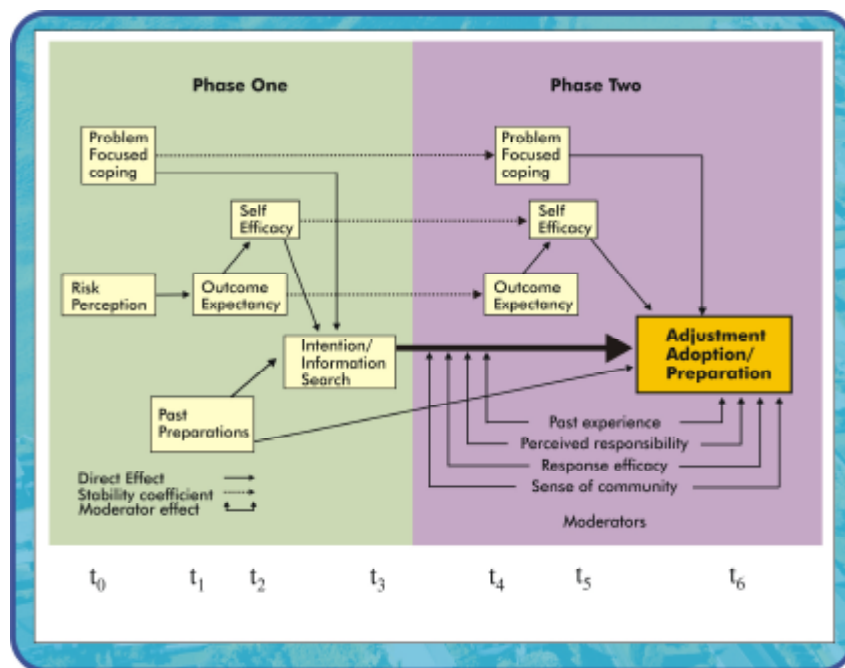


Figure 1: The proposed risk perception-preparation model

3 METHODOLOGICAL ISSUES

A complicating factor exists when individuals are observed on more than one occasion. Changes in self-rating measures may occur as a result of events in the intervening period, from unreliable aspects of the measures, or because respondents have formed different relations to, or perceptions of, the items they rate. Researchers need to assess whether changes in measures across time reflect real change. According to Golembiewski et al. (1976) an alpha - change occurs when an increase or a decrease in the score from a multi-item scale directly reflects a corresponding change in the latent construct. A beta - change occurs where an increase or decrease in the score signals a recalibration of the scale by respondents. Such forms of change can potentially be detected within the framework of the structural analyses we are proposing for the data collected in this study (Schaubroeck & Green 1989). By adopting this approach, it will be possible to plan further waves of data from the participants to enhance this study and advance our understanding of the relationship between risk perception and preventative behaviour over time.

This work also provides an opportunity to examine the relation between features of the communities from which the data are drawn and the variables in the model. One useful consequence of this opportunity is the potential to determine whether any of the characteristics of the local environment have a strong determining effect or moderating effect on the formation of intentions for the adoption of adjustments. From both a theoretical and a practical perspective, it is useful to know about level-two effects.

The effects that occur within individuals (psychologically speaking) are level-one effects. Beta/gamma changes in the self-efficacy, outcome expectancy and problem-focused coping variables across the waves of data will be examined. Factors that differentially affect subgroups of people, such as characteristics of whole communities, are level-two effects. The data used in this study will be partitioned into community/regions such that differences at level-two that affect the variables in the models we propose can be detected. Such effects can be detected using either separate structural analyses (where the numbers allow for it) or analytic comparisons among the sub-groups (multivariate analysis of variance)

4 CONCLUSION

Promoting resilience through encouraging individual preparation for earthquake hazards is a complex process. Diversity in the data accessed and the fact that several cognitive mechanisms influence the meaning attributed to it helps explain why the expected relationship between risk perception and preparation has proved tenuous, irrespective of the media used to promote risk perception and preparation. A major challenge for risk communication is ensuring that the information provided is meaningful to recipients, motivates risk acceptance, and the adoption and maintenance of risk reduction behaviour. A need to promote these outcomes during periods of quiescence for infrequently occurring hazards suggests that risk communication should focus on the immediate benefits of preparation. Attention should also be directed to developing valid measures of the constructs described here. Once modelled using appropriate longitudinal methodology and analysis, the effectiveness of the interventions derived from this process can be facilitated by integrating risk management and community empowerment initiatives.

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