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# Predictors of Intention to Prepare for Volcanic Risks in Mt Merapi, Indonesia

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This article is about modelling causal-relationship factors related to disaster preparedness. A model identifying the relationships between person- and community-level factors and intention to prepare for volcanic risks is tested in communities surrounding the Mt Merapi volcano, Indonesia. The analysis extends the test of a model developed by one of the authors in an individualistic culture, New Zealand, to members of a collectivistic culture. Using the data obtained from communities situated around Mt Merapi ( $n = 322$ ), analysis revealed that community-level (collective efficacy and community participation) and variables describing the quality of the relationship between community members and civic agencies played significant roles in predicting intentions to prepare for volcanic hazards. The analysis also revealed that individual-level variables (outcome expectancy) were less influential compared with studies applying the model in individualistic countries. Some policy implications related to the findings are discussed.

**Keywords:** Mt Merapi, Indonesia; community; intention; preparedness; volcanic risk

Central to disaster risk management is facilitating disaster preparedness at national, local, community and personal levels (Mileti, 1999; Tierney, Lindell, & Perry, 2001). These studies also argue that community-based approaches are essential to achieving this goal. This paper focuses on preparedness at personal and community levels and examines the cross-cultural equivalence of a model developed to predict natural hazard preparedness.

While disasters are not constrained by cultural boundaries, the same cannot be said for research into understanding why there is considerable variability in levels of preparedness. Most of the research on community and personal disaster preparedness has taken place in Western countries. Only a few research studies have attempted to investigate preparedness in the Asian context; for example, in Japan (Bajek, 2007), and in Thailand (Paton et al., 2006). This article seeks to extend this work and examine the cross-cultural equivalence of a model developed to predict preparedness in more individualistic cultures (New Zealand, United States). It does so by examining the ability of a model with proven utility in individualistic cultures to predict preparedness in members of a collectivistic culture (Indonesia).

Disaster preparedness at the household level is defined in this article as all types of activities carried out to enhance the ability of social units to respond when a disaster occurs (Tierney et al., 2001). A need for greater emphasis on encouraging disaster preparedness at community and personal levels was highlighted in the Hyogo Framework for disaster reduction (ISDR, 2005). Despite this, and many other calls and efforts to try and achieve this goal, levels of preparedness remain low. While some of the observed reticence of people to prepare can be attributed to factors such as poor living conditions (Pelling, 1998; Wisner, Blaikie, Cannon, & Davis, 2004), the fact that low levels of preparedness also prevail in more economically capable countries (Lindell & Hwang, 2008) suggests that the explanatory net must extend beyond specific environmental and economic factors to encompass the motivational and decision making processes. One line of inquiry thus concerns how socio-psychological factors influence levels of disaster preparedness.

Implicating socio-psychological factors in this process increases the potential to conduct cross-cultural comparisons. Studies of disaster and risk management in Asian countries must be able to accommodate the

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influence of the strong collectivistic cultural beliefs that underpin decision-making and behaviour (Bajek, Matsuda, & Okada, 2008; Bankoff, 2003; Okada & Matsuda, 2005, 2006; Paton et al., 2008).

Recognition of the potential influence of fundamental cultural differences between countries raises a crucial question. That is, whether models of disaster preparedness predictors developed in Western contexts can apply in more community-oriented Asian contexts? Identification of the fact that social context factors do influence preparedness decision-making in Western countries (Paton et al., 2008) provides a basis for comparison with collectivist cultures in which collective processes exercise a consistent influence on behaviour. The model at the centre of the present study identified how personal-, community- and institutional-level factors interacted to facilitate disaster preparedness at the household level in an individualist culture (New Zealand). This article discusses the cross-cultural equivalence of this model using data from Indonesian communities situated around the Mt Merapi volcano.

The article starts with a discussion on how public hazards education does not necessarily motivate people to prepare for disaster. It follows with arguments regarding why interaction between social context factors and people's beliefs must be accommodated if a comprehensive understanding of factors predicting people's decisions to adopt preparedness measures is to be developed. In order to examine its cross-cultural equivalence, the ability of the model to predict hazard preparedness is tested on communities residing in the shadow of the Mt Merapi volcano in Indonesia. Finally, comparison of these findings from work applying the model in New Zealand and Japan is used to frame discussion of the implications of the findings for cross-cultural research and risk management.

## Theoretical Framework

A common assumption in public hazard education is that providing the public with information (e.g., pamphlets) on hazards and how to mitigate their consequences will motivate people to carry out disaster preparedness (Lindell & Perry, 2004; Quarantelli, 1997; Smith, 2004). Thus, community organisations and governments often carry out hazard education by providing information to the public. The above assumption is unfounded (Ballantyne, Paton, Johnston, Kozuch, & Daly, 2000; Duval & Mulilis, 1999; Lindell & Whitney, 2000; McLure, Walkey, & Allen, 1999; Mulilis & Duval, 1995; Paton, 2006). This has led to the recognition that it is how people interpret their circumstances and the information available to them that underpins whether or not they decide to prepare for disaster (Lindell & Prater, 2002; Lindell & Whitney, 2000; Okada & Matsuda, 2006; Paton, 2003; Whitney, Lindell, & Nguyen, 2004).

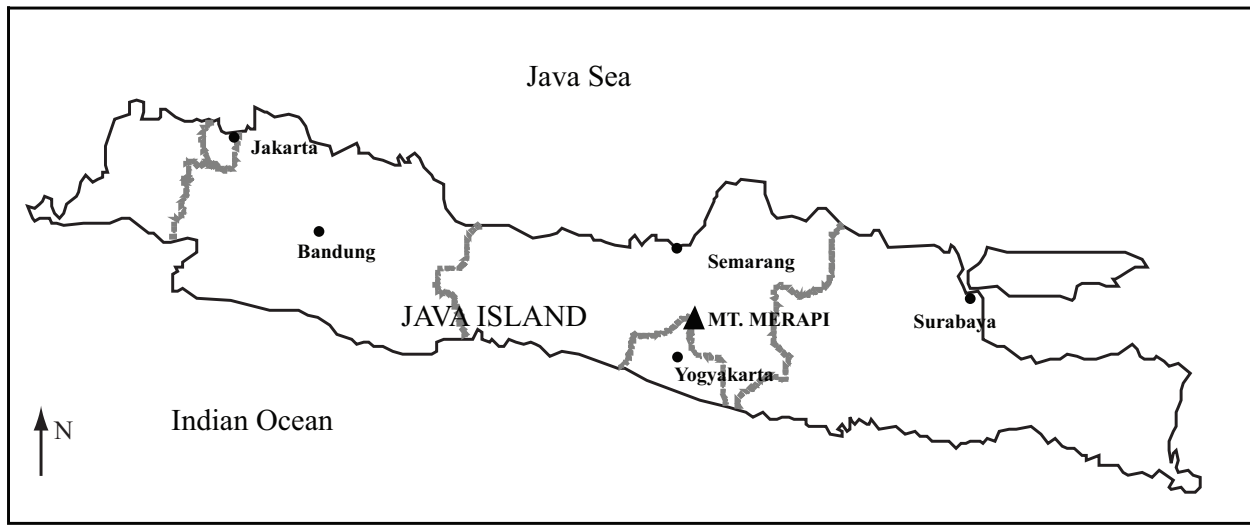
Building on work that identified how people's beliefs about hazards influenced behaviour (Lindell & Whitney, 2000; McLure et al., 1999; Paton, Smith, & Johnston, 2005), Paton et al. (2008) developed a model that argued that people's interpretation of infrequent and complex hazard events involved personal beliefs, the social context in which beliefs about risk and how to mitigate it, and people's beliefs about expert and civic sources of hazard information interact to influence whether or not people prepare. It is the inclusion of the social context, and evidence for it playing a significant role in Western (individualistic) cultures that provided the basis for its selection as an appropriate model for exploring cross-cultural similarities in the process underlying how people decide whether or not to prepare for disaster.

Paton et al. (2008) identified how interaction between two person-level variables (negative and positive outcome expectancy), two community-level variables (community participation and collective efficacy) and two institutional variables (empowerment and trust) could account for significant differences in levels of people's intention to prepare for hazard preparedness. Paton et al. (2008) found that, as might be expected when using data derived from members of an individualistic culture, that person-level variables played a significant role in predicting preparedness. However, the fact that community-level factors, such as community participation with people sharing similar beliefs and values made an additional contribution to people's risk perception and risk management choices, opens up the potential to use this model in cultures where collective processes play a more prominent role in community life.

## Study Area

Mt Merapi is the most active volcano in Indonesia. It has erupted regularly since 1548. This volcano is located at the border of Central Java Province and Yogyakarta Province (see Figure 1). In the past few decades, eruptions have been towards the south west of the crater. Since the occurrence of pyroclastic flows in 1994 that killed about 63 people, the eruptions constantly changed towards the south of this volcano. Thus, it is expected that people living close to the southern slope of the volcano have become more aware of the potential risks posed by this volcano. The latest eruption occurred in 2006. This eruption resulted in the Indonesian Government evacuating people to shelters located some 8 to 16 km from the volcano.

The areas selected for this study were the subdistricts of Pakem and Cangkringan, and Sleman District, Yogyakarta. These areas comprise communities located on the southern slopes of Mt Merapi, Yogyakarta, Indonesia. Data were collected from 320 randomly selected households in 14 hamlets located at the southern flanks of Mt Merapi. The process of data collection was conducted through meetings at each hamlet with



**Figure 1**

Study area: Mt Merapi in Indonesia.

each hamlet leader in January to February 2008. In each meeting, several head of households, representing about 15 percent of total household numbers, were invited to fill out the questionnaire. Consistent with cultural practices in these communities, some five to six facilitators were employed to assist the respondents during the process of completing the questionnaire.

### Measures

The variables selected for this study were those used in the study by Paton et al. (2008). Full details of the rationale for the model and the variables it comprises can be found in Paton et al. (2008). Key issues are summarised in the following section. The model first examines peoples' beliefs about the efficacy of protective actions. This was assessed by using the construct of outcome expectancy (Paton, 2008). Negative outcome expectancy reflects beliefs that hazard consequences are too catastrophic for personal action to make any difference to peoples' safety. If people hold this belief, no further action is likely to take place. In contrast, positive outcome expectancy (the belief that preparation can increase personal safety) can motivate people to prepare. However, a distinction can be drawn between the belief that preparing can be effective and knowing how to prepare. Consequently, if people hold positive outcome beliefs and possess the necessary knowledge and resources to prepare, they will act. If however, they need guidance to understand their circumstances and what they should do, people look first to other community members and subsequently to emergency management agencies.

Faced with complex and uncertain events, when lacking all the information they need themselves, peoples' perception of risk and how to manage it is influenced by information from others who share their

interests and values. 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 & Parker, 1994) was included in the model. However, the infrequent nature of volcanic activity means that people may first have to work out what consequences they may have to deal with to identify the information they need to prepare. Because it provides a means of assessing community members' ability to identify the information, resource and planning needs required to advance their tsunami preparedness, a measure of 'collective efficacy' (Zaccaro, Blair, Peterson, & Zazanis, 1995) was incorporated in the model. Paton and Johnson (2001) discussed how collective efficacy is a good indicator of cooperation and assistance available within a community and thus it represents a measure of the likelihood of the success of mitigation strategies that require collective and coordinated action.

Given that this process may identify new information and resource needs that cannot be met within existing community contexts, the degree to which these needs are met by expert sources has a salient role in the model. People's willingness to take responsibility for their own safety is increased, and decisions to prepare more likely, if they believe that their relationship with formal agencies is fair and empowering (e.g., agencies are perceived as trustworthy, as acting in the interest of community members). If this relationship is not perceived as fair and empowering, people lose a sense of trust in the agency (i.e., the source of information), reducing the likelihood that they will use the information and prepare. Empowerment means citizens' capacity to gain mastery over their affairs while being supported in this regard by external sources. 'Empowerment' was assessed using a

measure developed by Speer & Peterson (2000) and 'trust' with a measure used in an earlier study of hazard preparedness (Paton et al., 2005).

Finally, the model argues that the relationship between trust and action is mediated by intentions. Lindell & Perry (2004) suggest that people who seek information will be more likely to be motivated to prepare. Based on this assumption, this article examined how 'intention to seek information' mediated the relationship between agency variables and 'intention to prepare'. The dependent variable in the model was thus intention to prepare (Paton et al., 2008). The model suggests that people's decision to prepare reflects the outcome of a sequence of activities. It is hypothesised that negative outcome expectancy beliefs will reduce the likelihood that people will form intentions to prepare. In contrast, it is hypothesised that positive outcome beliefs will motivate people to form intentions to prepare or stimulate their engagement in collective activities (first with others in their community and then with formal sources) that culminate in their forming intentions to prepare.

It is hypothesised that the community (community participation, collective efficacy) and formal (e.g., civic emergency planners and also NGOs in disaster management) institutional (empowerment, trust) factors will mediate the relationship between positive outcome expectancy and intention to prepare. The hypothesised relationships are summarised in Figure 2. All the independent and dependent variables above are set into a structural equation model.

The analysis was conducted using Structural Equation Model (SEM). The model proposes that several independent variables interact to predict the dependent variable. SEM was selected for the analysis because it can calculate multiple and interrelated dependence relationships simultaneously (Byrne, 2001; Cheng, 2001; Kline, 1998). Thus, SEM can test the model as a whole and to show how well the data fit the hypothesised model (goodness-of-fit).

## Results

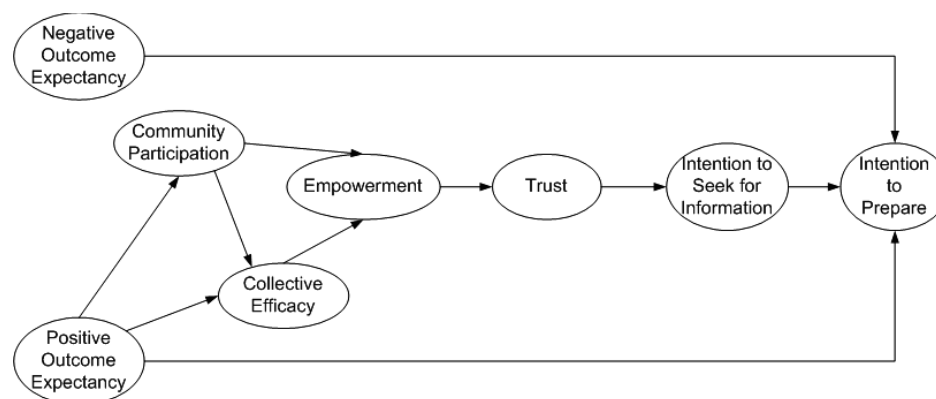
The results are presented in Figure 3. The degree to which the data fit the model was tested using the structural equation model software AMOS 7.0 (Arbuckle, 2006). Revisions to the relationships suggested by the modification indices, that were theoretically coherent, were included in the estimated model. The hypothesised relationship between negative outcome expectancy and intention to prepare failed to reach significance and was excluded from the model depicted in Figure 3.

The estimated model identified three variables with direct relations to intention to prepare. The paths were from the intention to seek for information, collective efficacy and positive outcome expectancy variables. All paths show positive relationships between variables. The estimated results confirm the validity of the model as a predictor on volcanic hazard preparedness. The goodness-of-fit statistics are: ( $\chi^2 = 193.88$ ,  $df = 222$ ,  $p = 0.914$ ), RMSEA = 0.00, NFI = 0.88, GFI = 0.96;  $R^2 = 0.64$ .

The goal of structural equation model is to find non-significant differences between the estimated model and the actual data (Cheng, 2001; Kline, 1998). This difference is measured by the chi-square ( $\chi^2$ ) value. The  $p$  value of 0.914 indicates that the difference between the actual and estimated model is nonsignificant. Thus, the estimated model is a close fit to the data. Moreover, other measures (RMSEA, NFI and GFI) also confirm the validity of the model (Arbuckle, 2006). Overall, the model accounts for 64% of the variance in intention to prepare for volcanic hazards. The overall goodness-of-fit of the model supports the value of the model as a means for understanding how members of communities in collectivistic cultures make decisions about preparing for volcanic hazard risks.

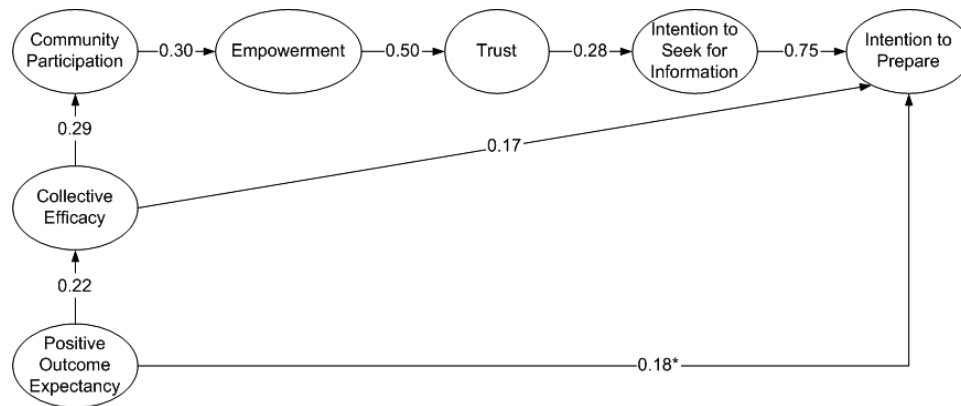
## Discussion

The estimated model shows that intention to prepare is directly predicted by three factors: intention to seek for information, collective efficacy and positive outcome



**Figure 2**

Proposed model of intention to prepare in Mt Merapi.



**Figure 3**

Summary SEM model of social predictors of intention to prepare for volcanic hazards in communities surrounding Mt Merapi, Indonesia.

expectancy. Evidence for the mediating role of community-level factors (i.e., community participation and collective efficacy) supports the view that relationships between people in the community play a highly significant role in facilitating disaster preparedness. Indeed, community participation has long been typical of community activities in Indonesia, which can be seen in the form of *gotong royong* or ‘communal labour’ (Wall, 1996), which literally means ‘working together’ to clean one’s own neighbourhood or village. Thus, the finding suggests that promoting disaster preparedness activities at a community level will be crucial to the development of effective risk-management strategies for this population.

The model reveals that individual-level factors were considerably less important than collective processes (e.g., community participation) and competencies (e.g., collective efficacy) in predicting intention to prepare. This finding reflects the fact that in a more culturally collectivistic society, preparedness is a collective activity that emerges when community members share their views with their neighbors or with those who share values with them. These findings are important. It highlights the importance of basing disaster management and preparedness strategies on community engagement, with the community being a significant resource for influencing the actions of its members.

### Personal Factors

As expected, when data were collected from members of communities in a collectivistic culture, like those living in the vicinity of Merapi Volcano, individual-level predictors played a less important role in preparedness decision making than was the case in members of a more individualistic culture. The hypothesised inverse relationship between Negative Outcome Expectancy and intentions was not supported by the analysis. It was thus omitted in the estimated model (Figure 3). While a positive relationship between Positive Outcome Expectancy

(POE) and Intention to Prepare was found, it was marginally fell short of reaching ( $p = .06$ ). As such, it offers only very tentative support for the existence of this direct path in the hypothesised model. However, it cannot be totally discounted as playing a role in preparedness decision-making. At this stage, it can be tentatively proposed that individual-level beliefs in members of highly collectivistic cultures do not exert direct influence on preparedness.

While the direct relationship between POE and intention to prepare just failed to reach significance, the hypothesis that its relationship with intentions would be mediated by community and institutional variables was supported (Figure 3). Positive Outcome Expectancy had an indirect effect that was mediated by collective efficacy, community participation, empowerment, trust and intention to seek information. This suggests that the degree to which community members believe that preparing can be effective (i.e., it is assumed that positive outcome beliefs are collective in nature) in mitigating hazard consequences, they more likely it is that community competencies will be mobilised in ways that increase levels of intention to prepare for volcanic hazards.

### Community Participation and Collective Efficacy

As predicted, the more significant role for the community-level factors (collective efficacy and community participation) confirm the important role that social interaction with others who face similar threats (share the living location), beliefs and values play in influencing community members risk-management decisions. This finding is not surprising, but indeed important, as this confirms the important role of collective activity in the daily lives of people living in the vicinity of Mt Merapi volcano.

Collective efficacy had a direct influence on both to community participation and intention to prepare. The role of collective efficacy in the model signifies the fact

that some people look to learn from their community before they take action to prepare. It may also reflect the existence of culturally specific mechanisms such as *gotong royong* that act as a cultural catalyst for collective action in everyday life, with this collective competence having a carryover effect with regard to hazard preparedness. People look at their relatives, close friends and neighbours before they make major decisions, such as those involved in preparing for a disaster that will have community-wide implications.

No direct relationship between community participation and intention to prepare was found. This was unexpected as the spirit of 'working together' is apparent in this community. Two separate but related explanations can be proposed to account for this. One is that with regard to confronting novel problems, such as preparing for volcanic hazards, the spirit of 'working together' has a more enduring impact on collective efficacy. Thus the discourse that occurs in community participation serves to identify new information or resource needs that arose from the exercise of their problem-solving (collective efficacy) competencies. This observation is consistent with the findings of Paton et al. (2008). It is possible that the infrequent nature of volcanic hazards means that community members do not have all the information or resources that they require, increasing the need to source these from formal sources. This is consistent with the finding that the relationship between community participation and intention is mediated by empowerment. Only when the needs and expectations of community members are met through their interaction with formal agencies (empowerment) will they progress their preparedness planning.

### Empowerment and Trust

As predicted, paths from institutional factors (empowerment and trust) show significant relationships in the estimated model. The findings of the roles of empowerment and trust illustrate that the communities need some institutional support to facilitate their seeking information on disaster risks.

The fact that institutional factors mediated the relationship between community processes and intentions supports the view that the more people feel they are empowered by institutions, the more they trust these institutions (as sources of information) and, consequently, the more likely they are to seek information from these sources and to use it to formulate their disaster-preparedness plans (intentions). In this case, it is noteworthy to mention the role of hamlet leader (*kepala dusun*) as a focal point that the residents refer to prior to taking action. The trust factor in this model illustrates the high level of trust by the local people to the current disaster response. Based on observations in the field, trust in the government institutions and officials, including the agency handling the disaster until the local

level derived from the trust people placed in the hamlet leader. Taken together, the above discussion suggests that, with the exception of the Negative Outcome Expectancy variable, similarity between the Merapi model and the original model provides some support for the existence of cross-cultural equivalence for this model. Further evidence can be gleaned from other sources.

### Comparisons With Cases in Auckland and Kyoto

When applying the model in New Zealand, Paton et al. (2008) found that outcome expectancy variables (person-level) were the most significant predictor, followed by the community-level variables. This is consistent with New Zealand (with the data used for the original model being from predominantly Pakeha or European New Zealanders) scoring relatively high on individualism. As such, preparedness decisions are predominantly the result of decisions made by individuals. However, even in this individualistic culture, interaction with other community members informed individual choices. The opposite pattern was found in a Japanese sample.

In the Japanese context, Bajek (2007) found that collective efficacy and community participation made stronger contributions to the model. This finding is consistent with the cultural predisposition in Japanese society for preparedness decisions to be carried with reference to what the communities do in general. For example, some people will carry out preparedness activities after seeing or confirming on how others see the problem and what actions are carried out to solve problems.

In the Mt Merapi data, community and institutional variables played a more significant role in determining intentions than was the case in Japan. Notwithstanding, comparison of the Kyoto and Merapi findings indicate that as the community becomes increasingly collectivistic in nature, the more community-level variables influence preparedness (Paton, Sagala, Okada, Jang, & Gregg, 2009). Overall, the structural relationships between the Merapi, Kyoto and Auckland models showed sufficient similarity to warrant their being indicative of some cross-cultural equivalence in how communities manage the risk posed by natural hazards.

The most noticeable difference between the Merapi model and those in Kyoto and Auckland concerned the role of Negative Outcome Expectancy. This was absent in Merapi, but present in the other two samples. While more research will be required to identify why this might be the case, a tentative explanation can be offered here. This could be due to relatively more frequent volcanic episodes increasing appreciation of the benefits of preparing (which would be less apparent in the other areas as a result of the considerably lower frequency of hazard events). Another possibility concerns the possible existence of a stronger relationship between appreciating the

benefits of living in the shadow of an active volcano (e.g., fertile soils) and the need to develop ways of coexisting with this beneficial, but occasionally hazardous, aspect of their living environment.

The observed differences between Auckland, Kyoto and Merapi case could also be due to differences in the characteristics of target area. While in Auckland and Merapi the source of hazard (volcano) is observable by the residents, the source of hazards (earthquake) in Kyoto is more unpredictable. However, overall cases bring some similarities. Findings from these three case studies highlighted that the quality of relationships between people, communities and civic agencies influence whether individuals intent to carry out disaster preparedness.

## Conclusion

This article discussed the testing of a model of disaster preparedness for volcanic hazards in communities living around Mt Merapi, Indonesia. The findings confirmed that, in members of a collectivistic society, preparing is a process that is carried out collectively, with factors such as 'community participation' and 'collective efficacy' derived from everyday life being particularly important. These findings imply that community-based approaches to risk management in Indonesia (and in other collectivist societies) will be more effective than those targeting individuals.

The literature provides many examples of community based disaster management in the developing countries (Allen, 2006; Luna, 2001; Purnomo & Mendoza, 2004; Suyanto, Applegate, & Tacconi, 2001). So-called community-based activities are commonly initiated by either a local champion in a community or by organisations in the form of an NGO, either local or international. The findings from the present study can be used to inform how these agencies work with communities. It allows them to target their intervention (e.g., ensuring hazard issues are identified and discussed in community groups, providing risk management activities in ways that increase collective efficacy). However, evidence suggesting that individual beliefs do play a role and suggest that some attention should be directed to this level of intervention. Identifying the contents of intervention at this level must, however, await additional work.

Currently, public hazard education and risk management promotion are carried out on a project basis or soon after a disaster occurs. Because this latter approach defines disaster preparedness as a process that is separate from people's daily activities, it lacks the condition necessary to facilitate community members' ability to identify and discuss hazard issues in the context of normal community activities. Thus, after a program or campaign, people are not motivated to apply the information into disaster preparedness. Our findings suggest it is impor-

tant to integrate risk management and community development for improving disaster preparedness in more collective society. The inclusion of risk management programs within the fabric of the daily life of community activities has the potential to increase levels of the competences (e.g., collective efficacy) and relationships (empowering) that contribute to improved disaster preparedness. Our findings also highlight the role of institutions (local government, emergency managers) in empowering community members. Appropriate coordination between local institutions and communities will increase trust and subsequently motivate people to search for information and carry out preparedness.

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