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ARE RESIDENTS OF SEATTLE READY FOR 'THE BIG ONE?

AN INTERVENTION STUDY TO CHANGE EARTHQUAKE PREPAREDNESS

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Abstract

Background: Community preparedness for natural hazards remains poor across cultures. In addition, evaluated intervention studies in natural hazard preparedness are scarce and contain methodological problems. This study presents results of an intervention study on earthquake preparedness conducted in Seattle, U.S.A. **Methodology:** This is a quasi-experimental, longitudinal, community intervention with a pretest-posttest design, focused on improving earthquake readiness at the household level. The sample included 157 adult residents of Seattle. Preparedness measures were assessed at baseline, one week after the intervention, and at three and 12 months after the intervention. This involved both of the groups in a survey and an observation of preparedness levels in their homes. The primary outcome measure was an observational tool of five preparedness items, which was implemented alongside a survey that measured psychological, social, demographic and self-reported preparedness variables. In addition, the intervention group completed a six-hour workshop on earthquake preparedness, divided over two days. The control group did not participate in the workshop. **Results:** The intervention group significantly improved their earthquake preparedness levels compared to baseline and to controls one week after the intervention. Nonetheless, the effect of the intervention faded at the 3-month follow-up, where no significant differences in earthquake preparedness were observed in the intervention group compared to baseline. In fact, preparedness appeared to increase for controls at three months compared to baseline and to one week after the intervention, and although not reaching statistical significance, it exceeded the intervention group's preparedness levels. Anxiety and trust predicted earthquake preparedness for the control group at three months. **Discussion:** Despite levels of earthquake preparedness improving significantly for the intervention group right after the intervention, this effect disappeared at the 3 month follow-up, stressing the need for the field to develop measures to facilitate the maintenance of behaviour change over time. Interestingly, controls continued to improve their levels of preparedness, suggesting that the home assessments themselves might have acted as an intervention that was sufficiently powerful to trigger behaviour change in controls. Contrary to the emphasis on self-efficacy and other cognitive variables in the literature concerning natural hazard preparedness, these results suggest that emotions such as anxiety and trust might play a more important role in preparedness. Future preparedness interventions should put emotive factors centre stage in targeting preparedness. The findings of this study have implications for national and international policies on the design and delivery of community interventions to increase hazard preparedness in lay people.

Keywords: earthquake preparedness, community intervention, behaviour change, anxiety, trust

1. Introduction

Community preparedness for earthquakes and other natural hazards is consistently low across cultures [1-3] and even regions at high risk are ill prepared [4-6]. The United Nations estimates an average cost of US$250 billion to US$300 billion per year for natural disasters globally [7]. Despite their importance in reducing personal, social and economic losses, well documented, systematically implemented intervention studies on natural hazard preparedness are scarce. Furthermore, the majority of existing preparedness interventions rely solely on providing the public with information via the internet, pamphlets and manuals, and this has not proven effective [8]. It is known that simply providing the public with information is not sufficient to elicit preparedness behaviours [1, 2, 9-11]. Even those interventions that provide elements other than information are often vaguely described. Therefore, more explicit and better designed interventions on natural hazard preparedness are needed.

An online review conducted in early 2015 with the words “natural hazards intervention”, “natural disaster preparedness” and “preparedness intervention” yielded nine studies. Two of them focused solely on earthquakes [12, 13]. Four of them concerned earthquakes, landslides and/or floods [5, 14-16], one on cyclones [17], and two on disasters in general [18, 19]. Studies were conducted in Turkey [5], Martinique [12], U.S. [18, 19], Australia [17], Iran [14], Pakistan [13], New Zealand [15] and Taiwan [16]. Some of the studies were conducted during critical time periods [5, 16, 17]. Some studies targeted vulnerable populations, such as children, teachers and parents and were conducted in schools [13, 15] and among low-income minorities [18, 19]. Most of these intervention studies contained limitations including lack of evaluation, exclusive use of self-report measures or providing little information about the behaviour change techniques that they contained or the extent to which they were based on particular theories.

To address these gaps, UCL’s EPICentre devised an intervention called ‘Fix-it’, which included longitudinal assessments at four points in time as well as observational measures combined with self-report tools, to assess the impact of the intervention on preparedness levels. The observational element of this study, a novelty in the empirical literature in this field, includes home visits and the review of people’s preparedness behaviours at home. The self-report element examined a range of demographic and psychosocial variables, as well as the preparedness variables that were also measured via observation. Earthquake anxiety and fatalism were also assessed, based on Paton’s theoretical model of natural hazard behavioural preparedness [4, 20-22], as well as previous EPICentre work[4].

The present intervention was carefully designed following a detailed review of the literature on natural disaster studies, social representational studies of earthquakes and other natural hazards and the literature on behaviour change. While the intervention included fire preparedness as well, this paper focuses only on the earthquake preparedness element of the intervention. The complete study methodology and results have been published elsewhere[23].

The ultimate goal of the present study is to improve preparedness levels in households. Further aims are to see if the intervention’s effects are sustained over time, explore which variables explain behaviour change and provide a template of a rigorously designed, community preparedness intervention to increase earthquake preparedness to develop the field of natural hazard preparedness.

2. Method

2.1 Study design

This is a quasi-experimental, longitudinal, community intervention study with a pretest-posttest design. Study objectives are 1) to increase household earthquake preparedness in homes and 2) to evaluate changes in levels of critical awareness, self-efficacy, perceived outcome, trust, corruption, empowerment, anxiety, social cohesion, as well as levels of earthquake preparedness after the intervention.

Participants completed assessments before and after the intervention, as well as three and 12 months after the intervention to measure changes in preparedness behaviour. Monetary incentives were given for participation

in the study. Participants in the intervention group were paid $250 for completing baseline and post-intervention assessments, as well as participating in a six-hour workshop divided over two days. Controls were given $100 for completing the baseline and post intervention assessments. To ensure completion of the workshops and pre-test and post-test assessments, participants in both groups were paid only on completion of the second assessment. In addition, participants were paid $40 per completed follow-up assessment at three and 12 months after the intervention (Fig.1).

Groups (N= 157)*	**Pre-Test** (1 week before workshop)	**Workshops**	**Post-Test** (1 week after workshop)	**3-Month Follow-up** (3 months after workshop)	**12-Month Follow-up** (12 months after workshop)
Intervention (n=85)	X	X	X ($250)	X ($40)	X ($40)
Control (n=72)	X	--	X ($100)	X ($40)	X ($40)

Figure 1. Study design chart

*Sample size dropped at three-month follow-up to N=145 (intervention n=73; control n=72) due to attrition

2.2. Sample

The sample consisted of 157 English speaking adults (aged 18-80), residents of North Seattle, U.S.A. The mean age was 49.77 (SD=13.30), 60% of residents were females, 77% identified as Caucasian, 47% identified as Christian, while 36% reported not having any religion; 59% were married or living with their partner, and 74.5% were home owners. More than half of the sample reported being employed (52.40%). There were no differences in sociodemographic, psychological variables, or earthquake preparedness levels between the intervention and control groups.

2.2. Participant recruitment and allocation

As sense of community and community participation has been found to be a strong variable affecting preparedness and the adoption of mitigation measures [3, 24], intervening in an existing community seemed appropriate for this study. Consequently, one area was selected for the intervention group and the intervention was conducted there (North East Seattle). An equally large area was assigned to be the control condition (North West Seattle). The areas constituted two matched areas, geographically separated from each other. Participants were nonrandomized. A recruitment agency from Seattle was hired to recruit 100 participants from the intervention area and 100 from the control area. Participants were recruited in August 2015 and the intervention was conducted in September 2015. Three month follow-up assessments were completed at the end of January 2016. The sample of 157 people (85 intervention and 72 control group) decreased at three months to 145 (73 intervention and 72 control group). In addition, 11 participants of the intervention group were found to be living in subsidised housing, and thus they were not able to make the required preparedness fixes at home. For this reason, their data was not included in the post-test and follow-up analyses. This finding calls for a separate analysis of such data to explore the effect of the intervention and barriers to prepare for vulnerable populations. Participants were called by a member of the agency to arrange a specific date and time to come to their homes to complete the baseline assessment. After completion of the baseline assessment, the intervention group participants were called and reminded of the day, date, time and location of their workshop. After completion of the workshop, participants in both groups were called by the agency to schedule a specific date and time to complete the post-workshop assessment and to receive their respective incentives for participation. This happened again at 3 months after the intervention and the one-year follow up takes place in September 2016.

2.2.1 Consent

Informed written consent was given by each participant before completing the baseline survey. A member from the recruitment agency collected all signed consent forms for participants in both groups. Both participants and recruitment agency members were blind to group allocation.

2.3 Intervention: *Fix-it*

Fix-it consisted of a six-hour interactive, face-to face workshop, divided over two afternoons, with one week in between. The workshop was led by an engineer who is an expert in emergency management training, and a clinical psychologist. Each workshop was devised to contain 25 people and included hands-on training, as well as using interactive tools, such as playing a video game, emailing photos of preparedness (or lack of) at home and participating on social media sites. The intervention was carefully designed by the psychology researchers of the project on the basis of their past work, a review of the natural disaster intervention and behaviour change literatures and a pilot study (June 2015). The intervention was named *Fix-it,* as it is focused on fixing and securing items in the home. It is a name that is easy to remember and with a positive connotation that promotes proactive behaviour.

Fix-it focused on securing items in the household, such as securing heavy furniture to the wall, securing the TV and computer and making sure that no framed objects are hanging above sofas or beds. *Fix-it* aims to improve adjustment measures that are low cost and easy to adopt. In addition, securing items in the house has been identified as one of the basic categories of preparedness by victims of earthquakes [25]. Despite this being considered as a key category of preparedness since its adoption is critical for people's outcomes in earthquakes, most preparedness intervention studies focus on survival measures (e.g., storing food and water) and do not evaluate securing items in the home [26, 27]. To address this gap, *Fix-it* aimed to increase the securing of items in the home by including the key ingredients of previous, successful preparedness interventions such as *hands-on training*, *face-to-face interactions*, *empowerment* and *community cohesion*. In addition, the following determinants of behaviour - *self-efficacy, outcome expectancy, and motivation* - were addressed through different behavioural techniques that have proven to be effective [28]. A detailed description of the *Fix-it* intervention has been published[23].

2.4 Materials

A 25-minute survey and checklist were used at all assessment points for participants in both groups. At the first visit, a week before the workshops, a member of the recruitment agency met with each participant in their homes and asked him/her to complete the survey on paper (self-report measure). Once finished, the agency member proceeded with the second part of the assessment, which was to conduct a tour around the house and examine with a checklist consisting of the five *fix-it* earthquake preparedness measures (Table 1), whether the participant had or had not adopted each of the measures. This is the observational measure of the study and the measure of earthquake preparedness.

2.4.1 Survey

The self-administered, computer-assisted survey was used to assess the following variables: *demographics, building characteristics* (type of residence, year and material of construction of the residence and earthquake retrofitting), *critical awareness* [29], *earthquake anxiety* [30], *self-efficacy* [31], *outcome expectancy*, assessed by a set of five questions for each of the preparedness measures, to which respondents could answer yes or no if they believe that adopting each of this measures is a good idea, *trust* [4], *fatalism* [4], *social empowerment* [32], *social cohesion* [33], *collective efficacy* [31], *sense of responsibility* [4], *perceived level of corruption* [4], *religiousness and barriers to preparedness.* Participants also self-reported on whether they had carried out 16

earthquake preparedness measures. This set of items used to assess preparedness is a modified version of the scale used in a previous study [4].

2.4.2. Checklist

A five-item checklist is the outcome measure for earthquake preparedness (Table 1). As described above, a member of the recruitment agency examined the respondent's household and checked whether each of the preparedness measures had been adopted by the participant or not.

Table 1. Outcome measure of earthquake preparedness

Please check if each of the following measures has been taken or not by the participant:

	NO (NONE)	YES (SOME)	YES (ALL)	Not Applicable
1. TV is secured (with Velcro, pad, straps, or locks)	❍	❍	❍	❍
2. Computer is secured (with Velcro, pad, straps, or locks)	❍	❍	❍	❍
3. Bookcase is secured to the wall (using nylon strap)	❍	❍	❍	❍
4. Large cabinet is secured to the wall (using nylon strap)	❍	❍	❍	❍
5. No objects (frames, mirrors) above sofas AND beds	❍	❍	❍	

Were any of these questions unclear or difficult for you to answer? If so, please state why:

3. Data analysis and management

Behaviour change for earthquake preparedness was measured in both groups between the different time points and t-tests were conducted to evaluate differences between means of behaviour change between the groups. Logistic regression analyses of the 5-item checklist on earthquake preparedness on the intervention group were conducted, with adjusted confidence intervals and p-values, as well as with the predictor variables to determine predictors of behaviour change. Correlations between self-report and observational measures on earthquake preparedness were also conducted. Furthermore, levels of self-efficacy, outcome expectancy, fatalism, collective efficacy, anxiety, empowerment, social cohesion, trust and corruption in relation to earthquake preparedness behaviours were examined. All statistical analyses were conducted using SPSS statistical software package, version 20 [34].

4. Results

4.1 Baseline analyses (Tables 2 and 3)

Baseline differences in sociodemographic and earthquake preparedness characteristics of participants were assessed in order to rule out selection bias due to the non-randomized sampling design of the study. No significant differences were found at baseline between groups in terms of their earthquake preparedness levels (Table 2).

Both intervention and control groups reported the following barriers to earthquake preparedness. The most common barrier reported for not preparing was 'Other things/problems to think about', followed by 'The time required to do it', 'The skill or knowledge required'. The least reported barrier for preparing for earthquakes was 'the financial cost' (Table 2).

Table 2. Earthquake preparedness levels and barriers for preparedness at baseline

	Intervention (n= 85)		Control (n= 72)		Total (n= 157)	
	M	**SD**	**M**	**SD**	**M**	**SD**
Earthquake preparedness	6.11	2.22	5.68	1.89	5.91	2.08
Barriers for preparedness						
Other things/problems to think about	0.53	0.50	0.46	0.50	0.50	0.50
Time required to do it	0.46	0.50	0.33	0.47	0.40	0.49
Skill or knowledge required	0.31	0.46	0.32	0.47	0.31	0.46
Financial cost	0.27	0.44	0.28	0.45	0.26	0.44
Need for cooperation with others	0.25	0.43	0.21	0.40	0.23	0.42
Information overload	0.14	0.35	0.13	0.33	0.13	0.34
None	0.05	0.21	0.06	0.23	0.05	0.22

Table 3 shows predictors of earthquake preparedness before the intervention. Predictors of earthquake preparedness at baseline were *empowerment* ($F(1,154)= 4.5$; $p= 0.034$, $R^2= 0.02$), *trust* ($F(1,154)= 3.9$; $p= 0.04$, $R^2= 0.02$), *corruption* ($F(1,155)= 5.6$; $p= 0.01$, $R^2= 0.03$) and *social cohesion* ($F(1,155)= 9.8$; $p= 0.00$; $R^2= 0.05$). These variables are mostly treated as moderators in successful models that explain the preparedness behaviour change process[30].

Table 3. Linear regressions of earthquake preparedness at baseline

	Earthquake Preparedness				
Predictors	**B**	**SE**	**β**	**R^2**	**p-level**
Empowerment	0.84	0.39	0.16	0.029	0.034*
Social cohesion	0.28	0.09	0.24	0.060	0.002*[1]
Trust	0.65	0.32	0.15	0.025	0.049*
Corruption	-0.73	0.30	-0.18	0.035	0.019*

* Significant predictors using univariate analysis
[1]Significant predictors also using multivariate analysis at the $p<0.05$ level

Correlations between self-reported preparedness in the survey and observational preparedness measures in the checklist are described in Table 4. Items that significantly correlated with each other at the 0.01 level were 'TV is secured', 'Bookcase is secured' and 'Cabinet is secured'.

Table 4. Correlations between self-report and observational measures of earthquake preparedness

	TV is secured	**Computer is secured**	**Bookcase is secured**	**Large cabinet is secured**	**No objects above sofas/beds**
TV is secured	0.333**				
Computer is secured		0.010			
Bookcase is secured			0.601**		
Large cabinet is secured				0.438**	
No objects above sofas and beds					-0.122

**Correlation significant at the 0.01 level (2-tailed)

4.2 What changed with the intervention? (Tables 5 and 6)

Immediately post-intervention, the intervention group had significantly improved its earthquake preparedness, $t(72) = 2.4$, $p = 0.018$ compared to baseline. Controls' levels of earthquake preparedness decreased slightly from baseline, though not reaching statistical significance. Between group differences of preparedness change means right after the intervention were significant for earthquake preparedness change ($p=0.019$), with the intervention group showing significantly more change (Table 5).

Table 5. Changes in earthquake preparedness one week after the intervention

	Intervention (n = 73)				Control (n= 72)				Between groups	
Post-intervention	**M[1]**	**SD**	**t-test**	**p-level**	**M[1]**	**SD**	**t-test**	**p-level**	**t-test**	**p-level**
Earthquake preparedness change	0.85	2.99	2.42	0.018*	-.0.22	2.42	-0.77	0.40	2.36*	0.019*

[1] Behaviour change means
*Significant at the p <0.05 level, **Significant at the p <0.001 level

Three months after the intervention, both the intervention and control groups had improved their earthquake preparedness, although the scores did not reach statistical significance (Table 6). Multivariate analysis of variance was conducted to explore levels of preparedness change between groups across two points in time, right after the intervention and at the three-month follow-up. Results show a significant interaction of time and group ($p=0.002$), for the intervention group changing significantly their earthquake preparedness over time, decreasing their levels from time 1 (post-intervention) to time 2 (three-month follow-up) (Fig.2).

Table 6. Changes in earthquake preparedness three months after the intervention

	Intervention (n = 73)				Control (n= 72)				Between groups	
Three month follow-up	**M[1]**	**SD**	**t-test**	**p-level**	**M[1]**	**SD**	**t-test**	**p-level**	**t-test**	**p-level**
Earthquake preparedness change	0.07	1.98	0.30	0.80	0.47	2.82	1.37	0.20	-0.94	0.348

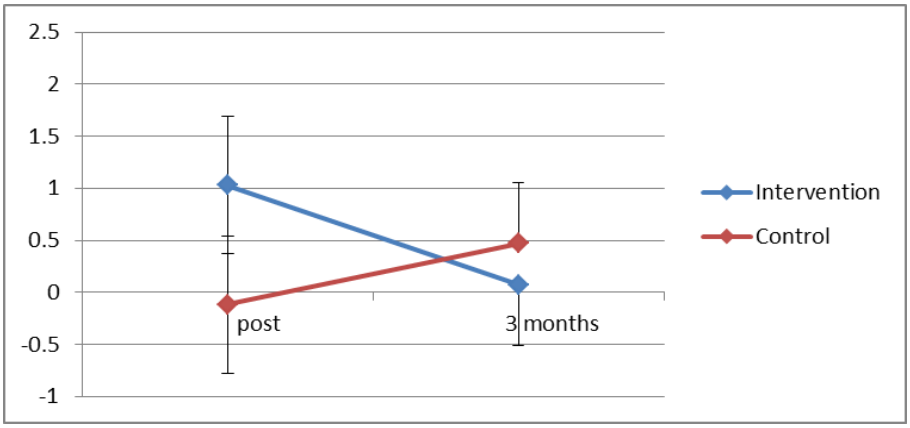

Figure 2. Earthquake preparedness change post and three months after the intervention

4.3. How does the data explain this? (Table 7)

No significant predictors of changes in earthquake preparedness were found for the intervention group at three-month follow-up using both univariate and multivariate analysis. However, for the control group, anxiety ($F(9,58)= 2.7$; $p= 0.043$, $R^2= 0.297$) and trust ($F(9,58)= 2.7$; $p= 0.009$, $R^2= 0.297$) were significant predictors of earthquake preparedness (conducting a multivariate analysis of self-efficacy, outcome expectancy, fatalism, collective efficacy, anxiety, trust, corruption, empowerment and social cohesion).

Table 7. Predictors of earthquake preparedness change at three-month follow-up
[1]Significant predictors found using multivariate analysis

	Intervention (n=73)					**Control (n=72)**				
Predictors of earthquake preparedness	**B**	**SE**	**β**	**R^2**	**p-level**	**B**	**SE**	**β**	**R^2**	**p-level**
Anxiety (earthquake)	0.65	0.77	0.12	0.166	0.405	1.60	0.77	0.24	0.297	0.043
Trust	-0.12	0.54	-0.03	0.166	0.814	-1.40	0.52	-0.32	0.297	0.009

5. Discussion

This is a longitudinal, non-randomized intervention study, aimed at improving earthquake preparedness at the household level. The detailed methodological design and description, as well as inclusion of self-report and observational measures to assess preparedness, are rare in the literature.

Results indicate that both intervention and control groups improved their earthquake preparedness at three-month follow-up compared to their baseline levels. In addition, the intervention group significantly improved their preparedness levels right after the intervention, as compared to their baseline levels and to controls, showing the effect of the *Fix-it* intervention on behaviour change. However, this effect faded at three months, and preparedness levels for the intervention group decreased at this point. This highlights the need for focusing on maintenance measures after a result has been achieved, with reminders and prompts being one way to do this [28]. On the other hand, earthquake preparedness levels for the control group increased at three months, surpassing preparedness levels of the intervention group at this point. Thus, since controls did not receive the *Fix-it* intervention, it is noteworthy that the home visits, which included a survey and observation of home earthquake preparedness, played a role in increasing preparedness behaviour in what had originally been designed as a control group.

Another important finding is the significant role that emotions play in this study. Consistent with the existing literature, anxiety was found to have a direct effect on preparedness behaviours [6, 30, 35, 36]. Despite some research suggesting that high anxiety can hinder preparedness, this study appears to show that an optimum level of anxiety is needed to bring about preparedness behaviours. Anxiety levels for the control group increased over time, causing them to increase their preparedness behaviour. It is likely that their anxiety increased because they had home assessments done yet were not given information on earthquake preparedness, as opposed to the intervention group, who was told exactly what to do to be better prepared, and whose levels of anxiety decreased after the intervention. In fact, some studies suggests that community hazard
education programs may actually reduce levels of preparedness, by having people transfer their responsibility for safety from self to others and thus, reducing the perceived risk [1]

Trust in the system (e.g., education, police, government, church, scientists) was another emotion directly affecting preparedness. This is consistent with previous research that shows that trust is a determinant of community action [37]. Other studies have found trust to moderate the relationship between intention to prepare and actual preparedness [30]. Research has shown that the greater the uncertainty people face, the more they attribute weight to their trust about a source of information [38, 39]. In this case, as controls had no information about how to prepare since they did not attend the workshop, trust in authorities increased over time, probably as a defence mechanism to protect them from their worry of not knowing what to do to become better prepared.

The possibility that the home visits acted as an intervention could have been determined by the inclusion of a second control group, who would not have undergone the baseline assessment. This possibility was considered but it was not possible due to financial limitations. Thus, the ability to ascribe causality to the intervention itself might be somewhat limited in this study.

In summary, it seems that the very act of going into people's houses, interacting face-to-face and checking their preparedness levels, as well as their emotions/cognitions, produces behaviour change, in this case, an increase in earthquake preparedness, over time. When people are left with anxiety concerning what they should be doing to improve their preparedness, they may seek to do what they understand to be the correct measures and so improve their preparedness.

Despite the above mentioned limitations, this study constitutes one of the firsts to evaluate a community, longitudinal intervention on earthquake preparedness using both self-report and observational measures. In addition, the intervention was carefully designed by a team of multidisciplinary researchers, from the fields of psychology and engineering, who had previously evaluated the social representations of earthquakes in the people of Seattle [4]. This study has significant implications for the field of natural disaster preparedness at a national and international level as well as for the area of interventions on hazard preparedness, as it will allow for replication, improvement, and therefore development of the field. Perhaps most significantly, overall, going into people's homes to observe whether they have prepared for earthquakes at multiple time points, as well as surveying their psycho-social characteristics relevant to earthquake preparedness, has the potential to increase earthquake preparedness without any further intervention.

6. Governance and ethical considerations

This study is part of a larger project seeking to improve and explore multi-hazard preparedness in different countries, primarily the U.S.A and Turkey. The research is funded by the Engineering and Physical Science Research Council, UK (Grant ref. EP/F012179/1). There are no known conflicts of interest. Ethical approval was obtained to conduct the study (UCL Ethics Project ID Number: 1392/001).

7. References

[1] M. Ballantyne, Paton, D., Johnston, D., Kozuch, M. and Daly, M., "Information on Volcanic and Earthquake Hazards: The Impact on Awareness and Preparation," Institute of Geological and Nuclear Sciences Limited Science Report Wellington2000.

[2] M. K. Lindell and D. J. Whitney, "Correlates of Household Seismic Hazard Adjustment Adoption," *Risk Analysis*, vol. 20, pp. 13-26, 2000.

[3] D. Paton, "Emergency Planning: Integrating community development, community resilience and hazard mitigation," *Journal of the American Society of Professional Emergency Managers*, vol. 7, pp. 109-118, 2000.

[4] H. Joffe, T. Rossetto, C. Solberg, and C. O'Connor, "Social representations of earthquakes: A study of people living in three highly seismic areas," *Earthquake Spectra*, vol. 29, pp. 367-397, 2013.

[5] A. N. Karanci, B. Aksit, and G. Dirik, "Impact of a community disaster awareness training program in Turkey: Does it influence hazard-related cognitions and preparedness behaviors," *Social Behavior and Personality: an international journal*, vol. 33, pp. 243-258, 2005.

[6] A. Rüstemli and A. N. Karanci, "Correlates of earthquake cognitions and preparedness behavior in a victimized population," *The Journal of Social Psychology*, vol. 139, pp. 91-101, 1999.

[7] A. Maskrey and S. Safaie, "GAR Global Risk Assessment," in *EGU General Assembly Conference Abstracts*, 2015, p. 6494.

[8] G. Perez-Fuentes, E. Verrucci, and H. Joffe, "A Review of Current Earthquake and Fire Preparedness Campaigns: What works?," presented at the 2nd International Conference on Dynamics of Disasters, Kalamata, June 29-July 2, 2015, Greece, 2015.

[9] D. Paton, L. M. Smith, and D. M. Johnston, "Volcanic hazards: Risk perception and preparedness," *New Zealand Journal of Psychology*, vol. 29, pp. 86-91, 2000.

[10] D. Paton, L. Smith, and D. Johnston, "When good intentions turn bad: Promoting natural hazard preparedness," *Australian Journal of Emergency Management*, vol. 20, pp. 25-30, 2005.

[11] R. W. Perry and M. K. Lindell, "Volcanic risk perception and adjustment in a multi-hazard environment," *Journal of Volcanology and Geothermal Research*, vol. 172, pp. 170-178, 2008.

[12] J.-C. Audru, J.-L. Vernier, B. Capdeville, J.-J. Salindre, and É. Mouly, "Preparedness actions towards seismic risk mitigation for the general public in Martinique, French Lesser Antilles: a mid-term appraisal," *Natural Hazards and Earth System Science*, vol. 13, pp. 2031-2039, 2013.

[13] N. W. H. Organization. (2013). *School Earthquake Safety and Preparedness Training Program* Available: http://www.newworldhope.org/School%20Safety.html

[14] A. Ardalan, H. Mowafi, H. Malekafzali Ardakani, F. Abolhasanai, A.-M. Zanganeh, H. Safizadeh, *et al.*, "Effectiveness of a primary health care program on urban and rural community disaster preparedness, Islamic Republic of Iran: A community intervention trial," *Disaster medicine and public health preparedness*, vol. 7, pp. 481-490, 2013.

[15] K. R. Ronan and D. M. Johnston, "Hazards education for youth: A quasi-experimental investigation," *Risk analysis*, vol. 23, pp. 1009-1020, 2003.

[16] L. Chen, Y. Liu, and K. Chan, "Integrated community-based disaster management program in Taiwan: a case study of Shang-An village," *Natural Hazards*, vol. 37, pp. 209-223, 2006.

[17] S. A. Morrissey and J. P. Reser, "Evaluating the effectiveness of psychological preparedness advice in community cyclone preparedness materials," 2003.

[18] D. C. Glik, D. P. Eisenman, Q. Zhou, C. H. Tseng, and S. M. Asch, "Using the Precaution Adoption Process model to describe a disaster preparedness intervention among low-income Latinos," *Health education research*, vol. 29, pp. 272-283, 2014.

[19] D. P. Eisenman, D. Glik, L. Gonzalez, R. Maranon, Q. Zhou, C. H. Tseng, *et al.*, "Improving Latino disaster preparedness using social networks," *American journal of preventive medicine*, vol. 37, pp. 512-517, 2009.

[20] D. Paton, R. Bajek, N. Okada, and D. McIvor, "Predicting community earthquake preparedness: a cross-cultural comparison of Japan and New Zealand," *Natural Hazards*, vol. 54, pp. 765-781, 2010.

[21] D. Johnston, J. Becker, J. McClure, D. Paton, S. McBride, K. Wright, *et al.*, "Community Understanding of, and Preparedness for, Earthquake and Tsunami Risk in Wellington, New Zealand," in *Cities at Risk*. vol. 33, H. Joffe, T. Rossetto, and J. Adams, Eds., ed: Springer Netherlands, 2013, pp. 131-148.

[22] D. Paton, "Risk communication and natural hazard mitigation: how trust influences its effectiveness," *International Journal of Global Environmental Issues*, vol. 8, pp. 2-16, 2008.

[23] H. Joffe, G. Perez-Fuentes, H. W. Potts, and T. Rossetto, "How to increase earthquake and home fire preparedness: the fix-it intervention," *Natural Hazards*, 2016.

[24] B. Bishop, D. Paton, G. Syme, and B. Nancarrow, "Coping with environmental degradation: Salination as a community stressor," *Network*, vol. 12, pp. 1-15, 2000.

[25] D. Paton and D. M. Johnston, "The Christchurch earthquake: Integrating perspectives from diverse disciplines," *International Journal of Disaster Risk Reduction*, 2015.

[26] M. J. Spittal, F. H. Walkey, J. McClure, R. J. Siegert, and K. E. Ballantyne, "The Earthquake Readiness Scale: The development of a valid and reliable unifactorial measure," *Natural Hazards*, vol. 39, pp. 15-29, Sep 2006.

[27] L. A. Russell, J. D. Goltz, and L. B. Bourque, "Preparedness and Hazard Mitigation Actions before and after 2 Earthquakes," *Environment and Behavior*, vol. 27, pp. 744-770, Nov 1995.

[28] S. Michie, M. Johnston, J. Francis, W. Hardeman, and M. Eccles, "From theory to intervention: mapping theoretically derived behavioural determinants to behaviour change techniques," *Applied psychology*, vol. 57, pp. 660-680, 2008.

[29] J. H. Dalton, M. J. Elias, and A. Wandersman, "Community psychology," *Wadsworth, Belmont, CA*, 2001.

[30] D. Paton, L. Smith, D. Johnston, M. Johnston, and K. Ronan, *Developing a model to predict the adoption of natural hazard risk reduction and preparatory adjustments*. New Zealand: Earthquake Commission, 2003.

[31] M. L. Riggs and P. A. Knight, "The impact of perceived group success-failure on motivational beliefs and attitudes: a causal model," *Journal of Applied Psychology*, vol. 79, p. 755, 1994.

[32] P. W. Speer and N. A. Peterson, "Psychometric properties of an empowerment scale: Testing cognitive, emotional, and behavioral domains," *Social Work Research*, vol. 24, pp. 109-118, 2000.

[33] P. Dickes and M. Valentova, "Construction, validation and application of the measurement of social cohesion in 47 European countries and regions," *Social indicators research*, vol. 113, pp. 827-846, 2013.

[34] N. Nie, C. Hull, and D. Bent, "IBM statistical package for the social sciences (SPSS Version 20)," *Computer Software. Chicago, IL: SPSS*, 2011.

[35] R. Miceli, I. Sotgiu, and M. Settanni, "Disaster preparedness and perception of flood risk: A study in an alpine valley in Italy," *Journal of Environmental Psychology*, vol. 28, pp. 164-173, Jun 2008.

[36] J. E. L. a. L. Lemyre, " "A social-cognitive perspective of terrorism risk perception and individual response in Canada." " *Risk analysis*, vol. 29, pp. 1265-1280, 2009.

[37] J. Dillon and M. Phillips, "Social capital discussion paper," *Unpublished manuscript, Curtin University, Perth, Western Australia*, 2001.

[38] C. Johnson-George and W. C. Swap, "Measurement of specific interpersonal trust: Construction and validation of a scale to assess trust in a specific other," *Journal of personality and Social Psychology*, vol. 43, p. 1306, 1982.

[39] L. Sjoberg, "Consequences of perceived risk: Demand for mitigation," *Journal of risk research*, vol. 2, pp. 129-149, 1999.