A communications intervention to motivate disaster risk reduction

Anne M. Sanquini
GeoHazards International, Menlo Park, California, USA
Sundar M. Thapaliya
Department of General Medical Disciplines, Stanford University, School of Medicine, California, USA, and
Michele M. Wood
Department of Health Science, California State University Fullerton, Fullerton, California, USA

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Abstract

Purpose – The purpose of this paper is to apply social theory to the creation of a mass-media communications intervention designed to encourage earthquake-resistant construction in Nepal.

Design/methodology/approach – A three-step process was employed in this study: first, a narrative literature review was completed regarding the motivation of protective action. Second, key informant elicitation interviews with 15 community members at five public schools who supported making their buildings earthquake-resistant informed the script for a documentary film. Finally, the film was reviewed with stakeholders, plus 16 community members associated with a school in need of seismic work. Sociograms were used to determine relative closeness of the study participants to the film role models.

Findings – Motivating factors identified in the literature synthesis were included in the film, which focussed on effective actions taken by role models, and avoided the use of fear-based appeals. Key informant interviews yielded role-modeling details for the film script, including triggers and obstacles faced by the community members, and outcomes of their actions. Sociogram outcomes guided film editing and increased relative screen time for those community members with whom the study participants felt greater closeness. A pretest-posttest cluster randomized trial (details reported elsewhere) showed greater gains in knowledge, perceived outcome effectiveness, and intended behaviors among intervention film viewers than control participants.

Originality/value – This three-step process yielded the information required by a practitioner to develop a theory-based, culturally appropriate mass-media intervention designed to motivate reduction of disaster risk.

Keywords Nepal, Natural hazard, Disasters, Earthquake, Risk mitigation, Mitigation strategies, Risk communications

Paper type Research paper

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Natural disasters occurring between 1994 and 2013 have affected 218 million people worldwide, and claimed 1.35 million lives (Center for Research on the Epidemiology of Disasters (CRED), 2015). In the period between 1980 and 2012, the global cost, in 2012 values, was US$3.8 trillion (the World Bank, 2013). These reports also reveal increasing rates of death and financial loss due to population growth and poor urban planning in hazard areas such as floodplains or earthquake zones. This is often the case in developing countries; more people die per-disaster in low-income countries than in high-income countries (CRED, 2015).

The work reported in this paper was performed from 2013 to 2015 in the Kathmandu valley, Nepal. High population growth, high seismicity, and poor building infrastructure (e.g. Dixit, 2014) place the area at great risk of disaster. However, even in this environment, some building owners have created earthquake-resistant schools, homes, and other structures. Mass communications programs for education and social marketing purposes could be applied to accelerate this desired behavior (Novick *et al.*, 2013), but oftentimes such programs are neither theory-based, nor tested for effectiveness (e.g. Needleman, 1987; Bradley *et al.*, 2014).

We used a three-step process to guide the design of the film intervention intended to motivate support for earthquake-resistant construction in the Kathmandu valley. The first step included a narrative literature review to develop the strategic framework for the film. We were keen to understand motivating factors that could potentially be boosted in a mass communications medium, such as knowledge, perceived self-efficacy, and effectiveness (e.g. Duval and Mulilis, 1999; Witte and Allen, 2000; Wood *et al.*, 2012). Conversely, we also sought to understand potentially demotivating factors such as fatalism (Lindell and Perry, 2000) and fear (Lopes, 1992; Duval and Mulilis, 1999). The review was targeted to inform decisions regarding two key elements of the intended communications intervention: the messages and the messengers, including roles of individuals cast in the film. The second step was film intervention content development. This led to a focus on community members who had already supported making their local public schools earthquake-resistant. A technical non-government organization, the National Society for Earthquake Technology – Nepal (NSET), and the Nepali Department of Education (DOE), provided local expert input and access to public school community members. These individuals were interviewed by a Nepali member of the research team. A documentary film script was produced that told the stories of real individuals who had taken action to make their local public school safer. It applies the theory of communicating actionable risk (Wood *et al.*, 2012), which posits that people will take preparedness action when they know what to do, think it would work, and receive accordant social cues (know or see someone who took the affected action). This theory is consistent with social cognitive theory (that we learn by observing the action of others; Bandura, 1986) and diffusion of innovations theory (that observable actions, with perceived relative advantage, are more readily adopted; Rogers, 2010). Following a strategic review of the pilot film to refine and finalize the intervention, the film was tested for effectiveness in Kathmandu valley using a cluster randomized controlled trial.

Strategic framework

There is a rich history of over 70 years of social science research into communications for the purpose of education, attitude, and opinion change. Modern theory and practice was advanced during Second World War (e.g. Hovland *et al.*, 1949; Lasswell, 1948). Research began over 40 years ago into correlates of factors related to earthquake preparedness and mitigation (e.g. Bourque *et al.*, 1973). The strongest motivation for

preparing for a future potential disaster has been correlated with having experienced a disaster (e.g. Lindell and Perry, 2000; Nguyen *et al.*, 2006). Demographic characteristics of age, sex, and education have also been associated variably with risk reduction action (e.g. Flynn *et al.*, 1994; Grothmann and Reusswig, 2006; Bubeck *et al.*, 2012). We sought to identify factors that could be manipulated via mass communications to guide the creation of a strategic framework (Figure 1) for the intervention.

Communication campaigns often employ the use of negative threat appeals to increase the perception of risk from the threat (e.g. Witte and Allen, 2000). An evaluation of international literature by Solberg *et al.* (2010) concluded that risk perception only weakly correlates with earthquake preparedness action, however. In an informal experiment conducted for the American Red Cross, 40 groups of individuals ($n = 4{,}739$ people) in tornado, flood, or earthquake prone areas were given a hazard-relevant presentation designed to encourage disaster preparedness (Lopes, 1992). At every-other-presentation given, about 25 percent of the slides were either images of the recommended preparedness actions, or images of hazard-caused damage. Both groups were given literature describing preparedness actions. At six-month follow up, participants who had viewed presentations containing actions-images reported a

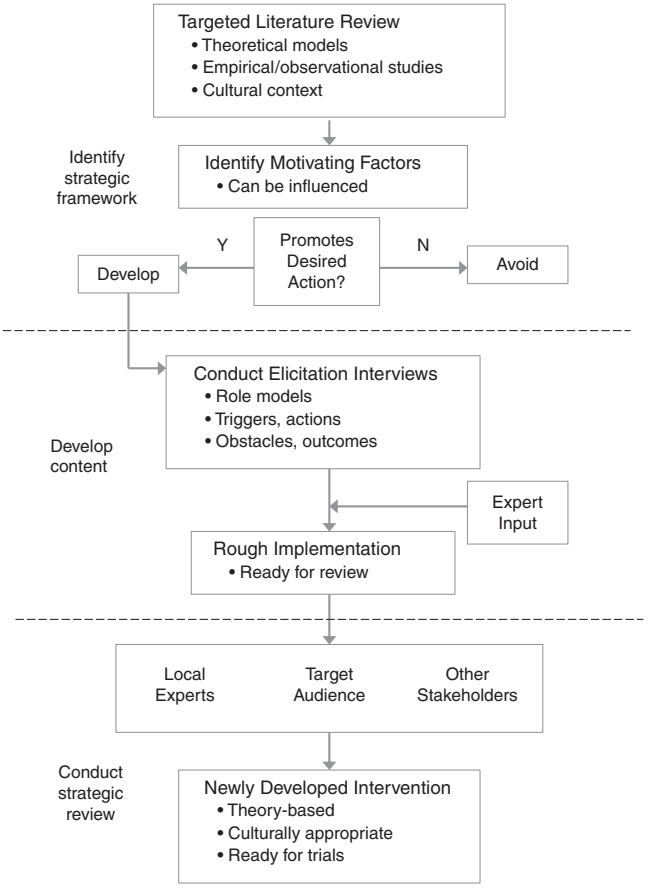

Figure 1. Creating a theory-based communication intervention

greater improvement in preparedness action taken than did those who saw the disaster images (Lopes, 1992). The same survey also measured change in the participants' level of perceived disaster readiness and belief that a disaster could happen to them where they live. The group that saw the action images demonstrated significant increases in perceived preparedness and in the belief that a disaster could happen to them. Participants who had seen the disaster images, however, showed a decrease in the percentage of people who responded that they "know what to do" among those who had seen the disaster images, and little change to the question "Do you really think a disaster could happen to you where you live?" Those who responded negatively to these last two questions were asked to explain why they felt the way they did. Most who saw the action images responded with apathy: "I haven't gotten around to it yet" while the disaster-image group responded with avoidance and denial: "I don't want to think about it" or "There's nothing I can do about it, anyway." The author suggests that the introduction of disaster images does little to increase risk perception and interferes with the communication and adoption of disaster preparedness recommendations.

A review of public health studies found that the combination of strong fear appeals and strong efficacy messages motivates the greatest protective behavior change, but when strong fear appeals are combined with weak efficacy messages, maladaptive action such as avoidance may result (Witte and Allen, 2000). Data from a risk perception survey relative to floods and landslides in Taiwan were analyzed by Lin *et al.* (2008), to understand why victims of such hazards were less willing to take mitigation measures than were other members of the public. The authors found that victims had a higher perceived hazard risk, including likelihood of occurrence and harm, than did other members of the public, but an even higher sense of powerlessness about what could or would be done to reduce the effect of the hazard. An experiment on earthquake preparedness motivations was performed with 240 California households by Duval and Mulilis (1999). Following baseline preparedness assessments, participants read essays that were interventions designed to manipulate the reader into a low, moderate, or high sense of threat. Participants then read essays designed to manipulate their assessment of how well they might cope with the potential earthquake, which included the individuals' ability to take risk reduction action and the possible effectiveness of such actions. At one-month follow up, researchers found that in general, for increasing threat levels, participants with the highest perceived level of resources increased their pre-post reported level of preparedness, while participants with the lowest perceived level of resources decreased their level of preparedness (Duval and Mulilis, 1999). Lindell and Whitney (2000) studied adoption of specific earthquake preparedness actions using a 12-item subscale of the Mulilis-Lippa Earthquake Preparedness scale (Mulilis *et al.*, 1990). In their convenience sample of 168 Los Angeles, California area university students, the vast majority of whom lived off-campus, perceived efficacy for protecting both people and property were significantly correlated with both intent and actual adoption of preparedness actions.

Fatalism, or the belief that nothing can be done to change the outcome of a situation, may present a barrier to taking preparedness action. A review by Lindell and Perry (2000) noted that earthquake preparedness and mitigation was inversely related to fatalism. McClure *et al.* (2007) studied the impact of post-earthquake news scenarios on earthquake fatalism. The authors exposed a convenience sample of 46 undergraduate students in New Zealand to two scenarios, as follows. An engineer indicated: most collapsed buildings were poorly designed; and several well-designed buildings collapsed. Participants judged damage more preventable, and that mitigation attempts would have been more successful under the first scenario. McClure *et al.* (2007) tested

similar scenarios, on a convenience sample of 119 non-student adults in New Zealand. This time, the spokesperson was either a reporter or an engineer. Participants again judged damage more preventable under the first scenario; this outcome was further strengthened with an engineer as the source of the message. Some news reports reaching citizens in the study area of Kathmandu valley may exacerbate fatalism. At the beginning of this study, a moderate earthquake of magnitude 5 occurred 330 km (over 200 miles) away from Kathmandu. Yet, the Kathmandu Post (2013) reported, "When the strong tremor jolted at 11:33 p.m. on Friday […] a majority of valley residents fled their homes to open spaces nearby." Discussions by the study author with local residents revealed that the news report overstated the felt earthquake ("strong") as well as the response of the people in the valley ("a majority […] fled").

Okazaki *et al.* (2008) conducted a field survey of about 800 households in the Kathmandu valley. When asked which of five disaster types would most affect their lives, 58 percent responded "earthquake," and anticipated loss to themselves, their families, and their properties in the event of a "big" earthquake. Over 60 percent indicated that their home was not strong enough to withstand such an earthquake. Of those, about two thirds indicated they had no plans to make their house safer, nor to move to a safer house. Of this last group, 87 percent said they were worried about collapse of their house due to earthquakes. In response to the question of to whom they would assign blame if their house collapsed in an earthquake, killing some of their family members, the majority, over 40 percent, responded that they would blame themselves. Other answer choices included the gods, the government, and house builders.

Communications intended to motivate action may be influenced by message framing, for example, whether a desired behavior is framed in positive or negative terms. This has been studied in areas such as public health (e.g. Rothman and Salovey, 1997). McClure *et al.* (2009) explored four versions of an earthquake preparedness message with a convenience sample of 240 non-student adults in New Zealand. These versions reflected a positive or negative action (if one is well or poorly prepared) and a positive or negative outcome (a greater or lesser chance of surviving, or of experiencing harm). The authors found that messages framed with negative outcomes resulted in higher preparedness intentions, for both general and specific preparedness action. For specific actions, the highest preparedness combination was a positive action (well-prepared) and a negatively framed outcome (less chance of experiencing harm).

Becker *et al.* (2014) explored societal issues and how they may influence household earthquake preparedness in a qualitative study of 48 self-selected adults from three urban locations in New Zealand. Participants responded freely to question prompts. Social influencers emerging from a grounded theory analysis included trust, responsibility, community participation, and social norms. A representative sample ($n = 3{,}300$ households) of the continental USA was surveyed to understand motivators of household disaster preparedness (Wood *et al.*, 2012). Following a path analytic framework analysis, the single most significant motivator was from receipt of social cues, such as knowing or seeing someone who took the affected preparedness action. Information density, knowledge of specific preparedness actions, and belief in effectiveness of such action also were significant motivators of preparedness.

Intervention content

The primary source for film content (Figure 1) was qualitative data obtained from interviews with local people who participated in making their public school buildings earthquake-resistant. Key informant elicitation interviews (Kumar, 1989;

Middlestadt *et al.*, 1996) were conducted with 15 individuals from five schools. These schools were from geographically dispersed areas of Kathmandu valley and represented both urban and rural settings. Participants in these formative research sessions included school principals, teachers, management committee members, parents, grandparents, masons, and other neighbors of the school. A structured script was developed in English and translated and localized to Nepali by the bilingual lead interviewer. With permission from each participant, these conversations were audio recorded, transcribed to English by the lead interviewer and annotated with research notes and other observations.

Role-model guidelines (Corby *et al.*, 1996) were used to develop the interview script. In-depth open-ended questions were employed to elicit the key informant's personal story about how he or she took action to help strengthen the local school. The approximately one-hour sessions collected information that could be used to establish the speaker as a member of the target population as well as describe risk in a way that was relevant to the audience. Questions elicited information about one action or goal that viewers could achieve, factors that influenced achieving the stated goal, triggers for taking the action, barriers encountered, and finally, the positive outcome in terms of a safer school building that was ultimately achieved.

Casting of local community members in the film was done to help give the intended audience the sense that the people in the film were similar to people in their own communities. The students of the public schools in Kathmandu valley are often from poor families who have moved into the urban area for work. As careers progress, school staff such as the principal and teachers may also be from outside the area. As such, one often sees diversity in a public school community. Masons and engineers have specific roles. As reported in the survey performed by Okazaki *et al.* (2008), when asked: "Who built your home?" the most frequent response from Nepali participants was local masons. In response to the question, "On whom do you rely for a safer house?" the most frequent responses from Nepali was engineers.

Secondary data sources for film content included references such as *Protection of Educational Buildings Against Earthquakes: A Manual for Designers and Builders* (Bothara *et al.*, 2002) and discussions with experts at the DOE and NSET. These were used to glean additional information on possible roles of community members in making their school buildings earthquake-resistant, and to ensure technical accuracy of the seismic resistant building concepts to be represented in the film. In addition, landmarks and other features of each key informant school site were incorporated in the film so that each setting would be visually recognizable as a public school located in the Kathmandu valley.

In preparation for on-site work in Nepal, a prototype seven-minute (6:44 min) film was created in California, USA during July-August 2013, using local US actors. The prototype film, which illustrates how a film intervention could be done, was used to help explain the study and engage the support of the Nepal DOE and of NSET. It also acted as an example to potential film production companies for the development of the actual film. An a priori decision was made to hire local Nepali filmmakers, as they were expected to have cultural competence in terms of how local people might perceive the film and also help people cast in the film to be as comfortable as possible in front of the camera. A YouTube video search was performed for Nepali filmmakers. They were evaluated based on their experience in capturing Nepali life in a realistic and positive way. Many films about disasters feature local people primarily as victims. Further, to recruit donors, local people are sometimes portrayed simply as aid beneficiaries. In their review of disaster risk reduction actions and challenges, the Asian Disaster Preparedness Center (ADPC) specifically noted that "[…] The role of the community must continue to evolve from that of victim and beneficiary to

partner […]" (Asian Disaster Preparedness Center, 2004). The group chosen to do the filming (Baardali Films, a group of media studies students from Kathmandu University) was selected because their portfolio included several short films that covered everyday situations and social issues in Nepal. The film crew recommended that most scenes be shot outdoors, to enhance film realism, with occasional sounds of cars, trucks and tractors, dogs barking, and children playing.

Strategic review

The purpose of this step (Figure 1) was to ascertain whether or not the film that had been developed was faithful to the strategic framework and content development intended in the first two steps. The pilot film was tested on a convenience sample of five NSET employees who had not received training on earthquake-resistant construction methods. It was also tested on a group that reflected the intended audience for the film: parents, teachers, and other community members of a public school in Kathmandu valley, where the school building(s) needed seismic work. This school was identified via reference from the principal of one of the schools that appeared in the film, and selected based on convenience.

The degree to which the participants were sympathetic to the people in the film was examined. After viewing the film, participants created sociograms (Northway, 1952) between themselves and the actors (Hogan *et al.*, 2007), as follows. Each participant received postage-stamp sized photos of the role models from the pilot film, and a paper with four concentric circles. The smallest center circle represented the participant. Participants then placed photos in the surrounding circles, depending on how close they were to the people in the film. This method was chosen because of ease of administration of a visual task to participants having a wide range of literacy levels. Each participant was asked to consider each photo, and imagine that this was a real acquaintance. To guide them, questions were adapted from Hogan *et al.* (2007, p. 123). The English back-translation of the questions asked was: "Do you think this is someone with whom you could discuss important matters?" "If you needed help, do you think this person is the kind of person who would help you?" The motivation here was to yield information that could be used to further edit the film and give more "air time" to role models who were placed by participants closer to the center circle.

Expert review of the film was also conducted. This included community outreach individuals from NSET, and engineers from the DOE, NSET, and from the Earthquake Science Center of the USGS.

Results

Results from each step of the intervention design process are as follows.

Strategic framework

Findings from the literature review were interpreted in implications for film content as follows. First, to support the sense of "knowing someone" who took action (Bandura, 1986; Wood *et al.*, 2012), it would be preferable if individuals selected to appear in the film intervention were the real people who took the desired action. As per Becker *et al.* (2014), these roles should be in harmony with expected community roles, responsibilities, and interactions, such as illustrating a local school committee discussing a hazard issue related to their school, local masons agreeing to be trained on earthquake-resistant construction, the school principal leading a fundraising effort, or local parents supporting the project. While actors could be used to achieve this, it would

require multiple viewings to facilitate audience identification with the actors as real people like themselves (Bandura, 2004). Second, the process of overcoming the barriers of doubt and uncertainty should be featured. During formative research, local experts in Kathmandu suggested that there is a common belief that "it's not possible" to retrofit an existing building to make it earthquake safe, and that attempting to build earthquake-resistant housing may be futile because "everything will collapse in an earthquake." Such fatalism can be detrimental to preparedness action (e.g. Lindell and Perry, 2000). Hence, the communications intervention should allow the viewer to see the role-model actor overcoming doubt and other obstacles. In this manner, the viewer may come to understand how the actors who have taken risk reduction measures found the resources to do so and how they feel about the effectiveness of their actions. Third, the film should include specific actions taken in support of earthquake-resistant construction, as such knowledge has been found to be motivating of preparedness (Wood *et al.*, 2012). Where possible, these actions should be framed in a combination yielding the most beneficial impact on preparedness (McClure *et al.*, 2009). Lastly, the arousal of fear should be avoided as risk perception only weakly correlates with action (e.g. Solberg *et al.*, 2010). Furthermore, we were concerned about backfire as noted in the experiment performed by Duval and Mulilis (1999) and triggering maladaptive behavior such as avoidance and denial, as summarized from health studies (Witte and Allen, 2000) and found in previous hazard research (Duval and Mulilis, 1999; Lopes, 1992).

Intervention content

Themes emerging during the key informant interviews that applied to role-model guidelines (Corby *et al.*, 1996) were represented in the film as follows.

Establish membership in target population, personalize. Each individual described his or her role related to the school. Some added details, such as having grandchildren who attended the school, or family donations of land for the original school buildings. They also described the actions of other community members who had worked to support the school. We noted heterogeneity in terms of gender, caste, accents, and socioeconomic levels. This was attributed, in part, to migration of school staff and students' parents into and within Kathmandu valley. We also learned that some parents of higher socioeconomic levels, whose children attended private schools, still supported the local public school financially, and demonstrated interest in student academic performance.

Describe risk relevant to audience. Many interviewees expressed concern over the risk of death or injury to the students and teachers from earthquake-induced building damage or collapse. Several individuals pointed out features of the buildings that had been improved and others that were still in need of improvement. The risk was described in terms of exposure of vulnerable people, especially the younger children. There was no mention of financial risk to the buildings.

Describe one specific goal. The goal was the same for all, to strengthen or reconstruct existing school building(s) to resist seismic damage.

Describe influencing factors, triggers for change. Various triggers were described. Several people talked about having been approached by engineers from the DOE, who indicated that the school building was not safe but would either be a good candidate to retrofit or should be rebuilt new. One individual came from another part of Nepal where his original home was damaged in an earthquake and people renting his house had died. When he arrived in Kathmandu, he observed that the condition of the local school

buildings were the same as his former home. A few people described the desire to expand the school by adding a second story to an existing school building. In this example, the existing building was not earthquake-resistant and the funding agency would not support additional floors until this was addressed.

Describe specific barriers encountered. One or more individuals described specific challenges, including: masons who skipped earthquake-resistant construction training sessions and instead went to work on other jobs; determining where to hold class while the school was being retrofitted; and initiating construction on a new, earthquake-resistant school building, but running out of money before completion.

Describe positive outcome. All interviewees expressed happiness, relief and gratitude that students and their teachers can now feel safe from earthquakes. Many individuals used the phrase "we are worry-free." A secondary positive outcome, mentioned by individuals at three of the five key informant interview locations, was that local masons who were trained during the school building process on what they referred to as "earthquake technology" had gone on to build new earthquake-resistant homes in the neighborhood.

Qualitative data from the key informant interviews were reviewed via repeated readings, coded for common themes, and annotated for sequences that could be incorporated in the draft film script. While the script was comprised primarily of the key informants' own stories, during filming, the role model actors were encouraged to *ad lib*, and speak extemporaneously about their experiences. The first person appearing in the film was a teacher who narrated the retrofit of his own school site. The film then progressed through various projects at the other four schools, and then returned to the original school. At the end of the film, photographs of many other schools that had been made earthquake-resistant were shown. All but one of the role models cast in the film was a local community member such as a parent, grandparent, teacher, or principal. Four of the community members also worked as masons, and one owned the local cement store. Some of the masons explained that they had been trained on "earthquake technology" (their words), subsequently built other schools and homes to be earthquake-resistant, and trained other masons. This was included to give the viewer the sense that "many" people like themselves had taken action to strengthen their schools, and that qualified workers might be available if they wanted to pursue such an avenue, whether for a school or home. The sole non-community member was an engineer, who had two purposes – he served as an initial obstacle to the community, and he described specific design requirements for earthquake-resistant construction.

Strategic review

The output of the sociogram exercise was used to inform editing of the film. As long as the original goals and requirements for the film could be maintained, the film-time of individuals who were in the outer circles was significantly reduced. In this manner, proportionately more film-time was given to those individuals with whom the intended audience indicated more relative closeness, to intensify the audience sense of "knowing someone" who took the desired action. All experts reviewing the film recommended the addition of more "live" construction to further illustrate some of the earthquake-resistant methods. Following the strategic review, these scenes were added to the film. This was done to enable the audience to more easily grasp some of the construction methods and to enhance belief that earthquake-resistant construction was

possible, by seeing it done. Some individuals recommended that scenes that are often included in risk communications, such as scientific background scenes to increase risk awareness, disaster images to increase risk perception, and various officials to increase trust in the message, be added. We elected not to add these "traditional" elements to the film as they were outside the theoretical framework of the study and could prove confounding to the study purpose. Having the results from the literature review guided these decisions. For example, we elected not to educate the intended audience about why earthquakes happen, since we only needed them to be aware that they do, indeed happen. Our formative research indicated this was likely the case (such as citizen reaction to the moderate earthquake just before the start of the study, as reported in the *Kathmandu Post*, 2013), and we confirmed it prior to testing the film. Including officials in the film could shift focus from seeing ordinary people like themselves who have taken the desired action, per our theoretical framework, to being told by an authority figure that they should take action. Our greatest concern was the potential use of disaster images. Unless the intended audience had a high belief in the effectiveness of the action and self-efficacy of their ability to do so, increasing fear could backfire. We wanted to create a film that could work to motivate preparedness action at scale, without potentially doing harm to those who may have low perceived effectiveness and self-efficacy.

Resulting film intervention

Following changes from the strategic review, the 20-minute (19:40 min) intervention film was ready for evaluation. The film as tested in this study, *Subharambha*, is available at: http://purl.stanford.edu/tg271wv6973 (Sanquini, 2013).

The experiment was a researcher-matched pair, cluster randomized, pretest-posttest controlled trial (Imai *et al.*, 2009) with an audience of 761 adults from 16 Kathmandu valley public schools in need of seismic work. The study participants were parents, teachers, and other community members of the local school. A 25-item survey instrument, the earthquake-resistant construction knowledge and opinions (EKO) scale (Sanquini, 2014; Sanquini *et al.*, 2016) was created to test the impact of this film on the following four factors: knowledge of earthquake-resistant construction design, materials, and methods; confidence in efficacy of such construction items; intention to support such construction; and intention to recommend building earthquake-resistant homes to others. When compared to those who saw a control film on an unrelated topic, participants who saw the intervention film statistically significantly increased their pretest-posttest scores on all four factors. Details of the randomized controlled trial are in preparation for publication. The questionnaire itself (Sanquini, 2014) is freely available, in Nepali and back-translated English, at http://purl.stanford.edu/ry685fs3812 and may be modified for use in other programs and studies.

The test of *Subharambha* (Sanquini, 2013) was completed just five weeks before the April 25 magnitude 7.8 earthquake (US Geological Survey, 2015) struck central Nepal. Although thousands of schools were damaged from seismic shaking, all schools shown in the intervention film survived, and classes resumed quickly. Per the strategic framework, we chose to further strengthen the perceived outcome effectiveness of the school building mitigation by augmenting the film with a new segment that revisits each school to show viewers what happened in the earthquake. This film, *Naya Suruwaat,* was publically released to aid in the reconstruction effort, illustrating that earthquake-resistant construction is effective (Figure 2). A version with English subtitles may be viewed at www.youtube.com/watch?v=KBxpAroO1vU

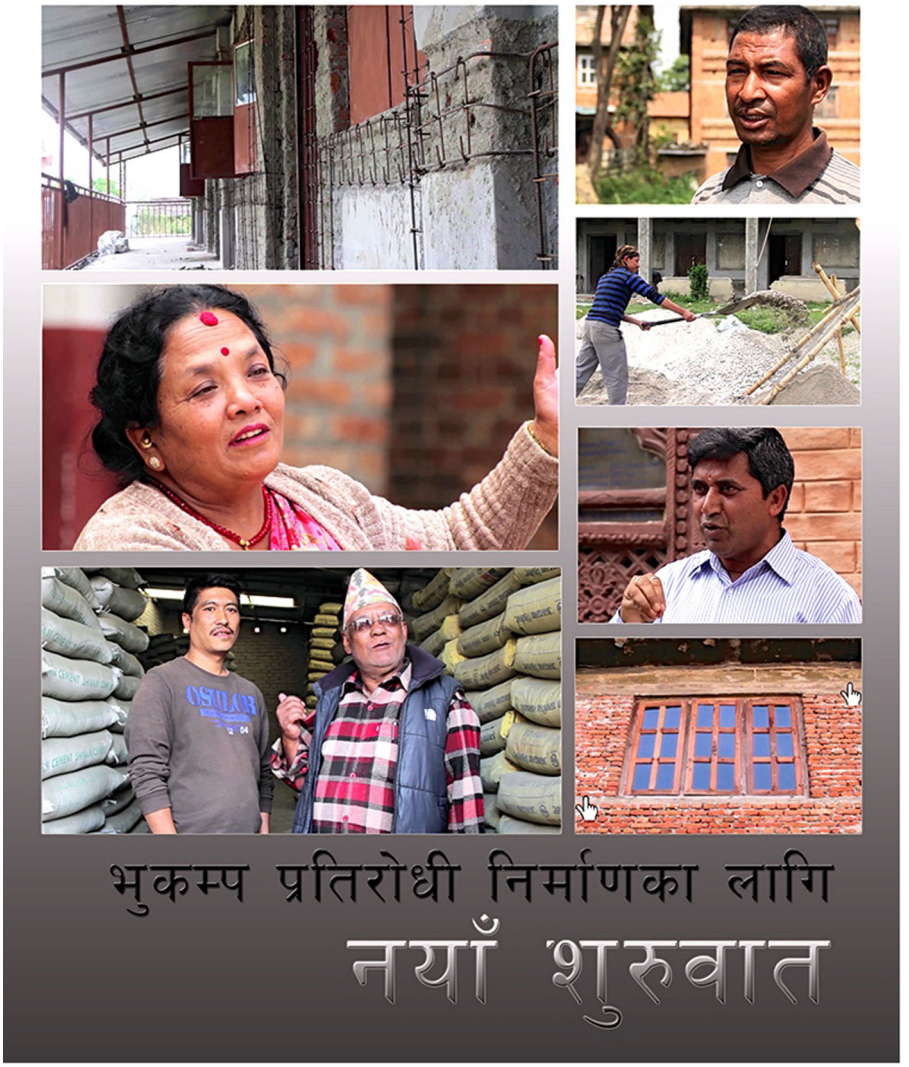

Figure 2.
Film images from Naya Suruwaat (A Good Beginning)

Discussion

Conclusions

This study provides a practical example of translating hazard preparedness research into practice. We created a mass communications intervention designed to accelerate the rate at which earthquake-resistant methods are diffused (Rogers, 2010) into Kathmandu valley building construction. The 20-minute film carefully casts community members who have taken the desired action as role models to others, providing powerful social cues as suggested by the findings of Bandura (1986), Becker *et al.* (2014), and Wood *et al.* (2012). In this manner, the intended audience may experience seeing people like themselves become aware of their risk, determine to take

action, overcome obstacles, and finally achieve their desired outcomes, following role-modeling guidelines (Corby *et al.*, 1996; Middlestadt *et al.*, 1996). Motivators such as self-efficacy and perceived effectiveness (Duval and Mulilis, 1999; Witte and Allen, 2000; Wood *et al.* 2012) are boosted through film images and dialog. Fatalism, the belief that nothing can be done to change the outcome of the situation, can thereby be reduced (Lindell and Perry, 2000; McClure *et al.*, 2007). This was done without the use of fear-based appeals, which may demotivate action (Lopes, 1992; Duval and Mulilis, 1999). The film represents the first formal application of the theory of communicating actionable risk (Wood *et al.*, 2012) to intervention design and evaluation.

Implications

Broadly speaking, this development and evaluation of a theory-based intervention gives practitioners an evidence-based alternative on which to base the design of risk communications that are intended to motivate action. This may provide a welcome change to the practice of doing what has been done before, with few effectiveness measures (e.g. Needleman, 1987; see also Bradley *et al.*, 2014). This approach had participation from the target community in the development of the intervention, including the film script, and employed local filmmakers. The documentation and dissemination of this approach might also enable a local community to create similar interventions with little real-time guidance.

Limitations

The intervention cast community members of public schools in Kathmandu valley as role models to the intended target audience of the film. As such, the potential film impact on audiences that differ from this one is unknown.

Future research

This approach for creation of motivational risk communication interventions may be generally applicable to other hazards, and to other countries. Our approach used a film, but other mass media, such as billboards, a television serial, or social media could be explored. Translation research should be done to discover the best, most effective ways to package the methods and findings of this work so that they may be translated to other cultures, and applied with a high level of fidelity and minimal intervention drift. Such research may also examine how an intervention could be designed in such a way that it becomes self-sustaining. In this manner, when some in a community adopt a new concept, the new practice may in turn diffuse into the community. This could foster additional adoption until the new practice becomes the social norm.

References

Asian Disaster Preparedness Center (2004), "Building disaster risk reduction in Asia: a way forward: ADPC looks ahead To 2015", Asian Disaster Preparedness Center, Bangkok.

Bandura, A. (1986), *Social Foundations of Thought and Action: A Social Cognitive Theory*, Prentice-Hall Inc, Upper Saddle River, NJ.

Bandura, A. (2004), "Social cognitive theory for personal and social change by enabling media", in Singhal, A., Cody, M.J., Rogers, E.M. and Sabido, M. (Eds), *Entertainment-Education and Social Change: History, Research, and Practice*, Routledge and Lawrence Erlbaum, Mahwah, NJ, pp. 75-96.

Becker, J., Paton, D., Johnston, D. and Ronan, K. (2014), "Societal influences on earthquake information meaning-making and household preparedness", *International Journal of Mass Emergencies & Disasters*, Vol. 32 No. 2, pp. 317-352.

Bourque, L.B., Reeder, L.G., Cherlin, A., Raven, B.H. and Walton, D.M. (1973), "The unpredictable disaster in a metropolis: public response to the Los Angeles earthquake of February 1971", Civil Defense Preparedness Agency, UCLA Survey Research Center, Los Angeles, CA.

Bothara, J.K., Guragain, R. and Dixit, A. (2002), *Protection of Educational Buildings Against Earthquakes: A Manual for Designers and Builders*, National Society for Earthquake Technology, Kathmandu.

Bradley, D.T., McFarland, M. and Clarke, M. (2014), "The effectiveness of disaster risk communication: a systematic review of intervention studies", *PLoS Currents Disasters*, Vol. 6, August. doi: 10.1371/currents.dis.349062e0db1048bb9fc3a3fa67d8a4f8.

Bubeck, P., Botzen, W.J. and Aerts, J.C. (2012), "A review of risk perceptions and other factors that influence flood mitigation behavior", *Risk Analysis*, Vol. 32 No. 9, pp. 1481-1495.

Center for Research on the Epidemiology of Disasters (CRED) (2015), "The human cost of natural disasters, a global perspective", available at: http://emdat.be/human_cost_natdis (accessed February 15, 2016).

Corby, N.H., Enguídanos, S.M. and Kay, L.S. (1996), "Development and use of role model stories in a community level HIV risk reduction intervention", *Public Health Reports*, Vol. 111 No. S1, pp. 54-58.

Dixit, A.M. (2014), "Risk and vulnerability assessment: experience of Nepal", in Shaw, R. and Izumi, T. (Eds), *Civil Society Organization and Disaster Risk Reduction*, Springer, Tokyo, pp. 79-113.

Duval, T.S. and Mulilis, J.P. (1999), "A person-relative-to-event (PrE) approach to negative threat appeals and earthquake preparedness: a field study", *Journal of Applied Social Psychology*, Vol. 29 No. 3, pp. 495-516.

Flynn, J., Slovic, P. and Mertz, C.K. (1994), "Gender, race, and perception of environmental health risks", *Risk Analysis*, Vol. 14 No. 6, pp. 1101-1108.

Grothmann, T. and Reusswig, F. (2006), "People at risk of flooding: why some residents take precautionary action while others do not", *Natural Hazards*, Vol. 38 Nos 1-2, pp. 101-120.

Hogan, B., Carrasco, J.A. and Wellman, B. (2007), "Visualizing personal networks: working with participant-aided sociograms", *Field Methods*, Vol. 19 No. 2, pp. 116-144.

Hovland, C.I., Lumsdaine, A.A. and Sheffield, F.D. (1949), *Experiments on Mass Communication*, Vol. 3, Princeton University Press, Princeton.

Imai, K., King, G. and Nall, C. (2009), "The essential role of pair matching in cluster-randomized experiments, with application to the Mexican universal health insurance evaluation", *Statistical Science*, Vol. 24 No. 1, pp. 29-53.

Kathmandu Post (2013), "Tremor sends chills down valley spine", *Kathmandu Post,* September 13, available at: www.ekantipur.com/ (accessed July 23, 2015).

Kumar, K. (1989), "Conducting key informant interviews in developing countries", Agency for International Development, Washington, DC.

Lasswell, H.D. (1948), "The structure and function of communication in society", in Bryson, L. (Ed.), *The Communication of Ideas*, Institute for Religious and Social Studies, New York, NY, pp. 37-51.

Lindell, M.K. and Perry, R.W. (2000), "Household adjustment to earthquake hazard: a review of research", *Environment and Behavior*, Vol. 32 No. 4, pp. 461-501.

Lindell, M.K. and Whitney, D.J. (2000), "Correlates of household seismic hazard adjustment adoption", *Risk Analysis*, Vol. 20 No. 1, pp. 13-26.

Lin, S., Shaw, D. and Ho, M.C. (2008), "Why are flood and landslide victims less willing to take mitigation measures than the public?", *Natural Hazards*, Vol. 44 No. 2, pp. 305-314.

Lopes, R. (1992), "Public perception of disaster preparedness presentations using disaster damage images", Working Paper No.79, Natural Hazards Research and Applications Information Center, Institute of Behavioral Science, University of Colorado, Boulder, CO.

McClure, J., Sutton, R.M. and Sibley, C.G. (2007), "Listening to reporters or engineers? How instance-based messages about building design affect earthquake fatalism", *Journal of Applied Social Psychology*, Vol. 37 No. 9, pp. 1956-1973.

McClure, J., White, J. and Sibley, C.G. (2009), "Framing effects on preparation intentions: distinguishing actions and outcomes", *Disaster Prevention and Management: An International Journal*, Vol. 18 No. 2, pp. 187-199.

Middlestadt, S.E., Bhattacharyya, K., Rosenbaum, J., Fishbein, M. and Shepherd, M. (1996), "The use of theory based semistructured elicitation questionnaires: formative research for CDC's prevention marketing initiative", *Public Health Reports*, Vol. 111 No. S1, pp. 18-27.

Mulilis, J.P., Duval, T.S. and Lippa, R. (1990), "The effects of a large destructive local earthquake on earthquake preparedness as assessed by the earthquake preparedness scale", *Natural Hazards*, Vol. 3, pp. 357-371.

Needleman, C. (1987), "Ritualism in communicating risk information", *Science, Technology, and Human Values*, Vol. 12 Nos 3/4, pp. 20-25.

Novick, L.F., Morrow, C.B. and Mays, G.P. (2013), *Public Health Administration: Principles for Population-Based Management*, 3rd ed., Jones and Bartlett, Sudbury, MA.

Nguyen, L.H., Shen, H., Ershoff, D., Afifi, A.A. and Bourque, L.B. (2006), "Exploring the causal relationship between exposure to the 1994 Northridge earthquake and pre-and post-earthquake preparedness activities", *Earthquake Spectra*, Vol. 22 No. 3, pp. 569-587.

Northway, M.L. (1952), *A Primer of Sociometry*, University of Toronto Press, Toronto.

Okazaki, K., Ilki, A., Ahmad, R.C., Kandel, R.C. and Rahayu, H. (2008), "Seismic risk perception of people for safer housing", paper presented at the 14th World Conference on Earthquake Engineering, Beijing, October.

Rogers, E.M. (2010), *Diffusion of Innovations*, Simon & Schuster, New York, NY.

Rothman, A.J. and Salovey, P. (1997), "Shaping perceptions to motivate healthy behavior: the role of message framing", *Psychological Bulletin*, Vol. 121 No. 1, pp. 3-19.

Sanquini, A.M. (2013), A film designed to motivate earthquake resistant construction in the Kathmandu valley, available at: http://purl.stanford.edu/tg271wv6973

Sanquini, A.M. (2014), "The Earthquake-Resistant-Construction Knowledge and Opinions (EKO) questionnaire", available at: http://purl.stanford.edu/ry685fs3812

Sanquini, A.M., Thapaliya, S.M. and Wood, M.M. (2016), "A survey instrument to isolate effectiveness of a novel risk communication intervention", *Natural Hazards*, Vol. 82 No. 1, pp. 59-72.

Solberg, C., Rossetto, T. and Joffe, H. (2010), "The social psychology of seismic hazard adjustment: re-evaluating the international literature", *Natural Hazards and Earth System Sciences*, Vol. 10 No. 8, pp. 1663-1677.

US Geological Survey (2015), "M7.8 – 34km ESE of Lamjung, Nepal", available at: www.earthquake.usgs.gov/earthquakes/eventpage/us20002926#general_summary (accessed July 23, 2015).

Witte, K. and Allen, M. (2000), "A meta-analysis of fear appeals: implications for effective public health campaigns", *Health Education & Behavior*, Vol. 27 No. 5, pp. 591-615.

Wood, M.M., Mileti, D.S., Kano, M., Kelley, M.M., Regan, R. and Bourque, L.B. (2012), "Communicating actionable risk for terrorism and other hazards", *Risk Analysis*, Vol. 32 No. 4, pp. 601-615.

World Bank (2013), "Building resilience: integrating climate and disaster risk into development", Lessons from World Bank Group Experience, The World Bank, Washington, DC.