Disaster Prevention and Management

Survivors perceptions of stakeholders and the 2009 South Pacific tsunami
Emma Apatu Chris Gregg Michael K. Lindell Joel Hillhouse Liang Wang

Received 11 November 2014
Revised 13 March 2015
18 May 2015
Accepted 28 May 2015

Survivors perceptions of stakeholders and the 2009 South Pacific tsunami

Emma Apatu
Public Health, University of North Florida, Jacksonville, Florida, USA
Chris Gregg
Geosciences, East Tennessee State University, Johnson City, Tennessee, USA
Michael K. Lindell
Hazard Reduction & Recovery Center,
Texas A&M University, College Station, Texas, USA
Joel Hillhouse
Community and Behavioral Health,
East Tennessee State University, Johnson City, Tennessee, USA, and
Liang Wang
Biostatistics and Epidemiology,
East Tennessee State University, Johnson City, Tennessee, USA

Abstract

Purpose – Near-field tsunamis provide short warning periods of equal to 30 minutes, which can complicate at-risk individuals' protective action decisions. In the face of a tsunami, people may turn to individuals such as friends, family, neighbors, or organizations such as the media to obtain warning information to help facilitate evacuation and/or to seek protection from the hazard. To characterize norms for protection action behavior during a near-field tsunami, the purpose of this paper is to explore American Samoan residents' perceptions of four social stakeholder groups on three characteristics – tsunami knowledge, trustworthiness, and protection responsibility – regarding the September 29, 2009, Mw 8.1 earthquake and tsunami in American Samoa.

Design/methodology/approach – The social stakeholder groups were the respondents themselves, their peers, officials, and media. Mean ratings revealed that respondents rated themselves highest for tsunami knowledge and protection against the tsunami but rated peers highest for trustworthiness. In addition, officials had the lowest mean rankings for all three stakeholder characteristics. MANOVA analyses found that there was a statistically significant overall effect for occupation status on respondents' perceptions of the four stakeholder groups and characteristics.

Findings – Employed respondents generally reported higher mean ratings for all stakeholder groups across the three characteristics than those that reported not having an occupation. Given the complexity of evacuation behavior, at-risk individuals may seek the assistance of other community members to support their protective action decisions.

Originality/value – The information gathered from this study provides local emergency managers with useful data that could support future disaster resilience efforts for tsunamis.

Keywords Emergency response, Natural hazard, Tsunami, Pacific Ichkslands

Paper type Research paper

This work was supported by the National Science Foundation under Grant No. IMEE 0900662. The authors would like to thank the local interview team and participants for their contributions. Any opinions, findings, and conclusions or recommendations expressed in this manuscript are those of the authors and do not necessarily reflect the views of the National Science Foundation. None of the conclusions expressed here necessarily reflects views other than those of the authors.

Disaster Prevention and Management
Vol. 24 No. 5, 2015
pp. 596-609

0965-3562
DOI 10.1108/DPM-11-2014-0230

1. Introduction

In the years since 2004, the Asia-Pacific region has experienced several large earthquakes that triggered deadly local tsunamis – Indonesia (2004, 2005, 2006), American Samoa (2009), Chile (2010), and Japan (2011). These are relatively infrequent hazards, but they have the potential to cause great destruction to coastal communities near their source. For example, the 2011 Tohoku-oki Earthquake and Tsunami that struck Japan resulted in approximately 15,703 deaths and 5,314 injuries in Japan and extensive damage totaling hundreds of billions of US dollars (US Geological Survey, 2013; World Bank, 2011). Additionally, the September 29, 2009, Earthquake and South Pacific Tsunami that struck American Samoa, Samoa, and Tonga claimed 192 lives (US Geological Survey, 2012). Not surprisingly, response to hazards such as local tsunamis is a complex process that involves many social stakeholders.

The term social stakeholder includes individuals and organizations that people perceive to have a role in mitigating the impact of a threat (Lindell *et al.*, 2006; Birkmann *et al.*, 2008). This study focusses on analysis of four social stakeholder groups through the study of 300 respondents who were also survivors of the 2009 earthquake and tsunami. They comprise the first social stakeholder group. The other social stakeholder groups are the people and organizations around them, including: the respondents' peers, officials such as public authority figures and agencies; and media. The goal of this study is to better understand how survivors' perceptions of the four social stakeholder groups influenced their decision making in response to the local tsunami on September 29, 2009.

Local tsunamis are a type of rapid onset hazard that affect nearby communities within 30 minutes. Surviving them generally requires that at-risk individuals begin evacuating from tsunami hazard zones immediately after ground motion from a parent earthquake stops and that they complete the evacuation by the time the first damaging wave arrives onshore. The short window of time between the formation of a local tsunami and its arrival in nearby coastal areas makes it difficult for official agencies such as Tsunami Warning Centers (i.e. one group of social stakeholders) to disseminate warning information quickly enough to provide affected communities with useful early warning. For example, the Pacific Tsunami Warning Center (PTWC) in Hawaii issued its first Tsunami Warning for the September 2009 tsunami 16 minutes after the earthquake was recorded. While this official PTWC warning was likely to be useful for some communities impacted at progressively later times, several communities were affected by the first wave in the tsunami 15 minutes after the earthquake. Consequently, this official source of information and other official agency information derived from it were of little use for some communities in the earliest stage of the impending disaster. As such, during a local tsunami people are forced to turn to other sources of warning information to help guide necessary protective behavior. These other sources include environmental cues or natural warning signs of the tsunami (e.g. ground motion from the parent earthquake and sight of the tsunami, respectively), in addition to other social stakeholders (e.g. peers and the media). See Gregg *et al.* (2006) for a discussion of sources of warning information in tsunamis.

To date, little attention has been placed on exploring at-risk individuals' perceptions of various social stakeholders, especially for tsunamis. This includes perceptions of the stakeholders': levels of knowledge of tsunami hazards, trustworthiness to provide accurate information, and perceived protection responsibility during tsunamis – a person's appraisal of who is most responsible for their protection (i.e. themselves or people around them, such as official agencies). Our study of residents' perceptions of

social stakeholders who experienced the 2009 South Pacific Tsunami will provide valuable insight into protective action decision making during a hazard with a very short fuse and the first local tsunami to strike US soil since Kalapana, Hawaii earthquake in 1975.

2. Theoretical background

Theory

Extensive research has explored how people react and respond to hazard warnings (Cutter *et al.*, 2003; Cutter and Barnes, 1982; Drabek, 1969; Paton *et al.*, 2006; Sorensen and Mileti, 1988; Rodriguez *et al.*, 2007). Mileti and Sorensen's (1987) Warning Response model describes how people who receive hazard warnings undergo a series of decision-making processes before deciding on whether or not to take protective action, such as evacuating or sheltering. The process begins with a person hearing about a hazard, perceiving a threat, understanding the information provided and attaching meaning to it, believing in the accuracy of information provided, personalizing the information (i.e. perceiving that the situation applies to them), and then deciding to respond. Lindell and Perry's (2012) model built upon previous theories such as those described by Perry *et al.* (1981) and Mileti and Sorensen (1987) by developing a detailed conceptual framework called the Protection Action Decision Model (PADM). According to Lindell and Perry's (2012) PADM model, protective action decision making during a hazardous situation begins when people learn of a threat through their experience with one or more sources of information. These include environmental cues (e.g. ground motion from an earthquake), social cues (e.g. seeing others evacuating), and warnings (e.g. messages received either informally from non-official sources such as friends or neighbors or from official agencies such as from the PTWC or emergency management agencies). Warning information in the form of written or audible messages passes through several information sources via multiple information channels (e.g. telephone, cell phone, radio). The information sources for warning messages are social stakeholders that fall into three categories: peers, officials, and media. Peers are individuals such as friends, family, and neighbors. In contrast, officials range in description from personnel such as police and emergency management to local authorities such as village chiefs, while the media include sources such as local news broadcasts. Once information from cues or warnings are received by an individual in danger it is hypothesized that they form three types of perceptions related to: social stakeholders, the hazard itself, and possible protection actions (e.g. moving to higher ground). As part of this process it is incumbent upon the individual(s) in danger to evaluate the feasibility of carrying out necessary protective actions considering their current socioeconomic status and any situational impediments (e.g. uneven terrain caused by earthquake damage) or facilitators (e.g. high ground being nearby and accessible by foot).

Research on tsunami social stakeholders

Previous sociological research on tsunamis and stakeholder perceptions has largely focussed on pre- and post-hazard vulnerability assessments (Bird *et al.*, 2008; Johnston *et al.*, 2005; Steckley and Doberstein, 2011; Wood and Good, 2004), not on at-risk individuals' perceptions of other people and organizations around them during the tsunami event and who may play important roles in protective action decision making. Typically, these former assessments aimed to gather local input on potential tsunami effects from various community members. For example, Wood *et al.* (2002) conducted a

pre-tsunami vulnerability assessment in the USA Pacific Northwest with 13 technical experts and 48 stakeholders, including residents and government officials, to gather perceptions of community vulnerability to earthquakes and tsunamis. Wood and colleagues used these data to strengthen preparedness in the region. In another study, Steckley and Doberstein (2011) examined post-disaster vulnerability perceptions of 40 Thai tsunami survivors of the 2004 Great Sumatra tsunami in the Indian Ocean. Study participants from two local communities identified priority populations for future disaster resilience planning efforts. Although pre- and post-tsunami vulnerability assessments are meaningful, this information does not provide an understanding of how residents view social stakeholders during tsunamis.

Social stakeholder perceptions

There is substantial research on people's perceptions of social stakeholder trust and protection responsibility. Trust is defined as the perceived credibility of the stakeholder to provide accurate information about issues such as human and structural vulnerability to hazard or protective action guidance, while protection responsibility is the degree to which the stakeholder helped protect at-risk individual(s) during hazardous events, such as by saving their lives (Basolo *et al.*, 2009; Christensen *et al.*, 2011; Maestas *et al.*, 2008).

Arlikatti *et al.* (2007) showed that social stakeholders can be evaluated on three traits: technical knowledge of the hazard (e.g. awareness of the magnitude of the hazard), trustworthiness, and protection responsibility. The authors explored general differences in mean ratings in the stakeholder groups and whether they differed by gender, location, and ethnicity. The investigation was a cross-sectional survey of 379 residents from southern California and western Washington in localities of high and medium earthquake risk. The participants rated themselves and six other social stakeholder groups on the three traits in relation to a hypothetical earthquake. The study's results revealed that respondents rated their hazard knowledge as higher than that of their peers but lower than that of authorities and news media. Furthermore, respondents rated authorities and media higher than their peers for trustworthiness. Moreover, respondents' mean ratings for protection responsibility were highest for the respondent themselves and their family, followed by peers and news media, which displayed the lowest mean ranking. Additionally, there was a gender difference in stakeholder perceptions such that female respondents displayed a greater degree of trust in media than males. In addition to Arlikatti *et al.*'s (2007) investigation of stakeholder perceptions, extensive research on human behavior has shown that other social variables such as age and occupation status can be useful in examining differences in population patterns for identifying community interventions (Parsons, 1940; Wray *et al.*, 2006). Also, Paton *et al.* (2008, 2009) discussed how social context such as beliefs about community empowerment and trust influence preparedness for tsunamis in communities at risk from local tsunamis in Alaska and Oregon.

American Samoa

American Samoa is a US territory that lies in the Samoan archipelago (approximately 2,897 km north of New Zealand), with an estimated population of over 55,000 people (US Census Bureau, 2010b). Tuna fishing and processing is the major source of employment on-island, but recent estimates show that unemployment has remained around 30 percent (Central Intelligence Agency, 2014). Culturally, individuals in American Samoa live in close-knit villages where it is common to find several families

of the same ancestral line living in close proximity to one another (Holmes, 1980). Cultural norms in American Samoa are heavily shaped by the Fa'aSāmoa (i.e. the Samoan way of life). Fa'aSāmoa values family (āiga) which not only includes immediate family members but extended relatives as well (Shore, 1982). Each āiga is led by a matai, a chief who serves as a family leader and who is in charge of making major family decisions related to familial issues, internal disagreements, and to represent the family in village affairs (Fitzgerald and Howard, 1990). In a study of resilience and recovery after the 2009 earthquake and tsunami on the island, survivors reported that during the events people expressed an inherent call of duty to help others in need, regardless if they were a family member or not (Brokopp Binder *et al.*, 2014).

Research objective

The current study attempted to extend previous research on tsunami risk communication by investigating tsunami survivors' mean ratings of four social stakeholders who were believed to play a role in peoples' protective active decision making during the 2009 South Pacific earthquake and tsunami in American Samoa. The four social stakeholder groups are: the survey respondents themselves, their peers, officials, and media. The purpose of this study was to examine differences in knowledge, trustworthiness, and protection responsibility with regard to the earthquake and tsunami event in the four social stakeholder groups.

Participants' perceptions of each social stakeholder group were evaluated using Arlikatti *et al.*'s (2007) traits with respect to which social stakeholder was: perceived as most knowledgeable about tsunamis, provided accurate tsunami information (trustworthiness), and most responsible for protecting at-risk residents from the tsunami (protection responsibility). Additionally, the unique effects of demographic moderators (i.e. gender, age, and occupation status) were tested to determine if stakeholder perceptions differed by these variables. According to Cutter *et al.* (2003), these variables can be used to test for meaningful differences in disaster settings. Based on the findings from Arlikatti's study on social stakeholder perceptions with regard to earthquake hazards, we hypothesized:

H1. Respondents would rate officials and media higher than themselves among the stakeholder groups for tsunami knowledge and trustworthiness.

H2. Respondents would rate themselves higher than the other stakeholder groups for protection responsibility.

H3. Mean ratings would differ by gender, age, and occupation status. The information gathered from this study will provide local emergency managers with useful data that could support future disaster resilience efforts for tsunamis and provide an understanding of residents' perceptions of community members that helped save lives during the 2009 earthquake and local tsunami.

3. Event background

Description of tsunami

The tsunami was caused by Mw 8.1 earthquake that began at 6:48 a.m. local time on the northern side of the Tonga trench, approximately 190 km south from American Samoa (Jaffe, 2013; Lay *et al.*, 2010). The tsunami run-up reached up to 12 meters above mean sea level on the western side of Tutuila Island, American Samoa, causing loss of life and significant property damage (Okal *et al.*, 2010).

In total, 34 people in American Samoa lost their lives and many more lost their lives in Samoa and Tonga combined (149 and nine, respectively) (US Geological Survey, 2012). An official warning about the tsunami came 16 minutes after the earthquake occurred, which was insufficient time for those who were confronted by the tsunami minutes before the warning (Fritz *et al.*, 2011). Many residents in American Samoa observed the forceful ground motion caused by the earthquake and the sights of the shoreline receding as the tsunami trough arrived along the coast (Jaffe, 2013). Fritz *et al.* (2011) documented that many people only evacuated after seeing others do so or only after seeing the tsunami. Fritz *et al.* (2011) suggest that conflicting pre-hazard information provided by officials in neighboring Samoa (formerly known as Western or Independent Samoa) about tsunami evacuation in motor vehicles might have hindered the evacuation decisions of those who were in cars. Overall, the proactive evacuation behavior that was exemplified in many of the affected areas has been regarded as extraordinary because post-tsunami evaluation studies show that thousands of people were in the tsunami inundation zone and could have lost their lives on the island (Jaffe, 2013). The positive response has been credited to extensive tsunami education that occurred in schools and local organizations during the months and week before the event. This material is reported to have helped people recognize and react to the earthquake and the tsunami in an effective manner (Dudley *et al.*, 2011; Jaffe, 2013).

4. Materials and methods

The study researchers used data collected from a (Apatu *et al.*, 2013) household survey that occurred in July 2011 within nine Western and two Eastern District villages on the island of Tutuila, American Samoa. In the Western District the study's interviewers endeavored to survey every household in the nine villages. In the Eastern District, the team conducted systematic sampling in which every other household was interviewed after an initial, starting house was chosen randomly. In both localities, the main objective of the survey was to gather information on residents' demographics, protective action decisions, and experiences during the September 2009 earthquake and tsunami. Local interviewers fluent in both English and Samoan administered the questionnaire. Participants were required to be 18 years or older and to have been on Tutuila during the tsunami event. A total of 300 residents were interviewed. Data from the section of the questionnaire that captured age, sex, occupation status, and perceptions of social stakeholders were utilized for this study.

Measures

Dependent variables. Respondents were asked to rate the four social stakeholders (the respondents themselves, their peers, officials, and media) on three traits, which followed Arlikatti *et al.*'s (2007) social stakeholder categories. The traits (i.e. response options) are as follows: hazard knowledge: "To what extent did you think each of the following was knowledgeable about the tsunami hazard?"; trustworthiness: "To what extent did you think each of the following was willing to provide you with accurate information about the tsunami hazard?"; and degree of protection responsibility: "To what extent do you think each of the following was responsible for your protection from the tsunami hazard?" The items were all anchored by a five-point Likert scale from "Not at All" = 1 to "Very Great" = 5.

Independent variables. We classified gender into two groups, male = 0 and female = 1. Age was divided into two groups, young adult (18-29) = 0 and older adults ($\geqslant$30) = 1.

This classification for young adult was based on previous work conducted by Borland *et al.* (2013) and to follow a standard cut off age for young adult documented in the literature. Occupation status was also dichotomized; those who reported not having an occupation were in one group (0) and those who had reported an occupation were in another group (1). More specifically, respondents selected from a list of occupations commonly found in American Samoa. These include: sales, production, transportation, management, fishing, farming, forestry, construction, and other trades, which were recorded by the interviewer. We coded the "other" occupation status as missing to focus on the above classifications listed in the census.

Statistical analysis

To assess general differences in stakeholder perceptions among the study sample, means were calculated for all respondents' social stakeholder ratings. Mean differences were examined by *t*-tests. We then investigated gender, age, and occupational status differences in perceptions of the three traits. MANOVA was used to examine both the independent and dependent variables at a steady $\alpha = 0.01$. Missing data were treated using mean substitution MANOVA. Significant MANOVA tests were then followed by ANOVAs. All analyses were conducted in SPSSVersion 20.

5. Results

Approximately half of the sample was female (50.7 percent) and the average age was 42 ± 14 years. A majority of respondents (59.7 percent) reported having an occupation. Mean ratings for the stakeholder characteristics are shown in Table I. The mean ratings for knowledge among the respondents themselves was statistically higher than officials ($t(299) = 7.358$, $p < 0.001$) and the media ($t(299) = 2.878$, $p = 0.004$). Conversely, there was no significant difference in mean ratings between the respondents themselves and peers ($t(299) = 2.153$, $p = 0.032$). The mean ratings for trustworthiness was statistically higher for the respondents themselves than officials ($t(299) = 9.22$, $p < 0.001$) and the media ($t(299) = 2.687$, $p = 0.008$). In contrast, there was no significant mean difference for trustworthiness ratings of the respondents themselves and peers ($t(299) = -1.086$, $p = 0.278$). Respondents' mean ratings for protection responsibility was statistically higher for themselves than for officials ($t(299) = 14.261$, $p < 0.001$). Additionally, respondents rated themselves higher for protection responsibility than the media ($t(299) = 9.477$, $p < 0.001$) and peers ($t(299) = 7.121$, $p < 0.001$).

The first MANOVA results revealed no overall significant effect for gender (Pillai's trace $= 0.023$, $F(287) = 0.584$, $p = 0.86$); therefore, males and females did not differ in their perceptions of the stakeholder knowledge, trustworthiness, or protection responsibility. Similarly, the second MANOVA findings did not show an overall significant effect for age (Pillai's trace $= 0.0841$, $F(12, 287) = 2.183$, $p = 0.013$) indicating that 18-29 year olds did not differ from older adults $\geqslant$30 years of age. MANOVA revealed a statistically significant overall effect for occupation status (Pillai's trace $= 0.1.59$, $F(12, 188) = 2.959$, $p = 0.001$). This MANOVA was then further tested by three separate ANOVAs for each social stakeholder trait. The first ANOVA indicated statistically significant main effects for occupation status with perceived tsunami knowledge among the respondents themselves and media (see Table II). Statistically significant main effects were revealed for occupation status and tsunami knowledge and themselves, $F(1, 199) = 10.11$, $p = 0.002$; and occupation study and tsunami knowledge and media $F(1, 199) = 9.65$, $p = 0.002$.

Characteristics	*n* (%) or mean ± SD
Gender	
Male	148 (49.3)
Female	152 (50.7)
Age	
18-29	67 (22.3)
⩾30	233 (77.7)
Occupational status[a]	
Yes	120 (59.7)
No	81 (40.3)
Hazard knowledge	
Self	3.7 ± 1.1
Peer	3.6 ± 1.0
Official	3.1 ± 1.1
Media	3.5 ± 1.1
Trustworthiness	
Self	3.8 ± 1.1
Peer	3.9 ± 1.0
Official	3.1 ± 1.2
Media	3.6 ± 1.1
Degree of protection responsibility	
Self	4.3 ± 1.0
Peer	3.9 ± 1.0
Official	3.2 ± 1.2
Media	3.6 ± 1.1

Notes: $n = 300$. SD, standard deviation. [a]There were 99 missing data for occupational status; valid percentages are provided

Table I. Characteristics of participants: a cross-sectional study in American Samoa, 2011

	Stakeholder groups			
	Self	Peer	Official	Media
Occupation status				
Yes	3.9 (0.8)	3.7 (0.8)	3.2 (1.1)	3.6 (0.9)
No	3.4 (1.2)	3.4 (1.1)	2.8 (1.3)	3.1 (1.2)
F	10.11	5.23	5.85	10.26
P	*0.002*	*0.02*	0.016	0.002

Notes: 99 missing cases for occupation. Statistical significance; < 0.01 indicated in italic

Table II. ANOVA results for occupation status and tsunami knowledge

The second ANOVA revealed statistically significant main effects wherein those with an occupation rated themselves, $F(1,199) = 10.579$, $p = 0.001$, peers $F(1, 199) = 8.613$, $p = 0.004$, and the media, $F(1, 199) = 10.072$, $p = 0.002$ higher for trust (see Table III).

The third ANOVA indicated statistically significant main effects for protection responsibility where those that had an occupation rated peers, $F(1, 199) = 0.7932$), $p = 0.005$, and media, $F(1, 199) = 18.606$, $p < 0.001$ higher for the trait (see Table IV). There were no statistically significant interaction effects between the moderator variables and the stakeholder characteristics: (gender × age) = (Pillai's trace = 0.094,

$F(12, 182) = 1.456$, $p = 0.12$); (gender × occupation status) = (Pillai's trace = 0.088, $F(12, 182) = 1.456$, $p = 0.145$); (age × occupation status) = (Pillai's trace = 0.104, $F(12, 182) = 1.762$, $p = 0.057$); (sex × age × occupation status) = (Pillai's trace = 0.047, $F(12, 182) = 0.741$, $p = 0.710$).

6. Discussion

In general, the study showed that respondents regarded themselves more favorable than officials and media for hazard knowledge, trustworthiness, and protection responsibility during the September 29, 2009 earthquake and tsunami. These findings do not support our hypotheses that the respondents would rate officials and media higher for the stakeholder traits. Furthermore, these findings conflict with Arlikatti *et al.*'s (2007) results, which showed that respondents rated officials and authorities higher for the stakeholder traits. Additionally, we did not find mean differences for tsunami knowledge and trustworthiness between the ratings for the respondents themselves and peers. It must be noted that overwhelmingly the mean ratings for officials ranked the lowest among all stakeholder groups. Perhaps residents might slightly mistrust officials due to previous experiences with authorities before, during, or after the September 29, 2009 earthquake and tsunami.

In regard to our gender-specific and age-specific ANOVA analyses, there were no overall effects for gender and age on perceived stakeholder tsunami knowledge, trustworthiness, and protection responsibility. Therefore, we fail to reject the null that there are any differences in stakeholder perceptions among these demographic variables. Conversely, occupation-specific analyses revealed statistically significant results; therefore, we accept our hypothesis that respondents' stakeholder perceptions would vary among those that reported being employed and those that were unemployed. Specifically, for tsunami knowledge, mean ratings for those who had an occupation were higher for the respondents themselves and the media. Similarly, the results showed a statistically significant difference in mean ratings for

Table III. ANOVA results for occupation status and trust

	Stakeholder groups			
	Self	Peer	Official	Media
Occupation status				
Yes	4.1 (0.8)	4.0 (0.9)	3.1 (1.2)	3.8 (0.9)
No	3.6 (1.2)	3.6 (1.0)	2.9 (1.4)	3.3 (1.3)
F	10.578	8.613	2.448	10.072
P	*0.001*	*0.004*	0.119	0.002

Notes: 99 missing cases for occupation. Statistical significance; < 0.01 indicated in italic

Table IV. ANOVA results for tsunami protection responsibility

	Stakeholder groups			
	Self	Peer	Official	Media
Occupation status				
Yes	4.4 (0.70)	4.1 (0.8)	3.3 (1.1)	3.9 (0.9)
No	4.3 (1.0)	3.7 (1.1)	3.0 (1.4)	3.2 (1.2)
F	0.200	7.932	3.813	18.606
P	0.5	0.005	0.058	< 0.001

trustworthiness when those with an occupation rated themselves, peers, and media higher than those without an occupation. Occupational status (those reported being employed vs those that were unemployed) also proved to have a statistically significant effect on mean ratings for protection responsibility. Both those who had an occupation and those without an occupation ranked themselves highest among all of the social stakeholder groups for protection responsibility. Mean ratings for those with an occupation were higher for their peers and the media.

Of the three independent variables, occupation status proved to be the most significant factor that affected how respondents rated each social stakeholder group. Lin (1999) reported that occupational status is tied to a person's access to social resources. Social resources include economic status, power, status, and social ties that are immediately or distally connected to an individual (Wray *et al.*, 2006). Thus, individuals with an occupation could have had more contact and interaction with individuals outside of their social network (Lin *et al.*, 1981). As such, we surmise that respondents with an occupation rated the other social stakeholders higher on the three traits because of their social resources. Therefore, the present study shows that occupation status is a variable that affected people's perceptions of social stakeholders during the September 29, 2009 earthquake and tsunami event.

Future work should build on this study by continuing tsunami workshops and ensuring that both officials and residents are meeting together to strengthen their relationship and trust. Moreover, researchers should further divide the social stakeholder groups that were included in this study and explore various social actors within each stakeholder subgroup. For example, peers could be separately evaluated for perceptions of family, friends, neighbors, and co-workers. Officials might include village chiefs and local emergency managers, and the media could include the various local news broadcast stations.

Although this study provided meaningful insights into local residents' social stakeholder perceptions it was not without limitations. The current study was reliant upon cross-sectional interview survey data, which might be limited given that it relied on self-report data. Additionally, even though we asked respondents to provide ratings of the three traits for the four social stakeholder groups, respondents' answers might have been shaped by their post-disaster perceptions and thus their responses might not truly be accurate of their stakeholder perceptions during the tsunami event. Moreover, given that extensive tsunami education was provided on-island before the tsunami, our respondents' perceptions of the other stakeholders could have been reduced by this fact. Despite these limitations, our study extends previous research such as Kelman (2006) that examined formal tsunami warning systems by providing insights into important questions concerning social context, trust, and protection responsibility for local tsunamis following a real tsunami rather than a hypothetical disaster such as that tested in the Arlikatti *et al.* (2007) study.

7. Conclusions

Local tsunamis force at-risk individuals to make quick protective action decisions to save their lives in a dynamic environment. For example, in areas impacted by an earthquake, the natural and built environments change in response to ground motion – buildings and bridges weaken and collapse, roads become impassable. Once the effects of the earthquake are realized and the first wave in a tsunami washes onshore and recedes, the landscape becomes more greatly affected and difficult to traverse. Consequently, and in order to facilitate protective action decision making, individuals

frequently turn to other community social stakeholders to assist them with finding answers to important questions or with physical response. Questions may include, for example, which protection action should be taken, when should it begin, and when should it be completed? In contrast, individuals may seek assistance in implementing a specific protective action, such inland or vertical evacuation.

In this study we examined people's perceptions of themselves, their peers, officials, and media for three traits: knowledge about the hazard, trustworthiness, and degree of protection responsibility. Findings showed that regarding the September 29, 2009 earthquake and tsunami that struck American Samoa, residents rated themselves highest for knowledge about the hazard during the event and being responsible for their personal safety. Additionally, they rated peers highest for trustworthiness. Respondents rated officials the lowest for all three traits. Furthermore, occupation status was an important factor in differentiating people's perceptions of social stakeholders.

In general, those respondents that reported being employed had more favorable ratings of other social stakeholders. Our findings support pervious research from Birkmann *et al.* (2008) that during a local tsunami people will rely on themselves to protect their lives against tsunamis but will also seek information from other community stakeholders to find answers to unresolved questions or simply to confirm aspects of the information. Confirming information and milling for information are well described in the literature (Mileti *et al.*, 1975; Drabek, 1969). Moreover, results from this study indicate that it is important for people to be employed prior to a tsunami not only to support their daily lives but to expand their social resources, which are of great utility in finding answers to questions and assistance. Self-protection during a local tsunami is indeed a social pursuit that involves the assistance of other social stakeholders.

References

Apatu, E., Gregg, C., Richards, K., Vogt-Sorensen, B. and Wang, L. (2013), "Factors affecting household adoption of an evacuation plan in American Samoa after the 2009 Earthquake and Tsunami", *Hawaiian Journal of Medicine and Public Health*, Vol. 72 No. 8, pp. 267-272.

Arlikatti, S., Lindell, M.K. and Prater, C.S. (2007), "Perceived stakeholder role relationships and adoption of seismic hazard adjustments", *International Journal of Mass Emergencies and Disasters*, Vol. 25 No. 3, pp. 218-256.

Basolo, V., Steinberg, L.J., Burby, R.J., Levine, J., Cruz, A.M. and Huang, C. (2009), "The effects of confidence in government and information on perceived and actual preparedness for disasters", *Environment and Behavior*, Vol. 41 No. 3, pp. 338-364.

Bird, D. and Dominey-Howes, D. (2008), "Testing the use of a questionnaire survey instrument to investigate public perceptions of tsunami hazard and risk in Sydney, Australia", *Natural Hazards*, Vol. 45 No. 1, pp. 99-122.

Birkmann, J., Setiadi, N. and Gebert, N. (2008), "Socio-economic vulnerability at the local level in context of Tsunami early warning and evacuation planning in the city of Padang, West Sumatra", *Paper for the 2008 International Conference on Tsunami Warning*, *Nusa Dua*.

Borland, R., Savvas, S., Sharkie, F. and Moore, K. (2013), "The impact of structural packaging design on young adult smokers' perceptions of tobacco products", *Tobacco Control*, Vol. 22 No. 2, pp. 97-102.

Brokopp Binder, S., Baker, C., Mayer, J. and O'Donnell, C. (2014), "Resilience and recovery in American Sāmoa: a case study of the 2009 South Pacific tsunami", *Journal of Community Psychology*, Vol. 42 No. 7, pp. 799-822.

Central Intelligence Agency (2014), *The World Factbook*, Central Intelligence Agency, available at: www.cia.gov/library/publications/the-world-factbook/geos/aq.html (accessed May 18, 2015).

Christensen, T., Fimreite, A.L. and Laegreid, P. (2011), "Crisis management: the perceptions of citizens and civil servants in Norway", *Administration & Society*, Vol. 43 No. 5, pp. 561-594.

Cutter, S. and Barnes, K. (1982), "Evacuation behavior and three mile island", *Disasters*, Vol. 6 No. 2, pp. 116-124.

Cutter, S., Boruff, B.J. and Shirley, W.L. (2003), "Social vulnerability to environmental hazards", *Social Science Quarterly*, Vol. 84 No. 2, pp. 242-262.

Drabek, T.E. (1969), "Social processes in disaster: family evacuation", *Social Problems*, Vol. 16 No. 3, pp. 336-349.

Dudley, W.C., Whitney, R., Faasisila, J., Fonolua, S., Jowitt, A. and Chan-Kau, M. (2011), "Learning from the victims: new physical and social science information about tsunamis from victims of the September 29, 2009 event in Samoa and American Samoa", *Earth-Science Reviews*, Vol. 107 Nos 1-2, pp. 201-206.

Fitzgerald, M.H. and Howard, A. (1990), "Aspects of social organization in three Samoan communities", *Pacific Studies*, Vol. 14 No. 1, pp. 31-54.

Fritz, H.M., Borrero, J.C., Synolakis, C.E., Okal, E.A., Weiss, R., Titov, V.V. and Liu, P. (2011), "Insights on the 2009 South Pacific tsunami in Samoa and Tonga from field surveys and numerical simulations", *Earth-Science Reviews*, Vol. 107 Nos 1-2, pp. 66-75.

Gregg, C.E., Houghton, B.F., Paton, D., Lachman, R., Lachman, J., Johnston, D.M. and Wongbusarakum, S. (2006), "Natural warning signs of Tsunamis: human sensory experience and response to the December 26, 2004 Earthquake and Tsunami, Thailand", *Earthquake Spectra*, Vol. 22 No. S3, pp. 671-691.

Holmes, L.D. (1980), "Factors contributing to the cultural stability of Samoa", *Anthropological Quarterly*, Vol. 53 No. 3, pp. 188-197.

Jaffe, B. (2013), "Surprises from the deadly September 29, 2009, Samoa tsunami", available at: http://soundwaves.usgs.gov/2009/12/ (accessed May 18, 2015).

Johnston, D., Paton, D., Crawford, G.L., Ronan, K., Houghton, B. and Bürgelt, P. (2005), "Measuring tsunami preparedness in coastal Washington, United States", in Bernard, E.N. (Ed.), *Developing Tsunami-Resilient Communities*, Springer, Dordrecht, pp. 173-184.

Kelman, I. (2006), "Warning for the 26 December 2004 tsunamis", *Disaster Prevention and Management: An International Journal*, Vol. 15 No. 1, pp. 178-179.

Lay, T., Ammon, C.J., Kanamori, H., Koper, K.D. and Hutko, A.R. (2010), "The 2009 Samoa-Tonga great earthquake triggered doublet", *Nature*, Vol. 466, August, pp. 964-968.

Lin, N. (1999), "Social networks and status attainment", *Annual Review of Sociology*, Vol. 2 No. 5, pp. 467-487.

Lin, N., Ensel, W.M. and Vaughn, J.C. (1981), "Social resources and strength of ties: structural factors in occupational status attainment", *American Sociological Review*, Vol. 46 No. 4, pp. 393-405.

Lindell, M.K. and Perry, R.W. (2012), "The protective action decision model: theoretical modifications and additional evidence", *Risk Analysis*, Vol. 32 No. 4, pp. 616-632.

Lindell, M.K., Prater, C.S. and Perry, R.W. (2006), "Emergency stakeholders", available at: http://training.fema.gov/EMIWeb/edu/fem.asp (accessed May 18, 2015).

Maestas, C.D., Atkeson, L.R., Croom, T. and Bryant, L.A. (2008), "Shifting the blame: federalism, media, and public assignment of blame following hurricane Katrina", *Publius: The Journal of Federalism*, Vol. 38 No. 4, pp. 609-632.

Mileti, D.S. and Sorensen, J.H. (1987), "Natural hazards and precautionary behavior", in Weinstein, N.D. (Ed.), *Taking Care: Understanding and Encouraging Self-Protective Behavior*, Cambridge University Press, Cambridge, pp. 189-207.

Mileti, D.S., Drabek, T.E. and Haas, J. (1975), *Human Systems in Extreme Environments*, University of Colorado Institute of Behavioral Science, Boulder, CO.

Okal, E.A., Fritz, H.M., Synolakis, C.E., Borrero, J.C., Weiss, R., Lynett, P.J. and Chan, I.C. (2010), "Field survey of the Samoa tsunami of 29 September 2009", *Seismological Research Letters*, Vol. 81 No. 4, pp. 577-591.

Parsons, T. (1940), "An analytical approach to the theory of social stratification", *American Journal of Sociology*, Vol. 45 No. 6, pp. 841-862.

Paton, D., Kelly, G., Bürgelt, P.T. and Doherty, M. (2006), "Preparing for bushfires: understanding intentions", *Disaster Prevention and Management*, Vol. 15 No. 4, pp. 566-575.

Paton, D., Houghton, B.F., Gregg, C.E., Gill, D.A., Ritchie, L.A., McIvor, D., Larin, P., Meinhold, S., Horan, J. and Johnston, D.M. (2008), "Managing tsunami risk in coastal communities: identifying predictors of preparedness", *The Australian Journal of Emergency Management*, Vol. 23 No. 1, pp. 4-9.

Paton, D., Houghton, B.F., Gregg, C.E., McIvor, D., Johnston, D.M., Burgelt, P., Larin, P., Gill, D.A., Ritchie, L.A., Meinhold, S. and Horan, J. (2009), "Managing tsunami risk: social context influences on preparedness", *Journal of Pacific Rim Psychology*, Vol. 3 No. 1, pp. 27-37.

Perry, R.W., Lindell, M.K. and Greene, M.R. (1981), *Evacuation Planning in Emergency Management*, Health Lexington Books, Lexington, MA.

Rodriguez, H., Quarantelli, E.L. and Dynes, R.R. (2007), *Handbook of Disaster Research*, Springer Science Business Media LLC., New York, NY.

Shore, B. (1982), *Sala'ilua: A Samoan Mystery*, Columbia University Press, New York, NY.

Sorensen, J.H. and Mileti, D.S. (1988), "Warning and evacuation: answering some basic questions", *Organization & Environment*, Vol. 2 Nos 3-4, pp. 195-209.

Steckley, M. and Doberstein, B. (2011), "Tsunami survivors' perspectives on vulnerability and vulnerability reduction: evidence from Koh Phi Phi Don and Khao Lak, Thailand", *Disasters*, Vol. 35 No. 3, pp. 465-487.

US Census Bureau (2010b), "Advance report for selected characteristics for American Samoa", available at: www.census.gov/newsroom/releases/archives/miscellaneous/cb12-tps56.html (accessed May 18, 2015).

US Geological Survey (2012), "Magnitude 8.1 – Samoan Island region", available at: http://earthquake.usgs.gov/earthquakes/eqinthenews/2009/us2009mdbi/#summary (accessed May 18, 2015).

US Geological Survey (2013), "Magnitude 9.0 – Near the east coast of Honsu, Japan", available at: http://earthquake.usgs.gov/earthquakes/eqinthenews/2011/usc0001xgp/#summary (accessed May 18, 2015).

Wood, N., Good, J. and Goodwin, R. (2002), "Vulnerability assessment of a port and harbor community to earthquake and tsunami hazards: integrating technical expert and stakeholder input", *Natural Hazards Review*, Vol. 3 No. 4, pp. 148-157.

Wood, N.J. and Good, J.W. (2004), "Vulnerability of port and harbor communities to earthquake and tsunami hazards: the use of GIS in community hazard planning", *Coastal Management*, Vol. 32 No. 3, pp. 243-269.

World Bank (2011), "The recent earthquake and tsunami in Japan: implications for East Asia", available at: http://siteresources.worldbank.org/INTEAPHALFYEARLYUPDATE/Resources/550192-1300567391916/EAP_Update_March2011_japan.pdf (accessed May 18, 2015).

Wray, L.A., Alwin, D.F., McCammon, R.J., Manning, T. and Best, L.E. (2006), "Social status, risky health behaviors, and diabetes in middle-aged and older adults", *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, Vol. 61 No. 6, pp. S290-S298.

Further reading

Fothergill, A. (1996), "Gender, risk, and disaster", *International Journal of Mass Emergencies and Disasters*, Vol. 14 No. 1, pp. 33-56.

Keim, M.E. (2011), "The public health impact of tsunami disasters", *American Journal of Disaster Medicine*, Vol. 6 No. 6, pp. 341-349.

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.

Mileti, D.S. and O'Brien, P.W. (1992), "Warnings during disaster: normalizing communicated risk", *Social Problems*, Vol. 39 No. 1, pp. 40-57.

US Census Bureau (2010a), "2010 American Samoa demographic profile data", available at: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_DPAS_ASDP3&prodType = table (accessed May 18, 2015).

US Government Accountability Office (2011), "American Samoa and the Commonwealth of the Northern Mariana Islands: employment, earnings and states of key industries since minimum wage increase began", available at: www.gao.gov/new.items/d11427.pdf (accessed May 18, 2015).

Corresponding author

Dr Emma Apatu can be contacted at: emma.apatu@unf.edu