

TECHNICAL REPORT

SURVEY RESEARCH ON STORM SURGE MESSAGE DESIGN

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Survey Research on the Effectiveness of Storm Surge Messaging

Abstract

A survey was conducted to assess how varying message types affect response and, secondly, to gain insight into factors that prevent people from following an evacuation order. The survey was conducted among women in Tacloban City, who chose not to evacuate during Typhoon Haiyan and kept their family at home. The survey results indicate a statistically significant increase in positive responses to evacuation orders with a more personalized and contextualized message. This seems to conform to a relational concept of risk communication. Moreover, there were multiple reasons given for not evacuating, which suggests that remedies in the risk communication process need also be multiple. The report ends with a list of recommendations for crafting messages regarding storm surges.

I. Scope and Purpose of Study

The study was designed to test how storm surge message design can affect responsiveness on the part of the reader. The foremost question is: can we improve how storm surge warnings are constructed, paying attention to language and structure of the message, to increase responsiveness? The goal of the study is to identify ways to improve message design and translate this into practical guidelines.

The literature on risk communication and disaster risk prevention provides considerable guidance on the factors that increase message effectiveness. The literature is reviewed in the next section and summarized in a general, relational concept for risk communication. The concept integrates multiple ideas from the literature and provides a useful general framework for guiding message design. The survey was then designed to test and refine the message design ideas emerging from the conceptual work.

The survey had a secondary goal, which is to identify factors that prevent residents from following an evacuation order. To do this, we studied households in Tacloban City, Philippines, where thousands lost their lives due to the storm surge brought about by Typhoon Haiyan (locally known as Typhoon Yolanda).

These households chose not to evacuate, and the team sought to understand the obstacles to motivating evacuation. This also translates to a number of useful principles for designing storm surge warning and evacuation messages.

2. Theory and Literature

In this section, we review the literature on risk communication --specifically, the issues of empathy and trust and the comparison between narrative and technical approaches to crafting messages. This leads us to a relational concept of risk communication, which encompasses all of these mediating factors. As discussed at the end of this section, the idealized risk communication situation is that of direct face-to-face communication between a person and a trusted other.

II.1 Empathy and Trust

Much work has been done, in different domains of research, in how messages can effect cooperation on the part of the recipient. Beyond the formal, ostensible information being conveyed, it is evident that there is important, tacit knowledge that needs to also be transmitted. This tacit knowledge has to do with the recipient understanding that the message is meaningful to her or him and that both messenger and message are to be trusted. Trust, in turn, is sometimes categorized in two different forms: cognitive trust, meaning belief that the source of the message and source are credible, and emotional trust, which is an affective disposition that the messenger is benevolent and sincere (McKnight & Chervany, 2002).

The cognitive basis of trust can be satisfied when the messenger, a government agency for example, is considered technically authoritative and dependable --this is the basic assumption of the theory of reasoned action (Fishbein and Ajzen, 1975). However, emotional trust can be missing when the messenger is an impersonal, distant body. To some extent, this type of trust is related to the characteristic of empathy, or the ability of the recipient of the message to understand and feel what the messenger is conveying. Part of the research on empathy is echoed by the work, discussed above, on transportation --i.e., when the message is

realistically and vividly conveyed, this can lead to a like empathic experience on the part of the recipient (Hofman, 2001) or perspective-taking (Batson, 2014), either of which can elicit the desired reaction to the message.

The persuasiveness of the message can be affected by the degree to which the recipient identifies with the messenger, which can be related to belonging to the same group, as suggested by social identity theory (McGarty et al., 1994; also Tajfel & Turner, 1986), or through similarity (Byrne, 1997). Empathy and trust can increase with familiarity with the messenger -- whether this involves direct relationship with the latter (Krebs, 1970; May, 1987) or affiliation of messenger and recipient with the same social group (Barr, 1999). The implication, for risk communication, is that people may be positively influenced when receiving a message directly from a relative, friend, or neighbor from that person's same social group. This is at odds with formal communication from government agencies, which usually display two relevant characteristics -- impersonality, which conflicts with the idea that the message be from someone in the recipient's social group of personal social network, and its technical nature, which conflicts with the language used in everyday, interpersonal communication.

Similar to the effect of identification with the source, message effectiveness can increase with identification of the recipient with the story. That is, when the message conjures up memories or thoughts about one's own experience and history, it triggers emotions that can heighten the impact of the message (Dunlop, Wakefield, and Kashima, 2008). In general, emotion inducing messages tend to be better recalled, as found in the fields of marketing (Escalas, Moore, & Britton, 2004; Lang, Dhillon, & Dong, 1995) and health communication (Biener, 2000; Biener et al., 2006; Dillard & Peck, 2000; Pechmann & Reibling, 2006).

A particularly interesting possibility is the effect of receiving messages from one's peers. Some research suggests that messages from peers can score higher on quality and likeability than messages from other sources (Sundar and Nass, 2001; Walther et al., 2010).

This suggests various avenues for investigation. One is the possibility of having the message be conveyed by a specific authority figure known to the recipient or from an organization directly related to the recipient. The other is to have messages coursed through other than official communication. The latter can take the form of informal or sms messages that can then be passed on from person to person within a social network. This can be done through digital media or phone, which preserves the aspect of familiarity. However, some research suggests that it can even be more effective when conveyed directly in face-to-face mode, since direct contact allows facial or bodily cues to facilitate emotional empathy (Iacoboni, 2007). The implication is the need for at least some messages to be put in everyday language that can be spread informally from person to person.

Another ostensibly powerful means of risk communication is through social media, since receiving messages from one's peer group may increase personal identification which may, in turn, increase self-relevance and credibility of the message. As an example, Joyce and Harwood (2014) found public health messages to have had greater effect when the recipients were told that the messages originated from a viral video rather than when they were told that it came from a health agency. The lesson is not one of choosing one route versus the other but to utilize both agency and social media routes of communication.

II.2 Risk Communication: Technical vs. Narrative Approaches

This section reviews the literature on risk communication vis-à-vis extreme weather events and other hazards. As will be discussed, one finding is that more innovative and varied approaches are needed for environmental risk communication in general, and specifically for storm surge. Thus, the use of narratives in a relational model of risk communication is explored.

As Kearney (1994) opined, information on global environmental change has been unsuccessful because it is not generally structured to take advantage of the way people process information. The dominant mode of environmental risk communication has been

‘paradigmatic’ (Bruner, 1986), essentially involving the use of empirical and experimental methods to verify and test for facts and empirical truth, and is a more scientific way of knowing. This should be supplemented with narrative approaches that include stories, case studies or analogies based on historical accounts, personal experience, the experience of others, invented or fictional stories and culturally common stories (Hinyard & Kreuter, 2007).

It is important to personalize information so that it relates to prior knowledge of a particular group. Anderson et al. (1987) have suggested ‘character identification’ and ‘life themes’ as important attributes of text that increases interest, and this is also applicable to non-text. Thus, narratives, which usually have characters and themes, are vital. With the plethora of information bombarding people everyday, information that is neither interesting nor catchy tends to be ignored. Narratives, through the use of characters and themes, also help narrow events on global scales to local/human scales that are neither overwhelming nor complex.

Narrative has been defined by Hinyard & Kreuter (2007:778) as “any cohesive and coherent story with an identifiable beginning, middle, and end that provides information about scene, characters, and conflict; raises unanswered questions or unresolved conflict; and provides resolution.” Some studies have compared the effects of narrative and non-narrative approaches (Table II.2-1). The question of which evidence type (anecdotal/narrative or statistical/base-rate) is most effective has been a topic in different fields of research such as marketing, public policy, health communication, cognitive psychology, mass communication and risk communication for over 60 years (Hornikx, 2007).

Table II.2-1 shows that an equal amount of the studies (thirteen studies each) stated that statistical evidence is more convincing than anecdotal evidence as the other way around. In nine studies, a difference could not be found between the two types of evidence.

In their evaluation of risk communication based on narrative versus technical presentations of information about radon, Golding et al. (1992) tested the hypothesis that people respond better

to risk communication that reflects more closely social-cultural conditions in their own lives. The compared a narrative comprised of personalized accounts of individuals making decisions about radon exposures, with a technical bulletin written in the scientific style (passive voice, general and impersonal language). They found that the readership levels declined less rapidly in the "narrative" group compared to the "technical" group. Their study also highlighted the need to personalize the risk, the need to involve local references, officials and personalities, and credible sources of information to help personalize the risks (Golding et al., 1992; also Desvousges & Rink, 1987).

Baesler & Burgoon (1994) compared the effectiveness of statistical (quantified descriptions) versus report (example, case history, story, narrative) evidence in influencing beliefs. They concluded that all forms of evidence were initially persuasive when compared to information with neither report nor statistical evidences; statistical evidence is generally more persuasive than story evidence over time; and statistical evidence, when combined with vividness, produced immediate, moderate (48hours) and long-term (1 week) persuasion. Betsch et al (2011) found narrative richness (i.e., level of detail) and emotionality to be important factors, as well. Earlier studies (e.g., Taylor and Thompson, 1982; O'Keefe, 1990) found anecdotal information to be more persuasive than statistical. On the other hand, Hoeken (2001) found the opposite effect.

Table II.2-1 Summary of Literature Comparing Statistical/Technical vs. Anecdotal/Narrative

	Author(s)	Year	Design	Result	Variable
1.	Kahneman & Tversky	1973	Base-rate vs. similarity	AN > SI	Judgements
2.	Bar Hillel	1975	Base-rate vs. story	AN > ST	Judgements
3.	Nisbett & Borgida	1976	Base-rate vs. story	AN > ST	Behavior
4.	Borgida & Nisbett	1977	Base-rate vs. concrete	AN > ET	Decision making
5.	Condit	1977	Base-rate vs. clinical strategy	AN > ET	Judgements
6.	Wells & Harvey	1977	Statistical vs. story	ST > AN	Persuasiveness
7.	Jeanette & Taylor	1979	Statistical vs. story	AN > ST	Beliefs
8.	Maria & Powers	1979	Statistical vs. case	AN > SI	Persuasiveness
9.	Linosar & Trope	1980	Base-rate vs. individuating information	AN > SI	Judgements
10.	Hanill, Wilson & Nisbett	1980	Statistical vs. report	AN > ST	Attitude
11.	Maria & Powers	1980	Base-rate information vs. case	AN > ET	Beliefs
12.	Dickson	1982	Abstract statistical information vs. case history information	ET > AN	Judgments
13.	Nadler	1983	Statistical vs. report	ST = AN	Persuasiveness
14.	Kyland	1983	Statistical vs. report	SI = AN	Decision making
15.	Shaner & Rogers	1984	Base-rate vs. case-history	ST = AN	Intention
16.	Koballa	1986	Data-summary vs. anecdotal	AN > ST	Persuasiveness
17.	Ijzerman & Kinder	1987	Statistical vs. report	ST = AN	Attitude
18.	Reyna, Woodruff & Brainerd	1987	Statistics vs. case history	ET = AN	Attitude
19.	Reinard	1988	Statistical vs. anecdotal	AN > ST	Persuasiveness
20.	Baessler	1991	Statistical vs. story	ST > AN	Persuasiveness
21.	Zilman, Hertens & Sundar	1992	Base-rate vs. exemplar	AN > SI	Attributions
22.	Kazleas	1993	Statistical vs. narrative	ST = AN	Attitude
23.	Allen & Preiss	1994	Statistical vs. narrative	ST > AN	Persuasiveness
24.	Baessler & Burgoon	1994	Statistical vs. story	ET > AN	Persuasiveness
25.	Slater & Reuner	1996	Statistical vs. anecdotal	ST > AN	Persuasiveness
26.	Hoeken & van Wijk	1997	Statistical vs. anecdotal	ST = AN	Persuasiveness
27.	Allen et. al	2000	Statistical vs. anecdotal	ST > AN	Persuasiveness
28.	Lox & Lox	2001	Statistical vs. anecdotal	SI = AN	Persuasiveness
29.	Hoeken	2001a	Statistical, anecdotal and causal evidence	ST > AN	Persuasiveness
30.	Hoeken	2001b	Statistical vs. anecdotal	ST = AN	Persuasiveness
31.	Hoeken & Hustinx	2002	Statistical, anecdotal, causal and authority evidence	ET > AN	Persuasiveness
32.	Greene & Brinn	2003	Statistical vs. narrative evidence	ST > AN	Intention
33.	Hoeken & Hustinx	2003	Statistical vs. anecdotal	ST > AN	Persuasiveness
34.	Hornikx	2005	Statistical, anecdotal, causal evidence	SI > AN	Persuasiveness
35.	Hoeken & Hustinx	2009	Statistical, anecdotal, causal and authority evidence	ST > AN	Persuasiveness

Source: Hofstra, C. (2013).

Allen & Preiss (1997) found statistical information to be slightly more persuasive than narrative evidence based on a meta-analysis of 16 studies. Further work by Allen et al. (2000) found that a combination of narrative and statistical information is optimal. The conclusion was that that combined evidence is the most persuasive, followed by statistical evidence, narrative evidence and no evidence, in that order.

Narratives vary in terms of being factual or fictional, told in first or third person, more or less interactive, long or short, etc. and these factors would likely affect a narrative's impact, but studies comparing these variations as a possible moderator of narrative persuasion are lacking (Hinyard & Kreuter, 2007). Communication channels such as print, TV, radio, video, computer and smartphones (Internet, social media) may also influence the effectiveness of narratives, as well as the sources of the narratives. Given differing effects of messages on different people, ample research recommend using multiple modes of message transmission above imply, employing relational approaches alongside conventional modes of risk communication. This means that in addition to national, regional and local advisories, risk information, evacuation orders and shelter arrangements should originate in the neighborhood, rather than blanket statements from the media or public officials (Stein et al., 2010). Community-based participatory approaches to designing and disseminating risk communication, as advocated for by Meredith et al. (2008), should be adopted.

Kazoleas (1993) investigated the relative persuasive effects of quantitative and qualitative evidence on initial attitude change towards seat belt use. They tested the vividness hypothesis (Nisbett & Ross, 1980), which posits that vividness mediates the effect of evidence type on attitude change. They also tested the availability heuristic hypothesis (Kahneman & Tversky, 1973), which posits that judgments are influenced by the relative availability or accessibility of like events in the individuals' memories. The availability heuristic hypothesis predicts that qualitative forms of evidence are more available and accessible in the receiver's cognition processes, and thus predicts greater recall and have a greater impact on decisions

than quantitative evidence. Kazoleas' results revealed that both forms of evidence were equally effective in changing attitudes but the attitude change elicited by the qualitative evidence was significantly more persistent over time than that generated by the quantitative evidence. The study also provided evidence for the availability heuristic hypothesis. However, the study failed to support the vividness hypothesis but the authors noted that this could have been a result of the study's weaknesses.

Kopfman et al. (1998), who are of the opinion that statistical and narrative evidences are equally important, examined the cognitive and affective reactions of both statistical and narrative evidences for organ donation strategies among 90 undergraduate students at a large mid-western university in the US participated in the study. They reviewed the heuristic systematic model of persuasion (Chaiken et al., 1989) which postulates that the two paths that lead to persuasion are a *systematic route* in which careful consideration is given to a persuasive message, and a *heuristic route* in which persuasion results from simple decision rules about factors other than the specific message content. Their results revealed that statistical evidence messages produced greater results on all of the cognitive dependent variables (thoughts, message ratings and causal relevance) while narratives produced greater results on all of the affective variables (anxiety and emotions), and level of prior thought and intent influenced both cognitive and affective reactions to the messages. This result, and Kaplan's (1991) argument that social judgment is a joint product of both cognition and affect indicate that a combination of both statistical and narrative evidence may be more effective.

Connelly & Knuth (1998) argued for the need to consider audience preferences for risk communication of human health concerns related to eating non-commercial Great Lakes fish affected by chemical contaminants. Using printed materials in a mail survey of 3536 residents of Great Lakes states with fishing experience, they measured target audience response to 4 different presentation formats: reading level, use of diagrams vs. text, commanding vs. cajoling tone and qualitative vs. quantitative information in a risk ladder. They found that lower reading level, graphics with

text, cajoling tone and quantitative formats were preferred by the participants but advised that their results be interpreted with caution because of the nature of their sample and the slight differences found between some format types, indicating the effectiveness of both. They concluded that no one communication strategy is likely to have similar effects on all target audiences, so a diversity of approaches and methods of communication is recommended. In addition to written word used in their study, they recommended videotapes, interpersonal contacts and signs or maps with symbols.

Morgan et al. (2002) examined farmers' attitudes toward messages in an agricultural safety campaign and found that narrative-based messages and messages incorporating fear appeals are more favorably evaluated by farmers than messages that simply inform farmers or messages that rely on statistics.

Kreuter et al. (2007) argued for the use of narratives for cancer prevention and control in their theoretical paper. They presented a framework to guide research and application, which they referred to as the typology of narrative application in cancer control. They outlined the distinctive capabilities of narratives as: overcoming resistance, facilitating information processing, providing surrogate social connections and addressing emotional and existential issues. These different capabilities were said to be applicable to different outcomes – prevention, detection, diagnosis, treatment and survivorship.

Betsch et al. 2011 investigated the impact of online narrative information on risk judgments and prevention intentions when statistical information is concurrently present. They argued that risk is theoretically constituted by two variables: the perceived probability of an event and its expected severity. This is supported by the subjective expected utility theory (a multiplicative rules model), which posits that threats will be ignored if either their severity or likelihood is zero. Thus, the study concluded that the effect of narratives is stronger than the effect of statistical information, and even a single narrative, as long as it is an emotional one, may affect risk judgment.

Strange & Leung (1999) examined whether accounts about individuals in concrete situations – read as news or fiction – influenced judgments about social problems' urgency, causes and cures. They developed an episodic recruitment model of causal generalization which posits that exposure to a person-in-situation instance increases the accessibility of scenario-congruent knowledge. That is, people tend to generalize from stories even when the cases presented in the story are not typical. This model was based on Iyengar's (1990) model of episodic news frames where stories that focus on individual actors rather than abstract issues direct attention toward individuals as causal agents, and Rucinski's (1992) personalized bias hypothesis which posits that accounts that focus on individual actors inhibit systemic attributions of responsibility. The study found support for the episodic recruitment model. Results revealed that both news and fictional stories influenced the participants' judgments about the causes of and solutions to the dropout problem in the US (causal generalization) and about the urgency with which policy makers should attend to educational and health care reform (agenda setting). In addition, the influence of the stories on responsibility judgments was facilitated when the accounts evoked memories of similar characters and causal reminders in the minds of readers. Therefore, similar to Price & Czilli's (1996) argument, stories about concrete instances of a problem may be better remembered than issue-centered stories. This is also supported by the exemplification theory (Zillman, 2002), which suggests that concrete incidents, particularly ones related to danger or risk, attract attention and are stored in long-term emotional memory. Such specific examples are also highly accessible and thus tend to influence decision-making.

To summarize, studies have not resolved whether narrative or technical forms of communication exert more influence on belief and behavior, but several studies point to the advantage of employing both simultaneously. When narrative is employed, vividness, richness, personalization, and emotionality can increase the degree of effectiveness.

Relational Approaches to Communicating the Risk of Extreme Weather

The literature on communicating the risks of extreme weather is relatively sparse, compared to studies in other fields (such as cited above). Nevertheless, some observations of this literature can be made.

In this section, we inquire into "relational" approaches to communicating risks of extreme weather. For example, as stated in Morrow & Nadeau's (2013:95), perhaps "we should aim to personalize any information we provide" for tropical and extratropical cyclone forecast products. Morrow et al.'s (2015) study also revealed that survey respondents called for products that can be immediately passed on through social media, such as Twitter and Facebook. Facebook, for example, recently implemented a similar concept (Safety Check) whereby people in a disaster-struck area receive notifications on their timelines to declare their safety for the benefit of their Facebook friends, as well as check to see if their friends are safe too. Therefore, countries and weather agencies can work with Facebook and other social media to broadcast warning products aimed at providing prevention or pre-event safety, rather than disaster response or post-event messages.

Also relevant is the literature on trust, discussed previously, specifically the idea that trust has to

do with not just authority (or competence) but, also, the quality of one's personality being known to the other (or motivation). People will assign greater credibility to a source that is reputable and known to them.

We propose an overall framework that encompasses all these considerations. The idea is, simply: the ideal, or foundational, model of communication is that of face-to-face exchange. Direct conversation allows each person to recognize the other, gain or possess trust in someone known to them, and to interact with or query each other. This type of direct exchange increases understanding and trust. Direct communication allows the listener to gauge the sincerity and even competence of the speaker. This relational model of communication is depicted in Figure 1.

The question, of course, is how to improve communication in situations where there cannot be direct contact between sender (e.g., national weather agency) and receiver (e.g., homeowner). Our response is to suggest that non-direct communication be crafted to simulate or approach the talk and interactivity of direct, face-to-face communication.

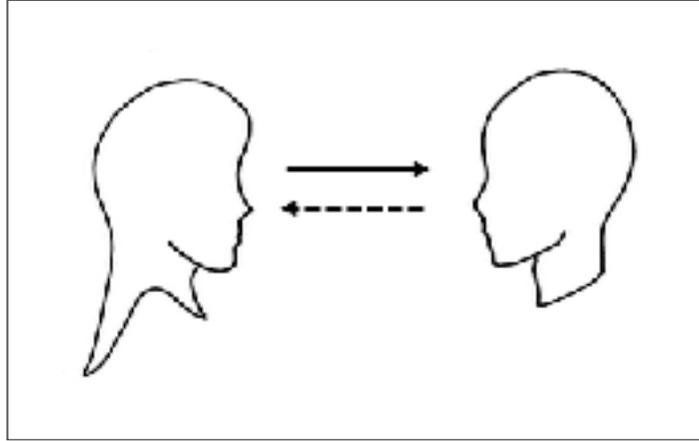


Figure 1. Idealized Communication Condition

This model well depicts a number of observations made by researchers. For example, one study found risk communication through TV and radio to be more effective than SMS texts (USDHS, 2014). This would be consistent with the model shown in Figure 1, where hearing a person's voice (and even seeing the person speak) is closer to the idealized communication condition than written text. Suggestions by researchers that greater personalization and contextualization of messages are more effective (e.g., Morrow, 2015) are consistent with this model, as well.

The model also provides some tentative hypotheses that can be tested in future work. For example, Appendix A discusses some difficulties with relying solely on hazard maps to warn communities about impending storm surges. The relational model developed herein points to another, potentially significant difficulty --a map is an object that communicates knowledge in a way that is impersonal, as opposed to text (even printed words) that approximates words spoken from one individual to another.

The model also provides suggestions for longer-term resilience planning. For example, it suggests that there is a power to eyewitness accounts, where a survivor can speak directly to other communities. For example, having narratives from survivors of Typhoon Haiyan be available to other communities (whether digitally or having testimonies given in person) can be a powerful way of spreading knowledge.

The preceding review gives us some tentative insights that can help us design the study, specifically, the survey. One can interpret the following, moreover, as working hypotheses that will be used to guide the study design.

1. Risk communication practices can take advantage of multiple routes of message processing.

While the theoretical literature often frames cognitive pathways as if they were mutually exclusive, the reality is that people employ multiple pathways simultaneously. In terms of dual process theory, for example, a message may influence people through both central and peripheral pathways. What this means, in practical terms, is that messages can be designed

to maximize effectiveness through different pathways, if possible. Similarly, a message might be primarily processed through a central pathway by one recipient, and peripherally by another --the implication being that, to whatever extent possible, messages might be crafted so as to appeal to multiple modes of cognition.

Another way of going about the same goal (that of appealing to multiple ways of message processing) is to use multiple lines or instruments of communication. Thus, the bulletin from the national weather agency might have a more formal, technical message that is meant to be processed through central pathways, but also include a less technical message, written in everyday language, that recipients can pass on from person to person, utilizing social networks to maximize receptiveness, as implied by social cognition theory. Yet other communication instruments might take advantage of narration or first-person testimonies and visuals to take advantage of transportation effects that increase a person's ability to see themselves in the described situation, which increases self-relevance, vividness, and realism of the scenario being constructed.

2. Contextualization and personalization may increase the self-relevance of messages.

As suggested by both the cognitive psychology and risk communication literature, messages might be more effective if framed in terms that speak to the recipient's immediate situation. This means including elements in the message that speak to details in the recipients context and, perhaps, even include some aspect of communicating directly to the recipient community (whether in the manner the message is transmitted, how it is written, etc.).

3. Narrative modes of communication may increase the transportation effect.

In some cases, storm surge warnings may take more story-like forms. First-person testimonials, narrated videos, and case studies are examples of this. Narrative works by transporting the recipient to the scene, making the depicted scenarios more real, thus increasing the degree to which the person is able to envision self in that situation. Vividness is increased by the use

of video or other means of representing the storm sure.

Narration also, conventionally, involves a narrator telling the audience the story directly. This type of face-to-face communication can be carried out by people disseminating the storm surge warnings directly to others in their social network. This has the added property of increasing self-relevance, as the recipient knows the message is from a relevant source.

4. High elaboration messages require adequate factual information on which to base a decision.

Information overload is one of the situations to be avoided in risk communication. However, ELM theory also posits that there should be enough information for a person to make an informed, calculating decision. Thus, a storm surge warning might need to spell out information regarding impacted areas/communities, timing, surge heights, and degree of hazard.

III.2 Designing the Survey

The survey involves recruiting members of the public in Tacloban City, Leyte Province, Philippines to test two alternative versions of risk communication messages. In addition to testing messages, the survey is also an opportunity to gain information from respondents regarding evacuation behavior during Typhoon Haiyan. The survey will investigate several hypotheses:

H1. Messages (e.g., hazard warnings) that are contextualized and personalized will be more self-relevant to recipients and, thus, can have a greater effect on their understanding of the situation and corresponding behavior.

H2. Reasons for not heeding risk communication messages are related to the lack of self-relevance, lack of vividness, and biases regarding the relative safety of one's home.

H1 was tested by having half of the respondents read one version of a message, and the other half an alternative version --a case control design. H2 was explored by surveying all the

respondents about their decisions regarding evacuation during Typhoon Haiyan.

The details of the survey are discussed below, and the actual survey instrument shown in the Appendix. The survey was translated into the local vernacular (i.e., Waray).

III. Methods

Recruiting Survey Respondents

In this study, the respondents were selected from two barangays, Brgy. 109 and Brgy. 109-A, in Tacloban City, Leyte, Philippines. Residents in these barangays are less traumatized because they were not heavily affected by the onslaught of typhoon Haiyan last November 8, 2013. The participants were married women who did not evacuate during typhoon Haiyan, with no immediate family members who were hurt during the typhoon, and with houses undamaged or only slightly damaged during the typhoon. These characteristics of the research locale and the participants were considered necessary to remove possible bias and to exclude sensitized respondents in relation to occurrence of storm surge.

Data Collection

Initially, the researchers conducted the interview themselves but experienced the problem of access to the respondents due to their limited availability. Thus, the researchers trained two Barangay health workers (BHWs) to do the data collection. BHWs were considered as interviewers because they have access and are trusted in the community. The interviewers randomly visited households from the two barangays and interviewed one woman from each household that satisfied the inclusion criteria. Each of the participant was assigned to a group: A or B. Participants in group A were asked to read a hypothetical warning message about the occurrence of storm surge using a narrative approach while those on Group B received the same warning message but phrased using a formal Bulletin approach of PAGASA. Participants were then asked questions about the likelihood of evacuating, self-relevance, vividness, trust of the sender, and authority of the sender of the message. The participants rated these five aspects of the message using a

scale from 1 to 7. They were also asked to answer questions about their typhoon Haiyan experience such as the reason for not evacuating, and to locate their houses in a flood risk hazard map and likewise interpret the said map.

Survey Instrument

The survey questions are found in the Appendix to this report. An important aspect of the survey was the comparison of willingness to evacuate between a group that received a narrative-like message (Group A) and a group that received a standard technical bulletin (Group B). The respective messages are shown below.

Message A

To residents of Barangay Pablo,

According to PAGASA, our barangay may experience a storm surge of 1 ft (up to your knees) tomorrow. You and your family may be in danger. Even if low, you may be swept by the water and carried away. You or your family can be hurt or even drown as the fast-moving water carries you. Please evacuate immediately. Call me should you need assistance.

Your tanod and PAGASA liaison,
Mariano Loreto.

Message B

PAGASA forecast: 1 ft storm surge by tomorrow.
Risk: Possible danger as this level of surge can sweep people away.
Hazard: Possible injuries from trauma or drowning from flood.
Recommendation: evacuation of residents in affected area.

The survey instrument also inquired into reasons for not evacuating during Typhoon Haiyan. Lastly, respondents were provided a storm surge inundation map and asked whether they could locate their homes on the map and interpret the map properly.

Data Analysis

Groups A and B were compared based on their responses with respect to the likelihood of evacuating, self-relevance, vividness, trust of the sender, and authority of the sender of the message. Two sample t test was used to assess the significance of the difference of the responses on these five aspects of the message. Also, frequencies and percentages were computed to further describe the participants in terms of their typhoon Haiyan experience and

the use of flood risk hazard maps. R statistical software was used in the data analysis.

IV. Results and Discussion

The characteristics of the survey respondents are summarized in Table 1. Since a major purpose of the survey is to test differences in message effectiveness between two groups (Group A, which received an enhanced narrative-like message, and Group B, which received a default technical bulletin), one concern is the possibility of significant differences in demographics or other variables between the two groups (since such differences can confound or dilute any effects of message design). The comparisons found on Table 1 indicate that differences between groups are relatively small (e.g., not a statistically significant difference in mean age between the two groups, p value of 0.368).

Table 1 Characteristics of Respondents

Characteristic	Group A		Group B		Total		Test Statistic p-value	
	No.	%	No.	%	No.	%		
Age	<i>(mean±s.d.)</i>		<i>(56.1±15.5)</i>		<i>(53.1±15.9)</i>		<i>(54.6±15.7)</i>	
	<i>21-30</i>	2	4.44	5	11.1	7	7.8	0.906 ^a
	<i>31-40</i>	9	20.0	6	13.3	15	16.7	0.368
	<i>41-50</i>	6	13.3	5	11.1	11	12.2	
	<i>51-60</i>	6	13.3	11	24.4	17	18.9	
	<i>60 and above</i>	22	48.9	18	40.0	40	44.4	
Number of Children	<i>(mean±s.d.)</i>		<i>(3.36±2.2)</i>		<i>(3.44±2.1)</i>		<i>(3.40±2.1)</i>	
	<i>0</i>	0	0.0	2	4.4	2	2.2	-0.198 ^a
	<i>1-3</i>	29	64.4	27	60.0	56	62.2	0.844
	<i>4-6</i>	11	24.4	12	26.7	23	25.6	
	<i>7-9</i>	5	11.1	4	8.9	9	10.0	

Education

<i>Elementary Level/Graduate</i>	1	2.2	2	4.4	3	3.3	3.843 ^{b,c,d}
<i>Secondary Level/Graduate</i>	4	8.9	10	22.2	14	15.6	0.146
<i>College Level/Graduate</i>	29	64.4	22	48.9	51	56.7	
<i>Graduate Level or Higher</i>	11	24.4	11	24.4	22	24.4	
Income							
<i>No answer</i>	4	8.9	3	6.7	7	7.8	5.851 ^{b,d}
<i>Less than 5000</i>	9	20.0	16	35.6	25	27.8	0.211
<i>6000-10000</i>	6	13.3	7	15.6	13	14.4	
<i>11000-15000</i>	8	17.8	4	8.9	12	13.3	
<i>16000-20000</i>	5	11.1	8	17.8	13	14.4	
<i>21000 and above</i>	13	28.9	7	15.6	20	22.2	
Employment							
<i>no answer</i>	2	4.4	2	4.4	4	4.4	0.069 ^{b,d}
<i>housewife</i>	15	33.3	16	35.5	31	34.4	0.995
<i>self-employed</i>	5	11.1	5	11.1	10	11.1	
<i>government/private employee</i>	9	20.0	9	20.0	18	20.0	
<i>retired employee</i>	14	31.1	13	28.9	27	30.0	

^a Two sample t-test ^b Chi-square test ^c Elementary/Secondary Level/Graduate combined because of very low frequencies ^d No answer category not included in computation

Survey responses to varying storm surge messages (Table 2) indicate a statistically higher positive response (in terms of willingness to evacuate) from Group A compared to Group B (5.156 versus 3.711, $p < 0.05$). Moreover, Message A registered higher in vividness and self-relevance, but no statistically significant difference in trust and smaller difference in authority. So, the message can emulate characteristics of direct face-to-face communication, where the sender is a person known to the receiver, and the message directly addresses the receiver's situation. This effect is enhanced by the wording of the message, which is written in second-person (i.e., addressed to "you").

(ii) fear of theft from home while at the evacuation center,

(iii) underestimating the risk from the storm surge was great,

(iv) negative perception of the evacuation center, and

(v) uncertainty over what a storm surge is.

It would be good if messages were designed with the above factors in mind. This means addressing concerns such as those expressed over conditions at the evacuation center and over possible theft in their homes. Messages should be crafted that respond to these concerns and, also, backed by measures on the ground (such as improving conditions at the evacuation center).

Table 2. Comparison of Means, Storm Surge Message (n =90)

Survey Item	Mean (Group A)	Mean (Group B)	t	p
Likelihood of Evacuating (1 to 7)	5.156	3.711	3.564	0.0003**
Self-Relevance (1 to 7)	5.667	4.636	2.962	0.0020**
Vividness (1 to 7)	5.511	4.667	2.290	0.0122**
Trust (1 to 7)	5.467	5.311	0.4679	0.3205
Authority (1 to 7)	5.444	5.000	1.4695	0.0726*

* greater than 90% confidence; ** greater than 95% confidence.

The survey also inquired into the reasons respondents gave for not evacuating during Typhoon Haiyan. The responses are shown in Table 3. The first observation is that many (in fact, most) of the possible reasons were rated highly (around or above 3.0). This means that there are many factors that keep residents from following evacuation orders, which means improving the situation would involve multiple remedies.

The most highly rated reasons are (in order of highest to lowest):

(i) a feeling that their home was the safest place to be,

Tables 4a and 4b summarize responses around the questions related to interpretation of a storm surge inundation map. About 22% could not interpret the map, and about 14% said they could not locate their home on the map. In the case of the respondents who reported an ability to interpret the map, it is unclear whether they, in fact, could use the map properly (e.g., whether their estimate residential locations in fact match well with their actual residential address).

Table 3. Summary Statistics: Questions about Typhoon Haiyan (n =90)

Item	Response Distribution (%)				Mean
	1	2	3	4	
I did not hear about or know about the coming flood/ or storm surge.	40.0	13.3	25.6	21.1	2.278
I heard about the flood/storm surge but did not think the risk was great.	13.3	15.6	27.8	43.3	3.011
I felt my home was the safest place to be.	6.7	6.7	18.9	67.8	3.478
I did not like to stay at the evacuation center.	16.7	16.7	17.8	46.7	2.966
Storm warnings in the past, before Yolanda, are usually exaggerated, nothing usually happens.	13.3	18.9	33.3	34.4	2.889
I heard about the storm surge but the information was unclear about what a storm surge is.	18.9	12.2	26.7	42.2	2.922
I did not think that the information about the storm surge applies to me or my local area.	15.5	23.3	24.4	36.7	2.822
I was afraid to leave my home because someone may break in and rob us.	23.3	4.4	16.7	55.5	3.044
I was waiting for some official or person I know to inform us [about the storm surge?] in person.	43.3	15.6	17.8	22.2	2.191

Table 4a. Response Distribution on Map Interpretation

What is the map telling you?	Group A		Group B		Total	
	n	%	n	%	n	%
no answer/missing	5	11.1	15	33.3	20	22.2
house location possibility of deep flood/flood risk	2	4.4	3	6.7	5	5.6
our location is safer	15	33.3	3	6.7	18	20.0
Our area is not prone to flooding/no flooding	12	26.7	16	35.6	28	31.1
improvement of drainage system is necessary	1	2.2	1	2.2	2	2.2
far from danger zone	0	0.0	2	4.4	2	2.2
flooding is minimal, recedes immediately, only when it rains hard	0	0.0	2	4.4	2	2.2
shows our home location	3	6.7	1	2.2	4	4.4
map is not clear	3	6.7	1	2.2	4	4.4
shows flood depth	2	4.4	1	2.2	3	3.3
need to evacuate	1	2.2	0	0.0	1	1.1
map is a good indicator	1	2.2	0	0.0	1	1.1

Table 4b. Storm Surge Map (n=90)

Item	Response		
	Yes	No	No Answer
Can you find your home on the map above? Please put an X where you think your home is.	78.9	14.4	6.7

Table 5 summarized responses regarding the source of information regarding storm surge. Responses indicate that, in Tacloban City, perhaps the most prevalent sources of warnings were TV and radio, with friends/relatives next.

Internet and news sources were less than these. What the table emphasizes is that people in Tacloban receive warnings through a redundant, overlapping set of sources.

Table 5. Recipients of Storm Surge Warnings

Question	GROUP A		GROUP B		TOTAL	
	No.	%	No.	%	No.	%
Source of information regarding storm surge*						
<i>tv</i>	25	55.6	19	42.2	44	48.9
<i>radio</i>	20	44.4	15	33.3	35	38.9
<i>internet</i>	1	2.2	3	6.7	4	4.4
<i>news</i>	0	0.0	4	8.9	4	4.4
<i>friends/relatives/officemates/neighbors</i>	9	20.0	3	6.7	12	13.3
<i>newspaper</i>	0	0.0	2	4.4	2	2.2
<i>after the typhoon</i>	1	2.2	0	0.0	1	1.1
<i>during the typhoon</i>	0	0.0	1	2.2	1	1.1
<i>PAGASA</i>	0	0.0	1	2.2	1	1.1
<i>no source/information at all</i>	4	8.9	2	4.4	6	6.7
<i>no answer</i>	2	4.4	4	8.9	6	6.7
Normally, who would be the one to receive information about flood warnings (you or husband or children)?						
<i>Wife</i>	9	20.0	15	33.3	24	26.7
<i>Husband</i>	23	51.1	15	33.3	38	42.2
<i>Children</i>	4	8.9	3	6.7	7	7.8
<i>Others</i>	7	15.6	7	15.6	14	15.6
<i>No answer</i>	2	4.4	5	11.1	7	7.8
Normally, who makes the decision about whether to evacuate or not (you or husband or children)?						
<i>Wife</i>	5	11.1	15	33.3	20	22.2
<i>Husband</i>	27	60.0	17	37.8	44	48.9

<i>Children</i>	2	4.4	1	2.2	3	3.3
<i>Others</i>	9	20.0	8	17.8	17	18.9
No answer	2	4.4	4	8.9	6	6.7

**Multiple answer*

V. Conclusion

In this study, different strands of the risk communication literature were synthesized into a reasonably comprehensive model that combines much of their combined logic into a relatively simple framework. The model we propose posits an idealized situation where communication takes place directly between individuals conversing face-to-face. Such a model would have considerable implications for situations where there is no possibility of face-to-face interaction (e.g., communicating through official bulletins or through an agency website). An immediate implication is that message texts should be designed upon the model of someone speaking directly to another.

We test this model of communication by designing a survey study comparing two versions of a storm surge warning: one based on a standard technical bulletin, and another based on a more narrative form. Results suggest greater responsiveness to the narrative form, which rated better in terms of vividness and trustworthiness.

The survey also inquired into people's reasons for not heeding an evacuation order. These factors should also be considered in message design.

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APPENDIX A

Survey Instrument

ID: _____

Group A

Part I. Background Information

Please fill in the blanks.

Age: _____ years

Address: _____

Nearest Street Corner: _____

Married (Yes or No)? : _____

Children (Yes or No)? _____ If Yes, how many children: _____

Total Monthly Family Income: _____ Pesos per month

Employment (if any) : _____

Education (Highest Attainment): _____

Previous Diagnosis of Malaria (Yes or No)? _____

Were you or your family personally affected
by Typhoon Yolanda (Yes or No)? _____
If Yes, how? _____

Did you and your family evacuate during Typhoon Yolanda (Yes or No)? _____

Part II.

Please read the message below, then answer the questions below.

BULLETIN

DOH advisory: Significant risk of malaria in densely populated communities in parts of the Visayas.

Transmission: Anopheles genus mosquito which is endemic to the region.

Symptoms: Chills, high fever, and nausea.

Recommendation: Receive RTS,S malaria vaccine from DOH, charge for vaccine is PhP50.

Contact local DOH or barangay office should more information or assistance be needed.

QUESTION

After reading one of the previous message, respondents will answer the following question:

Based on the previous message, how likely are you to request the malaria vaccine from the DOH center?

- (1) I definitely will not
- (2) I probably may not
- (3) Undecided, maybe not
- (4) Undecided, maybe
- (5) I more probably will
- (6) I definitely will.
- (7) I will do so immediately!

How much did the message vividly describe the situation? Choose one of the following (1 to 7).

- (1) Not at all.
- (2)
- (3)
- (4) In between.
- (5)
- (6)
- (7) Very much.

How much did you trust the one sending the message? Choose one of the following (1 to 7).

- (1) Not at all.
- (2)
- (3)
- (4) In between.
- (5)
- (6)
- (7) Very much.

How much authority does the sender of the message have? Choose one of the following (1 to 7).

- (1) None at all.
- (2)
- (3)
- (4) In between.
- (5)
- (6)
- (7) Very much.

Part III.

Please read the message below, then answer the questions on the next page.

MESSAGE

Dear Resident,

According to PAGASA, our barangay may experience a storm surge of 1 ft tomorrow. A 1 ft surge will go up to your knees but will also have a high velocity. You and your family may be in danger. Even if low, you may be swept by the water and carried away. You or your family can be hurt or even drown as the fast-moving water carries you away. Please evacuate immediately. Call me should you need assistance.

Your tanod, Mariano Loreto.

QUESTION

After reading the previous message, please answer the following questions.

Based on the previous message, how likely would you be to evacuate your home?

- (1) I definitely will not
- (2) I probably will not
- (3) Undecided, maybe, maybe not
- (4) Undecided, maybe
- (5) I will probably evacuate
- (6) Yes, I will evacuate by tomorrow
- (7) Yes, I would evacuate right now!

How much did the message vividly describe the situation? Choose one of the following (1 to 7).

- (1) Not at all.
- (2)
- (3)
- (4) In between.
- (5)
- (6)
- (7) Very much.

How much did you trust the one sending the message? Choose one of the following (1 to 7).

- (1) Not at all.
- (2)
- (3)
- (4) In between.
- (5)
- (6)
- (7) Very much.

How much authority does the sender of the message have? Choose one of the following (1 to 7).

- (1) None at all.
- (2)
- (3)
- (4) In between.
- (5)
- (6)
- (7) Very much.

Part IV. Typhoon Yolanda

During Typhoon Yolanda, what are the reasons you did not evacuate? Please feel in the blank below or just tell us your answer.

Also, please feel free to rate the following possible answers with

0 if the answer does not apply to you,

√ if the answer applies to you,

√√ if it applies quite a bit to you, or

√√√ if it applies very much.

- _____ I did not hear about or know about the coming flood/storm surge.
- _____ I heard about the flood/storm surge but did not think the risk was great
(source of information regarding flood/storm surge: _____)
- _____ I felt my home was the safest place to be.
- _____ I did not like to stay at the evacuation center (reason: _____)
- _____ Storm warnings in the past are usually exaggerated, nothing usually happens.
- _____ I heard about the storm surge, but the information was unclear about what a storm surge is.
- _____ I did not think the risk applied to my particular area, just the general area.
- _____ I was waiting for some official or person I know to inform us in person.

Other Reason:

ID: _____

Part V. Receipt of Honorarium

Please be advised that the messages you just read are all hypothetical. There is no warning of typhoon or storm surge forthcoming and no warning of a malaria outbreak. This is just for a study being conducted by the University of the Philippines.

In appreciation of your help, we would like to offer you the enclosed honorarium (voucher to use at Jolibee).

Please sign below to acknowledge receipt of the honorarium and to acknowledge your agreement to participate in the survey.

Print Name: _____

Signature: _____

Date: _____

ID: _____

Group A

Part I. Background Information

Please fill in the blanks.

Age: _____ years

Address: _____

Nearest Street Corner: _____

Married (Yes or No)? : _____

Children (Yes or No)? _____ If Yes, how many children: _____

Total Monthly Family Income: _____ Pesos per month

Employment (if any) : _____

Education (Highest Attainment): _____

Previous Diagnosis of Malaria (Yes or No)? _____

Were you or your family personally affected
by Typhoon Yolanda (Yes or No)? _____

If Yes, how? _____

Did you and your family evacuate during Typhoon Yolanda (Yes or No)? _____

Part II.

Please read the message below, then answer the questions below.

MESSAGE

Dear Resident.

Your barangay has been identified as a high-risk area of malaria. Malaria is caused by mosquito bites and is a dangerous disease. If you or your family members get malaria, you may experience chills, high fever, and nausea. You should act quickly. We are making available for you a new RTS,S malaria vaccine at a cost of only PhP50 --just go to the nearest barangay health center or lying-in center. Please contact me if you have questions.

Sincerely,
Edgar Ramirez, Municipal Health Officer.

QUESTION

After reading one of the previous message, respondents will answer the following question:

Based on the previous message, how likely are you to request the malaria vaccine from the DOH center?

- (1) I definitely will not
- (2) I probably may not
- (3) Undecided, maybe not
- (4) Undecided, maybe
- (5) I more probably will
- (6) I definitely will.
- (7) I will do so immediately!

To what extent did the message vividly describe the situation? Choose one of the following (1 to 7).

- (1) Not at all.
- (2)
- (3)
- (4) In between.
- (5)
- (6)
- (7) Very much.

How much did you trust the one sending the message? Choose one of the following (1 to 7).

- (1) Not at all.
- (2)
- (3)
- (4) In between.
- (5)
- (6)
- (7) Very much.

How much authority does the sender of the message have? Choose one of the following (1 to 7).

- (1) None at all.
- (2)
- (3)
- (4) In between.
- (5)
- (6)
- (7) Very much.

Part III.

Please read the message below, then answer the questions on the next page.

BULLETIN

PAGASA forecast:	1 ft storm surge by tomorrow, according to PAGASA storm surge model.
Risk:	Possible danger at this level of surge, high velocity flowrate.
Hazard:	Possible injuries from trauma or drowning from flood.
Recommendation:	Evacuation of residents in affected area.

QUESTION

After reading the previous message, please answer the following questions.

Based on the previous message, how likely would you be to evacuate your home?

- (1) I definitely will not
- (2) I probably will not
- (3) Undecided, maybe, maybe not
- (4) Undecided, maybe
- (5) I will probably evacuate
- (6) Yes, I will evacuate by tomorrow
- (7) Yes, I would evacuate right now!

To what extent did the message vividly describe the situation? Choose one of the following (1 to 7).

- (1) Not at all.
- (2)
- (3)
- (4) In between.
- (5)
- (6)
- (7) Very much.

How much did you trust the one sending the message? Choose one of the following (1 to 7).

- (1) Not at all.
- (2)
- (3)
- (4) In between.
- (5)
- (6)
- (7) Very much.

How much authority does the sender of the message have? Choose one of the following (1 to 7).

- (1) None at all.
- (2)
- (3)
- (4) In between.
- (5)
- (6)
- (7) Very much.

Part IV. Typhoon Yolanda

During Typhoon Yolanda, what are the reasons you did not evacuate? Please feel in the blank below or just tell us your answer.

Also, please feel free to rate the following possible answers with

0 if the answer does not apply to you,

√ if the answer applies to you,

√√ if it applies quite a bit to you, or

√√√ if it applies very much.

- _____ I did not hear about or know about the coming flood/storm surge.
- _____ I heard about the flood/storm surge but did not think the risk was great
(source of information regarding flood/storm surge: _____)
- _____ I felt my home was the safest place to be.
- _____ I did not like to stay at the evacuation center (reason: _____)
- _____ Storm warnings in the past are usually exaggerated, nothing usually happens.
- _____ I heard about the storm surge, but the information was unclear about what a storm surge is.
- _____ I did not think the information applied to me or my local area.
- _____ I was waiting for some official or person I know to inform us in person.

Other reason:
