

Survival communication under uncertainty and complexity: A review



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ABSTRACT

This study aims to propose the concept of survival communication in arbitrating the comprehension and interpretation of risk information during cascading disasters under uncertainty and complexity. A broad content review and synthesis were conducted based on the literature on notions of risk and crisis communication published before 2015. A concept of survival and communication was framed and discussed through the review of the literature and lessons from two cascading disasters. During cascading disasters, the public may be exposed to massive general risk information through various channels. The information often may not be on time or limited due to the cascading effect, including natural disasters with sequential events, damaged social infrastructure, insufficient information sources, and insufficient expertise knowledge. Accessing and understanding the risk information is key to supporting decision-making on time and disseminating information to protect people by themselves, particularly in a small-scale community. The public may need different information depending on a situation that could help deal with emergencies and decision making, support understanding and interpreting risk information by their language, and apply their knowledge to emergency activities. Based on that, this study proposes a concept of survival communication that is defined as a system that is organized for supporting multi-way communication for disaster risk and emergency information to protect individuals' lives during cascading disasters until the arrival of professional first responders at the disaster scene. Proposed survival communication could enhance disaster literacy on the basis of target-oriented risk information, experiences, wisdom, and local knowledge and reduce risks containing uncertainty and complexity of cascading disasters.

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1. Introduction

Industrialization, urbanization, the concentration of the population, and the aging society have emerged with high interconnection all over the world (Ikeda and Nagasaka, 2011; Pescaroli and Alexander, 2015; Schultz, 2006). With these changes, recent disaster patterns have shown cascading disasters that generate more severe consequences and sequential and/or simultaneous impacts. Unlike singular natural or human disasters, cascading disasters cause more complicated emergencies that require identifying where and what the needs for

response and survival are due to the complexity and uncertainty.

In order to reduce the risks of cascading disasters and minimize the consequences, global communities and multidisciplinary experts have made varying efforts over several decades (McEntire, 2001; O'Brien et al., 2006; Shiwaku and Shaw, 2008). Relevant research groups and experts have suggested applying effective risk communication, which began reducing food risks in the 1970s, and crisis communication for governments and businesses since the 1990s. Mainly, risk communication facilitates adequate disaster risk management and enhances disaster risk awareness of citizens using educational programs, including training and drills, and risk information disclosure that could be applied to the life span of disasters and emergencies (Eisenman et al., 2007; Shaw et al., 2004).

Although risk communication is literally well-known as interactive two ways communication

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between risk information senders and receivers, the recent studies identified risk communication is still in the way of top-down (Höppner et al., 2012). Moreover, risk communication is evidenced as a critical measure to support building environments for enhancing social capacity (Kuhlicke et al., 2011) to deal with potential disasters (Adger et al., 2005; Kuhlicke and Steinführer, 2010). However, a study revealed a gap between a theoretical and practical approach to implementing risk communication in reality by looking at the basis of literature and practices in Europe (Höppner et al., 2012). It also indicated the current risk communication adapts one-way dialogue among all stakeholders, including citizens, authorities, decision-makers, and experts. However, comprehended two-way risk communication is highlighted to increase risk awareness and knowledge.

Risk communication, in general, focuses on delivering available risk information, not considering the receiver's environments or conditions in the same way as the top-down approach before disasters break out (Pescaroli and Alexander, 2015). On the other hand, crisis communication contains information to deal with emergencies and business continuity plans (well-known as BCP). The public can be exposed to disaster information and knowledge from various sources, including social network systems, mass media, and education. However, the uncertainty and complexity of cascading disaster risks and the potential impact are still rarely considered in the applicable contents that could be shared with the public. The reason is that information often is not appropriately applied to all different situations and environments is a lack of experts and knowledge on the uncertainty and complexity of cascading disasters. In addition, critical information may not reach the public due to the highly interconnected social infrastructure that could be destroyed during cascading disasters. Thus, citizens need to know how to protect themselves, collect necessary information, and apply it to their varying situations through flexible interpretation when professional responders and resources are not available.

Due to the pandemic that we are experiencing now, the importance of communicating risk information has been underlined. Some studies proved that individual engagement is essential in reducing the risks of infecting viruses, particularly in vulnerable groups (Tambo et al., 2021; Wieland et al., 2021). Furthermore, it might be considered adapting to more complex and uncertain disasters during the pandemic that could be defined as cascading disasters. However, there is rare consideration on parties of individuals laid on the end of the communication channel and its implementation. Thus, the aim of this paper is to review the literature and analyze disaster cases to suggest an appropriate risk communication for promoting effective individual engagement and enhancing community coping capacity in an emergency. First, this study investigates how risk

and crisis communications have been established theoretically by looking at previous footsteps. In addition, this study discusses the roles of individuals are an essential factor in preparing for cascading disasters by looking at the lessons of earlier disasters, which are the 2005 Hurricane Katrina and the 2011 Great East Japan Earthquake and Tsunami. Then, lastly, we propose a concept of 'survival communication' considering various individual and environmental conditions under uncertainty and complexity of cascading disasters by looking at the review and cases.

2. Methods

Electronic databases were searched from Internet search engines to find relevant literature, such as published books, reports, and journal articles on risk information sharing types in different emergency conditions and practical implementation, theoretical concepts, and risk communication practices. In addition, articles on the major cascading disasters were investigated. Google Scholar search engine was used with the terms: Risk communication; crisis communication; risk information; risk information disclosure; business continuity plans; emergency management; community engagement; disaster literacy. The search included only written in English published in 2015. A total of 59 articles were retrieved from the initial examination. In addition, articles that met the initial searching criteria but were not related to the aim of this study and 16 study articles, books, and reports were included in this study. The reviewed literature was analyzed using the content analysis method, as a qualitative research method, to better understand the concept of risk and crisis communication and provide an opportunity to give insights into the differences between risk and crisis communication. Moreover, two cascading disasters that were among the most terrifying in the recent two decades were selected to obtain lessons from past experiences. The cases were qualitatively analyzed using three keywords, system, risk and crisis communication, and decision-making.

3. Results

3.1. Risk and crisis communication

For decades, there have been vigorous efforts to reduce increasing disaster risk and prepare for potential consequences through increasing risk perception and awareness. Among those efforts, risk communication has been applied to share and disclose disaster risk information among multi-stakeholders, including governmental and non-governmental organizations (NGOs), industries as private sectors, expert groups, and general citizens (Covello et al., 1986). The concept of risk communication was initiated as an efficient two-way to communicate food safety in the 1980s (Ball et al.,

1998) and expanded to different fields such as health care and risk and disaster management in the 1990s. It is focused on the risk message related to the possibility of severe threats (Covello, 1992; Freimuth et al., 2000) that targets all stakeholders extensively (Renn and Levine, 1991). The government adopted the concept in the lifespan of disasters and tried to communicate with all stakeholders (Bradley et al., 2016). Also, they have transferred risk information to their citizens to avoid disaster risks before and during disasters.

Theoretically, risk communication was introduced in different ways. It is defined as "an interactive process of exchange of information and opinion among individuals, groups, and institutions" (NRC, 1989) and "the exchange of information among interested parties about the nature, magnitude, significance, or control of a risk" (Covello, 1992). In addition, risk communication is introduced as an interactive two-way system for exchanging information regarding risks and benefits between experts and citizens (Ahl et al., 1993). Synthetically, risk communication is a process to share risk information and knowledge among all stakeholders in order to better manage disaster risks, which contain uncertainty and complexity, and the government's decisions and change the public's behavior.

On the other hand, the notion of crisis communication emerged in the 1990s. It is designed to protect businesses, companies, or organizations facing crises (Bundy et al., 2017; Coombs, 2007; De Wolf, 2013). Crisis communication requires strategically to serve strategic information that must solve crises timely and minimize damages (Holladay,

2009). In addition, crisis communication focuses on protecting stakeholders from hazards under uncertainty and unpredictability (Bundy et al., 2017) through transmitting necessary information to responders, which are companies or organizations, to maintain their reputation and businesses during a crisis (Fearn-Banks, 2016).

Some studies defined crisis communication as "the perception of an unpredictable event that threatens important expectancies of stakeholders and can seriously impact an organization's performance and generate negative outcomes" (Coombs, 2007) and "verbal, visual, and written interaction between the organization and its stakeholders (often through the media) before, during, and after a negative occurrence" (Fearn-Banks, 2016). The other studies mentioned that crisis communication is all information processes from the collection to transfer for crises (Holladay, 2009; Coombs, 2021). Compared to risk communication, crisis communication is more related to response and recovery during a crisis as specific moments in the perspective of BCPs.

There are some distinctive characteristics of risk and crisis communication, as shown in Table 1 which was re-organized from a comparison (Reynolds and Seeger, 2005). Risk communication aims basically to reduce, mitigate, and prepare for disaster risks and avoid negative probability. Risk communication leads to modifying the public's behavior at an individual level based on perceived messages through long-term regular education, training, and campaign. Therefore, the notices must be controllable and well-structured to make them easy to understand and accept in the public's daily life.

Table 1: The characteristics of risk communication and crisis communication

Items	Risk communication	Crisis communication
Message type	the probability of negative consequences	the statement of the current condition
Purpose	persuasion by education, advertising, campaigns	dissemination by media, early warning system, advisory
Target	the public	organizations, businesses
Duration	long-term (before emergency)	short-term (during an emergency)
Features of messages	controllable and structured	spontaneous and reactive

On the contrary, crisis communication is associated with a present statement and a specific situation. It aims to control and interrupt propagating impacts of disaster risks using direct information, such as emergency messages, advisory, and recommendations, that could be disseminated online, news, or speeches in the short term. Moreover, crisis communication leads to responding or reacting immediately to a varying crisis by experts or emergency managers within the scope of organizations. The messages are emerged spontaneously and reactively depending on crisis statements.

Although risk and crisis communication target different subjective, this involvement has brought an opportunity to increase risk perception and awareness levels. However, unexpected and severe consequences have continued with massive damages and risk and crisis communication failure under

uncertainty and complexity of cascading disasters. In this sense, essential facets of risk and crisis communication need to enhance the disaster literacy and coping capacity to complicated disaster risks among all stakeholders, including citizens. The reason is that the impact of cascading disasters varies depending on the region and the hazard scale. Therefore, it is more challenging to predict cascaded events. Thus, relevant stakeholders should consider how risk and crisis communication could be advanced against the potential cascading disasters from accumulated knowledge and past experiences.

3.2. Lessons from the major cascading disasters

Under the reviews of previous studies and literature, numerous resolutions intend achievement about risk and crisis communication to reduce damage to human beings and property. However,

casualties and the impact of economic are consistently expanded over the boundary of territories. Moreover, it aggravates the citizen's confusion during cascading disasters. Therefore, to identify a valuable direction to reduce such cascading risks, there is a need to improve the current concept of risk and crisis communication. This section investigated two major cascading disasters, the 2005 Hurricane Katrina and the 2011 Great East Japan Earthquake and tsunami, to learn from past experiences. Furthermore, this paper analyzed the cases based on the essential elements of risk and crisis communication, including system, trust, and decision-making.

3.2.1. Hurricane Katrina in 2005

On August 29, 2005, Hurricane Katrina affected the Gulf Coast widely, from New Orleans to Biloxi, Mississippi. It was the most devastating disaster that connected to the levee break, floods, oil spills, fires and explosions in chemical plants, and environmental pollution with 1,833 fatalities and \$ 96 billion of economic loss.

System: The United States commands disaster response over related regulations, and each state must submit a written request to support dealing with emergencies (Gheytanchi et al., 2007). In this system, the government affected by the disasters is required a while to get an agreement from the federal agency throughout some stages. Consequently, this complicated structure has postponed coping with the disaster. Moreover, at that time, the government was frustrated with cascaded events due to unpreparedness for such kinds of disasters within not prepared for such situations. As a result, the government made misjudgments during the disaster and could not adequately respond to disasters simultaneously and sequentially occurred in broad areas due to the destruction of social infrastructure. Moreover, the delayed response made insufficient emergency operations (i.e., evacuation, rescue, and relief assistance) and could not get other sources of support from the neighboring government and outside (Son et al., 2007). However, since Hurricane Katrina, the U.S. government has improved and enhanced its disaster risk management system in large parts.

Better communication with trust: The communication issues also postponed the response. Risk and crisis communication with institutions are fundamentally based on trust between the sender and receiver of messages (Engdahl and Lidskog, 2014), and the government's accomplishment determines the trust level of the public in the government (Nicholls and Picou, 2013). The result of Hurricane Katrina has shown plainly that the government had failed in its disaster management system, including risk and crisis communication, for saving its citizens and keeping the credibility of the public (Cole and Fellows, 2008). Communication failure has emerged within the state and federal

agencies due to multi-stages of the command system and a lack of trust between the state government and the community.

Decision-making to execute an action: When a hurricane approaches an area, the best prevention is to evacuate to safety shelters. However, the state government was late to command the citizens to evacuate to prearranged shelters. As a result, the public could not have appropriate information due to unclear messages and a lack of risk awareness (Cole and Fellows, 2008). Also, the recommendation from the administration was not mandatory. Consequently, the citizens stayed in their homes until the hurricane arrived and could not make proper decisions during disasters.

3.2.2. The great east Japan earthquake and tsunami in 2011

The Great East Japan Earthquake and Tsunami occurred in March 2011. The magnitude was 9.0, and this disaster was recorded as the worst and most severe disaster. Approximately 24,604 people were injured and died, and still, 2,525 people are missing as of March 2021. The loss of economic cost is the almost U.S. \$ 235 billion. In addition, this extreme earthquake caused a tsunami, various chemical accidents in the Sendai industrial parks, Fukushima nuclear power plant accidents, and global economic damage.

System: The Japanese government has a dichotomous disaster management system. The local government has taken the priority of responsibility to manage the stricken regions by disasters. Also, they have separated disaster management plans that reflect the local principles and physical environment. Each local community has an "autonomous organization for disaster reduction" to prepare for all disasters at the local level (Bajek et al., 2008). Thus, the local bureaucrats and community members perform a crucial role in disaster management in all phases of disasters, mainly focused on earthquakes and floods. The central government provides the main guideline for local disaster management and response and recovery when a disaster overwhelms the disaster capacity of the local government. Nevertheless, the disaster exceeded the coping capacity of local government and communities due to the disruption of the social infrastructure such as roads, transportation, and lifelines (Mimura et al., 2011) and unexpected hazards. The results of disasters implied that the current disaster management is required to improve potential cascading disasters in the recent future.

Appropriate communication regarding risk information with trust: Better disaster management requires valuable confidence among stakeholders, including citizens. The citizens can build trust by transparent disclosure of risk information from credible stakeholders, such as NGOs, experts, professional first responders, and local government. Unfortunately, during the 2011 disaster, the central government could not support the affected areas

appropriately due to the expanded damages of the tsunami and nuclear power plant explosion, and the collision of social infrastructures (Uslaner and Yamamura, 2016). Also, the central government could not control the support system and communicate with the local government. There has been a lack of correct and transparent information about the other risks and impacts for these reasons. As a result, the given risk information was modified several times, and it generated that the public in the nationwide and international community distrust their government (Goodwin et al., 2012).

Decision-making to execute an action: Ordering evacuation as mandatory gives a burden on the government and the citizens. It requires that the government have the empowerment to make critical decisions, such as enforcing compulsory evacuation when a disaster comes near the local community (Fairchild et al., 2006). There is no correct regulation regarding this problem in many countries. Therefore, even though people get an early warning on a natural hazard, they do not need to accept the recommendation. General citizens rely on the government during an emergency, but it does not mean the government can determine a response strategy for all citizens or save their lives. The residents need to know whether they will stay or leave. Following a survey, the residents who survived the GEJE said they did not know what they had to do when people had to evacuate, or what citizens needed to do for their survival because they had not experienced those massive disasters ever before. Some residents relied on their decisions and support from the neighborhood (Katada and Kanai, 2016), and some of them stayed in their homes and were swept by the tsunami.

4. Discussion

The review of the literature showed that there had been theoretically more outstanding efforts to communicate risk and crisis information in the academic, public, and private sectors. Risk and crisis communication approach different time set and targets by main agents for handling information, such as government or businesses; but it has inter-related goals to achieve reducing scopes of probable consequences from potential and unexpected events. However, the two case studies above described presented that risk and crisis communication may not enable disclosing adequate information to citizens who could be affected by the potential disasters. It also implies that the current ways of risk and crisis communication need to be more integrated for citizens who must be ready for unexpected and uncertain disasters and/or situations. The public should have the insight into seeing uncertain situations they will face and make a decision by themselves to save their lives.

Thus, more effective communication skills to secure safety and information for citizens on a small scale are required so that individuals as a portion of stakeholders can enhance their coping capacity to

potential cascading disasters (Frewer, 2004). Furthermore, there is a need to consider various factors such as policy, socio-demographics, regional resources, and past disaster experiences at the local level (Alexander, 2015). Also, decision-making at the local level is obliged to be associated with the communication for responding to a catastrophe emergency based on unique features (Bruine de Bruin et al., 2007), the experience of people (Juliusson et al., 2005), and literacy. Successful risk and crisis communication are required to update against changing disaster patterns. In this context, we propose a concept of survival communication that is flexible for an individual level.

'Survive' is defined as "continue to live or exist, especially despite danger or hardship" And "manage to keep going in difficult circumstances" in online 'Oxford dictionaries.' Differently, 'survival' is addressed as "the state or fact of continuing to live or exist, typically despite an accident, ordeal, or difficult circumstances." Common terminologies of disaster relate to some issues nearly as how people can protect their lives and what kind of disaster capacity people demand. Namely, those are supposed to close the interest of conserving, protecting, defending, or persisting stakeholders at an individual level.

We propose a notion of survival ability as the explanation of survival communication in order to make concrete the concept of survival communication. Survival ability can be defined as 'a combination of disaster capacity, wisdom, knowledge from experiences, and resources of individuals of the local community to manage disaster situations until the arrival of professional first responders at the scene.' Also, survival ability strengthens based on the local disaster risk management system, perceived risk awareness, and cooperation with other stakeholders such as local government officials, the local experts, and the local firefighter or police officers. Following the notion, survival communication is defined as 'a system that supports multi-way communication for disaster risk and emergency information to protect individuals' lives during cascading disasters until the arrival of professional first responders at the disaster scene.'

Phases of disaster management and purpose: Fig. 1 shows the difference in the scope of risk information among risk, crisis, and survival communication. Survival communication is stated as all actions in preparation for managing cascading disasters at an individual level. It aims to support building the citizens' survival ability via conducting appropriate roles in all phases of disaster risk management. The public is responsible as part of the local emergency plan until the arrival of professional first responders. Also, survival communication brings a community network chain. The chain involves not only individuals as well as community clusters consisting of each family and neighbor. Therefore, citizens could have different perspectives on cascaded events, although they are not professionals. This survival communication aims to see different emergencies and have insights to

identify potential disasters using their local knowledge, experiences, and perceived information.

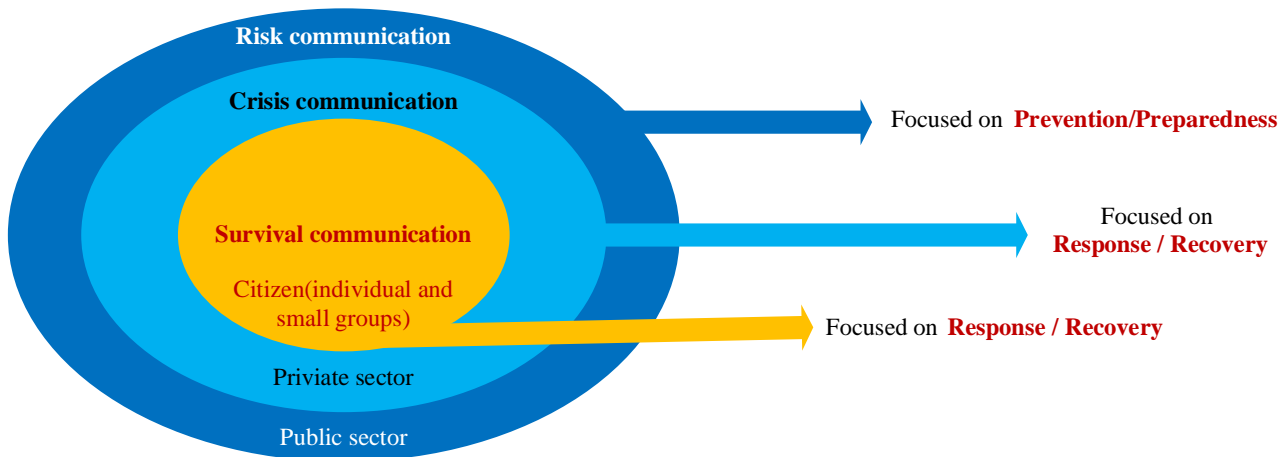


Fig. 1: A conceptual figure of risk, crisis, and survival communication

Targets, messages, and channels: The constituent parts are communicators as information sender and receiver, message, and channel for effective communication. In survival communication, individuals act as the most crucial communicator in extreme conditions. Notably, the partners of survival communication exchange their specific information. Its messages have to be considered various particular factors of the local community, including environmental factors such as risk area: Inundated, weak ground; socio-demographic factors such as vulnerable groups defined by WHO: Children, elderly, pregnant women, malnourished; age; races; and physical factor like the level of urbanization as well environment deconstructions. For example, when older people suffer from heat waves caused by climate changes, they must know measures for protecting themselves and any support facilities with

relevant policies considering environmental conditions (Chung, 2021). Also, it is essential to have multiple interrelationships among all stakeholders as a communicator to extend the effect of the communication. The communicator uses the spider network to exchange risk messages and information related to local members' lives.

Decision-making and approach: Generally, disaster management approaches the top-down system from the central government to the local government and the local community, as shown on the left side of Fig. 2. However, in some catastrophic disasters, this approach oriented to the top-down system has not worked adequately at the moment. In that situation, rapid decision-making by stakeholders in the scene is a critical element to decrease damage, help the affected area, and rescue damaged or trapped people.

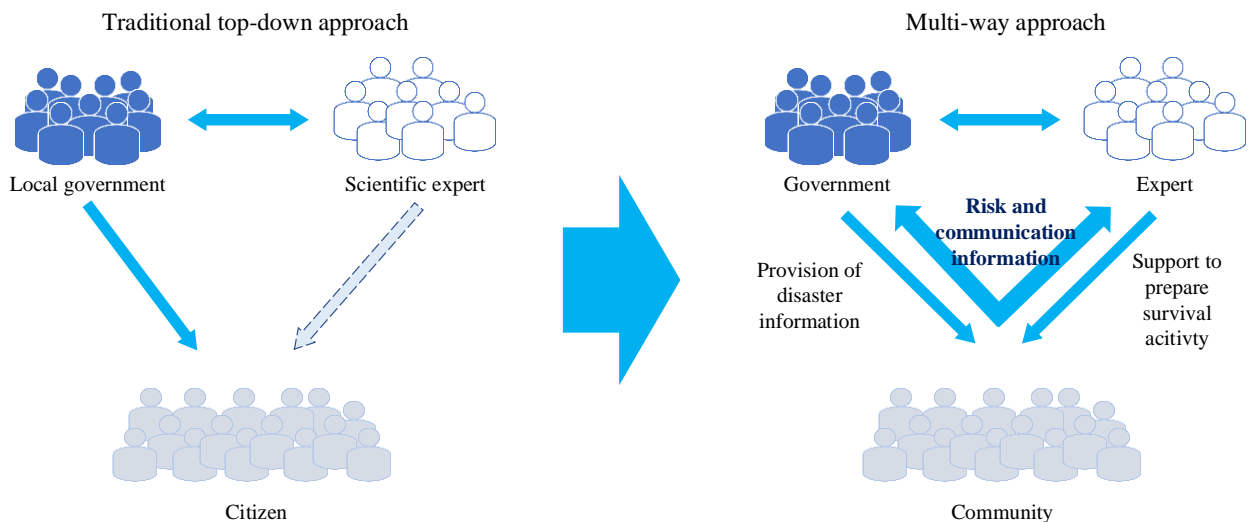


Fig. 2: Top-down system (left: (Scolobig et al., 2015)) and BU-TD approach (right: By author)

Survival communication addresses that individuals of the local community are considered a member of disaster risk management. Also, it has both approaches, the semi-bottom up-top down (BU-TD) approach, as shown in Fig. 2. However, the

conditions of catastrophic disaster proceed incomplete to exchange risk messages or information, and difficult to access the affected local community. For this reason, the local government, even the central government, should know the

condition of hit zones to support timely and adequately and should be a well-trained and prepared emergency strategy to protect the citizens against a catastrophic disaster.

All participants, including the government administrators and the local community, built a specific local emergency plan that meditated several aspects of the local community. Following this plan might contribute to establishing the national emergency strategy, and all stakeholders can consider the possibility of a catastrophic disaster in various aspects. All members of disaster management need to acknowledge that the most critical task is to develop deep trust among them. In an emergency planning process, residents' disaster capacity and literacy can improve naturally, and confidence among all stakeholders. The disaster capacity of the local disaster management team can be enhanced through the enhanced individual's survival ability. Moreover, as the first responder in the local community, the individuals could make a decision based on their judgment immediately after a catastrophic disaster.

Following the newly suggested concept of survival communication, it must be discussed and valid by other academic scholars theoretically. Since the review of the literature was implemented in a broad categorization, it needs a specific and practical approach to identify the applicability of the concept in real life. Moreover, for further study, the detailed measure and procedure for applying the concept of survival communication to local communities are required to develop and examine to use of probable scenarios of uncertain situations, such as cascading disasters.

5. Conclusion

With increasing the frequency and severity of disasters, many countries have advanced disaster risk management systems. Although there are great efforts to increase risk awareness and enhance disaster coping capacity by implementing risk and crisis communication, people and society has been suffering from the uncertainty of disasters with interconnected risks. This study aimed to identify the differences between risk and crisis communication concepts for risk information and how to improve the survival ability of the local residents, including social vulnerabilities and other stakeholders, at a small scale, such as local communities. Despite the advantages of risk and crisis communication, this study shows how the current risk and crisis communication need to be improved to enhance the citizens' disaster coping capacity and literacy. Also, the results imply that there is the possibility that risk information may not reach the public during cascading disasters bringing uncertainty and complexity. It shows there is still a gap between theoretical and practical concepts of risk and crisis communication through two cascading disaster cases.

In order to fill the gap, we suggest survival communication which is a different notion from risk and crisis communication. Considering a local community cannot have appropriate risk information during a complex emergency, survival communication involves not only general disaster knowledge but also regional environments at the local level and needs the proactive engagement of all local stakeholders, particularly local residents who know the risk and vulnerable factors of their livelihood's environment rather than other actors, including local officials and external experts. It implies that survival communication can enhance the survival ability of the citizens at the local level and increase disaster risk awareness in various ways. Moreover, the mutual relationship among all stakeholders would be strengthened on the basis of deep trust in each other.

Suggested survival communication is expected to help increase individuals' survival ability based on their judgment under cascading disasters and enhance the local disaster risk management system. Further study is required to develop appropriate guidelines for achieving survival communication. Furthermore, it needs concrete and flexible strategies to adapt to real-life considering multi-hazards under uncertainty and complexity. Lastly, this communication may provide various opportunities for growing the local community as well-trained first responders.

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Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

- Adger WN, Hughes TP, and Folke CC, Carpenter SR, and Rockström J (2005). Social-ecological resilience to coastal disasters. *Science*, 309(5737): 1036-1039. <https://doi.org/10.1126/science.1112122> PMID:16099974
- Ahl AS, Acree JA, Gipson PS, McDowell RM, Miller L, and McElvaine MD (1993). Standardization of nomenclature for animal health risk analysis. *Revue Scientifique et Technique* (International Office of Epizootics), 12(4): 1045-1053. <https://doi.org/10.20506/rst.12.4.744> PMID:8312610
- Alexander DE (2015). *Disaster and emergency planning for preparedness, response, and recovery*. Oxford University Press, Oxford, UK. <https://doi.org/10.1093/acrefore/9780199389407.013.12>

- Bajek R, Matsuda Y, and Okada N (2008). Japan's Jishu-Bosai-Soshiki community activities: Analysis of its role in participatory community disaster risk management. *Natural Hazards*, 44(2): 281-292.
<https://doi.org/10.1007/s11069-007-9107-4>
- Ball LK, Evans G, and Bostrom A (1998). Risky business: Challenges in vaccine risk communication. *Pediatrics*, 101(3): 453-458.
<https://doi.org/10.1542/peds.101.3.453> **PMid:9481013**
- Bradley DT, McFarland M, and Clarke M (2016). The effectiveness of disaster risk communication: A systematic review of intervention studies. In: Kapur GB, Bezak S, and Dyal J (Eds.), *Effective communication during disasters*: 81-120. CRC Press, Boca Raton, USA.
- Bruine de Bruin W, Parker AM, and Fischhoff B (2007). Individual differences in adult decision-making competence. *Journal of Personality and Social Psychology*, 92(5): 938-956.
<https://doi.org/10.1037/0022-3514.92.5.938>
PMid:17484614
- Bundy J, Pfarrer MD, Short CE, and Coombs WT (2017). Crises and crisis management: Integration, interpretation, and research development. *Journal of Management*, 43(6): 1661-1692.
<https://doi.org/10.1177/0149206316680030>
- Chung HT (2021). Investigation of the causes of vulnerable groups in body temperature control due to heat waves in climate change. <https://doi.org/10.33097/JNCTA.2021.05.01.65>
- Cole TW and Fellows KL (2008). Risk communication failure: A case study of New Orleans and Hurricane Katrina. *Southern Communication Journal*, 73(3): 211-228.
<https://doi.org/10.1080/10417940802219702>
- Coombs WT (2007). Protecting organization reputations during a crisis: The development and application of situational crisis communication theory. *Corporate Reputation Review*, 10(3): 163-176. <https://doi.org/10.1057/palgrave.crr.1550049>
- Coombs WT (2021). *Ongoing crisis communication: Planning, managing, and responding*. Sage Publications, Thousand Oaks, USA.
- Covello VT (1992). Risk communication: An emerging area of health communication research. *Annals of the International Communication Association*, 15(1): 359-373.
<https://doi.org/10.1080/23808985.1992.11678816>
- Covello VT, Slovic P, and Von Winterfeldt D (1986). Risk communication: A review of the literature. *Risk Abstracts*, 3: 171-182.
- De Wolf D (2013). Crisis communication failures: The BP case study. *International Journal of Advances in Management and Economics*, 2(2): 48-56.
- Eisenman DP, Cordasco KM, Asch S, Golden JF, and Glik D (2007). Disaster planning and risk communication with vulnerable communities: Lessons from Hurricane Katrina. *American Journal of Public Health*, 97(Supplement_1): S109-S115.
<https://doi.org/10.2105/AJPH.2005.084335>
PMid:17413069 PMCID:PMC1855003
- Engdahl E and Lidskog R (2014). Risk, communication and trust: Towards an emotional understanding of trust. *Public Understanding of Science*, 23(6): 703-717.
<https://doi.org/10.1177/0963662512460953>
PMid:25414929
- Fairchild AL, Colgrove J, and Jones MM (2006). The challenge of mandatory evacuation: Providing for and deciding for. *Health Affairs*, 25(4): 958-967.
<https://doi.org/10.1377/hlthaff.25.4.958> **PMid:16835174**
- Fearn-Banks K (2016). *Crisis communications: A casebook approach*. Routledge, London, UK.
<https://doi.org/10.4324/9781315684857>
- Freimuth V, Linnan HW, and Potter P (2000). Communicating the threat of emerging infections to the public. *Emerging Infectious Diseases*, 6(4): 337-347.
<https://doi.org/10.3201/e0604.000403>
PMid:10905966 PMCID:PMC2640909
- Frewer L (2004). The public and effective risk communication. *Toxicology Letters*, 149(1-3): 391-397.
<https://doi.org/10.1016/j.toxlet.2003.12.049>
PMid:15093286
- Gheyntanchi A, Joseph L, Gierlach E, Kimpara S, Housley J, Franco ZE, and Beutler LE (2007). The dirty dozen: Twelve failures of the Hurricane Katrina response and how psychology can help. *American Psychologist*, 62(2): 118-130.
<https://doi.org/10.1037/0003-066X.62.2.118>
PMid:17324037
- Goodwin R, Takahashi M, Sun S, and Gaines Jr SO (2012). Modelling psychological responses to the Great East Japan earthquake and nuclear incident. *PLOS ONE*, 7(5): e37690.
<https://doi.org/10.1371/journal.pone.0037690>
PMid:22666380 PMCID:PMC3364293
- Holladay SJ (2009). Crisis communication strategies in the media coverage of chemical accidents. *Journal of Public Relations Research*, 21(2): 208-217.
<https://doi.org/10.1080/10627260802557548>
- Höppner C, Whittle R, Bründl M, and Buchecker M (2012). Linking social capacities and risk communication in Europe: A gap between theory and practice? *Natural Hazards*, 64(2): 1753-1778. <https://doi.org/10.1007/s11069-012-0356-5>
- Ikeda S and Nagasaka T (2011). An emergent framework of disaster risk governance towards innovating coping capability for reducing disaster risks in local communities. *International Journal of Disaster Risk Science*, 2(2): 1-9.
<https://doi.org/10.1007/s13753-011-0006-7>
- Juliussen EÁ, Karlsson N, and Gärling T (2005). Weighing the past and the future in decision making. *European Journal of Cognitive Psychology*, 17(4): 561-575.
<https://doi.org/10.1080/09541440440000159>
- Katada T and Kanai M (2016). The school education to improve the disaster response capacity: A case of "Kamaishi Miracle". *Journal of Disaster Research*, 11(5): 845-856.
<https://doi.org/10.20965/jdr.2016.p0845>
- Kuhlicke C and Steinführer A (2010). Social capacity building for natural hazards: A conceptual frame. Report N. WP1, Helmholtz Centre for Environmental Research, Leipzig, Germany.
- Kuhlicke C, Steinführer A, Begg C, Bianchizza C, Bründl M, Buchecker M, and Faulkner H (2011). Perspectives on social capacity building for natural hazards: Outlining an emerging field of research and practice in Europe. *Environmental Science and Policy*, 14(7): 804-814.
<https://doi.org/10.1016/j.envsci.2011.05.001>
- McEntire DA (2001). Triggering agents, vulnerabilities and disaster reduction: Towards a holistic paradigm. *Disaster Prevention and Management*, 10(3): 189-196.
<https://doi.org/10.1108/09653560110395359>
- Mimura N, Yasuhara K, Kawagoe S, Yokoki H, and Kazama S (2011). Damage from the Great East Japan earthquake and tsunami—a quick report. *Mitigation and Adaptation Strategies for Global Change*, 16(7): 803-818.
<https://doi.org/10.1007/s11027-011-9297-7>
- Nicholls K and Picou JS (2013). The impact of Hurricane Katrina on trust in government. *Social Science Quarterly*, 94(2): 344-361. <https://doi.org/10.1111/j.1540-6237.2012.00932.x>
- NRC (1989). *Improving risk communication*. National Research Council, National Academies Press, Washington, USA.
- O'Brien G, O'keefe P, Rose J, and Wisner B (2006). Climate change and disaster management. *Disasters*, 30(1): 64-80.
<https://doi.org/10.1111/j.1467-9523.2006.00307.x>
PMid:16512862
- Pescaroli G and Alexander D (2015). A definition of cascading disasters and cascading effects: Going beyond the "toppling

- dominos” metaphor. Planet@Risk Glob Forum Davos, 3(1): 58-67.
- Renn O and Levine D (1991). Credibility and trust in risk communication. In: Kasperson RE and Stallen PJM (Eds.), *Communicating risks to the public*: 175-217. Springer, Dordrecht, Netherlands.
https://doi.org/10.1007/978-94-009-1952-5_10
- Reynolds B and Seeger MW (2005). Crisis and emergency risk communication as an integrative model. *Journal of Health Communication*, 10(1): 43-55.
<https://doi.org/10.1080/10810730590904571>
PMid:15764443
- Schultz B (2006). Flood management under rapid urbanisation and industrialisation in flood-prone areas: A need for serious consideration. *Irrigation and Drainage: The journal of the International Commission on Irrigation and Drainage*, 55(S1): S3-S8. <https://doi.org/10.1002/ird.237>
- Scolobig A, Prior T, Schröter D, Jörin J, and Patt A (2015). Towards people-centred approaches for effective disaster risk management: Balancing rhetoric with reality. *International Journal of Disaster Risk Reduction*, 12: 202-212.
<https://doi.org/10.1016/j.ijdrr.2015.01.006>
- Shaw R, Shiwaku K, Kobayashi H, and Kobayashi M (2004). Linking experience, education, perception and earthquake preparedness. *Disaster Prevention and Management: An International Journal*, 13(1): 39-49.
<https://doi.org/10.1108/09653560410521689>
- Shiwaku K and Shaw R (2008). Proactive co-learning: A new paradigm in disaster education. *Disaster Prevention and Management*, 17(2): 183-198.
<https://doi.org/10.1108/09653560810872497>
- Son J, Aziz Z, and Peña-Mora F (2007). Supporting collaborative decision making in disaster response and recovery through improved situation awareness. *Special Issue of Structural Survey on the Role of the Built Environment Professional in Disaster Management*, 26(5): 411-425.
<https://doi.org/10.1108/02630800810922757>
- Tambo E, Djuikoue IC, Tazemda GK, Fotsing MF, and Zhou XN (2021). Early stage risk communication and community engagement (RCCE) strategies and measures against the coronavirus disease 2019 (COVID-19) pandemic crisis. *Global Health Journal*, 5(1): 44-50.
<https://doi.org/10.1016/j.glohj.2021.02.009>
PMid:33850632 PMCID:PMC8032327
- Uslaner E and Yamamura E (2016). *Disaster and political trust: The Japan tsunami and earthquake of 2011*. MPRA Paper (No. 70527), University Library of Munich, Munich, Germany.
- Wieland ML, Asiedu GB, Lantz K, Abbenyi A, Njeru JW, Osman A, and Sia IG (2021). Leveraging community engaged research partnerships for crisis and emergency risk communication to vulnerable populations in the COVID-19 pandemic. *Journal of Clinical and Translational Science*, 5(1): E6.
<https://doi.org/10.1017/cts.2020.47>
PMid:33942018 PMCID:PMC7605400