

Modeling Risk Communication Effects on Risk Perception and Protective Actions in Communities during a Na-Tech Accident (English Presentation)

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The Great East Japan Earthquake and Tsunami has made a great impact in the field of disaster risk management, including the field of Natech disaster risk management. Natech refers to a technological disaster triggered by natural hazard event. During the 2011 Great East Japan Earthquake and Tsunami, many Natech accidents were reported, including the well-known nuclear power plant accident in Fukushima Prefecture. The same 9.0 magnitude earthquake had also caused damages to 1404 hazardous material facilities throughout Japan (Zama, et al., 2012).

In March 11th, 2011, at around 5 P.M., smoke caused by a Natech accident was observed in an oil refinery located in Tagajo City. The Natech event affected several areas within Tagajo City, and also in Shichigahama Town, and Sendai City. Due to the Natech event, three evacuation orders were issued by respective officials within the next 36 hours.

A household questionnaire survey was conducted in Tagajo City, Shichigahama Town, and Sendai City in 2015. 484 questionnaires were returned. The survey included questions regarding their experience, perception, and actions during the Natech event. From the data obtained, information including evacuee's timeline and evacuation behavior can be observed.

The household questionnaire survey was reported in the paper "Households' Risk Perception and Behavioral Responses to Natech Accidents" (Yu, Cruz, and Hokugo, 2017). The paper found significant differences in perceptions throughout different times during the event. In addition to that, location and wind

direction also showed significant correlation to the Natech perceived severity and more importantly, evacuation.

Following the previous paper, this research aims to develop a Natech evacuation behavior model based on the same data. As the first step to the modeling process, an Exploratory Data Analysis (EDA) was performed on the household survey data. Exploratory Data Analysis is based on graphical and numerical summaries to answer questions which arise from the data. EDA is best used especially when confronted with large unknown databases. The questions used in this analysis include:

1. Who were the people whose perception towards Natech were changing after sensing the Natech accident?
2. Did receiving an evacuation order have effects on people's decision to evacuate?
3. Where, when, and how did people receive the evacuation order?
4. How did sensing the Natech affect people's decision to take protective actions?

Then, from the analysis conducted, several findings were concluded. These findings are:

1. Positive association is shown between the ability to cope with risk (to evacuate) with the change in risk perception.
2. Perception change does not show significant correlation to house location (position relative to industrial area) as most people were not at home when they sensed the Natech.
3. People who received the evacuation were more

likely to evacuate and they evacuated faster than people who did not. However, no causal relationship was found between the two variables.

4. 30.2% of respondents received or learned about the evacuation order. 32% of them received the learned about the evacuation order from informal sources (family, neighbors and colleagues) while the other 68% received from formal sources (speakers, mass media, public relation vehicles, and government officials). Evacuees perception changes are slightly higher towards formal warning compared to informal warnings.
5. The way how Natech was sensed and the location where it was sensed both associate with the change in perception after sensing Natech and which action was taken. However, the action taken does not associate with the change in perception. The action taken tends to depend more on “what can be done” instead of how severe the individual perceives the Natech accident.

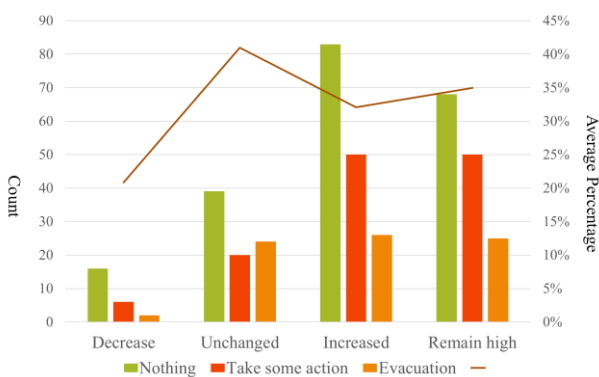


Figure 1. Action taken after sensing Natech based on perception change

At last, it is worth noting that each evacuee experienced different timelines throughout the event. In the future, a more refined modeling process is required to conduct further analysis. In the future, the author aims to use an Agent-Based Model analysis to

develop the Natech evacuation model based on the data.

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