

## FACTORS AFFECTING SURVIVAL IN TSUNAMI EVACUATION

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Many factors have influence on people behavior in a disaster, either at the time or during recovery process: age and gender, marital status, children, education, social networks, native to area or not, disaster experience, awareness of hazard and preparedness. All these affect the level of risk and the probability of casualty. During disasters, every second can be decisive but most people are unable to think clearly, and their decision-making is often illogical and irrational, or at best sub-optimal. There is evidence from previous disasters, notably the 2004 Indian Ocean tsunami, that foreign visitors have much greater difficulty than nationals in evacuating in time. There is also evidence that more women die than men, for example in the 1991 Bangladesh cyclone, the 1995 Hanshin-Awaji earthquake, the 2005 Kashmir Pakistan earthquake and the 2010 L'Aquila earthquake.

In Japan, after the Great East Japan Earthquake (GEJE) and tsunami in 2011, the majority of deaths were caused by a tsunami that was much larger than had been anticipated and prepared for. Survival was largely determined by timely evacuation. Evacuation procedures are highly developed in Japan and people are drilled in evacuation from childhood. There is evidence that the vast majority of nationals evacuated successfully but that many evacuation centers were overwhelmed by the unprecedented size of the waves. The casualty rates amongst foreigners were as high as predicted by other similar events, but exceptionally, more men died than women (Koyama et al., 2012).

Table 1 Number of fatalities and collapsed houses in Natori City, Miyagi (Murakami, 2012)

| Yuriage areas                    | Area1 | Area2 | Area3 | Area4 | Area5 | Area6 | Area7 |
|----------------------------------|-------|-------|-------|-------|-------|-------|-------|
| Number of human loss             | 49    | 200   | 43    | 84    | 64    | 138   | 89    |
| Population                       | 667   | 895   | 356   | 755   | 533   | 1062  | 832   |
| Fatality ratio (%)               | 7.3   | 22.3  | 12.1  | 11.1  | 12.0  | 13.0  | 10.7  |
| Ratio of elders - age over 75(%) | 11.8  | 14.6  | 17.3  | 16.5  | 7.4   | 9.7   | 4.9   |
| Ratio of houses washed away(%)   | 21    | 81    | 100   | 100   | 96    | 90    | 91    |

This paper reports recent research at Kyoto University to document evacuation after the 2011 event and to understand evacuation behaviour and their level of preparedness. One of the aspects studied is the difference between what people say they will do in a disaster and what they actually do in a real event. For example, in Japan many respondents said that they would run to a safe place, but in fact many people went home, often into danger, to seek and care for family members. (Murakami and Umezu, 2011).



Figure 1. Seven areas in Yuriage-Natori City, Teizanbori canal (blue line) and Yuriage area location (Size of Yuriage is about 1.2 Km<sup>2</sup> to 1.4 Km<sup>2</sup>)

Timely unambiguous early warning and making the right decision to evacuate immediately are obviously crucial to survival. But what makes people evacuate immediately? And are government programmes of awareness raising and drilling working effectively in Japan? This research produced some surprising results. For example experience of previous similar disaster had a negative impact on people evacuating in time and experience of drills had no effect. It was almost as if some people were complacent and thought they had more time. This is perhaps not so surprising. This coast had experienced the Chilean tsunami the previous year when the run up and inundation was much less than anticipated and many people evacuate unnecessarily. The initial warning issued in 2011 seemed to predict a similar sized event. This was quickly revised but many people had already made the decision to go home or in search of family or friends rather than run to safety.

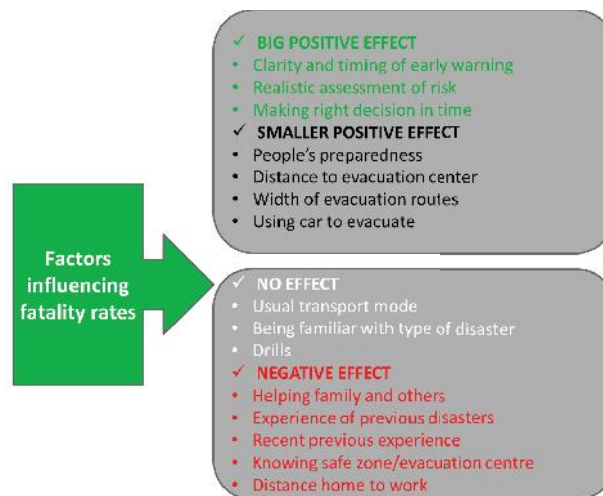


Figure 2. Main conclusions

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