



## BEHAVIORAL AND PSYCHOLOGICAL RECONSTRUCTION PROCESS OF VICTIMS IN THE 2004 MID-NIIGATA PREFECTURE EARTHQUAKE

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### ABSTRACT

The random sampled survey was conducted in the affected area of the 2004 Mid-Niigata Prefecture Earthquake in Japan. The findings of the survey were as follows: 1) About 70% of the respondents escaped to the outside of their home staying in cars, tents and garages on the day of the impact because of the terror of the aftershocks, 2) Almost 100% of the respondents tried to confirm the safety of somebody or/and something right after the impact, 3) According to the Reconstruction Calendar, the majority of the victims thought their offices/schools had resumed already and the financial situation of households were getting better 5 months after the impact, while other items about housing, daily life had not been restored yet.

Our group conducted the random surveys in the affected area of the 1995 Hanshin-Awaji Earthquake every two years after 1999. We examined the differences of the results of surveys conducted in two disaster areas, urban and rural area.

### Introduction

#### Background and Objective of this Study

The Mid-Niigata Prefecture Earthquake occurred on October 23, 2004. Forty-six people were killed, 4,801 people injured, 2,827 houses completely destroyed, 12,746 houses seriously damaged, and 101,509 houses partially destroyed during this earthquake disaster. This is the largest scale of casualties and physical damage caused by an earthquake since the Great Hanshin Awaji Earthquake in 1995.

The extent of the damage caused by a disaster depends on the relationship between the hazard and social vulnerability, i.e., the effects of an earthquake depends not only on the magnitude, but on the types of seismic tremors, geography of the region, urban environment, social structure, culture, history, disaster-prevention system, and so on (e.g., Burton et al. 1993;

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Mileti 1999; Wisner et al 2004). For the Mid-Niigata Prefecture Earthquake, “damage unique to rural mountain villages” was observed and the “type of seismic activities” differed from that of the Great Hanshin Awaji Earthquake, so the Mid-Niigata Prefecture Earthquake took on an entirely different aspect of human behavior from the Great Hanshin Awaji Earthquake. Accordingly, to comprehend the effects of the disaster clearly, it is necessary not only to discuss the extent of casualties and physical damage, but also to elucidate how this disaster influenced the residents.

Five months after the earthquake in March 2005, Fire and Disaster Management Agency, Ministry of Internal Affairs and Communications, and Disaster Prevention Research Institute, Kyoto University jointly conducted a survey using a questionnaire based on stratified two-stage random sampling. This “survey on the actual situation of the evacuation and life reconstruction after the Mid-Niigata Prefecture Earthquake” was intended to elucidate “the influence of the Mid-Niigata Prefecture Earthquake on the victims’ feelings and behavior, and the life reconstruction process at the time of the survey”. The analysis in this paper emphasized “the evacuation and safety confirmation behaviors of the victims and the current status of reconstruction /restoration.”

## **Method**

The survey was conducted in Ojiya City and Kawaguchi Town where the casualties and damage to the houses were serious throughout the area. Both male and female adults living in this area participated in this survey. The adopted method was stratified two-stage sampling. Initially, 50 spots in this area were randomly selected: 43 spots in Ojiya City and 7 spots in Kawaguchi Town, which is proportional to the population ratio. Then a sampling was conducted with the probability proportional to size. Using the basic registers of the residents, we sampled 20 individuals, which did not reside in the same household, from each spot. We specified the individual to complete the survey so that an equal number of male and female subjects were sampled. Consequently, 1,000 subjects were sampled, i.e., 2.19% of the population in the area (45,668 persons as of March, 2005).

We mailed the questionnaires to the subjects and asked them to return the completed survey via mail. We mailed the questionnaires on March 18, 2005 and collected them until April 5, 2005. Toward the end of March, reminders were mailed to those who had yet to return their questionnaires.

## **Results and Observations**

### **(1) Basic Attributes**

We collected 543 responses (response rate: 54.3%). Responses, which 1) were partially or not completed, 2) were error laden, 3) did not specify sex or age, and 4) were from individuals that did not reside in Ojiya City or Kawaguchi Town during the earthquake, were excluded. Hence, 518 completed surveys were collected (effective response rate: 51.8%).

To ensure random sampling, we verified that the respondents reflected the features of the general population in terms of basic attributes, i.e., sex and age (generation). The number of households and estimated population per municipality (as of March 1, 2005) and the estimated population per age (5-year increments) (aggregate) (as of January 1, 2005), which was published by the Emergency Management and Disaster Division, Niigata Prefectural Government, was used to determine the basic attributes of the general population.

The result of the goodness-of-fit test (Fig. 1) did not show significant differences in sex and age (generation) between the respondents and the general population (sex:  $\chi^2(1)=0.85$ , n.s., generation:  $\chi^2(2)=5.82$ , n.s.). Since there were not significant differences in the basic attributes, it was concluded that respondents do represent the tendencies of the area.

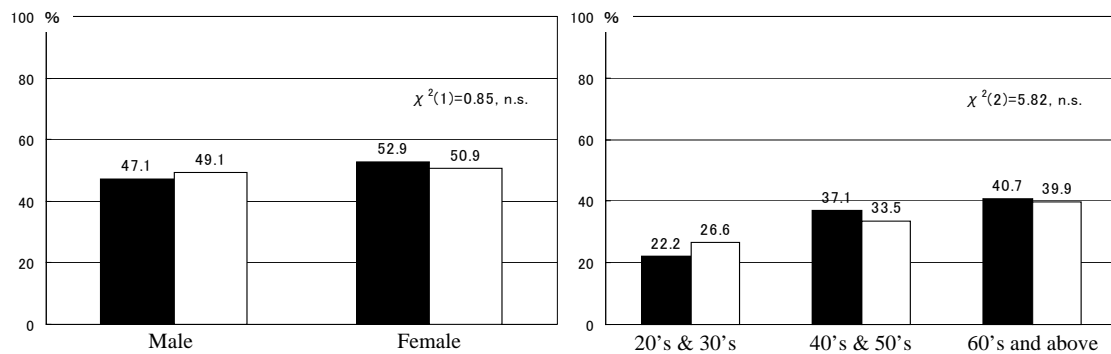


Figure 1. Statistical Test on Homogeneity of Respondents and Population

## (2) Changes in the Victims' Dwelling Places

To grasp the data of the dwelling places and shelters quantitatively, the respondents were asked about the types of dwellings and shelters they used on the day of the earthquake until six months afterwards (since the survey was conducted in March, 2005). The victims were specifically asked about their dwellings: 1) on the day of the earthquake, 2) two to four days after the earthquake, 3) two weeks after the earthquake, 4) one month after the earthquake, 5) two months after the earthquake, and 6) three to six after the earthquake. Based on the results, the dwelling habits of the area with time were determined.

A previous study on the victims of the Great Hanshin Awaji Earthquake verified that a logarithmic axis "changing at the intervals of 10 hours, 100 hours and 1,000 hours" is meaningful (Kimura et al. 1999, 2001, 2004). We compared the survey results from the victims of the Mid-Niigata Prefecture Earthquake (Fig. 2) to those of the Great Hanshin Awaji Earthquake (Fig. 3). Illustrating the changes of the victims' dwelling places on a logarithmic axis, it was clear that the earthquake disaster produced significant differences in the victims' behavior while reconstructing their lives.

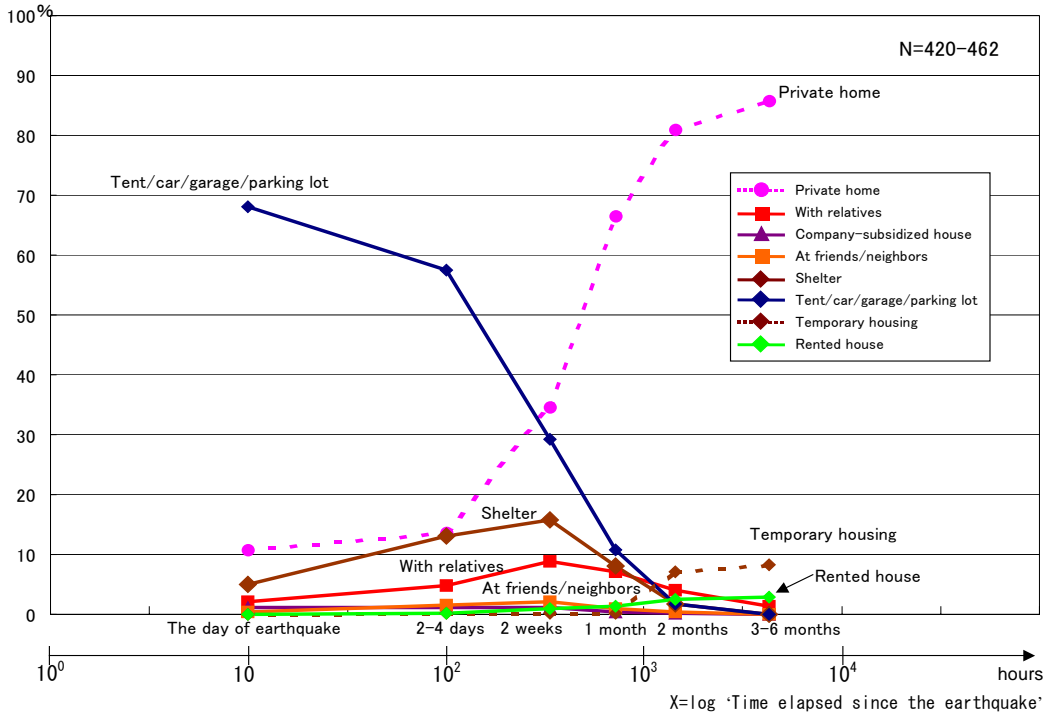


Figure 2. Changes in the Dwelling Places of the Victims

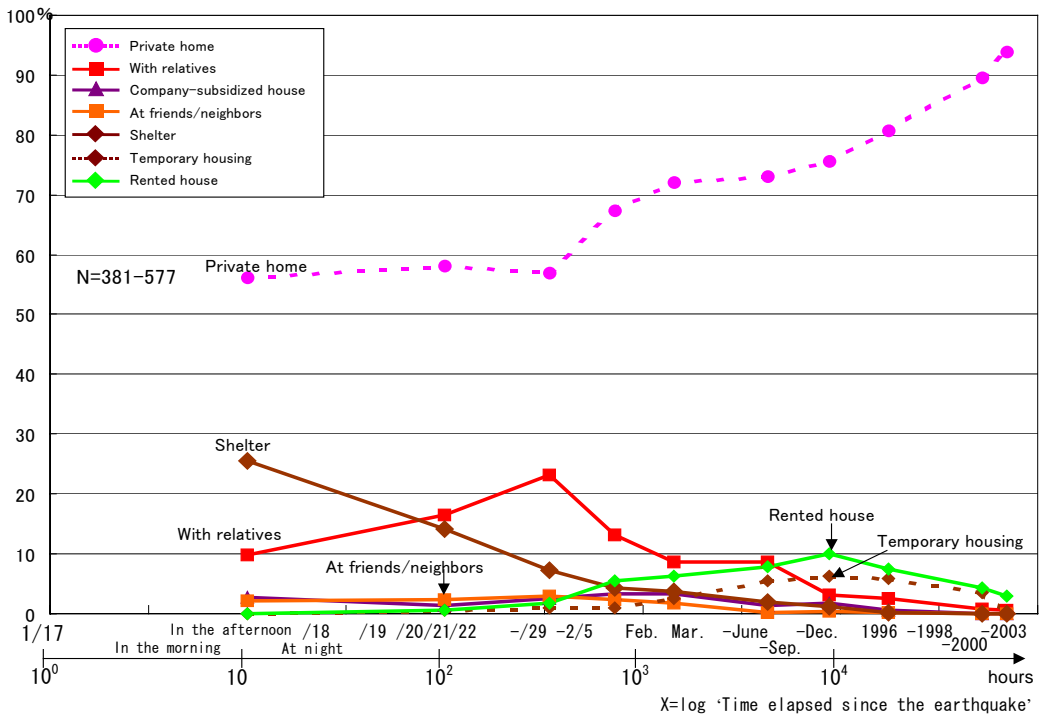


Figure 3. Changes in the Dwelling Places of the Victims of the Great Hanshin Awaji Earthquake

Table 1. Changes in the Dwelling Places of the Victims  
(Upper: This Survey, Lower: the Great Hanshin Awaji Earthquake (Survey in 2003))

Time elapsed since the earthquake	10hours		10 <sup>2</sup> hours		10 <sup>3</sup> hours					
	The day of earthquake	2-4 day	2 weeks	1 month	2 months	3-6 months	7-12months	2 years	3-6 years	7-8 years
Dwelling place										
Private home	10.7	13.7	34.6	66.6	81.0	85.7				
With relatives	2.1	4.9	8.9	7.1	4.0	1.4				
Company-subsidized house	1.1	1.1	1.1	0.5	0.2	0				
At friends/neighbors	0.5	1.5	2.2	0.9	0.5	0				
Shelter	5.0	13.1	15.8	8.0	1.6	0				
Tent/car/garage/parking lot	68.1	57.5	29.2	10.8	1.6	0				
Temporary housing	0.0	0.2	0.2	0.2	7.0	8.3				
Rented house	0.0	0.2	0.9	1.4	2.6	2.9				
Others	12.5	7.7	7.1	4.6	1.4	1.7				
N	439	452	462	437	427	420				

Time elapsed since the earthquake	10hours		10 <sup>2</sup> hours		10 <sup>3</sup> hours					
	The day of earthquake	2-4 day	2 weeks	1 month	2 months	3-6 months	7-12months	2 years	3-6 years	7-8 years
Dwelling place										
Private home	56.2	58.2	56.9	67.5	72.0	73.2	75.5	80.7	89.6	94.0
With relatives	9.9	16.4	23.1	13.2	8.6	8.6	3.1	2.5	0.8	0.5
Company-subsidized house	2.8	1.3	2.5	3.3	3.3	1.4	1.7	0.5	0	0
At friends/neighbors	2.1	2.4	2.9	2.4	1.7	0.2	0.5	0.2	0	0
Shelter	25.5	14.2	7.3	4.3	3.8	1.9	1.2	0.2	0	0
Temporary housing	0.0	0.7	0.9	1.0	2.6	5.5	6.3	5.9	3.6	0.3
Rented house	0.0	0.7	1.8	5.5	6.2	7.8	9.9	7.4	4.4	2.9
Others	3.6	6.1	4.5	2.9	1.7	1.4	1.7	2.5	1.6	2.4
N	577	457	441	418	418	421	413	404	386	381

The percentages assume the evacuees at each time as 100% (%)

The results of the Mid-Niigata Prefecture Earthquake survey (Fig. 2, Table 1: Upper row) show that only 10.7% of the victims resided at home on the day of the earthquake and two to four days later that increased to 13.7%. The majority of the victims dwelled outdoors in tents, cars, garages, and parking lots on the day of earthquake (68.1%) until two to four days after the earthquake (57.5%). The victims began to return home two to four days after the earthquake, but two weeks after the earthquake only 34.6% resided at home. It took one month for more than half (66.6%) to return home. 13.1% used shelters two to four days later. Shelter usage peaked two weeks after the earthquake (15.8%) and decreased to 8.0% one month after the earthquake. The percentage of victims that sought shelter at their relatives' houses was less than the percentage at shelters until one month after the earthquake. Thus, relatives' houses were not widely utilized as shelters. The percentage of temporary housing started to sharply increase one month after the earthquake. Three to six months afterwards 8.3% of the victims were dwelling in temporary housing. The percentage of victims that rented houses by themselves also began to increase one month after the earthquake and three to six months afterwards, that number rose to 2.9%.

Figure 3 and the lower row in Table 1 show the “changes in dwelling places of the victims in the areas hit by a tremor with a high six or seven intensity on the Japanese seismic scale” in

the random sampling survey conducted on the victims of the Great Hanshin Awaji Earthquake (Hayashi 2004). Comparing the two results illustrates some key differences. 1) In the Mid-Niigata Prefecture Earthquake there were a low percentage of victims that dwelled in their own homes and a high percentage that evacuated outdoors. This is most likely due to the frequent aftershocks, which were common for five days after the earthquake (Meteorological Agency 2004). These aftershocks caused anxiety about the safety of the buildings and led many victims to strongly feel that “it was not safe to stay indoors”.

Thus, the sporadic aftershocks substantially affected the victims’ evacuation and dwelling selection behavior. 2) Fewer victims used their relatives’ houses as shelters. In the Great Hanshin Awaji Earthquake, relatives’ houses were the largest alternatives to shelters two to four days after the earthquake. However, this tendency was not observed in the Mid-Niigata Prefecture Earthquake. This is probably because relatives’ houses were in close proximity to the disaster-stricken area and the community was more intimate than in an urban area so that they did not feel as uncomfortable or inconvenienced at the shelters. The interview of the community leaders in Kawaguchi clarified the strong social ties of community people in the time of disaster.

### **(3) Safety Confirmation of the Victims**

In addition to evacuating in the initial stage of an emergency, safety confirmation also occurs. Safety confirmation is defined as “the work to confirm the safety of people, things, and matters precious to oneself.” In this survey, the respondents were asked whether they actually confirmed the safety/damage of the following 6 items: 1) immediate family, 2) extended family, 3) private house, 4) furniture and effects, 5) private car, and 6) their rice and vegetable fields. They were asked to circle the date on the “calendar” in the questionnaire to indicate when they confirmed the safety/damage of each item.

Figure 4 shows the time when they confirmed the safety/damage. Within ten hours of the earthquake, the respondents confirmed the safety of their immediate families and then the condition of their private cars. It was obvious that they confirmed the means to evacuate before assessing the damage. Within the subsequent 10 hours, they confirmed the safety/damage conditions of their extended family, their private houses, furniture and effects. Within 100 hours, they confirmed the conditions of their rice and vegetable fields. Thus, the victims promptly assessed their situation after the earthquake.

### **(4) Reconstruction/restoration Process of the Victims**

The respondents were asked about the following feelings/behaviors/situations that mark the stages of their life reconstruction/restoration: 1) “Work or school has resumed.” 2) “The housing problems are finally settled.” 3) “My personal finances are no longer influenced by the earthquake.” 4) “Daily life has settled.” 5) “I no longer feel like a victim.” 6) “The local economy is no longer influenced by the earthquake disaster.” The respondents were asked to circle the date on the “calendar” in the questionnaire to indicate when they felt such feelings/behaviors/situations.

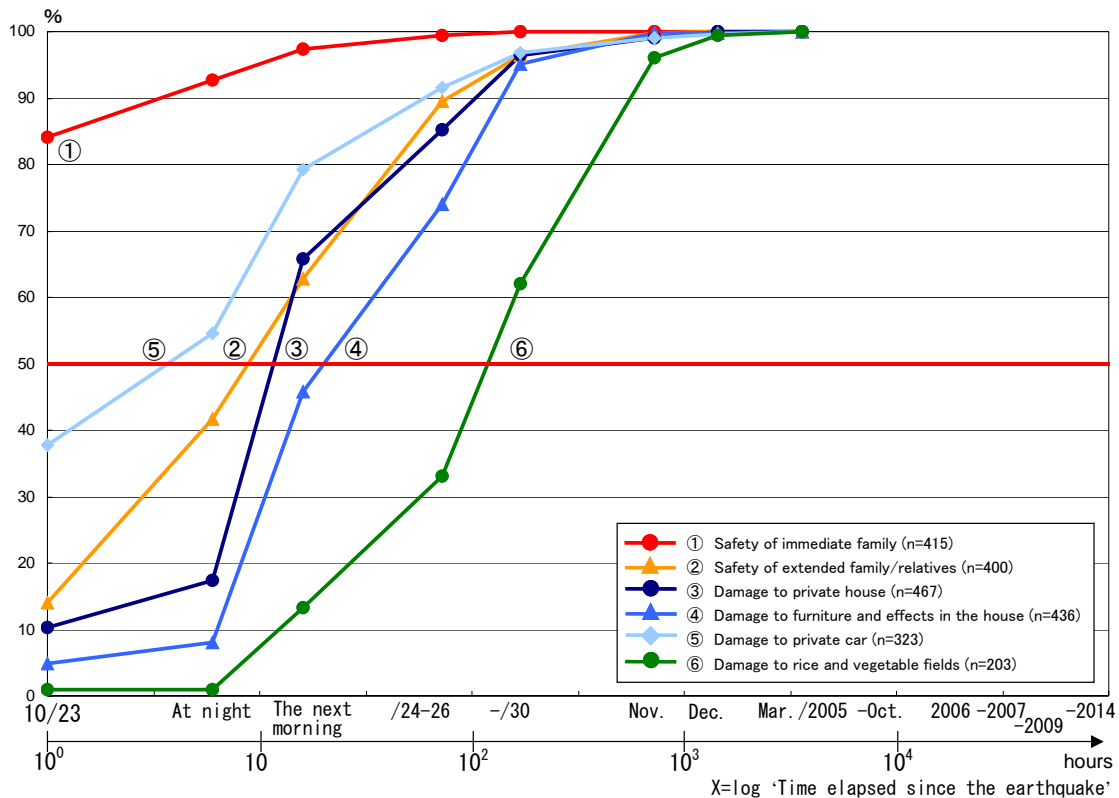


Figure 4. Time When the Safety and Damage were Assessed

The results (Fig. 5) show that their work or school resumed two weeks after the earthquake. It took two months (1,000 hours) for their lives to settle, but it took five months (March 2005) after the earthquake, for more than 50% to resolve their housing issues. As of March 2005, when the survey was conducted, 44.3% felt that their personal finances were no longer influenced by the earthquake, while 38.6% indicated that they no longer felt like disaster victims. However, only 12.1% felt that the local economy was no longer influenced by the earthquake. The subjective evaluation of the reconstruction/restoration process by the local residents clearly indicated that the earthquake drastically impacted personal finances and the entire area.

These results were compared to those from the survey conducted in the disaster-stricken area of the Great Hanshin Awaji Earthquake in January 2005. It was confirmed that the general pattern of life reconstruction/restoration process was similar for both. Especially, the reconstruction/restoration stages 1) to 6) occurred in the same order. This suggests that there is a general reconstruction/restoration pattern for earthquake disasters in modern Japan.

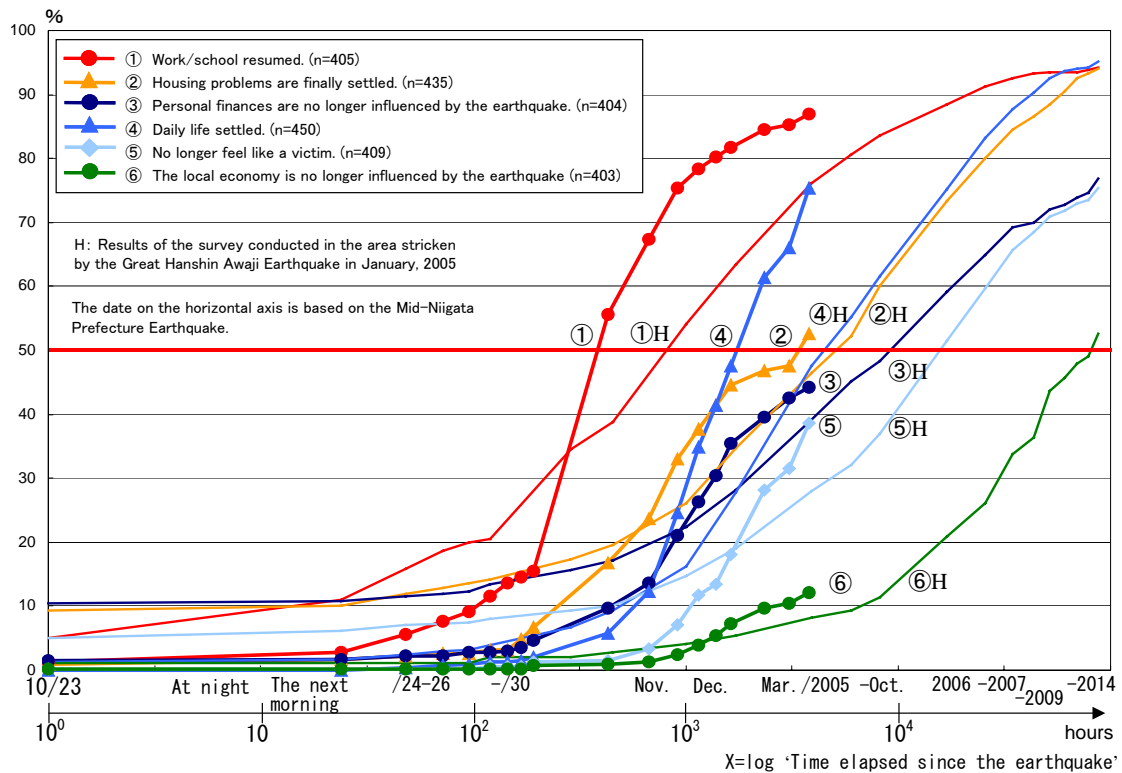


Figure 5. Life Reconstruction/Restoration Calendar (bold line: the Mid-Niigata Prefecture Earthquake, fine line: the Great Hanshin Awaji Earthquake)

### Conclusion

This paper examined the “Evacuation Behavior and Life Reconstruction Process of Victims in the 2004 Mid-Niigata Prefecture Earthquake.” The quantitative data, which was obtained by random sampling, clearly shows the changes in dwelling locations. It also indicates the order that the victims evaluated the safety of family, assessed the damage, and began to reconstruct their lives. More victims stayed “in the car, tent, garage or parking lot” two to four days (100 hours) after the earthquake, which is most likely due to the aftershocks. Unlike during the Great Hanshin Awaji Earthquake, the majority of the victims did not stay at home or seek refuge with relatives since the day of the earthquake.

When assessing the safety and damage, the victims confirmed the safety of their immediate family and then their private car (verifying the means to evacuate). Within ten hours after the earthquake, they confirmed the safety of their extended family, the damage to their own house, furniture, and effects. Within 100 hours, they confirmed the conditions of their rice and vegetable fields.

The reconstruction/restoration started two weeks (100 hours) after the earthquake by returning to work. After two months (1,000 hours), their daily lives had settled. Within six months (March, 2005), they had resolved their housing issues, felt like their personal finances



were no longer influenced by the earthquake, and that they were no longer victims. However, less than 50% felt that the local economy had recovered from the earthquake, which indicates the extensive impact that the earthquake caused in this area.

The disaster-stricken area is still in the process of reconstruction/restoration. To elucidate the entire recovery/restoration process, we plan to conduct follow-up surveys on a regular basis. We also would like to compare the obtained data to the results of other disaster studies (e.g., the Great Hanshin Awaji Earthquake, etc.) in order to determine the generality and applicability of this data.

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