Clarifying Suffering of the Elderly in the 2004 Niigata Flood and the 2004 Mid-Niigata Prefecture Earthquake

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ABSTRACT

This rapid pace of aging in Japan implies that the number of elderly persons requiring special care will also increase rapidly at the time of disaster. A sure sign of this state was seen in two recent disasters that occurred in Japan, which received public attention as a social problem of the suffering of the elderly. In the 2004 Niigata Flood, 12 of the 15 fatalities were over 65 years old. The Mid-Niigata Prefecture Earthquake resulted in over 1000 elderly refugees, who needed nursing care, staying in emergency shelters. This study aims to gather basic data on the response to elderly people and to show the necessity of constructing the discipline of disaster management care, a systematic approach to the disaster process of elderly people under drastic social environmental changes.

The major findings were as follows: 1. The care managers as the professionals licensed by the government-sponsored Long-Term Care Insurance System worked effectively to manage the needs of moving temporarily to care facilities, and 2. Thirteen percent of elderly people who moved to the care facilities as temporary shelters remained in the care facilities 6 months after the impact. These results suggest that care managers should be the more effective agents in responding to elderly people in disasters; however, they need the opportunity to learn about the disaster process of elderly people.

1. INTRODUCTION

Niigata Prefecture suffered two big disasters in 2004. The Niigata Flood occurred on July 13 and caused 15 deaths, 13 of which were senior citizens'. Of these 13 people who died, 8 were 75 years old or older. The disaster reminded the public that disaster-prevention measures for the elderly are necessary. The Mid-Niigata Prefecture Earthquake occurred on October 23 and had 1) long-lasting aftershocks, 2) evacuations by the village units, 3) officials advising a wide area to evacuate, and 4) substantial damage to the life line, which resulted in a larger number of evacuees and more senior citizens needing care. The aim of this study is to gather basic data on the response to the elderly, to show the necessity for disciplined disaster management care, and to develop a systematic approach to the disaster process for senior citizens under dramatic changes in the social environment (**Fig. 1**).

2. THE 2004 NIIGATA FLOOD

2.1 Background

An article from Niigata Nippo, a local newspaper, carried a horrible scene of heavy rain localized in Niigata Prefecture on July 13, 2004. The headline, "A Disaster Strikes the Elderly," clearly reflects how society took this flood. However, the concentration of elderly victims is not peculiar to this flood in Niigata. Another disaster still fresh in our memories is the high tide in Shiranui Bay caused by Typhoon No. 18 on September 24, 1999. That disaster claimed 12 lives, most of them elderly. It is generally taken for granted that the older we get, the more susceptible we become to

	Niigata Flood	Mid-Niigata Prefecture Earthquake	
Age	Casualties	Casualties	EQ-Related Deaths
5		3	0.16(2 months)
10		1,1,2,2	
15			
20			0
25			
30		4	2
35	7	9	
40	2	2	1,3,4
45			8
50		4	3
55		5	9
60	3	4	0
First Term 65			5,7,8,9
First Term 70	2,2,2		0,0,0,0,1,3,4
Latter Term 75	5,6,6,7,8,8	5,6,7,8,8	8,9
Latter Term 80	2,4	1	0,1,3,4,4
Latter Term 85	7		5,8,9
Latter Term 90			1

Male (black letters), Female (red letters)

Fig. 1 Victims of the Niigata Flood and Mid-Niigata Earthquake, 2004 (Source: Niigata Prefecture Government and Police)

KEY WORDS: the 2004 Niigata Flood, the 2004, Mid-Niigata Prefecture Earthquake, evacuation, people with special needs, the elderly

damage in disasters. This is why we need to consider the general tendency towards a concentration of elderly victims in disasters. This has become a critically important problem for us, a country with a progressive tendency towards more elderly people and fewer children. Our disaster prevention measures must consider how to deal with the particular susceptibility of the elderly to disasters.

2.2 Who is "Elderly"?

According to the definition by the Ministry of Health, Labor and Welfare, people aged 65 and over are elderly. Moreover, people from 65 to 74 years are called "first-term elderly," while people 75 years or older are "latter-term elderly." As shown in **Fig. 1**, among the 15 victims of the Niigata Flood, 12 were elderly as defined by the Ministry. However, as far as human development is concerned, only the concept of "elderly people" exists, although capacity vary widely among individuals. There are always personal variations at every stage of development from infancy to adolescence. Nevertheless, compared with development until adolescence, it is notable that people classified as elderly show remarkably large variations. When this fact is taken into account, it becomes clear that to uniformly treat all elderly people as fragile presents no real solution.

There was another matter of concern in the news coverage of the Niigata Flood. The flood report associated the concentration of elderly victims with the fact that the municipality was late in issuing an evacuation warning to the affected areas. It argued that this delay resulted in greater damage to elderly people. This argument was made on the assumption that if an evacuation warning had been issued earlier, the number of elderly victims could have been reduced. The argument is that giving an early warning increases the possibility of allowing more time for evacuation. However, this is just an assumption. It is necessary to conduct a fact-finding survey in order to understand how residents acted in the face of the disaster this time. Based on the results of the survey, the validity of the above-mentioned argument should be examined. It is also necessary to consider the technical possibility of giving an early evacuation warning and to verify the damage-reducing effect of such a warning.

2.3 Purpose of Research in this Case

The purpose of this study is to investigate the reason for the concentration of elderly victims in the Niigata Flood on July 13, 2004 and propose an appropriate measure for reducing the number of victims of flood disasters in the future. There are tens of thousands of people classified as elderly living in the districts stricken by the flooding. It is essential to analyze the reasons that only 12 elderly persons lost their lives and what factors made these persons different from others. Possible factors include the physical properties of the hazard, the geographical characteristics of the districts where the victims lived, and the personal attributes of the victims. This study aims to clarify and combine these factors and determine the causes of death in this disaster. In other words, this study aims to "profile" the causes of death.

The survey of disaster conducted this time under the Ministry of Education, Culture, Sports, Science and Technology covers three cases of flood damage that almost concurred in Niigata, Fukushima, and Fukui. This paper focuses on analyzing the flood in Niigata, which involved the most victims. The 15 victims of the Niigata Flood may be roughly classified as three victims of landslides and 12 victims of flooding. The target of this analysis is limited to the hazard of flooding, which claimed 12 lives, and excludes the three victims of the landslides. As shown in **Fig. 2**, a field survey was conducted this time in Nakanoshima Town where three persons lost their lives as a result of overflow from the broken left levee of the Kariyata River and Sanjo City where nine persons lost their lives as a result of overflow from the broken left levee of the Ikarashi River. The results of this survey are described in detail in this report.

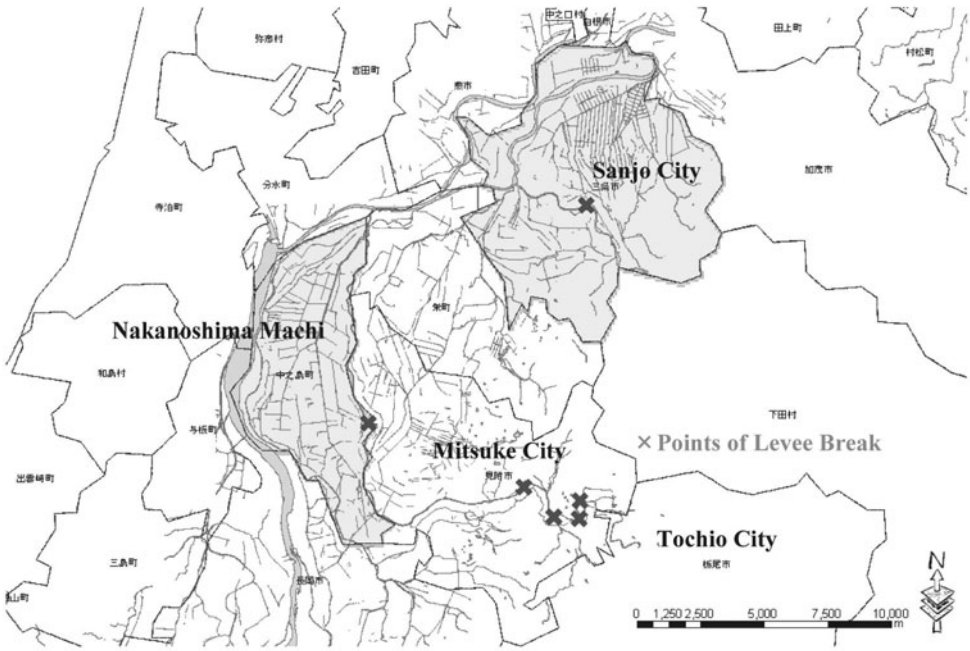

Fig. 2 Areas Covered by this Survey and Overflow from the Broken Levees

Fig. 3 Cumulative Rainfall (July 13th 0 am-12 pm) in the Affected Area of the 2004 Niigata Flood (Data from the Japan Meteorological Agency)

2.4 Hazard Characteristics of the July-13th Heavy Rain

Prior to the examination of the factors behind the human damage based on the results of the field survey, it will be verified that the July-13th flood was caused by a localized torrential downpour incomparable in recent years in terms of precipitation and changes in the water levels of the Kariyata and Ikarashi Rivers. Then, the municipal measures taken and official announcements made for this flood in Nakanoshima Town and Sanjo City will be summarized.

2.4.1 Precipitation

First of all, the severity of the hazard that caused this flood disaster will be reviewed with reference to the precipitation of July 13 and the water levels of the Kariyata and Ikarashi Rivers. According to "A Quick Report on Heavy Rain and River Disasters in Niigata and Fukushima in July 2004" compiled by the River Department of the Hokuriku Regional Development Bureau and the River Planning and Management Division of the Department of Public Works, Niigata Prefecture, it is pointed out that in only one day, "the stagnant front locally brought even more torrential downpour into a small area than the normal monthly rainfall in July." Looking at the spatial distribution of rainfall in **Fig. 3** and **4**, it is found that there was a huge amount of rainfall in the upper reaches of the Kariyata and Ikarashi River water systems.

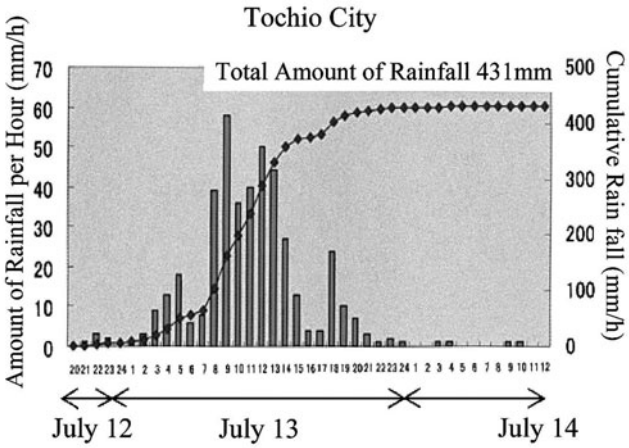

Fig. 4 The Distribution of Daily Rainfall on July 13 and Changes in Hourly Rainfall in Tochio City
(Source: "A Quick Report on Heavy Rain and River Disasters in Niigata and Fukushima in July 2004" compiled by the River Department of the Hokuriku Regional Development Bureau and the River Planning and Management Division of the Department of Public Works, Niigata Prefecture)

Rainfall of 431 mm/day was recorded at the Tochio Rainfall Observatory (Japan Meteorological Agency), which covers the Kariyata water system. This heavy rain was the first such experience for the majority of the local people. Looking at hourly rainfall, it is found that it began to rain on the night of July 12 and that rainfall of over 100 mm/hour continued for three hours after 3 o'clock in the morning on July 13. Although the rain eased at one point, it strengthened again and averaged over 30 mm/hour from 8:00 am until nearly 3:00 pm, during which time there was rainfall of about 300 mm. Between 9:00 and 10:00 am and between midday and 1:00 pm, the rain exceeded 50 mm/hour, the level at which the Japan Meteorological Agency indicates that the risk of flooding and landslide is high.

2.4.2 Levee Breaks

This heavy rain broke levees at 11 spots, and the time of breakage has been estimated for ten of these spots. As shown in **Table 1**, at 9:00 am, two breaks occurred in the left bank of the Noshiro in Shimo-okanbara, Muramatsu Town and in the left bank of the Saruhashi in Tomijima Town, Nagaoka City. At about 1:00 pm, the Ikarashi overflowed from the broken left bank in Suwa, Sanjo City, and the Kariyata overflowed from the broken left bank in Nakanoshima, Nakanoshima Town, causing human damage. At around that time, there were also breaks in both banks of the Nakanoshima in Shitanuma-shinden, Nakanoshima Town, and in both banks of the Chigoshimizu in Ikenoshima Town, Mitsuke City. These facts appear to indicate excavated rivers overflowing beyond their capacity. Moreover, at about 2:20 pm, the Kariyata overflowed from the broken right bank in Myosho Town, Mitsuke City, and from the broken left bank in Kawano Town.

2.4.3 Flood Damage in Sanjo City and Subsequent Countermeasures

This section will outline the process of breakage in the left bank of the Ikarashi and its subsequent overflow in Suwa, Sanjo City, where nine persons lost their lives. The city's countermeasures before and after the breakage according to "The General Situation of the Heavy Rain Disaster on July 13, 2004" compiled

Table 1. Times of Levee Breakage due to Flooding on July 13

Name of River	Break		City/Town	District	July 13											
	Spot	Width			8	9	10	11	12	13	14	15	16	17	18	19
Noshiro	Left bank	40	Muramatsu Town	Shimo-okanbara		About 9:00										
Ikarashi	Left bank	117	Sanjo City	Suwa (Magarifuchi)						About 13:07						
Nakanoshima	Left bank	6	Nakanoshima Town	Shitanuma-shinden						About 13:00						
	Right bank	6								About 13:00						
Kariyada	Left bank	50	Nakanoshima Town	Nakanoshima						About 13:00						
	Right bank	42		Myosho Town							About 14:20					
	Left bank	70	Mitsuke City	Kawano Town							About 14:20					
	Left bank	30		Miyanohara Town												
Chigoshimizu	Left bank	102	Mitsuke City	Ikenoshima Town						About 13:00						
	Right bank	50								About 13:00						
Saruhashi	Left bank	14	Nagaoka City	Tomijima Town		About 9:15										

Source: "A Quick Report on Heavy Rain and River Disasters in Niigata and Fukushima in July 2004" compiled by the River Department of the Hokuriku Regional Development Bureau and the River Planning and Management Division of the Department of Public Works, Niigata Prefecture

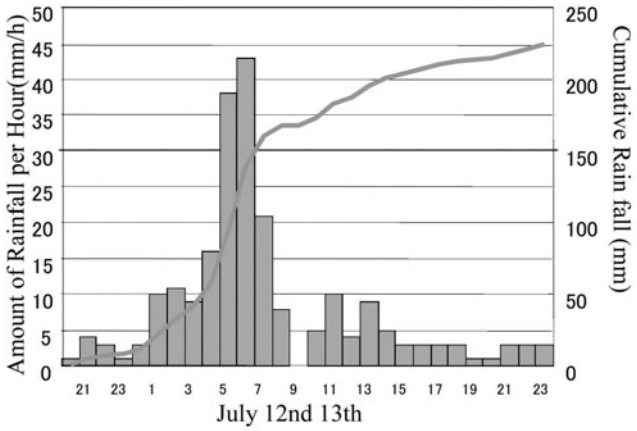

Fig. 5 Rainfall in Sanjo City in the July-13th Flood (Municipal Fire Defense Headquarters)

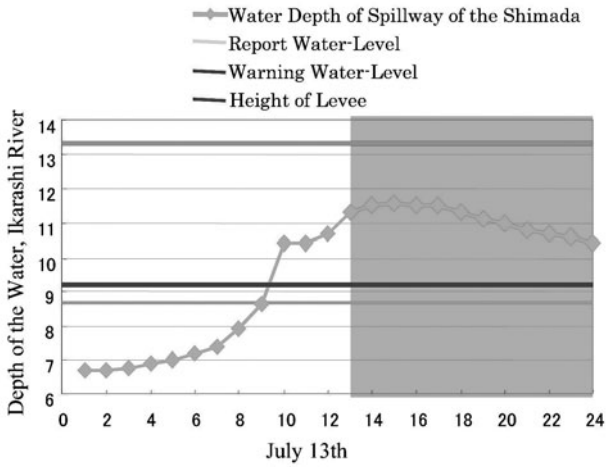

Fig. 6 Changes in Water Level of the Ikarashi (At the Shimada Spillway) Source: Sanjo City Office

by the Sanjo City Office will also be summarized.

The condition of rainfall in Sanjo City is shown in **Fig. 5**. The observation equipment of the Automated Meteorological Data Acquisition System in the Fire Defense Headquarters recorded rainfall of 217.5 mm/day from 0:00 to 24:00 on July 13 and a maximum of 44.5 mm/hour between 6:00 and 7:00 am. Sanjo City had sustained flood damage four times since 1961, namely in August 1961, August 1967, June 1978, and July 1999. The maximum daily rainfalls at the times of these floods were 184.0 mm on August 5, 1961, 106.0 mm on August 28, 1967, 169.0 mm on June 26, 1978, and 91.6 mm on July 21, 1999. However, the flood damage this time resulted from daily rainfall in excess of all these records.

Changes in the water level of the Ikarashi were observed at the spillway of the Shimada. The level changed every hour on July 13 as shown in **Fig. 6**. The highest level of the river at this spot is normally 11.60 m, so, with a height of 13.35 m, the levee is high enough to prevent flooding. However, at 9:00 am, the level exceeded the "report level" and continued to rise at a rapid pace. At 1:00 pm, the levee finally broke in the Suwa District. Even after that, the water level at this spot continued to rise and reached a peak between 3:00 and 4:00 pm.

Sanjo City took action as follows. The Anti-Disaster Headquarters was set up in the second reception room on the third floor of the City Office at 9:00 am on July 13. As the disaster expanded after that, the headquarters was moved to the conference room on the second floor. At 11:18 am, the headquarters requested the Governor of Niigata to send for the Self-Defense Forces. Afterward, a break in the left bank of the Ikarashi was recorded at 1:15 pm.

Evacuation warnings were issued to the districts shown in **Fig. 7** at the three times of 10:10, 11:00, and 11:40 am on the morning of July 13, before the time of the break. The first warning at 10:10 am targeted 2,300 households in Kagoba, Chushin, Nishi-osaki 1-chome to 3-chome, and Magarifuchi 2-chome in addition to the banks of the Ikarashi. The second warning at 11:00 am targeted 2,230 households in Sanchiku 1-chome, Higashi-shinbo, Magarifuchi 1-chome to 3-chome, Tsukioka 1-chome to 4-chome, and Suwa 1-chome to 3-chome. The final warning at 11:40 am targeted 6,016 households in Shimada 1-chome to 3-chome, Onohata, Kita-Yokkamachi, Yokkamachi, Minami-yokkamachi 1-chome to 4-chome, Nishi-yokkamachi 1-chome to 4-chome, Yuri, Jonan Town, Sakuragi Town, Nishi-honjoji Town 1-chome and 2-chome, Sugue Town 1-chome to 4-chome, Kita-shinbo 1-chome and 2-

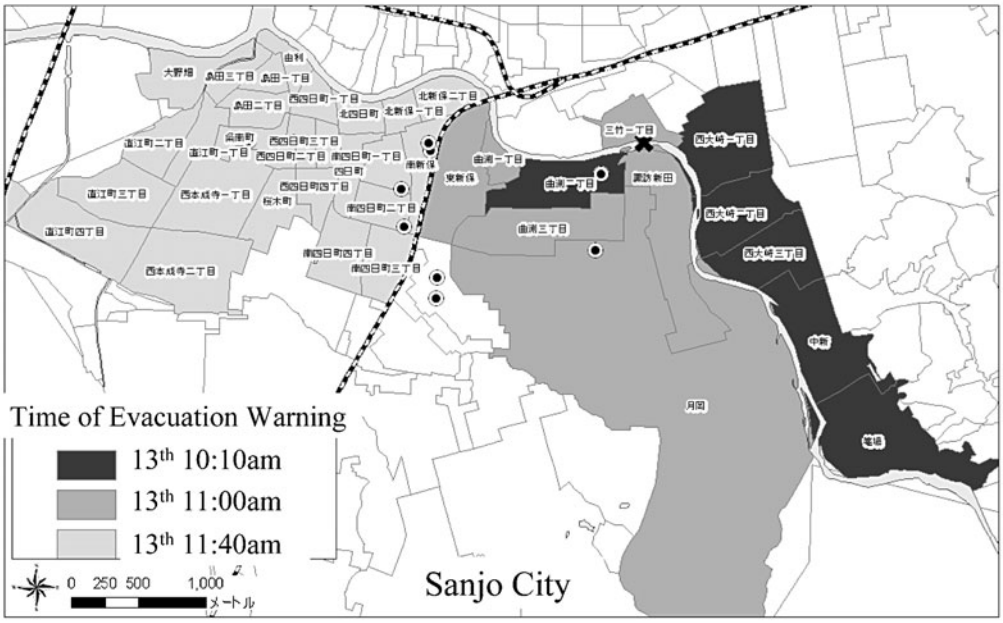

Fig. 7 Timing of Evacuation Warnings Given by Sanjo City

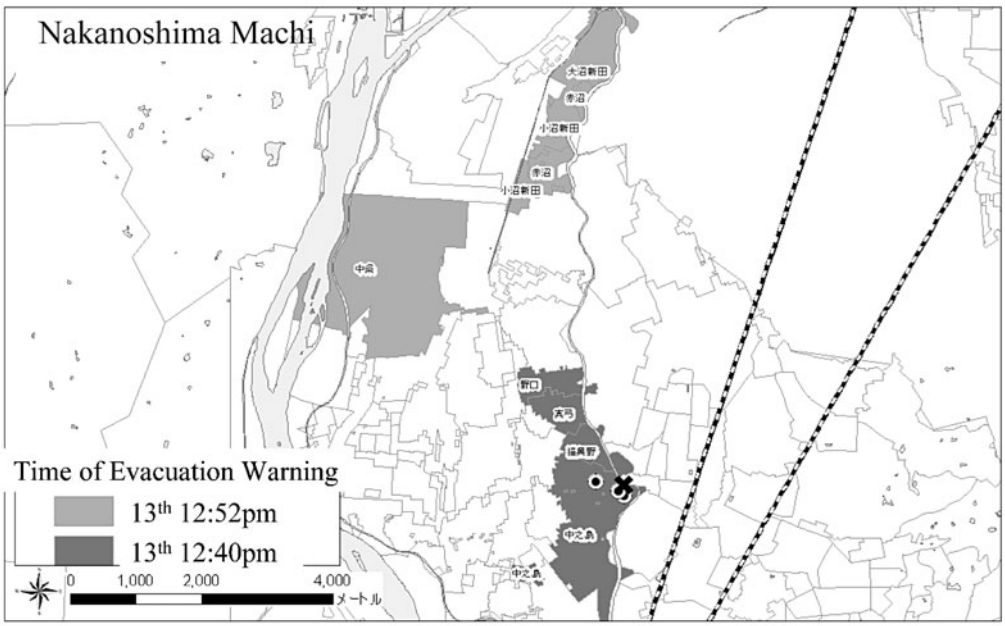

Fig. 8 Timing of Evacuation Warnings Given by Nakanoshima Town

chome, and Minami-shinbo.

With regard to flood damage in Sanjo City as of August 11, human damage included 9 persons dead, 1 seriously injured, and 79 slightly injured, while housing damage included 1 house completely destroyed, 55 half-destroyed, 5,437 flooded above the floor (including 138 condominiums), and 1,336 flooded below the floor (including 15 condominiums).

2.4.4 Flood Damage in Nakanoshima Town and Subsequent Countermeasures

In Nakanoshima Town, a break in the left bank of the Kariyata seriously affected the area down river from Imamachi Ohashi and took three lives. No information is available regarding hourly changes in rainfall in the town or the water level of the Kariyata. For rainfall data, the author referred to data available in the aforementioned Tochio City that belongs to the Kariyata water system. In the text that follows, the countermeasures taken by Nakanoshima Town on July 13 will be generally reviewed according to "A Quick Report on the July 13th Flood Damage" compiled by the Nakanoshima Anti-Disaster Headquarters issued on July 24.

On the day of the flood, sandbags started to the piled in the

area down river from Imamachi Ohashi Bridge to Nekoyono Bridge at close to 11:00 am. The Anti-Disaster Headquarters was set up between 12:20 and 12:40 pm, when evacuation warnings were issued to Oaza-nakanoshima, Nekoyono, Mayumi, and Noguchi. The Kariyata started flooding behind Myoeiji Temple down river from Imamachi-ohashi at 12:52 pm. At that time, evacuation warnings were issued to Kamidori, Nakajo, Shinjo, Saisho, and Mitsunuma. The timing of the warnings is shown in **Fig. 8**. With regard to human and housing damage, there were three persons dead and an unknown number of people injured, and there were 15 houses completely destroyed, 139 half-destroyed, 496 flooded above the floor, and 375 flooded below the floor.

Various measures were taken after the break in the levee. At 2:00 pm, the prefectural police started rescue activities by helicopter in Nakanoshima and Nekoyono. At 3:27 pm, the Air Self-Defense Force started rescuing children from Nakanoshima Nursery. At 6:40 pm, the power supply to the Town Office was cut off and public services were suspended. Then, the functions of the Anti-Disaster Headquarters were transferred to the Citizens Culture Center. By 7:40 pm, all children had been rescued from the above-mentioned nursery. At 10:35 pm, advance troops from the Defense Army started rescue activities by boat.

2.5 Survey Method

In Sanjo City and Nakanoshima Town, Niigata Prefecture, where people were affected by flooding, relevant available information was collected mainly by interviewing elderly people who survived the disaster in these areas and the persons responsible at the relevant agencies. The results of these interviews and information were compiled in the form of a database on GIS as shown in **Fig. 9**. Then, the following three situations were reproduced in order to determine the causes of death.

2.5.1 Information Collected

A) Physical Reconstruction of Flooding

The characteristics of flooding in the areas covered by this survey were clarified from physical and engineering standpoints and displayed on GIS. Basically, a two-dimensional map was drawn, but a three-dimensional mapping of a particularly badly affected area was also made for the neighborhood association concerned.

(1) Where did flooding occur?
(2) How deep was the flooding?
(3) How did flooding progress? The rate of flow, the direction of deep flow, and the velocity of flooding

B) Reconstructing Local Livelihoods

Regional characteristics in the following seven aspects of life were examined with the focus on the neighborhood associations to which the victims belonged. These aspects comprise housing, personal connections, community, preparations, mind and body, living conditions, and the relationship between the administration and residents, which were identified as structural factors in reconstructing livelihoods in the process of verifying rehabilitation from the Great Hanshin-Awaji Earthquake of 1999 (Hayashi, 2003).

(4) Housing structure, age, spatial arrangement
(5) Personal relationships with neighbors (including the need for volunteers)
(6) Town streets and local activities
(7) Preparations for disaster
(8) Mental and physical stress and health problems
(9) Occupation (salaried worker, commercial or industrial proprietor, farmer)
(10) Administrative anti-disaster measures

C) Reconstruction of Behavior during the Flood

The situations of residents in the flooded areas and the actions of each family against the flooding were clarified in order to resolve questions as to whether there were any special factors behind the occurrence of the deaths and what separated those who died from those who lived.

(a) Issuance and transmission of evacuation warnings
(b) Response of each family to the warnings

2.5.2 Preparations for Survey

As well as a preliminary study, the following preparations were made for a more efficient field survey.

1) As much information as possible was collected regarding where people were injured as well as personal data on the victims.
2) As much information as possible was collected regarding what measures the relevant agencies took before and after the disaster.
3) The details of TV and radio broadcasting were gathered.
4) Relevant articles from local newspapers were gathered.

2.5.3 Field Survey

The field survey was conducted as follows.

1) Period: 4 days from August 21 to 24
2) Coverage: Sanjo City, Nakanoshima Town, Niigata University, and Niigata Prefecture Office
3) Method: Collect information from the people concerned using the following method.
   -Choose affected areas with the same hazard characteristics and regional features and interview elderly people (coordinate their age and gender, if possible) who lived near the affected areas to ask how they acted in the face of the disaster.
   -Draw out the personalities and lifestyles of the victims from their interviews.
4) Participants: A total of 18 persons (6 from the Disaster Prevention Research Institute, Kyoto University; 5 from the Civil Disaster Prevention Research Institute; 1 from Doshisha

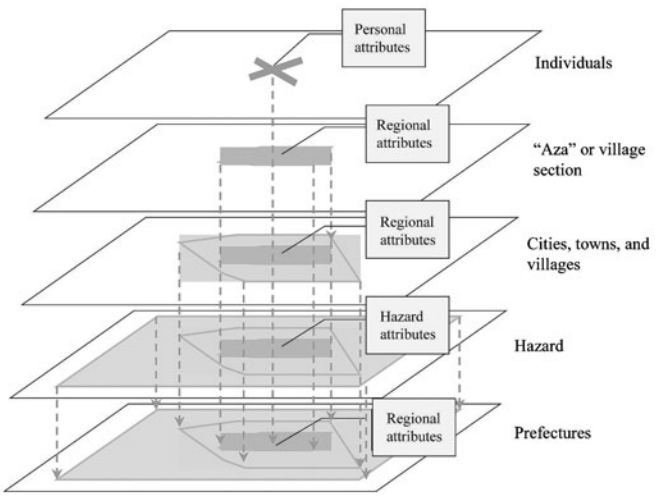

Fig. 9 Data Integration by GIS to Determine the Causes of Death

University; 1 from Nagaoka National Collage of Technology; 1 from the Disaster Management Office, Nagoya University; 1 from NTT West Japan; 2 from the Earthquake Disaster Mitigation Research Center (RDM), National Research Institute for Earth Science and Disaster Prevention (NIED); and 1 from ESRI-J)

2.6 Results of the Field Survey

Fig. 10 shows the districts covered by this interview survey, where the July-13th flood claimed several lives. Evidence and information were collected by interviewing the heads of the neighborhood associations in the six districts where residents lost their lives, namely the Nakanoshima District of Nakanoshima Town, Jonan Town, Minami-yokkaichi Town, Minami-shinbo, Shinbo, and Magarifuchi of Sanjo City. The depth of flooding was also measured from photographs of the flooded districts and marks of flooding.

2.6.1 Three Patterns of Death in the July-13th Flood

To state the conclusion of this survey first, the situations of the 12 victims in Nakanoshima Town and Sanjo City may be largely classified into three patterns, as shown in **Table 2**.

Pattern 1 applies to three cases of death in the Nakanoshima District of Nakanoshima Town. After a break occurred in the sharply curved left bank of the Kariyata, three latter-term elderly people died in their respective houses located near the break, which were destroyed by overflow from the break. Patterns 2 and 3 arose from the broken bank of the Ikarashi in Sanjo City. These two patterns can basically be divided by the railroad of the Shin'etsu Line. Pattern 2 occurred on the east side of the Shin'etsu Line near the break. All five victims died outdoors, but their ages vary. On the

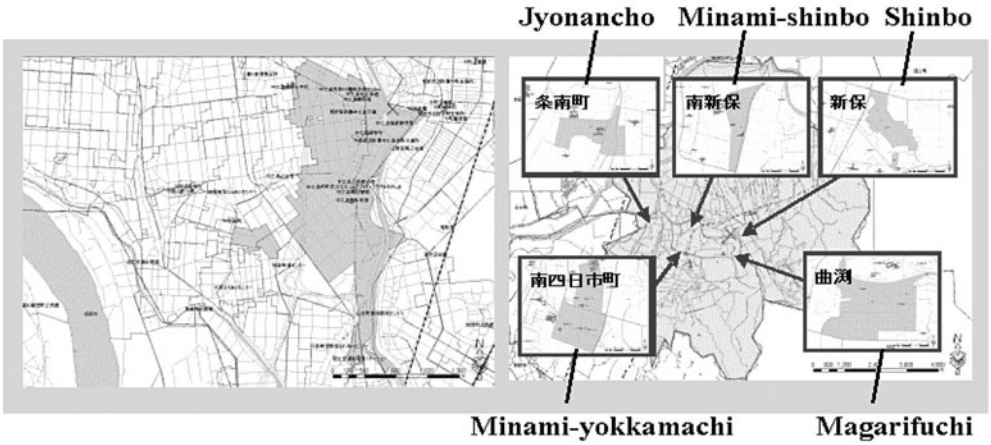

Fig. 10 Six Districts Covered by This Survey

Table 2. Patterns Leading to Death in the July-13th Flood

Pattern		Pattern 1	Pattern 2	Pattern 3
Region		Nakanoshima Town	Rannan, Sanjo City, east of the Shinetsu Main Line	Rannan, Sanjo City, west of the Shinetsu Main Line
		over 3 m	approximately 1.5 m	approximately 1.5 m
Conditions of the Hazard		a flood that could destroy houses	the water current had a high velocity; the flood that was not powerful enough to destroy houses	the water current was slow; flooded rapidly in about 1.5 hours after the bank broke
Conditions of damage		All became victims in a house destroyed by the floodwater	All became victims outdoors Two people fell victim while moving to a designated shelter	All of them died in their own houses All of them had difficulty walking and were not with a caregiver
age	35		**37**	
	40		42	
	45			
	50			
	55			
	60		**63**	
	65			
	70		**72**	
	75	75,**76**,78	78	76,**78**
	80			
	85			85,88

Red: Female, Black: Male

other hand, Pattern 3 occurred on the west side of the line. All four victims were latter-term elderly people who died in their homes. These results suggest that elderliness is a major factor that increased the fragility of three of the victims in the July-13th flood, but it does not explain all. In the text that follows, these three patterns will be examined in detail.

2.6.2 Pattern 1: Effect of Severe Hazard (Nakanoshima, Nakanoshima Town)

Fig. 11 summarizes the respective situations of victims killed by the overflow of the Kariyata in the Nakanoshima District of Nakanoshima Town. To display a clearer state of the hazard, flooding depth contours were drawn from on-the-spot measurements of depth using laser profiling technology on the three-dimensional map depicting the flooded areas just after the break. Three victims are indicated on the map with regard to the location of their house, age, gender, health condition, estimated time of death, time of discovery, and the assumed situation of death.

Fig. 11 shows that all of the victims' houses were located within a radius of 100 meters from the broken bank and were destroyed on the first floor. It was also found that the depth of flooding exceeded three meters. Moreover, it is apparent from the two photographs in **Fig. 12** that the rain continued to fall even after the levee broke and the flood reached the second-floor level. The intensely rising waves produced a strong current. After the water eased, sediment and various other floating objects piled up in the areas that had been submerged by over three meters of water. All of the houses in these areas were so severely damaged that they had to be demolished after the flood.

Three of the victims had the following aspects in common. First of all, they were found dead in their houses. Second, their houses were destroyed. Third, they were latter-term elderly. And fourth, they were healthy. Although many houses were destroyed

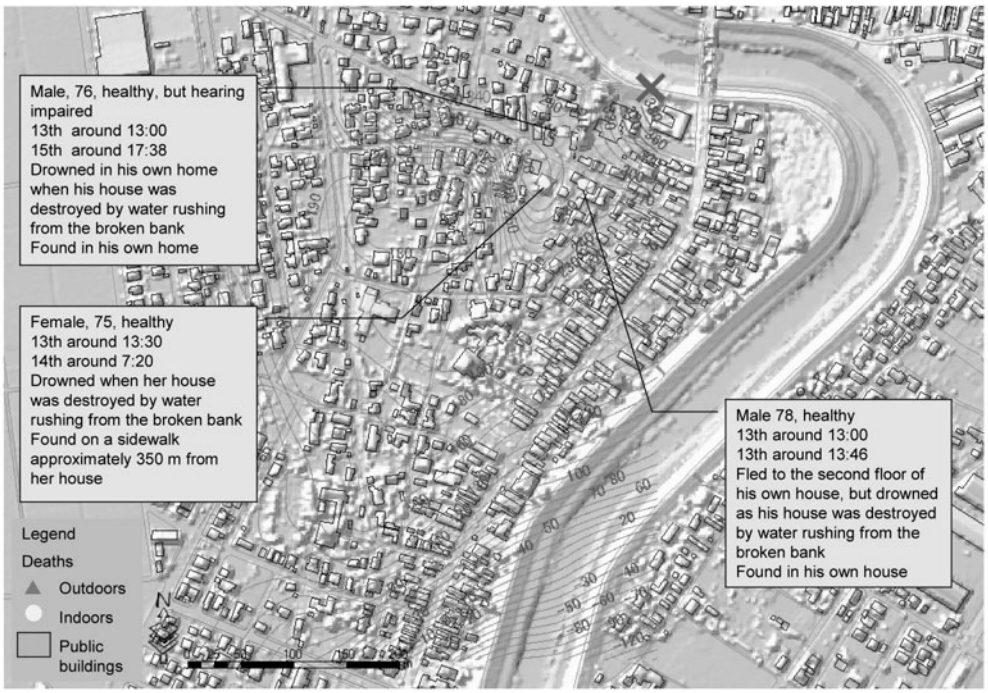

Fig. 11 Occurrences of Victims in Nakanoshima, Nakanoshima Town

Fig. 12 The State of Flooding just after the Break and Several Days Later near the Broken Bank in Nakanoshima Town (Photos by Mr. Kaichi Murohashi)

by the flood, only these three elderly people died. From this fact, it is certain that their elderliness hindered their evacuation from their homes. However, the severity of a three-meter flood strong enough to destroy houses also played a huge part in deciding the fate of these victims.

If these aspects are summarized, it may be concluded that in cases of severe flooding over three meters deep with a strong current, wooden houses near a broken bank are exposed to a high risk of collapse. The construction of private properties under such environmental conditions will increase regional fragility and influence the concentration of damage to the fragile latter-term elderly.

2.6.3 Pattern 2: Near the Broken Left Bank of the Ikarashi in Sanjo City

Fig. 13 shows the characteristics of the five cases on the east side of the Shin'etsu Line near the broken left bank of the Ikarashi, which belong to Pattern 2. The most striking features of this pattern are that the victims were found dead outdoors and all three were non-elderly. Even the house closest to the break was about 400 meters distant from it (marked with a small square in **Fig. 13**). This house was the most severely damaged in this affected area. The severity of the damage is shown in **Fig. 14**. It was a two-story wooden house. As the house was flooded above the floor and had clay sediment nearly one meter high inside, it looks uninhabitable and abandoned. However, the exterior of the house remains undamaged and it would still be basically habitable if it were cleaned. From the marks left on the neighboring houses, the depth of flooding was estimated to be about 1.5 meters in this area.

Two of the five victims died on their way to the shelter. Another two were living in other cities but visiting Sanjo City on business and died on the street. In the final case, the victim went to inspect his factory, which faced the railway of the Shin'etsu Line, and died just after arriving. According to witnesses, there was a

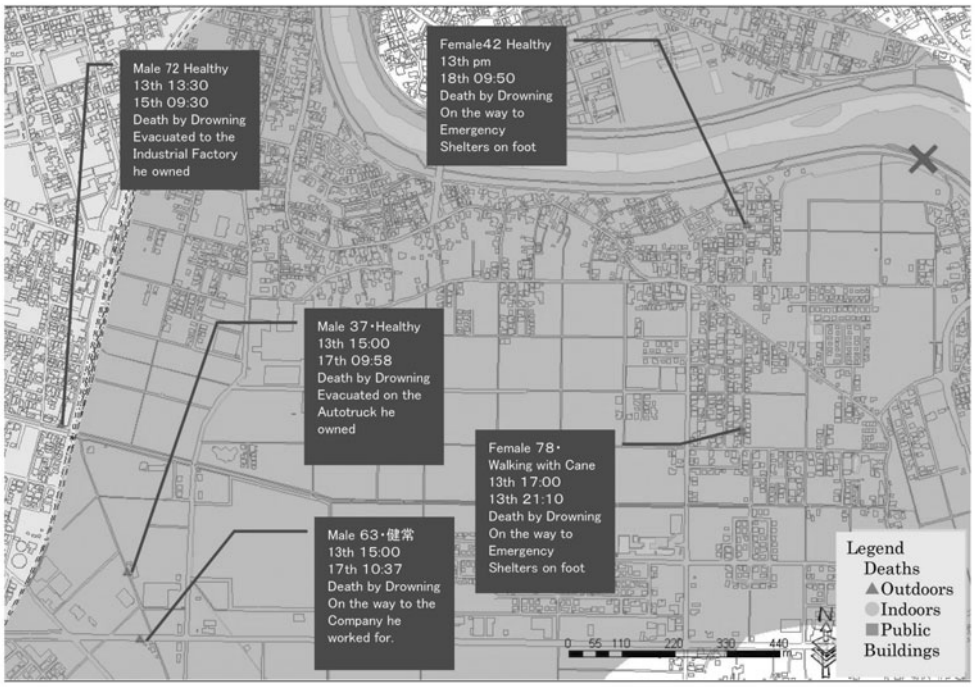

Fig. 13 Occurrence of Victims near the Broken Left Bank of the Ikarashi

Fig. 14 Damage to the House Closest to the Broken Left Bank of the Ikarashi (Photos by Haruo Hayashi)

considerably strong water current on the east side of the Shin'etsu Line. For example, it is reported that a rescue boat of the Self-Defense Forces was overturned by the strong water current in the Tsukioka District, designated as a shelter for residents near the break in Magarifuchi and Suwa.

In the five cases belonging to Pattern 2, all victims died outdoors. Judging from the fact that they included persons of 37 years and 42 years of age, elderliness was not necessarily a factor in the deaths. These cases strongly suggest that, even with a good reason, it is very dangerous to venture outdoors in a 1.5-m-deep flood with a strong current. As shown by the photographs in **Fig. 14**, even the house closest to the break suffered only partial structural damage. This suggests that death could have been avoided if the victims had escaped upstairs or if the visitors from other cities had escaped to nearby houses. This also raises questions as to whether or not it is safe to go to a designated shelter on foot against a strong current, especially when the current does not threaten to destroy houses.

2.6.4 Pattern 3: Western Vicinity of the Shin'etsu Line on the Left Bank of the Ikarashi in Sanjo City

The severity of the four cases belonging to Pattern 3 is shown in **Fig. 15**. This area is known as the Rannan District and is in the western vicinity of the Shin'etsu Line on the left bank of the Ikarashi. The flooding of this area was about 1.0 m to 1.2 m deep and started after 3:00 pm. This means that there was a time lag of two hours from the levee break until the start of flooding. Since this is a lowland area near the meeting point of the Ikarashi and the Shinano, water is always drained away with a pump. The local people experience floods of about 20 cm deep several times every

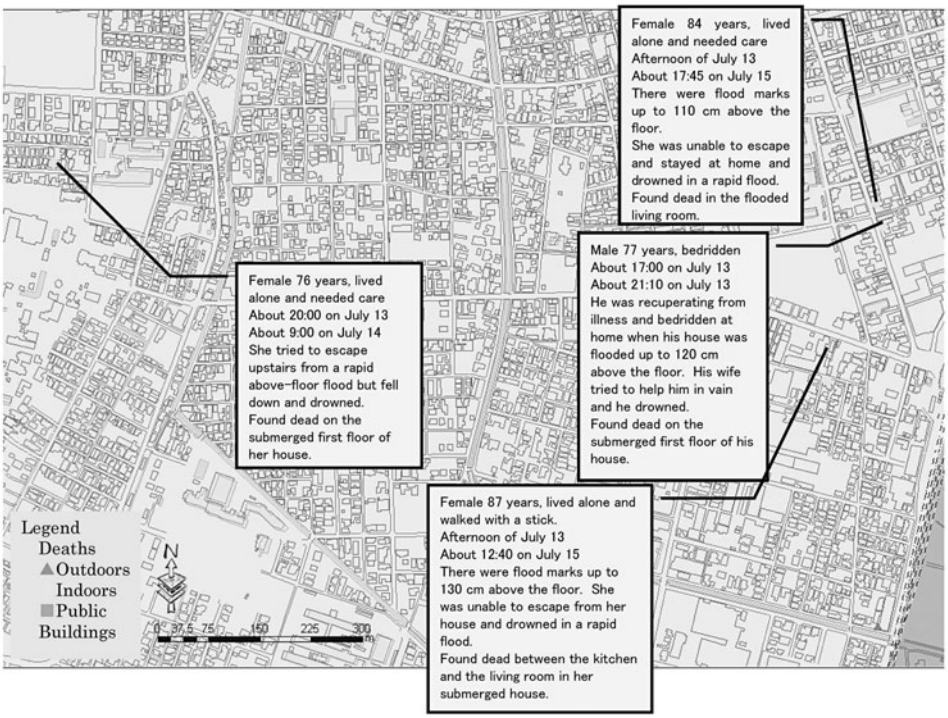

Fig. 15 The Situations of the Victims in the Western Vicinity of the Shin'etsu Line on the Left Bank of the Ikarashi in Sanjo City

Fig. 16 Examples of the Victims' Houses in the Western Vicinity of the Shin'etsu Line on the Left Bank of the Ikarashi in Sanjo City (Photos by Haruo Hayashi)

year. On the morning of July 13, too, there was an intense downpour and internal flooding in some districts. However, the residents took it for just another of the regular floods.

A witness of the flood, the acting head of the Rannan Neighborhood Association said, "At about 3 o'clock, something like a black snake appeared in a small pool of water on the ground." This shows that the external flood water on the east side of the Shin'etsu Line began to flow into the inland flood water about two hours after the break. When he saw something like a black snake appearing from sewage in a clear pool, he recalled what his mother had told him long ago: "If you see a black snake in the sewage, be careful!" There was once a break on the same bank of the Ikarashi in 1926. His mother, who experienced it at that time, said, "At the time of Suwagire, a snake appeared in clear water." As soon as he recalled what his mother had said, he started a rapid escape. According to this witness, the water level rose rapidly but the flow rate was not so quick.

In the two-story apartment house shown in **Fig. 16**, a woman who lived in the left-hand apartment on the first floor died. The whole of this area was flooded up to 1.2 m above the floor. However, damage to the houses cannot be seen from the exterior.

The four victims belonging to this pattern had the following features in common. The first feature is that all four victims were found dead in their own homes. The second is that all of them were latter-term elderly. The third is that they were unable to walk normally for some reason. More specifically, some walked with a stick, while others were bedridden and needed care. The fourth is that no helpers were available beside them at the time of flooding. Three of the victims lived alone. In the case of a 77-year-old bedridden man, his wife was with him at the time but she was also elderly. "I tried to pull my husband up over and over again, but could not move him from the bed," she said. In other words, victims were all latter-term elderly unable to walk by themselves who had nobody beside them to help them upstairs or to a safe place. The implication of these findings is that if any one of the latter three conditions had been different, everyone would have been able to survive.

2.6.5 The Meaning of "Elderly" Seen in the Three Patterns of Death in the July-13th Flood

Comparing the three patterns of death found in this survey makes the meaning of the headline "A Disaster Strikes the Elderly" clear. The occurrence of human damage may be regarded as a function of hazard severity and personal fragility. In both the Nakanoshima District of Nakanoshima Town (Pattern 1), which is considered to have faced the severest hazard, and the western vicinity of the Shin'etsu Line in Sanjo City (Pattern 3), which is considered to have faced the lightest hazard, the victims were all found dead indoors and were all latter-term elderly. This clearly shows that latter-term elderliness is a major factor that may determine personal fragility, and, as the newspaper article pointed out, there was certainly a concentration of elderly victims.

Although all of the victims in Patterns 1 and 3 were latter-term elderly, there were variations in the personal capacity of the victims of each pattern. In the three cases in Nakanoshima (Pattern 1), the victims were healthy but died in a disaster strong enough to destroy houses. In the four cases in Sanjo (Pattern 3), on the other hand, the flood was at most 1.5 m deep and not very rapid and there was an interval of one and a half hours between the break and the start of flooding. In this respect, the hazard was not highly life threatening. However, elderly people who usually had difficulty in moving or walking were found dead in their own homes without any helpers available beside them. This comparison suggests that hazard characteristics and personal and social attributes become causes of death: i.e. the occurrence of a severely hazardous flood over 3 meters deep strong enough to destroy houses, physical handicaps in everyday life, and the absence of helpers available on the spot.

Moreover, the analysis of the five cases on the east side of the Shin'etsu Line in Sanjo (Pattern 2) this time shows such exceptional conditions that latter-term elderliness does not prove a clear determinant. Of these cases, only the 78-year-old woman was latter-term elderly. Even if the range of elderliness is expanded to include the first-term elderly, only the 72-year-old man will be added. The remaining three were 37, 42, and 63 years old, and none of them was "elderly" as defined by the Ministry of Health, Labor and Welfare. This suggests that age was not the only causal factor in their deaths. The most notable feature common to these five cases is that all of the victims were found dead outdoors. This suggests that even in a flood about 1.5 m deep not severe enough to destroy houses, it is extremely dangerous to move in a rapid current. Two women among the victims died on their way to the designated shelter. This raises significant problems regarding how to secure safety at the time of a flood.

Care managers and nursing care workers have become social resources to assist the elderly since many senior citizens who live in their own homes receive nursing care insurance. These professionals essentially worked well during the disaster. However, one reason for the elderly deaths is that there was not a systematic emergency preparedness plan for community care managers. It was also concluded that there was a clear gap in the understanding of the senior citizens' needs between the nursing care workers and the leaders and sub-leaders of community associations or district welfare officers.

2.7 Lessons of this Survey for Damage Mitigation

What proposals can be made to reduce flood damage in the future based on the above results? There appears to be no universal measure to reduce the number of elderly victims. Rather, the results of this survey suggest that the following methods for reducing damage should be specifically determined for each of the three patterns.

- Where a severe flood threatens to destroy wooden houses:
- Ensure early escape to a safe shelter in anticipation of flooding above the second floor.
- Identify dangerous zones by mapping hazards.
- Advise residents to avoid constructing houses without considering flood preparedness in hazardous zones.
- Where a flood (above the floor) is not severe enough to destroy wooden houses:
- Avoid going out during the flood.
- Escape to somewhere safer inside the house.
- Where someone is latter-term elderly and unable to walk and yet has no helper beside him/her in an emergency:
- Utilize the care insurance system and local welfare resources.
- Ensure a system for transmitting information helpful for early recognition of unusually heavy rain or strong wind. And set

numerical standards for the system.

2.7.1 When a severe flood threatens to destroy wooden houses

As a precaution against a severe flood such as the one that occurred in the Nakanoshima District of Nakanoshima Town, it may first be concluded that land use avoiding the construction of wooden houses in areas at high risk of flooding should be fundamentally promoted. If possible, it is advisable to control the construction of private properties in such highly hazardous areas. If residents still insist on building their houses in such areas, anti-hazard house construction methods should be devised: e.g. the use of highly earthquake-resistant architecture such as reinforced concrete buildings, traditional levee raising, and the first floor constructed on piers to allow water through.

In post-war Japan, the population increase and the concentration of people in urban areas have accelerated the construction of many houses in floodplains in the vicinities of cities, which were formerly used for agriculture. As a result, the potential susceptibility of floodplains to disaster has risen. On the other hand, flood disaster measures have been taken with a focus on the promotion of river and embankment improvements for higher flow capacity and water control of the whole basin through constructing dams in the upper reaches of rivers. These measures have gradually reduced the frequency of floods. In turn, this reduction has increasingly facilitated the concentration of population in the floodplains.

The flood in Sanjo in 2000 really showed the limits of making river improvements for flood prevention. This disaster was a once-in-several-centuries event that resulted in external and internal flooding in the Shinkawa Basin on the right bank of the Shonai. The Shinkawa is a canal that was dug on the rural right bank of the Shonai in the Edo Period to protect the developing city center of Nagoya on the left bank from flooding. The recent development of land for housing has had an effect on the frequency of flood disasters in the Shinkawa Basin, which have occurred on such a large scale that insurance paid for written-off cars alone exceeds 100 billion yen. This example shows that there are limits to the hazards that can be prevented by river improvements. Floods now cause tremendous damage due to the increased fragility of the basin. The flood deterrence level of a river is represented by the recurrence cycle of flooding. Whereas a cycle of 200 years is assumed for first-class rivers, a cycle of 5 to 10 years is assumed for small and medium-sized rivers and drainage systems. The fragility of floodplains in the face of hazards beyond such scales has been sharply increased by the recent concentrations of population.

In this situation, efforts toward damage mitigation should start with making local people aware that they are living in a dangerous place. For this purpose, a hazard map needs to be prepared to ensure that local people take hazards into account when using land.

2.7.2 When a flood (above the floor) is not severe enough to destroy wooden houses

This applies to the two patterns of death in Sanjo City where wooden houses were not destroyed. For the five victims who died outdoors near the break on the east side of the Shin'etsu Line in the city, it seems that their deaths could have been prevented by clarifying the concept of evacuation. Where the flooding of wooden houses is not severe enough to destroy them or where flooding of just the first floor is predicted, staying at home should be considered as an important means of escape: i.e. going upstairs or using the second floor of a neighbor's house as a shelter.

After this disaster, the staff in charge of disaster prevention in the Cabinet Office set up a "conference on the transmission of information and provision of support to elderly people in case of heavy rain." This conference considered the concept of evacuation with respect to those who need care and help in a disaster. "Evacuation" when used as an administrative term is defined as "spatial movement from one point to another." However, the pattern of death near the break on the east side of the Shin'etsu Line in Sanjo City suggests how dangerous walking in the water above the hips is once the town begins to be submerged in over one meter of flood water. From the aspect of life saving, it should be regarded as an active escape for those who are able to walk by themselves to stay in a safe indoor place available near them instead of going to a designated shelter far away. This requires the local people to make it a habit to not only escape with their own families but also mutually help neighbors or even strangers just passing by. In the United States and Europe, where more weight has been given to anti-terrorism measures in recent years, staying at home is regarded as a fundamental means of escape from the leak of toxic substances or the detonation of explosives. For escape from terrorist attacks, staying at home is considered as the main means of protection.

2.7.3 When someone is latter-term elderly and unable to walk and yet has no helper beside him/her in an emergency

Even in a flood that did not destroy wooden houses (flooding above the floor), four elderly victims were found dead in their own homes in the western vicinity of the Shin'etsu Line in Sanjo City. This fact will fuel the argument that staying at home is not a safe means of escape. However, they were latter-term elderly and unable to walk by themselves and yet had no helpers available with them at the time of flooding, and these personal conditions exerted a great effect on their suffering. The fragility of the victims had a substantial effect on their suffering because they were not flexible enough to act in response to a rapid change in their circumstances.

On the other hand, it was found through the field survey that the local communities in the affected areas have remained strong. The local people, who have sensitive and humane feelings, are highly capable of self-help and mutual help. Paradoxically, it may be because of this sense of mutual support that the Sanjo victims who needed care were able to live at ease in their communities. Ironically, it is highly possible that if they had lived in a large city, they may have been nursed in homes for the elderly, where the risk of death is probably rather low. When considering the problem of safety for those who need to be cared for at home, it is important to regard it not as a personal problem of those in need of help but as a social issue of how to coordinate welfare resources in the community with individual needs in as swift and proper a manner as possible in a disaster. Specifically, it is a significant issue for the future to examine how to integrate the problem of disaster into the framework of the care system that started in 2000.

2.8 Model of Support for Evacuation of People Needing Care and Transmission of Information in the Case of Storm and Flood Damage

The results of the field survey are summarized in **Fig. 17**. To conclude this survey, five points to be examined will be described in relation to damage mitigation in the future.

2.8.1 Staying at Home as a Means of Escape

In order to escape storm and flood damage, inhabitants of an

area evacuate to a shelter designated by the administration, usually in a school or community center. This means of escape could be considered simplistic. Instead, we need to consider taking actions more appropriate to the circumstances presented. If moving to another place is very dangerous and a house has a low risk of collapse, we should consider it as a proper means of escape to go upstairs or to a place high enough for safety in the neighborhood and stay there until the storm or flood subsides.

The role of the hazard map is very significant in providing a basis for determining whether people should move to a safe place in their homes or go to a designated shelter. In an area where the flood threatens the collapse of houses, it is advisable to escape to a very safe place such as a designated shelter well before the flooding starts. In contrast, in an area where the flooding of wooden houses is not expected to be deep enough to destroy them, should staying at home not be considered a means of escape? In either case, it is clearly dangerous to go out in a flood.

2.8.2 Positioning Helpers for Disaster Prevention

The conventional approach to escape has treated people uniformly under the general concepts of "sufferer" and "evacuee" without taking specific personal needs into consideration. With this approach, we have unconsciously assumed healthy adult men. The flood this time raises new questions about how to cope with people needing care. In other words, it is pointed out for the future that we are required to consider not only how to get ourselves out safely on the one hand, but also how to support the people needing care around us on the other.

When considering the evacuation of people needing care, we should not leave it to them to escape by themselves but should consider how to make caretakers and helpers available to them. Securing such supporters is impractical in the conventional anti-disaster community. Rather, a very realistic way to secure support is linkage with the care insurance system whereby the supportive function of the welfare community will be reinforced to cope with a disaster.

2.8.3 Self-determination on Proper Escape as a Target of Disaster Prevention

A fundamental rule of escape is self-help. For us to escape safely using our own judgment, we need to correctly understand when we should evacuate our homes and when we should not. For this purpose, a system for providing information needs to be established. Local people are not certain to take safe action just because a municipality issues an evacuation warning. Information influencing the decision to evacuate is not limited to warnings issued by the administration but also includes various types of information such as TV, radio and other mass media, the Internet, word-of-mouth communication, and information directly obtained by the five senses. We usually reach a decision after considering all of these types of information in combination. Accordingly, the municipality should not consider it sufficient just to provide information to urge local people to evacuate their homes. Instead, they should regard such information as a reference to aid local people in understanding the situation.

2.8.4 Setting Numerical Standards for Forecasts and Warnings

Since the municipality is responsible for securing the safety of the lives and properties of individual residents, it is required to issue a warning or an order of evacuation depending on the circumstances. Even the staff in charge of disaster prevention is basically general members of the municipality who take charge in rotation. In reality, the staff members in charge are not always highly specialized or sufficiently experienced in this area. Therefore, standards for issuing forecasts and warnings need to be set in numerical

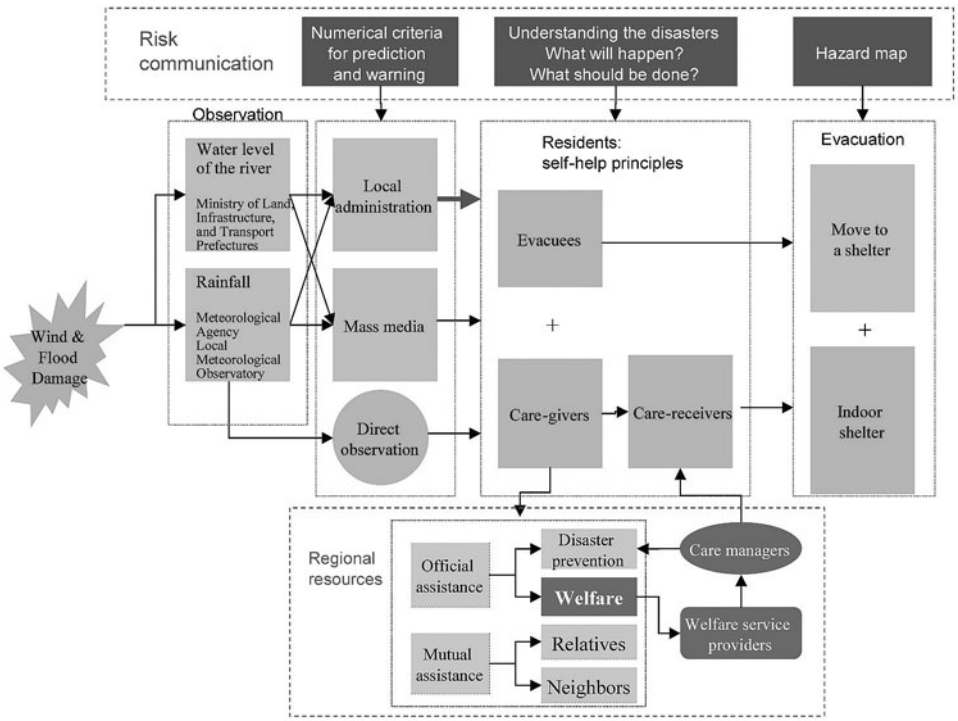

Fig. 17 A General Model of Evacuation from Storm and Flood Damage

terms so that everyone can make correct judgments with certainty.

2.8.5 Establishing a System for Observing Low and Medium River Water Levels and Flows for Each River Basin

A prerequisite for setting numerical standards for forecasts and warnings is the availability of data on rainfall and water level observations. Water level observations for rivers under direct national control and those under indirect prefecture control vary. In the latter case, there are many small and medium-sized rivers for which water levels are not observed. Moreover, as these rivers are subject to improvement works to prevent only small-scale five- to ten-year-interval floods, they have a high risk of overflow compared with rivers under direct national control. Moreover, while the rivers under direct national control are improved to cope with rare one- to two-hundred-year-interval floods, the water levels of small and medium-sized rivers at high risk of overflow are not well observed. Many small and medium-sized rivers lack sufficient data on water level, volume of flow, and river cross-section for estimating discharge capacity or for considering flood control and risk management.

In the July-13th flood, breaks occurred not in the banks of the Shinano, the main stream, but in those of the Ikarashi and the Kariyata, flowing into the Shinano. Before these breaks, inland flooding occurred in Rannan, Sanjo City. The suffering that ensued reflects the fact that observation networks had not yet been established for the immediately threatening external flooding of small and medium-sized rivers or inland flooding despite being fully established for the rivers under direct national control that have a greater impact on a larger area. It is a problem for the future to coordinate the observation system of small and medium-sized rivers with the evacuation of the local people.

3. THE 2004 MID-NIIGATA EARTHQUAKE

3.1 Background

The Mid-Niigata Prefecture Earthquake occurred on October 23 and had 1) long-lasting aftershocks, 2) evacuations by the village units, 3) officials advising a wide area to evacuate, and 4) substantial damage to the life line, which resulted in a larger number of evacuees and more senior citizens needing care. The aim of this study is to gather basic data on the response to the elderly, to show the necessity for disciplined disaster management care, and to develop a systematic approach to the disaster process for senior citizens under dramatic changes in the social environment.

3.2 Survey 1: Social Random Sampled Survey in the Affected Areas

3.2.1 Subject disaster and area

The survey was conducted in Ojiya City and Kawaguchi Town where casualties and damage to 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, who did not reside in the same household, from each spot. We requested 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.

3.2.2 Basic Attributes

We collected 543 responses (response rate: 54.3%). Responses that 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

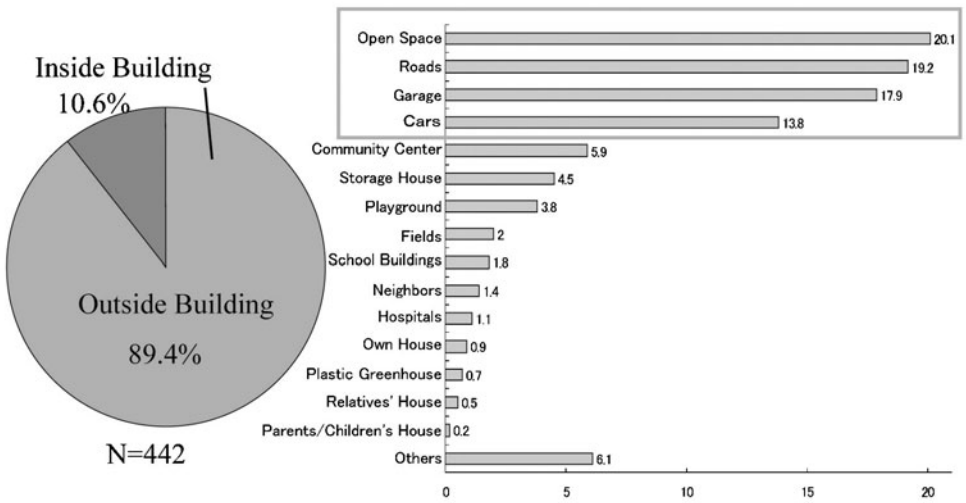

Fig. 18 After the Impact, Which Place were You Evacuated to?

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), published by the Emergency Management and Disaster Division, Niigata Prefecture Government, were used to determine the basic attributes of the general population.

The result of the goodness-of-fit test 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 no significant differences in the basic attributes, it was concluded that the respondents do represent the tendencies of the area.

3.2.3 The Results of Survey 1

Fig. 18 shows that 89.4% of the people who lived in the affected area were evacuated outside the buildings because many aftershocks occurred (over 500 aftershocks occurred from Oct 23-31), while 10.6% of the people chose to stay at home. A total of 20.1% of them were evacuated to open spaces, 19.2% went onto roads, 17.9% went into their own garage, and 13.8% stayed in their cars. The survey asked the respondents why they chose to stay at home, and 35.7% of them answered that because they had elderly people in their family, they did not move somewhere else (**Fig. 19**).

The subject area of Survey (2), which assessed "the Mid-Niigata Prefecture Earthquake on October 23," was Ojiya City, Niigata Prefecture.

3.3 Survey 2: Social survey of Care Managers and Senior Citizens

3.3.1 Subjects of this survey

Survey (2) included 23 care managers who provided home-based nursing care support in Ojiya City and 399 senior citizens who were sent to welfare facilities for the elderly or hospitals during the emergency evacuation. Since it was difficult for some senior citizens to answer the questionnaire, we asked the care managers who cared for the senior citizens evacuated to welfare facilities or hospitals to answer the questions on the senior citizens' behalf.

3.3.2 esults of Survey 2

(A) General situation

The questionnaires were distributed on January 15, 2005 through the Geriatric Welfare Division, Ojiya City Office, and collected on January 31, 2005. A 100% response rate was achieved with the assistance of the Geriatric Welfare Division since all 23 care managers that provide home-based nursing care in Ojiya City responded to Questionnaire-A in Survey (2). Questionnaire-B was distributed to 399 senior citizens, although 382 were returned; only 257 were assessed to be useful for the survey. Consequently, the effective response rate was 64.4%.

(B) Situation of the senior citizens received at welfare facilities and hospitals in Ojiya City after the Mid-Niigata Prefecture Earthquake

The graph in **Fig. 20**, which is based on the data from the Geriatric Welfare Division, Ojiya City, chronologically shows the extent to which care managers coped with the emergency evacuation needs. The division accumulated the data by calling the welfare facilities and hospitals to confirm the senior citizens received during the emergency evacuation based on reports from the care managers. The division continued calling the facilities and hospitals until December 12, 2004, and the total number of people received reached 399. On the day of the earthquake, the need for emergency evacuations arose mainly for "the elderly, who are highly dependent on medical care." The needs then shifted to "senior citizens, who have difficulties staying at the shelters for a

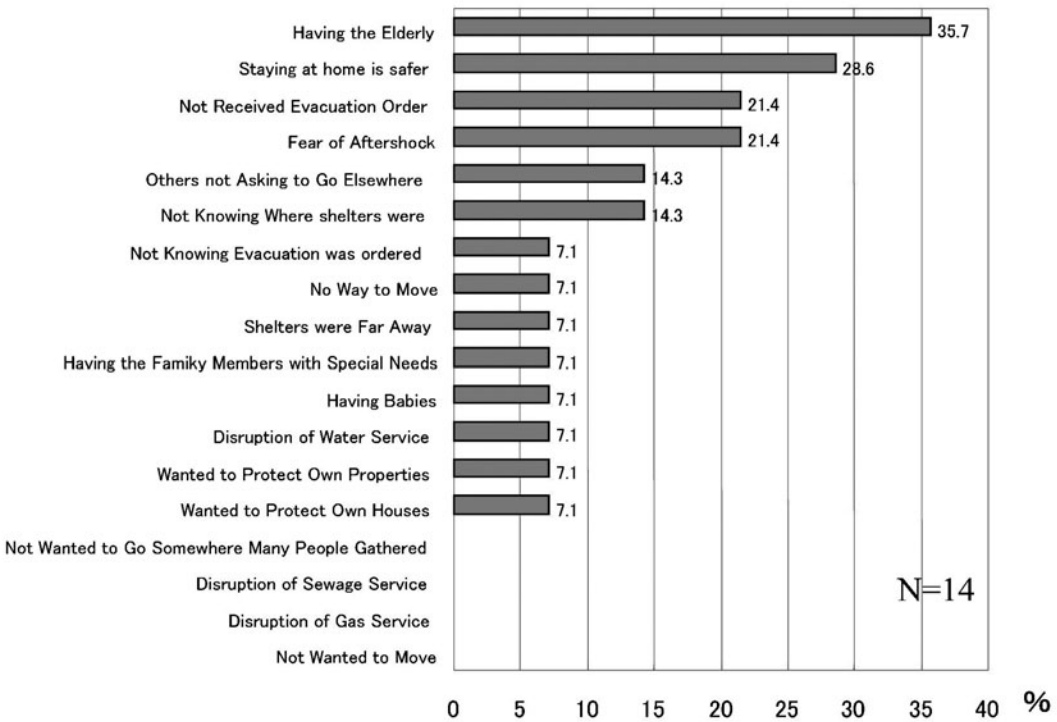

Fig. 19 Reasons of the People for Choosing to Stay at home after the Impact

long period." These needs peaked on October 27, 4 days after the earthquake.

(C) Actual situation of the elderly received at welfare facilities or hospitals during the emergency evacuation

The average age of the 257 "senior citizens received during the emergency evacuation" was 84. A total of 89.9% were 75 or older, 6.2% were 65 to 74, and 3.9% were under 65. The reasons for their emergency hospitalization or reception at welfare facilities were: 1) their houses were damaged and it became impossible to receive home-based nursing care (58.2%), 2) it became impossible for the family member(s) to care for them at home (19.5%), 3) their facilities suffered physical damage (8.6%), 4) their needs changed (2.3%), 5) their conditions changed (1.8%), 6) they evacuated outside the city (1.8%), and 7) other (7.8%). The resources that supported the home-based care decreased by 77.7%.

Before the earthquake, 65.9% of the senior citizens received dwelled at home and 27.1% resided in welfare facilities ("others" comprised 7%). On the day of the earthquake, 37.1% stayed in a

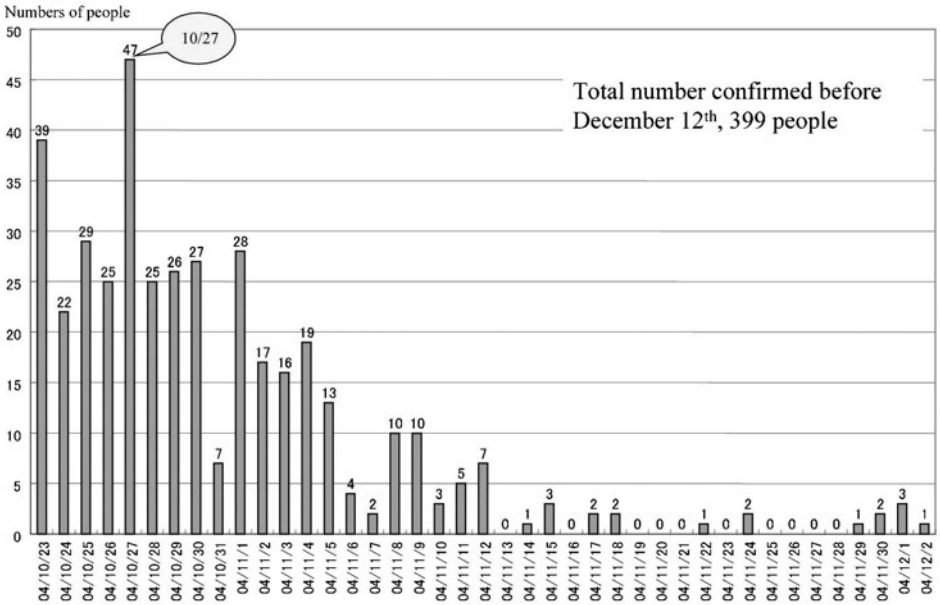

Fig. 20 Elderly People Evacuated to Hospitals/Welfare Facilities in Ojiya City after the Mid-Niigata Prefecture Earthquake

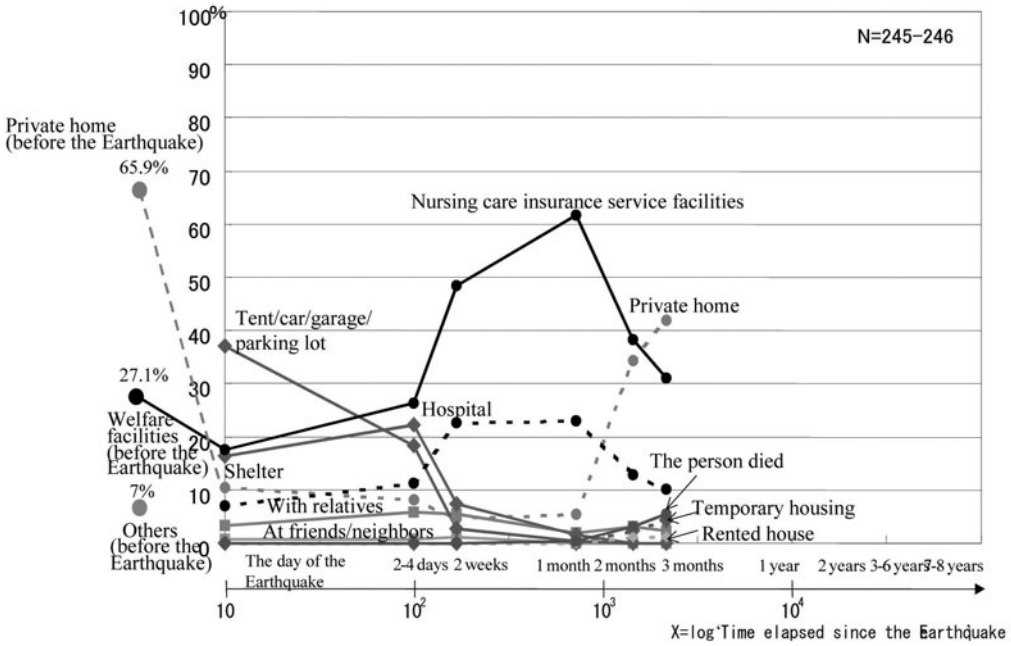

Fig. 21 Changes in Dwelling Places of Victims Received during the Emergency Evacuation

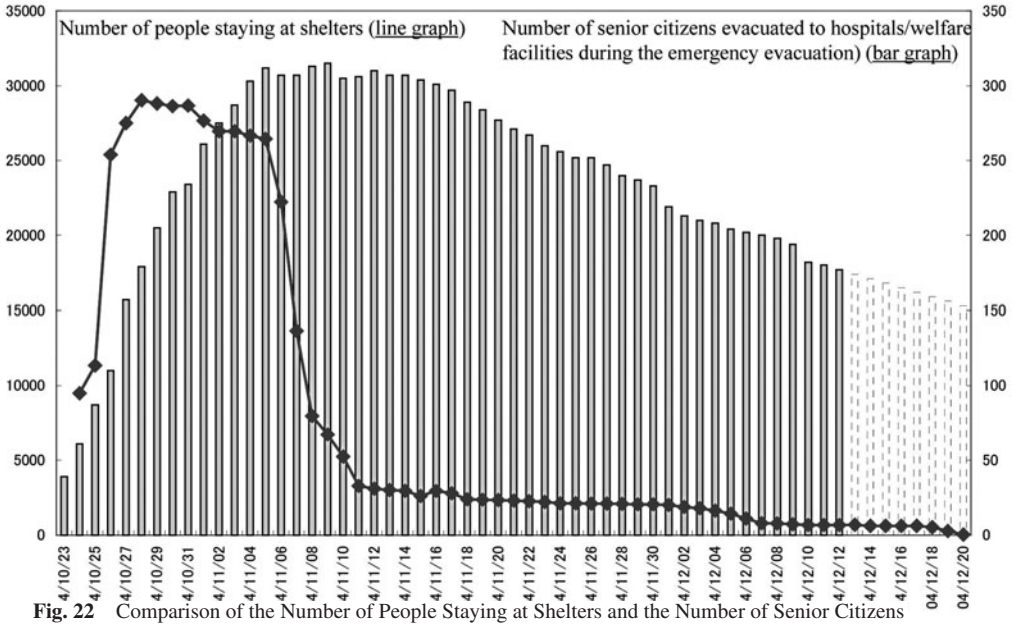

Fig. 22 Comparison of the Number of People Staying at Shelters and the Number of Senior Citizens Evacuated to Hospitals/Welfare Facilities during the Emergency Evacuation

tent or a car, 16.3% evacuated to shelters, 17.6% stayed in welfare facilities, 6.9% stayed in hospitals, and 10.6% remained at home. Two to four days after the earthquake, 20% were still living in tents, cars, or shelters. One week after the earthquake, the number of senior citizens received at welfare facilities and hospitals increased and peaked one month after the earthquake. By that time, 61.7% had moved to welfare facilities and 23.0% to hospitals ("others" comprised 15.3%). Two months after the earthquake, the number of senior citizens at welfare facilities and hospitals decreased, implying that they started to return home. However, three months after the earthquake, only 42.0% of the senior citizens received had returned home (**Fig. 21**).

(D) Senior citizens returning home from hospitals/welfare facilities

Fig. 22 chronologically compares "the number of senior citizens received at hospitals/welfare facilities during the emergency evacuation" and "the number of evacuees staying at shelters." The number of evacuees peaked five days after the earthquake. A total of 29,000 of the 44,000 residents in Ojiya City evacuated the area. The number of evacuees started to decline two weeks after the earthquake and all of them had returned home by December 20, 2004. On the other hand, the number of elderly people received at welfare facilities and hospitals during the emergency evacuation increased in accordance with the increase of evacuees at the shelters and peaked 12 days after the earthquake. Although the number of evacuees sharply declined two weeks after the earthquake, the number of the senior citizens at the welfare facilities and hospitals did not decline as rapidly. The number of senior citizens staying at welfare facilities and hospitals gradually declined to 177 as of December 12. These findings suggest that the senior citizens who needed care were unable to reconstruct their lives compared to the other evacuees. Via a verbal confirmation on February 17, 2005, 67 senior citizens were still at hospitals and welfare facilities. As of May 27, 2005, this number decreased to 50. Thus, our current task is to help these 50 senior citizens return to their own homes.

4. CONCLUSION AND OBSERVATIONS

An essential issue in disaster planning is how to help people that have difficulties evacuating an area by themselves. Typically, the welfare services that support the lives of these people are only provided at fixed times and cannot handle abrupt catastrophic disasters. Nevertheless, care managers play a pivotal role in the current welfare service and are knowledgeable about senior citizens and their need for assistance when a disaster occurs. Care managers also have a strong sense of responsibility for the safety of people in need. Thus, these care managers must be involved in developing individual evacuation plans for future senior citizens who need support. Since care managers determine the evacuation plan for senior citizens who require care, individuals and organizations, which will become life-saving resources in an emergency, must be secured. Once these resources are ascertained, the administration, the welfare-related employees, and the community need to simulate evacuations and provide training in order to improve the disaster prevention abilities of the community.

On July 13,2004 in Niigata Prefecture, 15 people were killed due to the disaster caused by severe rains. Twelve of them were classified as "elderly" people who were over 65 years old. We investigated using a profiling technique the causes of the deaths of the 12 persons who died in the flood disasters based on the integration of various kinds of related information through GIS. Three distinct patterns were identified: 1) Death was caused by severe flooding that exceeded 3 meters high and collapsed the wooden houses where the victims were located; 2) It was caused by strolling in the flooding area; 3) It was caused by individual vulnerabilities such as being over 75 years old, having a need for assistance due to difficulty in walking capability, and the unavailability

of assistance at the time of flooding. The survey clarifies that many elderly survivors of the flood were assisted well by care managers, professionals of the government-sponsored Long-term Care Insurance System.

After the emergency period of the Mid-Niigata Prefecture Earthquake was over, the care managers mainly provided support to the elderly requiring care by facilitating their reception at welfare facilities and hospitals. However, there are fundamental issues. 1) The facilities were selected from the limited options within the care managers' network. It was difficult to select facilities that might help these senior citizens reconstruct their lives. 2) These senior citizens tended to have prolonged stays at these facilities. In Ojiya City, which was hit by the Mid-Niigata Prefecture Earthquake, more than 50 senior citizens (as of May 27, 2005 when this paper is written) have yet to return to their previous lives within the community.

The resources available to care receivers living at home decreased due to the disaster, which prevented these senior citizens from leaving the hospitals and welfare facilities and from returning home. Hence, a new special area called "disaster care management" must be established. This area allows care managers to play a leading role in systematizing knowledge, techniques, and networking for total care management during a disaster and remaining within the framework of the nursing care insurance system.

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