

## Impact on Ambulance Call of Differences in Living Environment After a Major Disaster

Tomoyuki Ushimoto<sup>1,2)\*</sup>, Kenshi Murasaka<sup>2)</sup>, Hideki Morita<sup>2)</sup>,  
Masaru Sakurai<sup>3)</sup>, Masao Ishizaki<sup>3)</sup>, Yukihiro Wato<sup>2)</sup>

<sup>1)</sup> *Department of Anesthesiology and Perioperative Medicine, Kanazawa Medical University Graduate School of Medical Science*

<sup>2)</sup> *Department of Emergency Medicine, Kanazawa Medical University*

<sup>3)</sup> *Department of Social and Environmental Medicine, Kanazawa Medical University*

**Abstract: [Purpose]** After the Great East Japan Earthquake in 2011, many temporary housing complexes with various living environment levels were built in Kamaishi City. This study focused on the changes in ambulance calls before and after the earthquake and investigated the effects of living environment on ambulance calls of residents.

**[Methods]** After the earthquake, residential facilities in Kamaishi City were classified into owners housing and three temporary types of housing by living environment (i.e., with support center, without support center, and community-care-type). For 3 years before and after the earthquake, data on each group's population and the profile of ambulance calls were collected, and statistical analysis was conducted.

**[Results]** After the earthquake, the ratio of age-adjusted ambulance calls decreased in the temporary housing as a whole, and ambulance calls significantly increased in owners housing. No significant difference was found between groups with and groups without a support center. The number of ambulance calls has increased significantly at each severity and time zone. The decrease in each severity was lower in the community-care-type than in other temporary housing. The rate of ambulance calls made outside daily medical service hours was unchanged compared with before the earthquake. It was suggested that measures focusing on factors other than medical care are necessary and that a high level of medical support is not necessarily required. In addition, whereas people in temporary housing have been provided various interventions, focus on the lack of interventions for people in owners housing is needed.

**[Conclusion]** To improve the temporary housing environment, providing medical support, equipment and community formation and considering comprehensively the geographical environment and other factors are necessary. Providing support to residents of owners housing, which has less administrative intervention than temporary housing and which allows an increase in ambulance call, is also important.

**Key Words:** The Great East Japan Earthquake, temporary housing, ambulance, emergency medical service, catastrophic disasters

### Introduction

At 2:46 p.m. of March 11, 2011, a massive earthquake of magnitude 9.0 (Richter scale) occurred, with its epicenter off the Sanriku coast (38.1 N, 142.9 E), Japan, at a depth of 24 km. A massive tsunami along the coast of the Tohoku region was triggered by the earthquake, which caused widespread human and

physical damage. In the whole of Japan, the human damage was extremely severe; 18,131 people died and 2,829 people went missing. Severe damage to houses also occurred; the tsunami caused complete destruction to 129,000 houses, partial destruction on approximately 743,000 houses and flooding (or wipe out) to about 36,000 houses (1). In Kamaishi City, Iwate Prefecture, 968 people were killed, 153 people went missing and 3,704 houses were affected (2). In the disaster stricken area of Iwate, Miyagi and Fukushima Prefecture, 53,222 emergency temporary housing units (temporary housing) were constructed, including 3,164 units in Kamaishi City.

\* Department of Emergency Medicine, Kanazawa Medical University, 1-1 Daigaku, Uchinada, Kahoku, Ishikawa 920-0293, Japan  
E-mail: ushi@kanazawa-med.ac.jp  
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In accordance with national standards and administrative procedures, the prefectural government proceeded with the construction of temporary housing. In this situation, the municipalities selected the sites where the temporary housings are to be built, and the Disaster Relief Act in Japan specifies that temporary housings are to be built on public land. Even before the disaster, Iwate Prefecture had been provided a list of candidate sites for construction of emergency temporary housing so that it can prepare to build temporary housing in case of emergency. However, most of the provided public sites in Iwate Prefecture were not available for construction because they were located in flooded urban areas affected by the tsunami. Thus, the temporary housing was built on private land. A large vacant lot in the suburbs became the location of the large temporary housing complex (3), which is inconvenient for residents.

On the other hand, Kamaishi City and Tono City in Iwate Prefecture were the locations for the construction of the first community-care-type temporary housings, which was the aim proposed by the University of Tokyo and Iwate Prefectural University for the community formation of disaster victims (4). Some problems on temporary housing were pointed out and considered based on past experiences with earthquake disasters. For example, because only living space was provided in temporary housing and because of a lack of barrier-free style and difficulty in accessing medical cares and daily-life services, forming a community among residents is difficult (5).

In Kamaishi City, the community-care-type temporary housing complex was constructed following the barrier-free style. For example, to promote community formation among residents, the entrances of the houses were strategically placed facing each other. Some facilities were also provided in the complex, such as an open place for residents to communicate, a support center, a clinic and stores.

In disaster-stricken areas in Iwate Prefecture, some people lived in classic temporary housings, some lived in community-care temporary housings and some stayed in their own houses. It has been stated that the health status of the residents may be affected by the differences in living environment in the temporary housing. For example, compared with the conventional temporary housing, a community-care-type temporary housing complex had various facilities for residents, which may have a positive effect on the health status of residents. However, in the case of large-scale disasters such as the Great East Japan Earthquake, providing an appropriate service environment for all temporary homes is difficult because many temporary homes need to be installed.

How differences in living environments affect

residents' health is not yet clear. Clarifying what services are suitable for temporary housing and considering the environment of temporary housing in the event of a future disaster are important. In particular, when assessing health, dependence on emergency medical care can be a good indicator of life and of mental and physical health. Deterioration in self-management of one's health and changes in the living environment lead to worsening of underlying diseases and new diseases, leading to the spread of emergency medical care. Also, the deterioration of mental status leads to easy access to ambulance. These may lead to an increase in dependence on emergency medical care. Therefore, in this study, the authors focused on changes in ambulance call rates, as an index of the dependence on emergency medical care, between before and after the earthquake and investigated how differences in residential environment affect the rate of ambulance calls of residents.

## Participants and Methods

### 1. Target population

The population considered in this study was residents of Kamaishi City, Iwate Prefecture, who were living in temporary housing complexes. After the earthquake, there were 67 temporary housing complexes in Kamaishi City, 2 of which were community-care-type temporary housing complexes and 4 had support centers inside or next to the facilities and 61 had no support centers. In a support center, public services, such as morning and evening monitoring activities, community support, owners counseling, day services and livelihood support services to support the safe daily lives of elderly people requiring long-term care and households in temporary housing, are provided to the residents (office communication of the Ministry of Health, Labor and Welfare, April 19, 2011).

Information on the total population of Kamaishi City for the 3 years before (2008-2010) and 3 years (2011-2013) after the disaster was obtained from the Kamaishi City office. Information on population by living environment after the disaster was also obtained. On the basis of living environment after the Great East Japan earthquake and tsunami, residents in Kamaishi City were classified into four groups: owners housing, temporary housing with support centers, temporary housing without support centers and community-care-type temporary housing.

### 2. Evaluation of the number of ambulance calls

Information on annual ambulance call rates based on emergency transportation records for 3 years before and 3 years after the disaster in Kamaishi City was obtained from the Kamaishi Otsuchi district administrative office firefighting headquarters. Information obtained included the following: the number of ambulance calls, the sex

of the caller, patient age (<18, 18-64, ≥65 years old), disease severity (death, severe [life-threatening], moderate [hospital admission] and mild [outpatient treatment]) and time of ambulance call (morning, afternoon and outside of daily medical service hours).

### 3. Statistical analysis

The state of ambulance calls was compared by living environment (four groups). The chi-square test was used to compare the background of the residents in the four groups and the characteristics of ambulance calls. The rate of ambulance calls was calculated as annual number of ambulance calls divided by the population. The population and the rate of ambulance calls 3 years before the disaster, as a standard, were used to calculate age-adjusted the rate of ambulance calls (95% confidence interval) for each group. Similarly, age-adjusted rate ratios were calculated by sex, age group, severity and time of ambulance call and were compared among the four groups.

Statistical analysis was carried out using SPSS Statistics 24, and  $p < 0.05$  was considered statistically significant.

### 4. Research Ethics

The Mayor of Kamaishi City and the Chief of Fire Department, Kamaishi Otsuchi District Administrative Affairs Association, provided approval to conduct this research project. Nonlinkable, anonymized statistical information owned by the Kamaishi City and Kamaishi Otsuchi District Administrative Affairs Union Fire Headquarters were used in this study, and no individual-level data were used. This study was approved by the Research Ethics Committee of Kanazawa Medical University (I-455) and conducted in accordance with Helsinki declaration and the Ethical Guideline for Medical and Health Research Involving Human Subjects issued by Japanese Ministry of Health, Labour and Welfare.

## Results

### 1. Population formation of each group

The population composition of Kamaishi City before (2010) and after (2012) the disaster is shown in Table 1. There was no significant difference in the sex ratio before and after the earthquake. Regarding age, 50.7% of the residents were 19 to 64 years old, 34.8% were 65 years or older and 14.4% were 18 years or younger before the disaster. Significant differences in age distribution among the four living environment groups after the earthquake were found; that is, the support center group and community-care group had a higher proportion of residents 19 to 64 years old and a lower proportion of residents 65 years or older.

### 2. Features of ambulance call before and after the earthquake

The total number of ambulance calls during the 3 years before and 3 years after the disaster is shown in Table 2. There were no changes in sex ratio before and after the disaster. By age group, both before and after the earthquake, those 65 years or older accounted for the largest proportion of calls (about 63%). In addition, after the earthquake, ambulance calls among those 19-64 years old increased slightly and ambulance calls among those whose age was unknown decreased. Regarding the time of ambulance call, before the earthquake, most of the calls (65%) were made outside of medical service hours, which did not change after the disaster. With regard to severity, the percentage of people with moderate symptoms increased, from 29% before the earthquake to 34% after the earthquake. There were no differences before and after the earthquake in the proportion of mild and serious disease and death. The rate of untransported cases was 4.9% before the disaster and it significantly decreased after the disaster.

**Table1.** Characteristics of residents in Kamaishi City before (2010) and after (2012) the earthquake according to living environment.

		Before the earthquake (2010)	After the earthquake (2012)			p*	
			Owners Housing	Temporary housing			
			With a Support Center	Without a Support Center	Community-Care type		
Total		39,574	37,639	592	4,968	565	
Sex	Male	18,543 (46.9%)	17,814 (47.3%)	297 (50.2%)	2,374 (47.8%)	268 (47.4%)	0.535
	Female	21,031 (53.1%)	19,825 (52.7%)	295 (49.8%)	2,594 (52.2%)	297 (52.6%)	
Age (yr)	≤18	5,713 (14.4%)	5,405 (14.4%)	92 (15.5%)	679 (13.7%)	72 (12.7%)	<0.001
	19-64	20,082 (50.7%)	19,511 (51.8%)	348 (58.8%)	2,657 (53.5%)	344 (60.9%)	
	≥65	13,772 (34.8%)	12,723 (33.8%)	152 (25.7%)	1,632 (32.9%)	149 (26.4%)	

\* p for chi-square test.

**Table2.** Characteristics of ambulance calls before and after the earthquake in Kamaishi City.

	Before the earthquake (2008-2010)	After the earthquake (2011-2013)	p*
N	4,058	4,241	
Sex			
Male	2,050 (50.5%)	2,241 (52.8%)	0.253
Female	1,874 (46.2%)	1,987 (46.9%)	
Unknown	134 (3.3%)	13 (0.3%)	
Age (yr)			
≤18	196 (4.8%)	169 (4.0%)	0.045
19-64	1,180 (29.1%)	1,336 (31.5%)	
≥65	2,543 (62.7%)	2,710 (63.9%)	
Unknown	139 (3.4%)	26 (0.6%)	
Time category at ambulance call			
AM9-AM12	676 (16.7%)	726 (17.1%)	0.064
PM1-PM5	685 (16.9%)	791 (18.7%)	
Outside of daily medical service hours	2,697 (66.5%)	2,724 (64.2%)	
Severity			
Mild	1,814 (44.7%)	1,875 (44.2%)	<0.001
Moderate	1,176 (29.0%)	1,430 (33.7%)	
Severe	823 (20.3%)	833 (19.6%)	
Death	128 (3.2%)	103 (2.4%)	
Unknown	117 (2.9%)	0 (0%)	
Untransported	199 (4.9%)	166 (3.9%)	0.028

\* p for chi-square test.

### 3. Ambulance calls in the 3 years after the earthquake by living environment

The number and contents of ambulance calls for the 3 years after the earthquake by living environment are shown in Table 3. No significant differences were found in sex or age distribution among the four groups. With regard to time of ambulance call, residents in temporary housing made significantly more calls outside of daily medical service hours than did those in owners housing. In particular, the rate of ambulance calls made outside of daily medical service hours was significantly higher in the temporary housing without support centers and the community-care type temporary housing. With regard to severity, there was a significantly higher number of patients with mild symptoms in temporary housing than in owners housing, especially in the temporary housing without support centers and the community-care-type temporary housing. These results were statistically significant.

### 4. Changes in age-adjusted ambulance call rates after the earthquake

Changes in age-adjusted ambulance call rates after the earthquake are shown in Figure 1. Compared with Kamaishi City's total ambulance call rate before the earthquake, the age-adjusted ambulance call rate ratios (95% CI) for the owners housing group was 1.14 (1.06-1.24) in 2012 and 1.15 (1.06-1.25) in 2013.

**Table3.** Ambulance calls for the 3 years after the earthquake, compared with living environments.

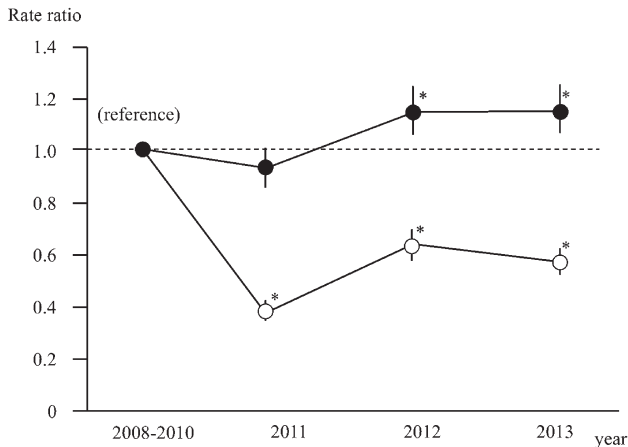
	Owners Housing	With a Support Center	Without a Support Center	Community-Care type	p*
N	3,946	27	230	38	
Sex					
Male	2088 (52.9%)	18 (66.7%)	112 (48.7%)	22 (57.9%)	0.249
Female	1,843 (46.7%)	9 (33.3%)	118 (51.3%)	16 (42.1%)	
Unknown	15 (0.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Age (yr)					
≤18	156 (4.0%)	3 (11.1%)	9 (3.9%)	1 (2.6%)	0.075
19-64	1,236 (31.3%)	7 (25.9%)	73 (31.7%)	20 (52.6%)	
≥65	2,529 (64.1%)	17 (63.0%)	147 (63.9%)	17 (44.7%)	
Unknown	25 (0.6%)	0 (0.0%)	1 (0.4%)	0 (0.0%)	
Time category at ambulance call					
AM9-AM12	678 (17.2%)	7 (25.9%)	37 (16.1%)	4 (10.5%)	0.014
PM1-PM5	758 (19.2%)	2 (7.4%)	27 (11.7%)	4 (10.5%)	
Outside of daily medical service hours	2,510 (63.6%)	18 (66.7%)	166 (72.2%)	30 (78.9%)	
Severity					
Mild	1,720 (43.6%)	13 (48.1%)	121 (52.6%)	21 (55.3%)	0.027
Moderate	1,336 (33.9%)	7 (25.9%)	76 (33.0%)	11 (28.9%)	
Severe	793 (20.1%)	5 (18.5%)	31 (13.5%)	4 (10.5%)	
Death	97 (2.5%)	2 (7.4%)	2 (0.9%)	2 (5.3%)	
Unknown	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Untransported	154 (3.9%)	0 (0.0%)	12 (5.2%)	0 (0.0%)	0.297

\* p for chi-square test.

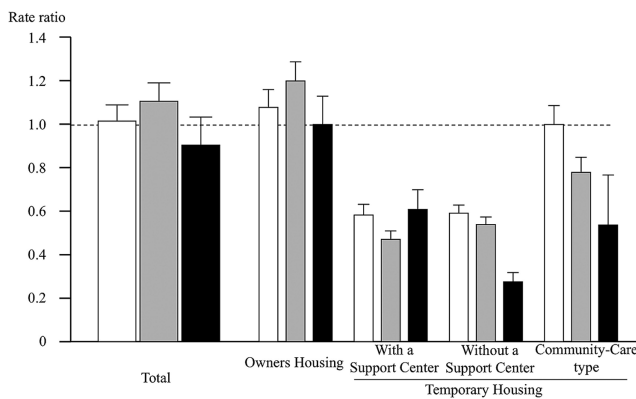
In contrast, the age-adjusted rate ratios for temporary housing was 0.38 (0.35-0.41), 0.63 (0.58-0.68) and 0.56 (0.52-0.61) in 2011, 2012 and 2013, respectively, and were significantly decreased after the earthquake.

**5. Changes in the ratio of age-adjusted ambulance call rates by severity during the 3 years after the earthquake**

After the disaster, in the whole city, the number of ambulance calls involving patients with moderate illnesses became 1.12 times higher (95% CI, 1.05-1.20), whereas rates involving patients with severities of mild and serious illnesses and deaths didn't change (Figure 2). In owners housing group, the rate of ambulance calls



**Figure 1.** Age-adjusted rate ratios for ambulance call (RRs) after the 2011 Great East Japan Earthquake at Kamaishi, Iwate, Japan. Rate ratios were adjusted for the age using the population and the rate of ambulance calls before the disaster as a standard. ● = owners housing; ○ = temporary housing. \**p* < 0.05.



**Figure 2.** Changes in the ratio of age-adjusted ambulance call rates by severity in the 3 years after the earthquake. Age-adjusted rate ratios were calculated using the population and the rate of ambulance calls before the disaster as a standard. □ = mild; ■ = moderate; ■ = severe and death. \**p* < 0.05

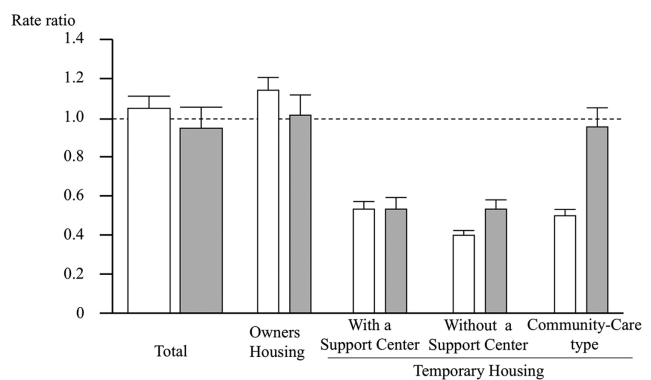
involving mild and moderate cases increased after the disaster; the rate ratios for mild and moderate cases were 1.09 (1.02-1.17) and 1.21 (1.14-1.30), respectively.

Meanwhile, the number of ambulance calls for almost all severity groups in the temporary housing decreased after the disaster. Rate ratios were as follows: in the group with a support center, 0.59 (0.54-0.64) for mild emergency cases, 0.48 (0.45-0.52) for moderate to severe cases and 0.61 (0.55-0.70) for severe to death cases; in the group without a support center, 0.60 (0.56-0.65) for mild to moderate cases, 0.54 (0.51-0.58) for moderate to severe cases and 0.29 (0.26-0.33) for severe to death cases; in the group with community-care system, 0.79 (0.74-0.86) for moderate to severe cases and 0.55 (0.43-0.78) for severe to death cases. There were no significant changes in the rate of ambulance calls of mild severity for the community-care system group.

**6. Changes in age-adjusted ambulance call rate by time of ambulance call in the 3 years after the disaster**

In the whole Kamaishi City, after the disaster, the rate of ambulance calls made within the daily medical service hours increased, with age-adjusted rate ratios of 1.06 (1.01-1.12). In contrast, there were no changes in rates of ambulance calls made outside of medical service hours.

In terms of living environment, for the owners housing group, the ratio of ambulance calls made inside of medical service hours was 1.16 (1.10-1.23) times higher after the disaster. For the temporary housing groups, the ratio of ambulance call rates made within daily medical service hours was 0.41-0.51 and significantly decreased in all temporary housing groups.



**Figure 3.** Changes in the ratio of age-adjusted ambulance call rates by time zone of ambulance call in the 3 years after the disaster. Age-adjusted rate ratios were calculated using the population and the rate of ambulance calls before the disaster as a standard. □ = inside of medical service hours; ■ = outside of medical service hours. \**p* < 0.05



On the other hand, the ratios of ambulance calls made outside of medical service hours were 0.53 (0.49-0.59) and 0.57 (0.52-0.63) for the groups without and with a support center, respectively, showing a significant decrease compared with before the disaster. There were no changes after the disaster for the community-care group in the rate ratio of ambulance calls made outside medical service hours.

### Discussion

In Kamaishi City, 34.8% of the population is 65 years or older, which is higher than the percentage in the total Japanese population. Both before and after the disaster, in Kamaishi City, the percentage of ambulance calls from the older population was approximately 63%, which is higher compared with the rate in the total Japanese population, 55% (6). In terms of severity, the number of ambulance calls for mild and moderate disease was lower and the number of ambulance calls for severe disease and death was higher, in comparison with the national average.

The survey didn't include the number of ambulance calls immediately after the disaster and didn't include injuries and illnesses directly caused by the disaster. Therefore, the change in the number of ambulance calls after the earthquake may be a result of chronic changes, such as changes in the living environment after the earthquake. Many studies have shown that victims of disasters such as great earthquakes were mentally and physically unhealthy (7-14). Ambulance call rates may be affected by these changes in health status.

In this study, there were no changes in ambulance call rates and time of ambulance call before and after the disaster. Of the 26 hospitals and clinics in the Kamaishi area, 21 were affected by the disaster. Eight of these had resumed providing medical care at their original facilities and nine had resumed providing medical care at temporary facilities as of March 2012. After the disaster, patients needing continued hospitalization were transferred to facilities in non-disaster-affected areas, and patients who needed continuous medical care were also transferred to clinics outside the affected area. Moreover, it might be difficult for patients with chronic diseases and who are at high risk for emergency medical care to live in the disaster area. Therefore, a number of people were moved out of the city, and evacuation from the city continued even after the earthquake. This is one of the reasons there was no change in the ambulance call rate after the disaster.

With regard to severity, there was no significant difference in terms of lower severity and death between before and after the earthquake. The percentage of people with moderate severity increased from 29% before the earthquake to 34% after the earthquake. The increase in the number of patients

requiring hospitalization due to aggravation of underlying diseases as a result of the disaster may be the reason for the increase in moderate disease. Also, there is a possibility that patients with unknown severity before the earthquake may have been actually been moderate severity. The rates of untransported cases before and after the disaster were 4.9% and 3.9%, respectively. Although the differences were statistically significant, these values were similar.

The increase ambulance calls by the residents in the temporary housing was expected in this survey, as there have been many reports on health impairment among victims, especially residents in the temporary housing (14-20). However, age-adjusted ambulance call rate ratios after the earthquake increased for the residents in their own housing, in contrast with the decrease for those living in temporary housing. The decrease in ambulance calls from residents in temporary housing may be the effect of social factors. The living environment of evacuees differed according to the type of housing, such as evacuation centers, temporary housing, public housing and reconstructed housing for disaster victims, evacuation to areas other than disaster-stricken areas and owners housing. For example, some social support was provided to evacuees at evacuation centers and temporary housing. Public health nurses and city officials regularly visited temporary housing and listened to the residents living in the temporary housing stating the issues regarding living conditions and health status. Health monitoring for the residents was also conducted, and advice to receive medical care was given to those who need medical care. There have been reports that the outcome of care of lifestyle-related diseases after the earthquake has been greatly improved as a result of the government's intervention in temporary housing (21). However, those who stayed in their own homes had to go to a consultation desk for consultation. It has been reported that because victims living in their own house were not fully provided social support, these evacuees tended to be isolated if, after the disaster, they could not receive social services that met their actual demand (22, 23).

The living environment and condition of medical services may have also affected the results. It might be difficult for old people or individuals with chronic disease to live in unfamiliar and inconvenient environment of temporary housing, and they might move outside of the disaster areas (24-26). Therefore, the low rate of ambulance call may have been due to these high-risk people who need medical care tending to move away from temporary housing.

The results may have also been affected by access to medical services. In the rural areas of Japan, private vehicles play an important role in transportation. Even in Kamaishi, residents had been depending on private

vehicles in their daily life. However, the earthquake and tsunami caused damage to many private vehicles. The precise number of damaged private vehicles in Kamaishi City is unknown, while it was reported that in Iwate Prefecture at least over 17,700 vehicles were wiped out (27). After the disaster public transportations took a role of private vehicles completely in affected areas. Public bus transport service after the disaster was operated by the city, and some bases for the residents, such as the temporary housing, medical institutions and public facilities, were connected. It has been reported that many people who needed medical care were linked to medical institutions by using public buses (28). This easy access encourages residents to visit medical institutions on their own, and this has led to a decrease in ambulance calls during the daytime from temporary housing.

Based on experience with earthquake disasters, there have been recommendations that residents move into temporary housing, with an emphasis on local communities. In fact, residents were placed in temporary housing by local communities. As a result, community reformation was relatively easy, and social participation, including events in temporary housing, was also good. In the environment of evacuating to rental housing and temporary housing after a disaster, it has been reported that those residing in temporary housing had better social participation and good mental health and self-health assessment (28, 29). Some measures were taken based on experience with previous earthquake disasters, such as enhancing the environment and constructing a local community within the temporary housing (30). These may have affected the decrease in the rate of ambulance calls for the residents in the temporary housing. On the other hand, it is possible that victims staying in their own houses may have been left behind in terms of social services. In the future, it is necessary to take measures to provide the same services to both evacuees in temporary housing and those who are staying at home.

When comparing ambulance call rates among the temporary housings, residents in temporary housing with and without a support center had decreased ambulance call rates. On the other hand, the decrease in ambulance call rates after the disaster was less for the residents in the community-care temporary housing than for those in other temporary housing. In particular, after the earthquake, there was no change in the ratio of ambulance calls made outside daily medical service hours.

The community-care-type temporary housing is the first temporary housing in Japan, and it was the largest temporary housing complex in Kamaishi City. The University of Tokyo and Iwate Prefectural University proposed this temporary housing complex as a new

model of temporary housing where individuals considered being socially vulnerable, such as people with disabilities, the elderly and the child-rearing generation, can live safely until the postdisaster period. The goals are to create a living space where each and every resident can live in the community without being isolated and to facilitate smooth life support from the outside. This is the ideal temporary housing to reduce the health damage among the victims of disaster in the aging population who live in temporary housing, which will advance further in the future (31-33). However, some shortcomings of the community-care-type temporary housing have been pointed out. At first, compared with classic temporary housing, it took a long time to complete the facilities in the community-care-type temporary housing. Also, before the disaster, local social communities were not considered in the selection of the residents, in contrast to the other temporary housings. Secondary, the complex was located on a hill away from the urban area, which provided inconveniences in transportation and supplies, and to visit a medical institution, people must use the public bus or a private vehicle. During the day, public buses were in operation, but outside of daily medical service hours, there is no public bus service. In cases where residents needed to see a doctor outside of medical service hours and they did not have a private vehicle, they must rely on an ambulance (3, 28).

Ideally, facilities offering social, medical and daily-life support, like those in a community-care-type temporary housing complex, should be offered in all types of temporary housing. However, installing all these at a high level in temporary housings will be difficult in cases of a disaster like the Great East Japan Earthquake, as well as earthquakes directly under the Tokyo metropolitan area or the Nankai Trough, which are expected to occur in the future.

It has been reported that the health behaviors of victims may be affected by worsening changes in economic status after a disaster, for example, not receiving medical examination or deteriorating health (14, 34-37). Therefore, it is necessary to establish a system to support residents from an economic perspective, and a comprehensive response that includes various factors such as improvement of the geographical environment of temporary housing and respect for local communities is needed.

### **Limitation**

In this study, The authors were not able to collect information on the medical background of each residents, such as households with long-term care needs and underlying diseases, which might affect the results. Further investigation and consideration will reveal the level of medical support required for the victims.

## Conclusion

The living environment in Kamaishi City, Iwate Prefecture, after the Great East Japan earthquake was evaluated from the viewpoint of ambulance calls. After the disaster, the rate of ambulance calls increased for the residents in owners housing and decreased for residents in temporary housing. This decrease in the rate of ambulance calls among those living in temporary housing was not noteworthy for the community-care-type temporary housing. Developing a temporary housing environment requires not only medical support, equipment and community formation but also comprehensive consideration of the geographical environment and support for owners housing.

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## Conflict of Interest

The authors have no conflicts of interest directly relevant to the content of this article.

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