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Living environment, health status, and perceived lack of social support among people living in temporary housing in Rikuzentakata City, Iwate, Japan, after the Great East Japan Earthquake and tsunami: A cross-sectional study

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ABSTRACT

The Great East Japan Earthquake and tsunami hit a wide area of East Japan in 2011. We aimed to describe the living environment and health status of those living in temporary housing in Rikuzentakata, Iwate, as well as to identify the factors associated with perceived lack of social support. We therefore conducted a cross-sectional study using a self-administered, structured questionnaire distributed to all households living in temporary housing in Rikuzentakata in August 2013. More than one-third of the respondents said that their physical (34.2%) or mental (34.0%) health had deteriorated over the previous year. Younger people with more health complaints and living with more people had higher levels of distress. The major factors associated with a perceived lack of social support were having trouble with neighbours (AOR 3.68, p=0.002), difficulties providing care for a family member (AOR 3.28, p=0.036), higher levels of distress regarding living conditions (AOR 2.62, $p < 0.0001$), being younger(AOR 2.32, p=0.003), and being male (AOR 1.77, p=0.019). These findings suggest that life in temporary housing is quite stressful and could lead to deterioration in physical and mental health. The total level of QOL, however, was only slightly lower than the standard average. Focusing on the most vulnerable people placed in temporary housing after a major disaster is particularly important.

1. Introduction

On 11 March 2011, a huge earthquake and tsunami hit a large area of East Japan. This claimed approximately 18,000 lives [1], the majority through drowning. The Great East Japan Earthquake and Tsunami (GEJET) affected an area with a large population of older people and fewer young workers. After several months, the surviving victims were moved from shelters to temporary housing.

Rikuzentakata City, Iwate Prefecture, is in northern Japan, near the border with Miyagi Prefecture. The city had a population of approximately 24,000 in January 2011 [2]. The tsunami claimed approximately 7.5% of the city's population, and the total population in

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February 2016 was about 19,000 [2,3].

The tsunami hit Rikuzentakata at about 15:30 on 11 March, when many offices and shops were open and people were actively working across the city. The tsunami even hit the designated evacuation centres, such as the city hall and gymnasium, causing many deaths. The highest tsunami wave measured more than 19 m above sea level, and it destroyed the four-storey city hall. In total, around 1600 residents were killed and about 200 people are still missing [3–6].

Rikuzentakata provided approximately 2200 prefabricated temporary houses in 53 clusters throughout eight areas of the city [7]. Residents of this temporary housing came from various tsunami-affected areas. Drawing on lessons learned from the 1995 Great Hanshin Earthquake, the local authorities tried to allocate people from the same community to the same temporary housing zone or to a neighbouring area. For example, the temporary housing area known as 'Takata 1st Middle High School' housed a large group from the Takata area. Temporary housing in Yahagi had more from Kesen, a neighbouring town than from Takata, which was the most severely devastated area in Rikuzentakata [7].

Each victim's situation varies. People have had to accept strangers as new neighbours. Existing studies have reported that disasters have negatively affected victims' physical health [8–16], psychological or mental health [17–22], and even caused suicides [23–25].

To mitigate or relieve the suffering of victims of the GEJET, several interventions have been tried [26,27]. Previous studies indicated that social capital or social support might positively affect the health, behaviour, and living environment in post-disaster communities [28,29].

Social support is one of the most important functions of social relationships [30]. It is intended by the provider to be helpful, distinguishing it from intentionally negative interactions (such as criticism or undermining). Social support is commonly categorized into the following four types [30]. Emotional support is expressions of empathy, love, trust, and caring. Instrumental support is tangible aid or services, such as childcare. Informational support is the provision of advice, suggestions, and information. Appraisal support is information that is useful for self-evaluation [31]. Existing studies have shown that social support has a positive effect on disaster victims' mental health, particularly emotional support [32].

Some studies have measured quality of life (QOL) of disaster victims [33–40]. QOL is a broad multidimensional concept that usually includes subjective evaluations of both positive and negative aspects of life [33]. At the individual level, QOL includes perceptions of physical and mental health, health risks and conditions, functional status, social support, and socioeconomic status [34].

In previous study that measured the QOL of victims of major disasters, psychiatric disorders such as depression reduced overall QOL [35]. One study also found that deterioration of psychological and physical health, and lower levels of social support, negatively affected QOL [36]. The psychological elements of QOL changed over time and also varied by gender and age of those involved [37]. Other studies found that major disasters were associated with an increase in the prevalence of atrial fibrillation [38], diabetes [39], polycythemia [40], and deterioration of physical health status [16].

There is, however, little evidence about the effect of temporary housing, although the subjective accounts of disaster victims from other situations might be useful.

We therefore sought to (1) describe and measure living conditions, social support and health status, including QOL, of tsunami victims living in temporary housing, and (2) identify factors associated with their perceived social support and health status.

2. Materials and methods

2.1. Study design

We used a cross-sectional study with a self-administered, structured questionnaire, including open questions.

2.2. Participants

We targeted all households living in temporary housing in Rikuzentakata, Iwate Prefecture. We recruited either the head of household or that person's spouse.

2.3. Study area

The temporary housing in Rikuzentakata was in clusters throughout all eight areas or towns: Takata, Yonezaki, Takekoma, Otomo, Yokota, Kesen (Osabe and Imaizumi), Yahagi, and Hirota. The number of households in each cluster varied from fewer than 10 to more than 200. All the temporary housing was prefabricated, and the majority was terrace-style housing.

2.4. Ethical approval

We obtained ethical approval from the ethical committee of Hosei Graduate School of.

Human Society Studies, Tokyo, Japan (July 2013, No. 0004).

We obtained written consent from the president of each cluster of temporary housing. We also documented and explained the study protocol and all ethical considerations verbally to the head of each household and to all respondents.

2.5. Measurements

2.5.1. Assessment of life in temporary housing

We developed a self-administered questionnaire to explore the sociodemographic characteristics, living conditions, social capital, and health status of the respondents. Their satisfaction level with the living conditions in their temporary housing was measured across six aspects: 'Security, peacefulness', 'Level of comfort', 'Older people-friendly', 'Child-friendly', 'Concerned about neighbours', and 'Communication with neighbours'. The questionnaire used a Likert-type scale with five response levels ranging from 'strongly agree' (5) to 'strongly disagree' (1). The total score for assessment of living conditions therefore ranged from 6 to 30, which we treated as a continuous variable. A high score was interpreted as a high level of distress about the temporary housing.

2.5.2. Perceived social support and confidence in neighbours

We used four questions to measure the participants' perceived emotional and social support as well as their confidence in their neighbours. The first two questions measured the participants' perceived social support. They were, 'I have neighbours who help me when I have problems or am in trouble' and 'I have neighbours whom I can talk to and consult on personal matters'. The next two questions measured the respondents' confidence in their neighbours. They were, 'I have neighbours with whom I can casually chat when I meet them' and 'I have neighbours to whom I say hello'. The answers were divided into three levels with one to three points. Respondents were asked to say whether they had 'enough neighbours' (1 point), 'someone' (2 points), or 'no-one' (3 points). Cronbach's alpha coefficient for these questions was 0.819, which is sufficiently high that we treated these variables as reliable continuous variables [41]. A high score indicates low levels of social support.

2.5.3. Quality of life (QOL) index

We also asked about respondents' QOL, across four domains. These

were (1) physical health, (2) psychological health, (3) social relationships, and (4) living environment. We gave one point for each physical or psychological health symptom, and summed the scores for each domain. A high score indicates low health-related QOL. Cronbach's alpha coefficient for these questions was 0.693, thereore, we treated these variables as reliable continuous variables. To compare these scores with existing QOL scales such as WHOQOL-BREF [42], we transformed the raw QOL score into a percentage score. The possible score range was 8–46 points, with 46 as the worst score (4+6+6+30). We then calculated percentage score by dividing the raw score by 46, multiplying by 100, and then subtracting the answer from 100. A high score indicates a good QOL.

2.6. Open questions

We also collected qualitative data by asking the respondents open-ended questions. They were asked for their personal opinions about their social relationships and communication among residents.

2.7. Sociodemographic characteristics and living condition

We measured sociodemographic characteristics and living conditions in temporary housing as possible covariates. Sociodemographic characteristics included age, sex, former and current living area, occupation, income, and cohabitation status.

2.8. Statistical analysis

We used bivariate tests including the chi-squared test to explore crude associations between living conditions, level of social support, and all other variables. We then ran both logistic and linear regression analysis to identify the determinants of low social support and distress about the living environment, controlling for potentially confounding factors. We treated *p*-values of less than 0.05 as statistically significant. We used SPSS version 22.0 for Windows (SPSS Inc., Chicago, IL) for all statistical analyses.

3. Results

3.1. Sociodemographic characteristics of the participants

We distributed 2020 questionnaires, and collected 899 answer sheets, a response rate of 44.5%. Table 1 shows the sociodemographic characteristics of the participants. There were 337 male participants (40.4%), and the rest were female. The mean age was 61.5 (SD 10.5) years old. Approximately one-third (313 out of 820, or 38.1%) lived in a two-generational household, such as parents and daughters or sons. Around one-quarter (24.8%, or 203 of 820) were living with someone as their spouse, and 22.1% (181 of 820) were living alone. Only 7.8% (64 of 820) lived in a three-generational household.

More than half (59.1%) commented that their monthly income had decreased since the disaster, while about one-third (35.5%) had not seen any real change.

3.2. Assessment of living conditions in temporary housing

Table 2 shows the results of the respondents' assessment of their living conditions. Good internal consistency was observed with a Cronbach's alpha coefficient of 0.865; we used this score to measure the living environment in temporary housing as a continuous variable. A high score shows higher levels of distress. The total average assessment index score was 17.63 (SD 6.97). The highest mean dissatisfied score was for 'temporary housing is not child-friendly' (3.77, SD 1.09), followed by 'concerned about neighbours' (3.76, SD 1.27).

'Not secure, not peaceful' had the lowest mean score (2.56, SD 1.22). More than half of all respondents (62.8%) were worried about the presence of neighbours and that their housing was not child-friendly (60.3%). Over half (50.2%) were also worried that it was not older people-friendly.

Table 1
Sociodemographic characteristics of study respondents.

Study variables		n	%
Sex (n = 834)			
	Male	337	40.4
	Female	497	59.6
Age		Mean 61.5 (SD 1.5)	
	< 20	2	0.2
	20–29	16	1.9
	30–39	56	6.5
	40–49	117	13.6
	50–59	156	18.1
	60–69	224	26.0
	70–79	206	23.9
	≥ 80	85	9.9
Household members (n = 820)			
	Parent(s) and daughters/sons	313	38.2
	Spouse	203	24.8
	Alone	181	22.1
	Three-generation family	64	7.8
	Other	59	7.2
Change in average monthly income compared with before earthquake and tsunami 2011 (n = 784)			
	Decreased (considerably or slightly)	463	59.1
	Almost the same	278	35.5
	Increased (considerably or slightly)	43	5.5

Table 2
Assessment of living environment in temporary housing.

Variables	n	%	mean	SD
Assessment index score[a)] (Each score: 1–5. Possible total score range: 6–30)				
Total score (1–6)			17.63[a)]	6.97
1. Not child-friendly			3.77	1.09
2. Concerned about neighbours			3.76	1.27
3. Not older people-friendly			3.50	1.19
4. Not comfortable			3.16	1.26
5. Less communication with neighbours			2.57	1.14
6. Not secure, not peaceful			2.56	1.22
Summary of subjective perception about temporary housing life (multiple answers possible)				
Not child-friendly Strongly agree or agree	447	60.3		
Concerned about neighbours Strongly agree or agree	528	62.8		
Not older people-friendly Strongly agree or agree	417	50.2		
Not comfortable Strongly agree or agree	331	39.7		
Less communication with neighbours Strongly agree or agree	162	19.1		
Not secure, not peaceful Strongly agree or agree	186	22.2		

Number of items in index=6.
Reliability (Cronbach's alpha)=0.865.
[a] Strongly agree =5, agree =4, neutral =3, disagree =2, strongly disagree =1.

3.3. Confidence in neighbours in temporary housing

The majority (70.3%) agreed that 'I have some neighbours who help me when I have problems or am in trouble', and 61.5% agreed that 'I have some neighbours whom I can talk to and consult on personal

Table 3
Level of social support available in temporary housing.

Variables	Have enough		Have someone		Have no-one		Japan's national data[a] (2007)
	n	%	n	%	n	%	%
I have neighbours who help me when I have problems or am in trouble (n = 821)	35	4.3	577	70.3	209	25.5	–
I have neighbours to whom I can talk, and consult on personal matters (n = 802)	33	4.1	494	61.6	275	34.4	Yes, I have somebody 10.7
I have neighbours to whom I can casually chat (n = 824)	184	22.3	607	73.7	38	4.6	Yes, I have somebody 30.9
I have neighbours to whom I can say hello (n = 815)	340	41.7	468	57.4	7	0.1	Yes, I have somebody 19.4
	–		–		–		I have no neighbours to talk or say hello to. 39.0

http://www5.cao.go.jp/seikatsu/whitepaper/h19/10_pdf/03_youshi/pdf/07sh_yo002_1.pdf.
Chart 2-1-19 (in Japanese). p17 (accessed 20 November 2016).
[a] Cabinet Office, Government of Japan. Preference study on people's basic life 2007 (in Japanese).

matters'. Almost three-quarters, 73.7%, responded positively to 'I have neighbours to whom I can casually chat'. Approximately one-quarter (25.5%), however, responded, 'I have no neighbours who help me when I have problems or am in trouble', and about one-third (34.4%) said, 'I have no neighbours whom I can talk to and consult on personal matters' (see Table 3). In a recent national survey in Japan, nearly half of respondents (39.0%) reported that they had no neighbours with whom they could talk or say hello, while only 10.7% had some neighbours whom they can talk to and consult on personal matters [43].

3.4. Opinions about life in temporary housing

Several female respondents over 60 years old commented unfavourably on living in temporary housing. They said:

- "I cannot be comfortable with being open. After the earthquake and tsunami, I got to know some other victims living in the same temporary housing, but now I understand that people are untrustworthy. Here, everybody will abandon you after a while. I know someone has been spreading lies about my personal life. I have often observed that certain groups leave someone out. I feel afraid of this closed community. I now keep a distance from my neighbours."
- "I do not always want to participate in residents' events, but it's really hard to avoid doing so. It is like the Black Hole of Calcutta."
- "I even hear the neighbours talking. I want to leave here as soon as possible."

3.5. Self-reported health status

Table 4 shows the respondents' self-reported health status. Just over one-third said that their physical or mental health (34.2% and 34.0%, respectively) had deteriorated since a year before. More than half said that their physical or mental health remained the same (60.8% and 60.6%, respectively). The most common health complaints were stiff shoulder/back pain (46.2%) and insomnia (31.5%). The rate of 'no health complaints' was 27.2%, but on a national level, this figure for those aged 65 years old and over was 46.7% [44]. The average national rate for stiff shoulder/back pain was 9.2% in male, and 11.8% in female [45].

3.6. Determinants of distress for living in temporary housing

Table 5 shows the result of the linear multiple regression analysis. The model's R^2 was 0.301. Younger people were more likely to have higher levels of distress (standardized beta =−0.162, t=−4.422, $p < 0.0001$). Having more health complaints was significantly associated with higher levels of distress (standardized beta =0.179, t=4.964, $p < 0.0001$). Living with more people was also likely to lead to higher levels of distress (standardized beta =0.116, t=3.209, p=0.001).

Table 4
Self-reported health status of the respondents.

Variables	n	%	Japan's National statistics ≥65years old (%)
Current self-reported health status compared with 1 year prior			
Subjective physical general health status (n = 872)			
Improved	44	5.1	
Same	530	60.8	
Deteriorated	298	34.2	
Subjective general mental health status (n = 861)			
Improved	46	5.3	
Same	522	60.6	
Deteriorated	293	34.0	
Major physical/mental complaints (multiple answers possible)			
No health complaints	174	27.2	46.7[a]
Backache, physical pain	286	46.2	Male 9.2[b], Female 11.8[b]
Insomnia, sleep-onset insomnia	192	31.5	
Easily annoyed, get frustrated	188	30.9	
Feel more stress than before	170	28.1	
Weight gain	169	27.5	
Wake early	124	20.4	
Headaches	87	14.7	
Increase of alcohol intake	67	11.4	
Weight loss	59	10.0	

[a] Cabinet Office, Government of Japan. White Paper on Aging Society 2016 (in Japanese) http://www8.cao.go.jp/kourei/whitepaper/w-2016/zenbun/pdf/1s2s_3_1.pdf, Chart 1–2–3-1. 466/1000 population (≥65 years old) =46.7% (Accessed 10 November 2016).
[b] Ministry of Health, Labour and Welfare, Government of Japan. National Livelihood Survey 2013 (in Japanese). http://www.mhlw.go.jp/toukei/saikin/hw/k-tyosa/k-tyosa13/dl/04.pdf. Chart No.24 (Accessed 10 November 2016).

3.7. Determinants of perceived lack of social support

Table 6 shows the results of the multiple logistic regression analysis to identify determinants of 'I have no neighbours who help me when I have problems or am in trouble', that is, a perceived lack of social support. Significant factors were having some trouble with neighbours (adjusted odds ratio [AOR] 3.68, 95% CI 1.61–8.40, p=0.002), having

Table 5
Determinants of distress about temporary housing (multiple linear regression).

Variables	Beta coefficient	SE	t	p-value
Age group[a)]	−0.162	0.164	−4.422	< 0.001
Self-reported health status score[b)]	0.179	0.105	4.964	< 0.001
Household family structure[c)]	0.116	0.198	3.209	0.001

R^2 =0.301 for the best model by backward elimination
[a)] < 20 years old =1, 20–29 years old =2, 30–39 years old =3, 40–49 years old =4, 50–59 years old =5, 60–69 years old =6, 70–79 years old =7, ≥80 years old =8.
[b)] Have symptoms of selected health complaints: no =0, agree =1, strongly agree =2. Higher score indicates worse health status; mean =2.71 (SD 2.22).
[c)] Living alone =1, living as spouse =2, living with parents and daughters/sons =3, living as three-generation family =4.

Table 6
Factors associated with perceived lack of social support among residents of temporary housing (multiple logistic regression analysis).

	Adjusted odds ratio	95% CI		p-value
I have no neighbours who help me when I have problems or am in trouble (dependent variable)				
Having some troubles with neighbours	3.68	1.61	8.40	0.002**
Difficulties providing care for a family member	3.28	1.08	9.94	0.036*
Distress about living environment (higher assessment score > mean)	2.62	1.58	4.33	< 0.0001***
Weight gain	2.50	1.34	4.66	0.004**
Age (< 50 years old)	2.32	1.32	4.07	0.003**
Increased alcohol intake	2.30	0.95	5.53	0.064
Worries about health status	2.13	1.28	3.56	0.004**
Male (sex)	1.77	1.10	2.85	0.019*
Difficulty in going shopping	1.58	0.95	2.63	0.079
Living in different community before tsunami	1.40	0.99	1.98	0.059

We entered the variables with $p < 0.05$ in cross-tabulation (χ^2).
Backward elimination was used to generate the best model.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.0001$.

difficulties providing care for a family member (AOR 3.28, 95% CI 1.08–9.94, p=0.036), higher levels of distress about living conditions (AOR 2.62, 95% CI 1.58–4.33, $p < 0.0001$), weight gain (AOR 2.50, 95% CI 1.34–4.66, p=0.004), being younger (< 50 years old, AOR 2.32, 95% CI 1.32–4.07, p=0.003), worrying about health (AOR 2.13, 95% CI 1.28–3.56, p=0.004), and being male (AOR 1.77, 95% CI 1.10–2.85, p=0.019). Having had to change community or area after the disaster (AOR 1.40, 95% CI 0.99–1.98, p=0.059) was slightly insignificant ($p <$ 0.05). Difficulty in going shopping (AOR 1.58, 95% CI 0.95–2.63, p=0.079) and increased alcohol intake (AOR 2.30, 95% CI 0.95–5.53, p=0.064) had p-values of slightly over 0.05, but they were identified as almost significant.

3.8. Quality of life of the respondents

Table 7 shows the respondents' level of QOL. All the respondents had lost their houses and belongings after the tsunami. The mean score for the physical health domain was 0.96 (SD 1.15), indicating that they had on average one physical symptom or health complaint out of a possible four. The mean for the psychological health domain was 1.04 (SD 1.23), an average of about one psychological symptoms out of the possible six. To assess aspects of social relations and living conditions, we used the results in Tables 2, 3. We gave a high score (maximum 3 points) to those who had low perceived social capital. The total score ranged from 11 to 83 when we transformed all the raw scores into

Table 7
Quality of life (QOL) among respondents.

Variables	**Possible score range**	**mean**	**SD**
1. Physical health domain	Possible score 0–4	0.96	1.15
Backache, physical pain	0,1		
Catch colds easily	0,1		
Headaches	0,1		
Weight gain	0,1		
2. Psychological health domain	0–6	1.04	1.23
Feel more stress than before	0,1		
Feel difficulties providing care for a family member	0,1		
Feel stress being friendly with neighbours.	0,1		
Insomnia, sleep-onset insomnia	0,1		
Easily annoyed, get frustrated	0,1		
Wake early	0,1		
3. Social relationship domain (Table 3)	2–6	4.37	1.13
I have neighbours who help me when I have problems or am in trouble	1,2,3		
I have neighbours to whom I can talk, and consult on personal matters	1,2,3		
4. Living environment domain (Table 2)	6–30	17.63	6.97
Total possible QOL raw score: sum of score in 1–4 above[a)]	8–46		
Transformed QOL score[b)]	11–83	45.55	15.06

Each QOL raw score: agree =1, not agree =0. For the cumulative score, high score indicates low health status, low social ties, and poor living environment.
Reliability (Cronbach's alpha) =0.693
[a)] QOL Assessment index score:
[b)] Transformed QOL score =100−(raw score/46[worst score]×100).

percentage scores. The mean QOL score was 45.55 (SD 15.06).

4. Discussion

Our four principal findings were as follows:

1) Many of the residents of temporary housing were very frustrated (Table 2).
2) A prolonged period of living in temporary housing affected both the physical and mental health of the residents. The study group reported much higher levels of physical pain than the national average among those aged 65 years and over (study findings: 46.2%, national average: male 9.2%, female 11.8%).
3) Having difficulties providing care for a family member and having some trouble with neighbours were identified as major determinants of a perceived lack of social support in temporary housing.
4) The mean level of QOL among respondents (45.55) was lower than the existing standard value of QOL measurement SF-36, mean of 50 [46].

4.1. Frustration with living in temporary housing for 2 years or more

We observed a wide prevalence of distress about the living conditions in temporary housing. The majority of temporary housing in the study area was prefabricated and terrace-style, which might affect noise levels. Before the GEJET, the study site had high levels of home ownership (88% in 2008), and many people may have owned houses that were larger than their temporary housing [47]. The participants' lifestyles were therefore altered, and they were not used to living in small houses without gardens. Several studies have shown that victims had poorer mental health than before, using the K6 score [22,28], or that their mental health was significantly worse than the Japanese average K6 score [48]. At the time of this study, the master plan for the relocation of the city had not yet been disclosed, so people were not able to decide where they should move from their temporary housing.

Younger residents were identified as most affected by the frustration of living in temporary housing (Table 5). This may be because they are also bringing up children and need to find jobs, which affect their decisions about where to move. The number of families with children has drastically decreased in temporary housing, suggesting that some might have moved to other places. Our informal interviews suggested that younger people had to respect their elders' decisions on this subject, which might lead them to feel more frustration about their living situation.

The answers to the open questions also showed that participants felt that it was difficult to develop community ties in their temporary housing. Table 3 shows that more than 60% of residents agreed that they had neighbours who would help when they had a problem or were in trouble, whom they could talk to and consult on personal matters, and with whom they could casually chat. Their self-expressed views, however, were far from satisfactory, and they felt that they had a problem communicating with neighbours.

4.2. Self-reported health status and associated factors

About one-third of the respondents (34.0%) complained that their mental health had deteriorated in the last year (Table 4). Around 20–32% reported symptoms of poor mental health such as insomnia, being easily annoyed, feeling more stress than before, or waking early (Table 4). Another study conducted in the Iwate and Miyagi prefectures after the GEJET identified that about 35% of the victims showed signs that could be consistent with post-traumatic stress disorder or depression [23].

The major self-reported physical problems were stiff shoulder/back pain, insomnia, and weight gain. These symptoms might be caused by the lack of physical activity linked to living in a smaller house for a long period [13,14,16]. Our result, that only 27.2% had no health complaints, was significantly worse than national figures, but similar to the results of a previous study in areas of Miyagi prefecture affected by the GEJET [28]. Several studies have emphasized that promoting physical activity, such as gardening or regular physical exercise, might be effective in preventing problems such as dementia and becoming bedridden, particularly among those in temporary housing [26,27,29]. Various physical interventions have been tried among this group of residents of temporary housing, but it appears that they have been insufficient.

4.3. Perceived lack of social support and associated factors

We found that about one-quarter of respondents claimed they did not have any neighbours who would help them if they had problems or were in trouble (Table 3). One-third reported that they had no neighbours whom they could talk to or consult on personal matters. The rest, over 60%, said that they had someone to help (Table 3). We compared these figures with those of previous studies measuring the situation nationwide during peacetime in Japan. These found that the percentage reporting that they had confidence in their neighbours was 36.8% (2003) to 40.5% (2010) [47]. Our results showed that fewer than 5% of residents agreed with the statements, 'I have enough neighbours who will help me when I have problems or am in trouble' and 'I have enough neighbours whom I can talk to and consult on personal matters'. Almost half (41.7%) responded positively to, 'I have enough neighbours to whom I say hello'. Our study participants had significantly higher confidence in their neighbours than the national figure (2007) in Japan. Only a few of the group, however, had made close friends among their neighbours. About 30–35% had not found anyone in their immediate neighbourhood who could help with problems or who could be consulted about personal matters.

The majority (73.7%), however, had someone with whom they could casually chat, and more than half (57.4%) felt they had someone they would greet when they met. This suggests that many of the participants were basically polite to their neighbours. We suggest that there may be a number of reasons for these findings.

First, our study site was badly damaged by the earthquake and tsunami, and all of those surveyed had been affected. This was, therefore, an emergency situation, rather than 'peacetime'. Second, our study participants came from villages and towns that were similar before the GEJET, so strong community ties may have continued. They also had many relatives in the same city, and they had been brought up to be polite to their neighbours. Third, we may have experienced some response bias: respondents may have given more favourable answers because they were keen to acquire better living conditions once they move on from the temporary housing. Our study, however, found factors associated with a lack of perceived social support. In other words, these may be determinants of a feeling of isolation. The first of these was having some trouble with neighbours (AOR=3.68, p=0.002). We found that residents had various problems with living in temporary housing. Once they had trouble with their neighbours, people may have found it difficult to improve these relations because they knew that they would be living in temporary housing for a limited period.

Second, we found that problems providing care for a family member was one of the barriers to better communication with neighbours, and it may also lead to feelings of isolation. Some tsunami victims have to care for older members of the family, even when residing in temporary housing. After the GEJET, the community caregiving service system deteriorated in this area. It has been gradually restored but perhaps not adequately. Caregiving in temporary housing may be a heavy burden for the tsunami victims. Previous studies have shown that caregivers often tend to be or feel socially isolated [49,50]. One study also suggested that the GEJET might have accelerated cognitive decline among older victims in the Miyagi area [51]. The burden of caregiving may therefore be higher in the area affected by the GEJET.

The third area linked to a lack of perceived social support was health complaints (weight gain, p=0.004; worries about health, p=0.004), which is consistent with earlier studies [22]. The average age of the study participants was over 60 years old. After the GEJET, the local medical/health service system deteriorated, and the disaster also destroyed public transport, so residents' daily activities suffered. Difficulty in going shopping, although not significant (p=0.079), was also an issue mentioned by some residents. Other studies have suggested that residents of temporary housing should have opportunities to go out [26].

Fourth, we found that being male was a significant determinant of having lower confidence in neighbours, although one previous study emphasized that women were more likely to exhibit anxiety and depression [17]. Our results were consistent with other evidence that men have a higher risk of suicide, one of the endpoints of poor mental health [52]. Japanese national suicide data shows that around 70% of suicides are carried out by men [53]. We suggest that gender disparities should be considered in disaster scenarios and that particular attention should be paid to men who live alone [17]. These people are more likely to be socially and mentally isolated, which may cause or exacerbate mental health problems.

Fifth, our study results also suggest that those who moved to a different town to live in temporary housing felt that they had fewer social ties. This was particularly the case for those who moved to a town that had not been affected by the tsunami (Table 5). This may be because of disparities of sympathy between the two area types. Our study showed that tsunami victims found it difficult to be accepted by people who had not been affected by the tsunami. One solution might be to ensure that people from the same area are able to live together as a group [28].

4.4. Quality of life (QOL) of the respondents

As shown in Table 7, the average score for QOL of this study (45.55)

was slightly lower than Japan's national average of 50.00 found using SF-36 [53], which is commonly used around the world to measure QOL. Although the respondents in this study were all victims of a major disaster, this did not have the same effect on all QOL domains. Their mean score for the physical health (0.96/4.00) and psychological health domains (1.04/6.00) were very low, but the mean score for the social relationship (4.37/6.00) and living environment domains (17.63/30.00) were relatively high. This might suggest that a sudden and unexpected drastic change in living conditions and social relations, such as living with new neighbours because of the GEJET, were shocking events for the victims, and affected their health. The total level of QOL, however, was only slightly lower than the national standard. This might suggest that strong social support/ties can be developed under these circumstances, which can overcome the overall effect of poor physical and psychological scores on QOL, as shown in Table 3.

4.5. Recommendations

Our results suggest that governments, including local authorities, should take effective measures to protect the health of victims of disasters. Efforts to build and maintain communities and develop social support could be among the most important activities, even several years after a disaster. We suggest that the government needs to take swift action to relocate communities by building new towns. The victims' mental health and social ties should be carefully taken into account when doing so.

4.6. Limitations

This study has several limitations. First, this was a cross-sectional study, so we cannot identify any causal relationships between living conditions, mental or physical health status, or level of social support. The situation may also alter over time. Second, both mental and physical health were self-reported, so the data are not fully objective. Third, we used quantitative data from structured questionnaires and limited open questions, and each individual case varies. We did not describe personal cases in detail or analyse any individually. Fourth, although we assessed living conditions, social support, and physical and mental health status using closed questions, we did not use a common QOL measurement such as SF-36 or WHOQOL-BREF. Our results cannot, therefore, be directly compared with previous studies that used these standard scales. Despites of these limitations, our study showed precious evidence colleting from victims those who experienced inconceivable miserable disaster.

5. Conclusions

We found that life in temporary housing was quite stressful and could lead to low QOL, deterioration in physical and mental health. The situation was likely to be particularly stressful for those with high levels of distress about their living environment, a heavy burden of family caregiving, or health complaints, and men under 50 years old. We found, however, the level of social support was higher than the national level.

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Competing interests

The authors declare that they have no competing interests.

Ethical Approval

We obtained ethical approval from the ethical committee of the Hosei Graduate School of Human Society Studies, Tokyo, Japan (July 2013. No. 0004). We obtained written consent form from the president of each cluster of temporary housing. We also documented and explained the study protocol and all ethical considerations verbally to the head of each household, and to all respondents.

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