

Factors Affecting the Sense of Coherence (SOC) for Long-term Evacuees after a Large-Scale Disaster in Japan

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Abstract—Disasters has been occurring frequently all over the world, and an increasing number of people have been forced to continue their evacuation life for a long time. In the aftermath of the 2011 Great East Japan Earthquake and the Fukushima nuclear power plant accident in Japan, some people are still unable to return to their homes due to radioactive contamination and are forced to live as evacuees for long periods of time. It is considered a serious public health issue to keep mentality healthy under the stress of living after the disaster. Therefore, the purpose of this study was to examine the factors that affect the sense of coherence (SOC), which is considered as the ability to cope with stress and maintain health, in residents who continue to live as evacuees after a large-scale disaster. The method was a self-administered questionnaire survey of 1,602 long-term evacuees in Japan. Multiple logistic regression analysis was conducted with the high and low SOC score groups as dependent variables in order to identify factors that predicted high and low SOC.

The results showed that the SOC tended to decrease in the elderly and those with deteriorating mental health. On the other hand, those who were active in education and hobbies, and those who socialized with their neighbors and friends tended to have the higher SOC. In order to support residents who have been forced to continue living as evacuees for a long period of time, it is important to provide them with psychological and emotional support to prevent them from being emotionally overwhelmed, as well as living environment improvement and economic support. It was suggested that the promotion of resident-led activities that lead to mental relaxation and the introduction of stress reduction methods that can be easily adopted by residents are effective in maintaining mental health.

Index Terms— Mental health, disaster, sense of coherence, stress coping.

I. INTRODUCTION

Disasters has been occurring frequently all over the world, and an increasing number of people have been forced to continue their evacuation life for a long time. Due to the wake of the 2011 Great East Japan Earthquake and the Fukushima nuclear power plant accident in Japan, 40,000 people have still been unable to return to their homes due to radioactive contamination, and continue to live in long-term evacuation [1]. It is said that the difficulty of rebuilding the lives of people living in such highly separated or damaged areas will be the risk factor for mental health deterioration [2]. According to the Japanese Cabinet Office, the number of suicides related to the Great East Japan Earthquake accounted for about half of all suicides in Fukushima

Prefecture, where the nuclear accident disaster occurred, over a period of about 10 years [3]. Various factors related to the suicide were found and they are from stressful life events in the past six months, lack of social networks and economic factors, health conditions and awareness of local residents, and the influence of mass media [4], [5]. Moreover, mental ill-health condition due to severe stress situations has also been reported as a factor related to suicide among survivors [6]. It is clear that residents affected by the nuclear power plant accident, and had multiple problems, are at high risk of developing secondary mental health problems. Therefore, from the perspective of suicide prevention, it is essential to provide long-term mental health support according to residents' stress coping abilities.

As a personal quality of stress coping, Antonovsky proposed the Sense of Coherence (SOC) [6], which is a concept of stress coping ability or health maintenance ability. The concept of SOC is based on the three subconcepts of comprehensibility, manageability, and meaningfulness, and is based on the idea that individuals mobilize their own "General Resistances Resources: GRRs" to manage stress and overcome the pathogenic effects of daily environmental influences and unreasonable demands. In recent years, the concept of SOC has attracted attention in fields related to interpersonal services such as health care, medical care, and nursing, and the scales of the concept have been developed. [7], [8] SOC is regarded as the ultimate health factor in people's life and creates health. The higher the SOC, the less stressed and the better able to cope with stress [9], [10].

By studies on the SOC of residents affected by natural disasters, it has been reported that those with higher PTSD (post-traumatic stress disorder) three months after the disaster had lower SOC [11], and that earthquake-related stress affected pregnant women's SOC who experienced the earthquake and are living in the affected areas [12]. In this way, empirical studies have begun to recognize the relationship among SOC, health maintenance and disease prevention from the effects of stress caused by natural disasters.

However, these previous studies have focused on the SOC of disaster victims in response to short-term stress reactions, and not on the SOC in response to medium- to long-term stress reactions caused by living through a disaster such as the nuclear power plant accident. In addition, there is no practice of empirical research on the actual situation of SOC and related factors among long-term evacuees after a large-scale disaster in Japan. Therefore, the purpose of this study is to clarify the factors that affect SOC in the adversity caused by an enormous disaster and to provide suggestions on how to support long-term evacuees to prevent secondary

mental ill-health and suicide.

II. METHODOLOGY

A. Survey Participants and Data Collection Methods

We conducted a community-based, cross-sectional study to 1,602 residents living as long-term refugee in Fukushima Prefecture in Japan. An anonymous self-administered questionnaire was mailed to each subject and requested to complete and return it. Valid responses were received from 1,375 individuals (effective response rate: 85.8%).

B. Survey Item

The questionnaire asked each recipient about her/his SOC status, attributions (gender, age, area of residence, whether or not they live together, degree of sociality, and frequency of going out), stress level, stressors, how the recipient was coping with it, and mental health status.

The SOC3-UTHS was used to examine the subjects' coping with stress and health maintenance skills status [8]. The SOC3-UTHS has been verified for reliability and validity. The alpha coefficient indicating the internal reliability of the SOC3-UTHS used in this study was 0.877. The total score was calculated from three items (ranging from 3 to 21 points) using a 7-point Likert method ranging from "1 - not at all true" to "7. very often true. We divided the participants into two groups: SOC high group (mean + standard deviation of SOC total score) and SOC low group (mean - standard deviation of SOC total score).

To determine the mental health status of participants, we used the Japanese version of the K6 questionnaire [13], which was developed to screen for mood and anxiety disorders. The respondents could choose their answers from a five-point Likert scale: 0-Not at all, 1-Seldom, 2-Sometimes, 3-Usually, and 4-Always. The total of the scores for six items (0 to 24 point range each) was calculated. A higher score indicates a lower level of mental health. On the basis of the K6 score, 13 points was used as the cut-off value, and the participants were divided into two groups: those with good mental health (score less than 13 points) and those with poor mental health (score more than 13 points).

C. Procedure

The purpose of the study was explained to the municipality A, whose residents had been evacuated en masse due to the effects of the Great East Japan Earthquake and the Fukushima nuclear power plant accident, and permission for research cooperation was obtained. A total of 1,602 evacuees aged 20 years or older who were referred by the municipality, who agreed to cooperate in the study and who applied for the health checkup were sent an anonymous survey form and a letter requesting cooperation by mail. The questionnaire was anonymized to protect privacy, and submission of the questionnaire was regarded as consent to participate in the study.

D. Analysis

The analysis was as follows.

IBM SPSS Statistics 27 program was used for statistical analysis. We were able, by using descriptive statistics, to measure the SOC status of the subjects. We examined

whether the SOC status of the respondents differs with respect to demographics, changes in socializing and activities, stress level, stressors, presence or absence of ways to relieve stress, social supports, and mental health status. Comparison tests between the two groups — those with high SOC and the ability to maintain health and those without — were performed using the χ^2 test and t-test. To identify the variables that influence the presence or absence of low SOC, we conducted a multiple logistic regression analysis. We identified candidate variables that affect SOC degree at the 5% level by univariate analysis and selected variables that had a significant association. In doing so, we determined that there was no multicollinearity if the Spearman's correlation between the candidate variables was 0.3 or less. The two-tailed test was done with all assays and we determined it significant if logistic regression analysis shows the association with $p < 0.05$. The examination was performed after the approval of the ethics committee of the institution involved.

III. RESULTS

A. The Background of the Subjects

The background of the subjects is shown in Table I. The subjects were 525 men (38.2%) and 850 women (61.8%), with an average age of 58.2 ± 14.8 (20-90), and 62.3% were in the age group of 20-64 years. As for the current evacuation residence area, 90.8% of the respondents moved to the area mediated by the local government and 9.2% moved to the area voluntarily decided. As for the current family structure, 86.4% of the respondents had a family living with them, and 13.6% lived alone. As for the main way of spending time during the day, 21.5% of the respondents did nothing, while 13.9% were working. In terms of frequency of going out, those who go out almost every day were the most common at 41.2%. In terms of socializing with neighbors, 37.3% of the respondents only greeted their neighbors, while 17.9% had no social interaction with them at all. The mean SOC score was 13.6 ± 3.7 , with males at 13.7 ± 4.0 and females at 13.5 ± 3.5 . Since the average SOC of a typical Japanese adult is reported to be 15.0 ± 3.5 for males and 14.9 ± 3.3 for females [14], the average SOC of the subjects was significantly lower.

TABLE I: THE BACKGROUND OF THE SUBJECTS

		<i>n</i> =1375	
	Variables	n	%
Gender	Male	525	38.2
	Female	850	61.8
Age composition	20~64 years old	857	62.3
	65~74 years old	362	26.4
	75 and above	156	11.3
Evacuated area	Government mediation	1249	90.8
	Self-selection	126	9.2
Cohabitation Family	Yes	1189	86.5
	No	186	13.5
Main activities during the day	Work	191	13.9
	School	3	0.2
	Shopping	135	9.8
	Hospital visit	63	4.6
	hobbies	190	13.8
	housekeeping	283	20.6
	Family care	59	4.3

	Do nothing	295	21.5
	Other	156	11.4
Frequency of going out	Almost every day	567	41.2
	4 to 5 a week	370	26.9
	2 to 3 a week	347	25.2
	About one day a week	49	3.6
	The following 2 to 3 a month	19	1.4
Degree of social interaction with neighbors	Almost nothing	13	0.9
	Other	10	0.8
	Greeting each other	513	37.3
	Talking to each other	344	25.0
	Visiting each other	243	17.7
	Very little socializing	246	17.9
	Other	29	2.1

School	1(0.4)	0(0.0)
Shopping	19(8.1)	12(7.7)
Hospital visit	13(5.5)	5(3.2)
hobbies	47(19.9)	18(4.6)
housekeeping	53(22.5)	28(17.9)
Family care	9(3.8)	9(5.8)
Do nothing	40 (16.9)	53(34.0)
Other	18(7.6)	7(4.5)

B. Background Characteristics of Long-term Evacuees by SOC Scores

The mean (standard deviation) of the SOC scores of the subjects was 13.6 (3.7) points. In terms of SOC components, comprehensibility was 4.6 (1.4) points, manageability was 4.7 (1.3) points, and meaningfulness was 4.3 (1.4) points. Univariate analysis was conducted between the high and low SOC scores of the long-term evacuees and the background characteristics of the subjects to determine the factors associated with them (Table 2). The results showed that SOC was significantly related to five variables: [age composition], [evacuation area], [how to spend time during the day], [frequency of going out], and [degree of socializing with neighbors] ($p < 0.05$). In other words, compared to the group with higher SOC, the group with lower SOC was older, lived in an evacuation area mediated by the local government after the earthquake, spent most of their time at home doing nothing during the day, and had little social interaction with their neighbors.

TABLE II: UNIVARIATE ANALYSIS OF SCORES ON SOC; COMPARISON WITH DEMOGRAPHICS, MAIN ACTIVITIES DURING THE DAY, FREQUENCY OF GOING OUT, AND DEGREE OF SOCIALIZING WITH NEIGHBORS

Variables	SOC Number of people (%)		p
	SOC high group (n=255)	SOC low group (n=171)	
Gender			
Male	112(44.1)	67(39.4)	0.367
Female	142(55.9)	103(60.6)	
Age composition			
20~64 years old	168(66.1)	89(52.7)	< 0.001
65~74 years old	67(26.4)	47(27.8)	
75 and above	19(7.5)	33(19.5)	
Evacuated area			
Government mediation	203(87.6)	129(91.5)	< 0.01
Self-selection	29(12.4)	12(8.5)	
Cohabitation family			
Yes	44(17.3)	26(15.6)	0.689
No	210(82.7)	141(84.4)	
Main activities during the day			
Work	36(15.3)	24(15.4)	< 0.01

Frequency of going out			
Almost every day	127(50.2)	59(34.5)	< 0.001
4 to 5 a week	65(25.7)	44(25.7)	
2 to 3 a week	51(20.2)	51(25.7)	
About one day a week	4(1.6)	10(5.8)	
The following 2 to 3 a month	3(1.2)	1(0.6)	
Almost nothing	0(0.0)	5(2.9)	
Other	3(1.2)	1(0.6)	
Degree of social interaction with neighbors			
Greeting each other	85(34.3)	60(36.4)	< 0.001
Talking to each other	70(28.2)	34(20.6)	
Visiting each other	57(23.0)	248 (14.5)	
Very little socializing	36(14.5)	47(28.5)	

Note. The χ^2 test

C. Comparison of Stress Levels and Stress Causes between High and Low SOC Scores Groups of Long-term Evacuees

We conducted the χ^2 test to compare stress levels and stress causes between the high and low SOC score groups of long-term evacuees. As a result, there was a significant relationship ($p < 0.05$) with the following 16 variables: [Stress level], [Health problems], [Disaster or nuclear power plant accident], [inability to return to home], [Change of life after disaster], [Economic anxiety], [family relationships], [relationships with neighbor], [Living environment], [convenience of transportation], [Loss of work and roles], [Loss of purpose in life], [No one to talk to], [Too much free time], [Anxiety about the future], and [wish for death] (Table 3). In other words, the group with low SOC was more stressed than the group with high SOC due to the loss of purpose in life due to the loss of their homes and jobs as a result of the disaster and nuclear power plant accident, as well as anxiety about the economy, health problems, and relationships.

TABLE III: UNIVARIATE ANALYSIS OF SCORES ON SOC; COMPARISON BETWEEN STRESS LEVEL AND STRESS CAUSE

Variables	SOC Number of people (%)		p
	SOC high group (n=255)	SOC low group (n=171)	
Level of Stress			
Not at a	18(7.3)	5(3.1)	< 0.001

Not much	67(27.3)	31(19.0)		Not much	76(30.2)	48(28.7)	
Somewhat	114(46.5)	64(39.3)		A little	51(20.2)	37(22.2)	
A great deal	46(18.8)	63(38.7)		Yes	48(19.0)	54(32.3)	
Cause of stress				Loss of work and roles			
Health problems				Loss of purpose in life			
No	46(18.7)	17(10.2)	< 0.001	No	57(22.7)	29(17.7)	< 0.05
Not much	56(22.8)	30(18.1)		Not much	53(21.1)	30(18.3)	
A little	96(39.0)	56(33.7)		A little	54(21.5)	23(14.0)	
Yes	48(19.5)	56(33.7)		Yes	87(34.7)	82(50.0)	
Disaster or nuclear power plant accident				No one to talk to			
No	28(11.2)	10(6.1)	< 0.01	No	74(29.4)	26(15.7)	< 0.00
Not much	33(13.3)	12(7.4)		Not much	94(37.3)	40(24.1)	
A little	63(25.3)	30(18.4)		A little	54(21.4)	44(26.5)	
Yes	125(50.2)	111(68.1)		Yes	30(11.9)	56(33.7)	
Inability to return to home				Too much free time			
No	24(1.8)	8(4.8)	< 0.001	No	82(32.7)	24(14.5)	< 0.001
Not much	139(10.7)	14(8.4)		Not much	78(31.1)	38(23.0)	
A little	354(27.2)	30(18.1)		A little	49(19.5)	48(29.1)	
Yes	786(60.3)	114(68.7)		Yes	42(16.7)	55(33.3)	
Change of life after disaster				Anxiety about the future			
No	14(5.6)	8(4.9)	< 0.001	No	25(10.0)	3(1.8)	< 0.001
Not much	31(12.4)	7(4.3)		Not much	30(12.0)	11(6.6)	
A little	57(22.9)	23(14.0)		A little	69(27.5)	34(20.4)	
Yes	147(59.0)	126(76.8)		Yes	127(50.6)	119(71.3)	
Economic anxiety				Wish for death			
No	40(15.9)	11(6.7)	< 0.001	No	174(69.3)	70(42.2)	< 0.001
Not much	61(24.2)	32(19.4)		Not much	52(20.7)	47(28.3)	
A little	86(34.1)	50(30.3)		A little	15(6.0)	18(10.8)	
Yes	65(25.8)	72(43.6)		Yes	10(4.0)	31(18.7)	
Family relationships				<hr/> <i>Note.</i> The χ^2 test <hr/>			
No	73(29.1)	25(15.2)	< 0.001	D. Comparison of Stress Reduction Methods and Mental Health States of Long-term Evacuees between Groups with High and Low SOC Scores			
Not much	69(27.5)	42(25.6)		We conducted the χ^2 test to explore the relationship between stress reduction methods among the high and low SOC score groups of long-term evacuees.			
A little	65(25.9)	43(26.2)		As a result, SOC was significantly related to the following 11 variables. There were "existence of stress reduction methods" and the specific contents of stress reduction methods: "health care," "diet," "socializing with neighbors," "socializing with family and relatives," "clothing," "going out," "housework," "culture and hobbies," "massage," and "herbal tea."			
Yes	44(17.5)	54(32.9)		As a result of t-test to examine the relationship between SOC score and mental health states(K6), it was found that the			
Relationships with neighbor							
No	65(25.9)	30(18.1)	< 0.001				
Not much	89(35.5)	39(23.5)					
A little	57(22.7)	49(29.5)					
Yes	40(15.9)	48(28.9)					
Living environment							
No	34(13.5)	16(9.8)	< 0.001				
Not much	55(21.9)	15(9.1)					
A little	86(34.3)	45(27.4)					
Yes	76(30.3)	88(53.7)					
Convenience of transportation							
No	77(30.6)	28(16.8)	<0.01				

higher the SOC, the lower the mental health score and the healthier the person, and the lower the SOC, the higher the mental health score and the tendency to be under severe mental stress. ($p < 0.05$) (Table 4)

TABLE IV: UNIVARIATE ANALYSIS OF SOC SCORES; COMPARISON WITH STRESS REDUCTION METHODS AND MENTAL STATES

Variables	SOC Number of people (%)		<i>p</i>
	SOC	SOC	
	High group (n = 255)	Low group (n = 171)	
Stress reduction methods			
Exist	154(61.1)	50(30.1)	< 0.001
Absent	98(38.9)	116(69.9)	
Types of stress reduction methods			
Health care			
No	110(43.1)	91(53.2)	< 0.05
Yes	145(56.9)	80(46.8)	
Eating			
No	138(54.1)	115(67.3)	< 0.01
Yes	117(45.9)	56(32.7)	
Drinking			
No	184(72.2)	126(73.7)	0.408
Yes	71(27.8)	45(26.3)	
Smoking			
No	219(85.9)	150(87.7)	0.347
Yes	36(14.1)	21(12.3)	
Socializing with neighbors and friends			
No	128(50.2)	123(71.9)	< 0.001
Yes	127(49.8)	48(28.1)	
Socializing with family relatives			
No	158(62.0)	137(80.1)	< 0.001
Yes	97(38.0)	34(19.9)	
Clothes			
No	203(79.6)	156(91.2)	< 0.01
Yes	52(20.4)	15(8.8)	
Work			
No	240(94.1)	165(96.5)	0.190
Yes	15(5.9)	6(3.5)	
Go out			
No	72(28.2)	83(48.5)	< 0.001
Yes	183(71.8)	88(51.5)	
Housework			
No	192(75.3)	146(85.4)	< 0.05
Yes	63(24.7)	25(14.6)	
Liberal arts and hobbies			
No	127(49.8)	130(76.0)	< 0.001
Yes	128(50.2)	41(24.0)	

Gambling			
No	241(94.5)	161(94.2)	0.518
Yes	14(5.5)	10(5.8)	
Massage			
No	216(84.7)	157(91.8)	< 0.05
Yes	39(15.3)	14(8.2)	
Aromatherapy			
No	247(96.9)	170(99.4)	0.092
Yes	8(3.1)	1(0.6)	
Herbal tea			
No	240(94.1)	171(100.0)	< 0.001
Yes	15(5.9)	0(0.0)	
Mental sanity (K6)	4.9 ± 5.1	9.7 ± 6.7	< 0.001 ^a

Note. χ^2 Test; ^at Test

E. Logistic Regression Analysis with SOC as the Dependent Variable

To predict high and low SOC, we conducted a logistic regression analysis with SOC as the dependent variable. The 32 variables that showed significant associations in the univariate analysis were used as candidate variables, and 16 items with Spearman's correlation of 0.3 or less between the candidate variables were adopted, and logistic regression analysis using the variable reduction method was conducted (Table 5). The 4 variables that were significantly related to SOC were "age composition," "mental health status," "activities such as education and hobbies" and "socializing with neighbors and friends," which are stress relievers. This model accurately predicts the whole at a rate of 76.5%, which is useful for predicting SOC.

TABLE V: PREDICTOR OF SOC OF LONG-TERM EVACUEES AFTER THE DISASTER (LOGISTIC REGRESSION ANALYSIS)

Variable	OR	95% CI	<i>p</i>
Age composition			
20~64 years old	1.000	[1.277,2.896]	< 0.01
65 years old and above	1.923		
Mental sanity K6 score			
Mental sanity K6 score	1.164	[1.109, 1.222]	< 0.001
Activities of the liberal arts and hobbies			
No	1.000	[0.272,0.830]	< 0.01
Yes	0.475		
Socializing with neighbors and friends			
No	1.000	[0.200,0.631]	< 0.001
Yes	0.356		

Note. OR = odds ratio; CI = confidence interval; Multiple logistic regression analysis $p < .05$; Model χ^2 Test $p < .01$; Discrimination hit rate 76.5%

IV. DISCUSSION

People who were forced to live in long-term evacuation for more than 3 years due to the Great East Japan Earthquake and the Fukushima nuclear power plant accident had lower SOC scores than the general population in Japan. Therefore, they

have lower stress resistance and are considered to be at higher risk of developing secondary mental disorders. In order to predict the likelihood of developing secondary mental disorders and other health problems among long-term evacuees, it is important to understand [age structure], [mental health status], [activities such as culture and hobbies] and [socializing with neighbors and friends]. Focusing on identifying and supporting long-term evacuees who are at risk for such problems will help prevent the onset of secondary mental disorders and suicide. More than 3 years after the disaster, an increasing number of residents, especially the younger generation, are looking for work and voluntarily stepping into a new life. On the other hand, a large percentage of elderly people tend to stay in the evacuation areas mediated by the government because they cannot foresee their future. Because of this situation, the older people are, the more they are unable to cope with stress and their SOC tends to decline. It is necessary to watch over the affected elderly people so that they do not become socially confined. And an association was revealed that people with low SOC had higher K6 scores, which indicate mental health status, and their mental health tended to deteriorate. The relationship between the level of mental health and SOC of the victims in this study was similar to the findings of the Japanese elderly [15] (Yoshii, 2005) and rural residents [16] (Tomoko Hatayama, Kaoruko Honjo, Yuko Hirano et al., 2008). In other words, people with low SOC may have more depression and serious mental ill-health than those with high SOC, because they have difficulty in coping with the same stressors by utilizing effective resources. Therefore, it is important to provide psycho-emotional support to prevent residents from becoming emotionally overwhelmed. First of all, regular mental health observation of long-term evacuees, along with physical health surveys, would be the first step for early detection of those who are at high risk.

In addition, those with low SOC were found to have a lack of stress reduction methods, such as [no activities through education or hobbies] and [no socializing with neighbors or friends]. These results suggest that activating effective stress reduction methods can enhance stress coping skills and promote physical and mental recovery. It has been reported that it is desirable to provide support for long-term evacuees to build connections in the community, along with livelihood recovery support such as improvement of living environment and economic support [17]. It was suggested that increasing opportunities for interaction and activities among residents that lead to mental relaxation of the survivors, and introducing stress reduction methods that they can easily adopt, would be effective.

V. CONCLUSION

This study found that the stress coping and health retention skills of long-term evacuees tended to decline. SOC was found to be related to things such as age, mental health status, and social activities and socializing with outsiders as stress relievers. It was suggested that it is important to provide continuous social support in order to improve stress coping ability and health maintenance of adults who have to live in long-term evacuation. Along with material and financial

support, it is advisable to regularly monitor the mental state of the evacuees, provide psychological support, promote community connections, and support them to learn effective stress reduction methods. There is room to consider whether these predictors of SOC can be applied to other countries in the event of a disaster, as disasters occur more frequently worldwide. We believe that conducting international comparative studies and building support systems are future tasks to us.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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