

Doshisha University

Graduation Thesis

Life Recovery Patterns among Survivors of the Great East

Japan Earthquake and Verifications of Disaster Case

Management in Natori City:

Natori Life Recovery Panel Survey Findings

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Title: Life Recovery Patterns among Survivors of the Great East Japan Earthquake and Verifications of Disaster Case Management in Natori City: Natori Life Recovery Panel Survey Findings

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Many of the public support for the survivors of the Great East Japan Earthquake were implemented on the basis of Disaster Victim Certificate. However, it can miss assisting the sufferers who demand special relief since it is provided solely based upon degrees of house damage. Disaster Case Management have been developed recently to tackle the problems. Given the advantages of Disaster Case Management, this study aims to examine the validity of the assist method using 2014-2017 Natori Life Recovery Panel Survey data (N=510). The statistical analyses of the data clarified the following two points: 1) The victims who could not feel life recovery during the survey period experienced full house damage, did not have family bonds, lacked social capital as both private and public goods, had physical/mental health problems in both themselves and their families, and could not be better off as compared to pre-earthquake days due to retirement. 2) Those who actually received personal support and those shown in 1) did not congruent with one another, which indicates tailored assistance did not reach the survivors who were excluded socially.

Keywords: the Great East Japan Earthquake, Disaster Case Management, life recovery

1 Introduction

In Japan, a variety of natural disasters frequently occur and cause tremendous damage to many people and structures. The Great East Japan Earthquake (GEJE), which struck broad areas of eastern Japan in 2011, is one of the most severe disasters among all the disasters that have taken place recently. Since the 2011 GEJE has caused survivors struggle with reconstructing their lives, which cannot be accomplished so readily, those in disaster-stricken areas have needed continuing support. Nevertheless, many of the current support systems are not adequate to help survivors rebuild their lives because such systems can miss supporting sufferers who require them. Given the problematic situation, personal support systems have been developed to complement the current ones. However, it needs to be verified whether the supplementary systems reach the survivors who particularly demand support, which should be supplied based on appropriate assessments of their life circumstances. Therefore, this study identifies the sufferers who have difficulty recovering their lives and examines whether personal support has been provided to them by analyzing longitudinal panel survey data.

1.1 Social Background of the Great East Japan Earthquake Survivors

Attaining life recovery from a disaster damage is by no means straightforward since it needs various foundations in multiple facets. Hayashi (2016) states that life reconstruction for individual disaster victims can be achieved on a basis of infrastructure reestablishment, economic recovery (i.e. restoration in major industries, small businesses), and physical recovery (i.e. rebuilding of housing, land use planning). Given the social reconstruction processes, he also argues huge disasters necessitate more than 10 years to recover sufferers' lives when damaged by them. Consequently, long-lasting support are required in order to help survivors who have been confronting difficulties in their livings.

In spite of the needs of assistance, most of the current support systems that provide aids to survivors are insufficient for relieving them. This is attributed to the fact that these assists are offered based on Disaster Victim Certificate, or degrees of house damage (Cabinet Office, 2013). Sugano (2015) contends that support solely founded on the classifications of Disaster Victim Certificate is not appropriate because the house damage categories are not related to the significant difference in survivors' socioeconomic life situations. For instance, when the government compare the survivors who dwelled in fully damaged leased houses but did not lost their jobs, and the survivors who resided in partially damaged own houses but are thrown into unemployment and thus have no income, the former victims are to receive more public aids. This distinction in the amount of support results from the judgment based on Disaster Victim Certificate. However, socioeconomic perspective indicates that the latter sufferers have trouble reconstructing their lives because various factors other than

house damage are involved. Therefore, if the current support system goes on at this rate, some sufferers may have difficulty in accomplishing life recovery as they cannot obtain suitable resources for livings.

Disaster Case Management (DCM), which examines victims' lives closely and provides tailored personal support that combines normal time and emergency assistance based on the assessment, can address the problem of the current supporting systems. Sugano (2015) emphasizes the importance and the benefit of DCM as a supplementary assistance system since it can minutely support victims and tackle their complicated life problems. DCM was originally implemented for the sufferers of Hurricane Katrina and Hurricane Rita which occurred in 2005 in the US and introduced in a number of disaster-hit areas after the 2011 GEJE in Japan (Sugano, 2017). At the earliest stage of DCM, there is a phase called "screening" which is the stage of making judgmental decisions on who needs special assistance. As stated above, since the support supplied on the basis of Disaster Victim Certificate is not totally adequate, various criteria besides degrees of house damage are required to pinpoint victims who are particularly suffered in the screening phase. By providing suitable support to survivors with decent criteria, DCM can be effective as a support system.

1. 2 Previous Studies on Life Recovery

(1) Research on Life Recovery from the Great Hanshin-Awaji Earthquake
The Seven Critical Element Model (SCEM) could provide criteria which assess survivors' life recovery situation. SCEM was constructed through attempts to specify what exactly life recovery is, which was an indefinite and ambiguous concept until the Great Hanshin-Awaji Earthquake (GHAE) took place in 1995. In order to clearly spell out the conception, a series of grass-roots assessment workshops on life recovery with the GHAE impacted citizens were organized. Based on the results founded in the workshops, Tatsuki and Hayashi (2001) identified seven factors that would help victims feel that "I am no longer a disaster victim" after a disaster, which form SCEM. The elements are the followings: *housing, social ties, community involvement, physical/mental stress management, preparedness, livelihood, and relations to government*. This model has been utilized to evaluate the levels of victims' life circumstances.

After the GHAE, a sequence of research projects had been conducted which examined the relationships between survivors' subjective life recovery sense and SCEM. Tamura et al. (2001), Tatsuki and Hayashi (2002), and Tatsuki et al. (2004) elucidated the influences that SCEM has toward sense of life recovery from the results of Hyogo Life Recovery Panel Survey. Moreover, Kuromiya et al. (2006) analyzed the study data with the framework of longitudinal research in order to clarify the long-term life recovering process. Kuromiya et al. classified the life recovery sense transitions in Fiscal year (Fy) 2001-2003-2005 into four patterns and revealed that having abundant

social capital (Putnam, 2001) prevent victims from decreasing sense of life recovery within those whose life recovery shifts remained at a low level.

(2) Research on Life Recovery from the Great East Japan Earthquake

SCEM have also been used for research studies to explore life recovery from the GEJE. Matsukawa et al. (2015) confirmed that SCEM can be also utilized to explain the GEJE survivors' sense of life recovery from Fy2014 Natori Life Recovery Panel Survey data. Tatsuki (2016) and Matsukawa et al. (2016) clarified that to live in a designated temporary housing was not a facilitating factor of subjective life recovery sense for every survivor as compared with residing in a prefabricated temporary housing, from the results of Fy2014 and Fy2015 survey, respectively.

Other studies which did not use the SCEM scale also demonstrated that GEJE victims' subjective evaluation of life recovery was influenced by their life circumstances after the disaster. Tsuchiya et al. (2014) elucidated that restoration of community, everyday diet, work situation, housing, and social connections in neighborhood and community had affected life recovery using the 2012-2013-2014 panel data conducted in multiple cities. Abe (2015) used the same life recovery scale as Matsukawa et al. (2015), Tatsuki (2016), and Matsukawa et al. (2016) and showed that household income and housing types had effects on victims' sense of life recovery from 2011-2013 panel survey data. From the research studies shown above, it is considered that SCEM could be applied as criteria in the screening phase of DCM since it has been confirmed that various life aspects can predict survivors' life recovery.

1.3 Research Purpose

Given the effectiveness of DCM and the validity of SCEM as life recovery predictors, the objective of this study is to verify whether personal support by DCM actually provided to the victims who particularly need assistance on the basis of legitimate assessments of their life situation. This is achieved by responding to the following two research questions.

RQ1: Who had been suffered the most among the GEJE survivors?

RQ2: Was personal support actually supplied to those shown in RQ1?

Specifically, the characteristics of those who demand special support are to be identified with utilizing SCEM in the first analyses, and possible criteria for DCM screening are presented to answer RQ1. In the second analyses, it is to be confirmed whether the features of them are congruent with those of DCM support receivers, and appropriateness of actual DCM screening are examined to respond to RQ2.

2 Methods

2.1 Survey Sample

The survey samples of this study were those who responded the Natori Life Recovery Panel Survey for four successive years. This survey was conducted at four different time points, in January of 2015 (fiscal year 2014), January of 2016 (fiscal year 2015), August of 2016 (fiscal year 2016), and November of 2017 (fiscal year 2017). The research subjects of Fy2014 survey were all households and their members over the age of 18 that were registered by Natori city as the residents of prefabricated temporary housing (PTH) units and designated temporary housing (DTH). The research subjects of Fy2015, Fy2016, and Fy2017 surveys were all households and their members over the age of 18 that were residing in PTH, DTH, and restored or newly rebuilt homes. The subject households included 1) those who lived in Natori city prior to the 2011 GEJE and 2) those who were living outside (mostly in Fukushima) and had moved to Natori city after the 311 Fukushima disaster. The survey questionnaires were mailed to the subjects as a package which consisted of a household questionnaire and six sets of individual member questionnaires in Fy2014, Fy2015, and Fy2017 surveys. Only individual member questionnaires were mailed in Fy2016 survey. Table 1 displays the overview of the responses and the survey periods.

Table 1. Overview of panel survey sample

Survey	Housing type	Household questionnaire			Individual member questionnaire			Survey period	
		Number of distribution	Number of response	Response rate	Number of distribution	Number of response	Response rate		
Fy2014 survey	Temporary housing	PTH	702	500	71.2%	1,293	820	63.4%	2015/1/13- 2015/3/4
		DTH	831	607	73.0%	2,220	1,151	51.8%	
Fy2015 survey	Temporary housing	PTH	523	408	78.0%		637		2016/1/15- 2016/3/9
		DTH	664	604	91.0%		886		
	Restored or newly rebuilt home	1,144	683	59.7%		1,631			
Fy2016 survey	Temporary housing	PTH				823	450	54.7%	2016/8/31- 2016/11/2
		DTH				1,256	578	46.0%	
	Restored or newly rebuilt home				3,705	1,262	34.1%		
Fy2017 survey	Temporary housing	PTH	245	91	37.1%	407	132	32.4%	2017/11/17- 2017/12/15
		DTH	252	97	38.5%	604	187	31.0%	
	Restored or newly rebuilt home	1,521	502	33.0%	4,520	1,218	26.9%		

1107 (72.2%), 1695 (72.7%), and 690 (34.2%) of household questionnaires were valid in Fy2014, Fy2015, and Fy2017 surveys, respectively. 1971 (56.1%), 3154, 2290 (39.6%), and 1537 (27.8%) of household member questionnaires were valid in Fy2014, Fy2015, Fy2016, and Fy2017 surveys, respectively. In this paper, 510 subjects who responded to all four surveys formed the panel survey sample.

2. 2 Instruments

Based on SCEM, scales/items were included in the surveys to capture each of the elements. These scales/items were designed as the independent variables. The life recovery scale which were constructed and repeatedly used in Hyogo Life Recovery Surveys (Tamura et al., 2001; Tatsuki and Hayashi, 2002; Tatsuki et al., 2004; Kuromiya et al., 2006) was used to form the dependent variable. Table 2 shows the overview of the variables measured in the surveys.

Table 2. Overview of independent and dependent variables

Scale	Description
Socio-demography	Gender, Household size, Age
House damage	Degree of house damage
Life recovery	Life fulfillment, Life satisfaction, One year prospect
<i>Housing</i>	Temporary housing types
<i>Social ties</i>	Strength of social ties (before 311, Fy2014)
<i>Community involvement</i>	Community outlook
<i>Physical/Mental stress management</i>	Physical and mental stressfulness, Family health
<i>Preparedness</i>	Concerns for future disaster risk
<i>Livelihood</i>	Financial leeway
<i>Relation to government</i>	Paternalistic, liberal, and communitarian attitude toward government

(1) Socio-demography and House Damage

The following variables were used as independent variables: gender, household size, age, house damage. Age was categorized into five age-groups (39 and younger, 40-49, 50-64, 65-74, and 75 and older). Household size were separated into three levels (one person, two persons, and three persons). House damage were classified into three categories (full house damage, large scale half house damage/half house damage, and Evacuated from Fukushima/Unknown).

Socio-demography and House Damage The life recovery scale consists of 14 five-point Likert scale items which inquire about the subjective assessments of 1) life fulfillment compared to pre-earthquake days, 2) life satisfaction, and 3) future prospects. Seven items asked the degree of life fulfillment in such areas as liveliness of everyday life, the meaning of life, social relationships, living an enjoyable life, hope for the future, energeticness, and work. Six life satisfaction items inquire about satisfaction in everyday life, health, human relationships, household finance, family life, and work. One item was used to measure the prospects in the respondents' life one year from the time point of each survey. These 14 items were summed up and the total score formed the life recovery score.

(2) Seven Critical Element Model of Life Recovery

a) *Housing*

The measure of *housing* in this study is the temporary housing types that the subjects dwell in. Respondents were asked whether they live in a prefabricated temporary housing (PTH) or designated temporary housing (DTH) at the time of Fy2014.

b) *Social Ties*

The strength of *social ties* was measured by 1) number of neighbors/relatives/friends with whom they have social conversations before the 2011 GEJE and as of Fy2014 and 2) number of people who they meet in hobby/circle/social gatherings before the 2011 GEJE and as of Fy2014. These numbers at different two time points were sorted into four categories (none, 1 to 4, 5 to 9, and 10 and more) first, and then were optimal-scaled to quantify these categories.

c) *Community Involvement*

The subjects were asked to report their community outlooks at the time of Fy2014 by choosing one of the following options: 1) Residents socialize very often and participate well in community events, 2) Residents socialize to a certain degree and some greet each other, 3) Residents do not socialize but neighborhood representatives seem to be more or less active, and 4) Residents do not socialize with each other and live by themselves.

d) *Physical/Mental Stress Management*

Two instruments were used to measure the subjects' *physical/mental stress management* as of Fy2014. The first measurement was respondents' subjective evaluation on physical and mental health over the previous month. They were inquired about the frequency of feeling three types of physical stress (heart palpitates, get short of breath, and feel squeezing chest pain) and three types of mental stress (feel lonely, feel depressed, and think about negative things one after another). Every item was measured by five-point Likert scale. These six items were added up and formed physical and mental stress score. The other measurement was two dichotomous instruments which asked whether the respondents' family had a member who has problems in physical and mental health. These items were optimal-scaled and yielded family health score.

e) *Preparedness*

Respondents were inquired about what they attach a high value in rebuilding their houses at the time of Fy2014 and were asked to select three of them out of 13 given items. Those who chose either "safety from disasters" or "robustness of the building" were regarded as holding high concerns for future disaster risk.

f) *Livelihood*

The subjects were asked to compare pre-earthquake and post-earthquake (Fy2014) levels of household income, expenditure, savings, and loan/debt and were also asked to choose from among three options (increase, decrease, or no change) in each item. These items were optimal-scaled and the scores were used to measure financial leeway.

g) *Relations to Government*

Trichotomous items were used to ask respondents' attitude toward three governmental issues as of Fy2014 (how to enforce rules to separate different types of garbage, how to promote community development, and how to vitalize community activities) in either paternalistic, liberal, or communitarian orientations. Optimal scaling of the three items produced a two-dimensional structure, where the first solution contrasted paternalism versus communitarian and the second solution differentiated liberalism from the other two attitudes.

(3) Life Recovery

The life recovery scale consists of 14 five-point Likert scale items which inquire about the subjective assessments of 1) life fulfillment compared to pre-earthquake days, 2) life satisfaction, and 3) future prospects. Seven items asked the degree of life fulfillment in such areas as liveliness of everyday life, the meaning of life, social relationships, living an enjoyable life, hope for the future, energeticness, and work. Six life satisfaction items inquire about satisfaction in everyday life, health, human relationships, household finance, family life, and work. One item was used to measure the prospects in the respondents' life one year from the time point of each survey. These 14 items were summed up and the total score formed the life recovery score. Study 1: Identification of the Survivors Who Needs Special Support

3 Study 1: Identification of the Survivors Who Needs Special Support

3.1 Result

(1) Classification of Life Recovery Transitions

In order to reveal the characteristics of those who particularly suffered, the life recovery sense score of 510 subjects who responded to all of Fy2014 to Fy2017 surveys were analyzed. SPSS version 25 was used for all of the statistical analyses below. Referring to Kuromiya et al. (2006), a cluster analysis was conducted to group together the similar transitions of identical victims' sense of life recovery. Ward method and squared Euclidean distances were adopted for clustering. As a result, the transitions were separated into five distinctive patterns. Two-way repeated measures analysis of variance demonstrated that there were statistically significant differences between those patterns ($F_{11,75,1483.56}=25.48, p<.01$). Figure 1 illustrates the shifts of life recovery sense from Fy2014 to Fy2017 by each pattern.

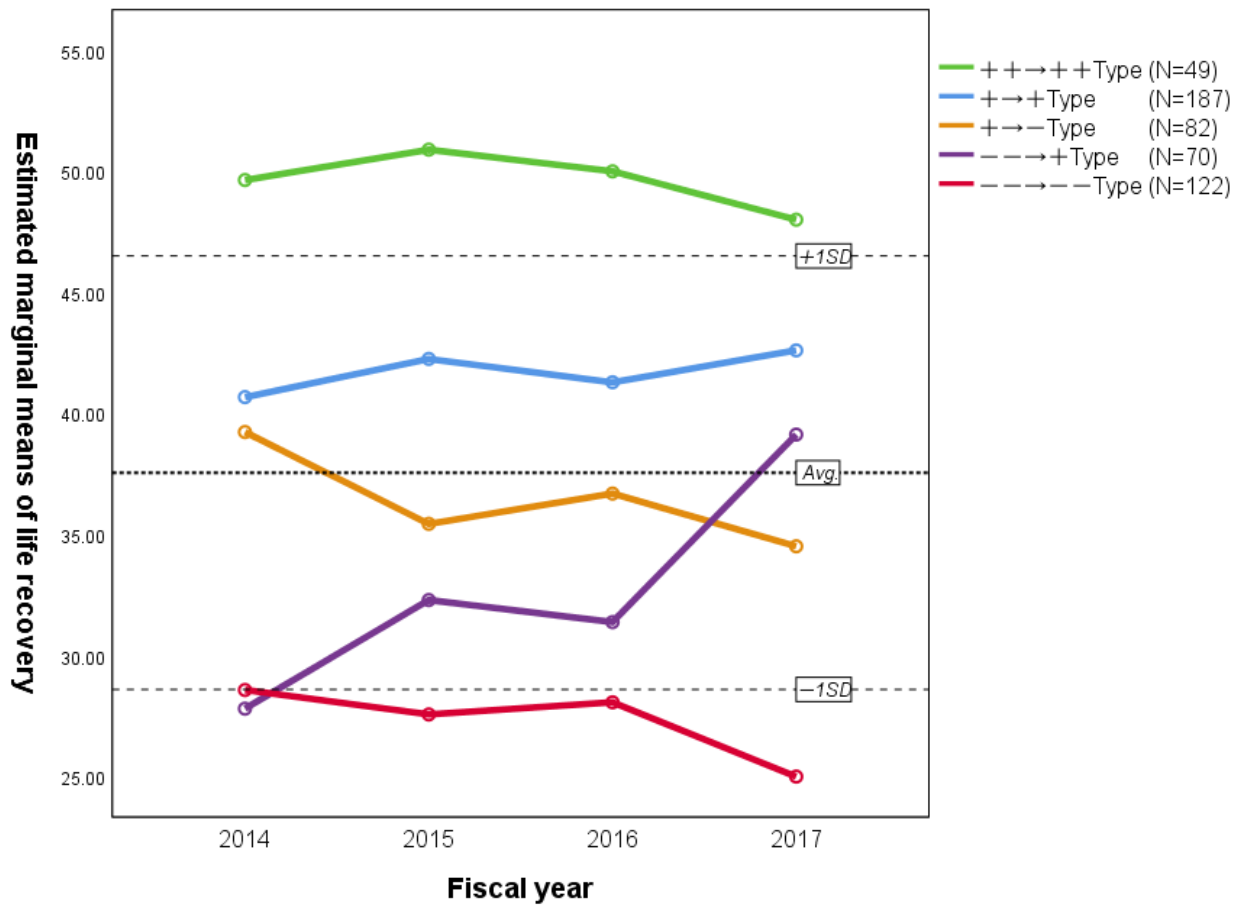


Figure. 1 Five life recovery patterns by the 2011 GEJE survivors

Every pattern has remarkable features in its shapes of life recovery transitions that can be differentiated from each other. First, those whose life recovery scores were over +1 standard deviation (SD) as of Fy2014 had sustained their scores at a high level since then. This type were named “++--++ Type”. Second, there were two groups among those whose life recovery scores were between +1SD and the average at the first time point. One had scored moderately high in their life recovery until Fy2017, while the other experienced slight declines in the scores over time. The former was labeled as “+--++ Type”, and the latter was called “+-- - Type”. Third, there were two kinds among those whose life recovery scores were between the mean and -1SD at the time of Fy2014. One had boosted their life recovery scores, whereas the other’s scores had remained at a low level and even decreased marginally at the end. The former was named “-- -- + Type”, and the latter was labeled as “-- -- -- Type”.

It should be noted that there is a distinction between the life recovery patterns of the 2011 GEJE victims and those of the 1995 GHAE victims. Kuromiya et al. (2006) sorted

the shifts of life recovery that the 1995 GHAE survivors sensed into four patterns (+ + Type, + Type, - Type, -- Type). Figure 2 displays the classification by Kuromiya.

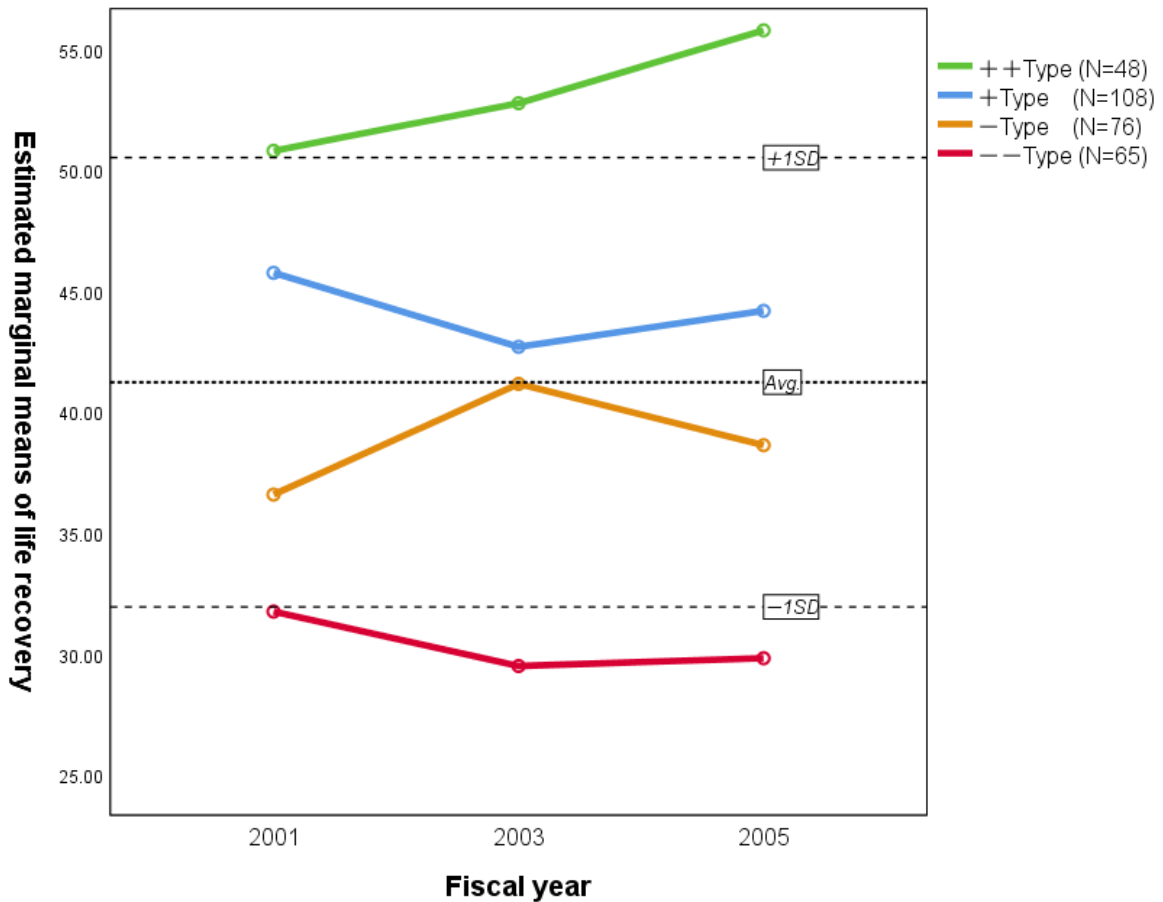


Figure. 2 Four life recovery patterns by the 1995 GHAE survivors

In figure 2 above, no crossover was observed among those four patterns during the research years 2001 to 2005. By contrast, the five patterns that was obtained in this study (Figure 1) did not maintain the orders of life recovery level though the period. Especially, $-\rightarrow+$ Type and $-\rightarrow--$ Type cannot be distinguished at the first research time point solely. Therefore, only the earliest phases of life recovery should not be focused in order to shed light on those who demand special assistance such as personal support. Rather, it is necessary to follow up the shifts of long-term life recovery and clarify the characteristics of those whose degrees of life recovery continues to be low. This research study, which was initiated three years after the disaster and conducted for four consecutive years, revealed this noticeable point.

(2) Identifications of the Characteristics of Five Life Recovery Types

Since ---Type appears to have special support needs among all these types in terms of life recovery, data analyses were conducted on the assumption that the sufferers in this type are those who need relief by DCM. Identification of the features of this type which are found at the earliest period would enable predictions of the life recovery levels afterward. Additionally, it leads to judgments on who needs special assistance in an early phase of a future disaster. Thus, the analyses below expose the traits of dependent variables as of Fy2014 and before the 2011 GEJE, which are the earliest time point in the dataset. Indeed ---Type should be examined most minutely, but the other four types were also analyzed to specify the difference between ---Type and the other types. Five logistic regressions were calculated to predict each type based on socio-demography, house damage, and SCEM variables. Binary independent variables (e.g. ---Type=1, the other four types=0) were set for every type. 448 survey samples had complete sets of dependent and independent variables. Table 3 summarizes the results of the five analyses on the 448 samples.

First, the characteristics of +++Type were examined. There were statistically significant differences between +++Type and the other types in *social ties*, *community involvement*, and *physical/mental stress management* from SCEM. 1) *Social ties*: To have abundant social connections as of Fy2014 showed a positive effect ($p < .01$) on +++Type. 2) *Community involvement*: Living in a community where “residents socialize very often and participate well in community events” was found to be a significantly positive predictor ($p < .05$) compared to “residents do not socialize with each other and live by themselves”. 3) *Physical/Mental stress management*: To feel strong physical and mental stress confirmed to yield a negative impact ($p < .01$). The first row of Table 4 summarizes the results of +++Type analysis.

Second, the features of ++Type were considered. Statistically significant differences were observed between ++Type and the other patterns in age from socio-demography, and *community involvement*, *physical/mental stress management*, *livelihood*, and *relations to government* from SCEM. 1) Age: Being under 39 or 40s have a significantly positive effect ($p < .05$ for both ages) upon ++Type in comparison with being over 75. 2) *Community involvement*: To live in a community where “residents do not socialize but neighborhood representatives seem to be more or less active” was confirmed to have a negative impact ($p < .05$) when compared to “residents do not socialize with each other and live by themselves”. 3) *Physical/Mental stress management*: Feeling strong physical and mental stress displayed a negative effect ($p < .05$). Regarding family health, being a member of a physically and mentally healthy family was found to be a significantly positive predictor ($p < .05$). 4) *Livelihood*: To have financial leeway demonstrated a positive impact ($p < .01$). 5) *Relations to government*: Holding a liberalism attitude tended to have a negative effect ($p < .10$). The second row of Table 4 sums up the results of ++Type analysis.

Table. 3 Logistic regression analyses on five life recovery types results

Independent Variables (Reference)	+++++ Type				+++ Type				+--+ Type				----+ Type				----- Type				
	β	SE	OR	P	β	SE	OR	P	β	SE	OR	P	β	SE	OR	P	β	SE	OR	P	
DEMOGRAPHY																					
Gender (Female)	-1.84	.356	.832		.282	.218	1.325		-.516	.297	.597 *		-.506	.298	.603 *		.406	.276	1.500		
Household size (One person)	.341	.520	1.406		.333	.301	1.396		-1.026	.373	.358 ***		.777	.423	2.176 *		-.299	.348	.741		
Age (75 and older)	.082	.552	1.086		.471	.315	1.601		-.433	.384	.649		.556	.454	1.743		-.786	.398	.455 **		
	4.34	.712	1.543		1.308	.509	3.699 **		-.885	.613	.413		.344	.765	1.410		-3.480	1.160	.031 ***		
	40-49	-.693	.866	.500	1.218	.521	3.382 **		-.494	.598	.610		-.499	.851	.607		-.405	.588	.667		
	50-64	-.310	.644	.734	.510	.453	1.665		-.622	.507	.577		.708	.680	2.029		-.418	.472	.658		
	65-74	-.690	.731	.501	.437	.474	1.549		-.914	.548	.401 *		1.081	.689	2.948		-.280	.484	.756		
HOUSE DAMAGE																					
House damage (Full house damage)	.651	.658	1.917		.706	.446	2.025		-1.076	.783	.341		.010	.686	1.010		-1.372	.748	.254 *		
House damage (Half house damage)	.472	.620	1.604		-.433	.464	.648		-.358	.671	.699		-.040	.600	.961		.462	.604	1.587		
Evacuated from Fukushima/Unborn																					
HOUSING																					
Temporary housing types (DTH)	PTH	-.091	.446	.913		-.071	.249	.931		.085	.327	1.089		.125	.336	1.133		.011	.309	1.011	
SOCIAL TIES																					
Social ties score	Social ties (optimal scaling score) (before)	-.102	.249	.903		-.178	.138	.837		-.239	.186	.787		-.127	.181	.881		.497	.168	1.644 ***	
Social ties score	Social ties (optimal scaling score) (FY2014)	.597	.231	1.817 ***		.189	.137	1.208		-.057	.187	.945		-.007	.180	.993		-.483	.176	.617 ***	
COMMUNITY INVOLVEMENT																					
Community outlook (Residents do not socialize but neighborhood not socialize with each other and live by themselves)	Residents do not socialize but neighborhood representatives seem to be more or less active	.244	.673	1.277		-.879	.396	.415 **		.326	.501	1.386		.852	.420	2.343 **		-.003	.435	.997	
	Residents socialize to a certain degree and some greet each other	.315	.466	1.370		.061	.251	1.063		.403	.336	1.496		-.137	.357	.872		-.550	.317	.577 *	
	Residents socialize very often and participate well in events	1.428	.565	4.172 **		-.112	.389	.894		-.102	.539	.903		.144	.558	1.154		-1.287	.555	.276 **	
PHYSICAL/MENTAL STRESS MANAGEMENT																					
Physical and mental stress score	Physical and mental stress (total score)	-.208	.053	.812 ***		-.054	.023	.948 **		-.039	.031	.962		.100	.027	1.105 ***		.071	.027	1.073 ***	
Family health score	Family health (optimal scaling score)	-.066	.200	.937		.290	.121	1.336 **		-.087	.156	.916		.303	.167	1.353 *		-.498	.148	.608 ***	
PREPAREDNESS																					
Concerns for future disaster risk	High concerns for future disaster risk (dummy variable)	.465	.363	1.592		-.097	.217	.907		.099	.288	1.104		.155	.295	1.167		-.212	.275	.809	
LIVE/HOOD																					
Financial leeway score	Household financial leeway (optimal scaling score)	.197	.187	1.218		.396	.115	1.486 ***		-.228	.161	.796		-.195	.162	.823		-.423	.156	.655 ***	
RELATION TO GOVERNMENT																					
Relation to government scale	Paternalistic vs. Communian attitude score (optimal scaling score)	.036	.196	1.037		-.021	.110	.980		-.181	.148	.835		.270	.158	1.310 *		-.143	.143	.867	
	Liberal attitude score (optimal scaling score)	.002	.184	1.002		-.213	.111	.808 *		-.153	.145	.858		.294	.152	1.342 *		.214	.143	1.238	
	Intercept	-.841	.957	.431		-.817	.614	.442		-.178	.729	.837		-4.254	.892	.014 ***		-1.278	.683	.279 *	
N=448																					
*** p<.01, ** p<.05, * p<.10, SD: Standard error, OR: Odds ratio																					
Nagelkerke R ² =.280																					
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Nagelkerke R ² =.170																					
Nagelkerke R ² =.357																					

Third, the traits of +→- Type were explored. Statistically significant differences were found between +→- Type and the other types in gender, household size, and age from socio-demography. 1) Gender: Being male showed a significant tendency that it yields a negative impact (p<.10) on +→- Type in contrast with being female. 2) Household size: Two-person households was a significantly negative predictor (p<.01) as compared to single households. 3) Age: Being 65 to 74 tended to show a negative impact (p<.10) compared with being over 75. The third row of Table 4 abridges the results of +→- Type analysis.

Fourth, the characteristics of -→+ Type were observed. There were statistically significant differences between -→+ Type and the other patterns in gender and household size from socio-demography, and *community involvement*, *physical/mental stress management*, and *relations to government* from SCEM. 1) Gender: Being male displayed a significant tendency that it has a negative effect (p<.10) upon -→+ Type in contrast to being female. 2) Household size: Two-person households tended to show a positive impact (p<.10) when compared with single households. 3) *Community involvement*: To live in a community where “residents do not socialize but neighborhood representatives seem to be more or less active” was found to demonstrate a positive impact (p<.05) as compared to “residents do not socialize with each other and live by themselves”. 4) *Physical/Mental stress management*: Feeling strong physical and mental stress was a significantly positive predictor (p<.01). With regard to family health, being a member of a physically and mentally healthy family showed a significant tendency that it yields a positive impact (p<.10). 5) *Relations to government*: To take a paternalism view tended to have a positive effect (p<.10) in comparison with communitarian view. Plus, holding a liberalism view exhibited a significant tendency that it shows a positive impact (p<.10). The fourth row of Table 4 briefs the results of -→+ Type analysis.

Fifth, the features of -→-- Type were scrutinized. Statistically significant differences were confirmed between -→-- Type and the other types in household size, age, and house damage from socio-demography, and *social ties*, *community involvement*, *physical/mental stress management*, and *livelihood* from SCEM. 1) Household size: Three-or-more-person households showed a negative effect (p<.05) on -→-- Type when compared to single households. 2) Age: Being under 39 was a significantly negative predictor (p<.01) compared with being over 75. 3) House damage: To have experienced large scale half house damage/half house damage tended to have a negative impact (p<.10) as compared to those who have undergone full house damage. 4) *Social ties*: To have abundant social connections before the 2011 GEJE demonstrated a positive effect (p<.01), while holding abundant social connections as of 2014 showed a negative effect (p<.01). 5) *Community involvement*: Living in a community where “residents socialize very often and participate well in community events” was confirmed to have a negative impact (p<.05) and also “Residents socialize to a certain degree and some greet each other” exhibited a

tendency that it holds a negative effect ($p < .10$) in comparison to “residents do not socialize with each other and live by themselves”. 6) *Physical/Mental stress management*: To feel strong physical and mental stress demonstrated a positive effect ($p < .01$). Concerning family health, being a member of a physically and mentally healthy family displayed a significantly negative effect ($p < .01$). 7) *Livelihood*: To have financial leeway was found to yield a negative impact ($p < .01$). The fifth row of Table 4 recaps the results of $---\rightarrow---$ Type analysis.

Table. 4 Overview of the characteristics of five life recovery types

Type	Characteristic
$++\rightarrow++$ Type	<p>Seven Critical Element Model of Life Recovery</p> <ul style="list-style-type: none"> · <i>Social ties</i> : Abundant private connections with people after the GEJE · <i>Community involvement</i> : Abundant public connections among citizens · <i>Physical/Mental stress management</i> : Less physical/mental stress
$+\rightarrow+$ Type	<p>Socio-demography</p> <ul style="list-style-type: none"> · Age: 49 and younger <p>Seven Critical Element Model of Life Recovery</p> <ul style="list-style-type: none"> · <i>Community involvement</i> : Lacking in public connections with people · <i>Physical/Mental stress management</i> : Less physical/mental stress, No one in family have health problem · <i>Livelihood</i> : Having financial leeway · <i>Relation to government</i> : Not liberalism
$+\rightarrow-$ Type	<p>Socio-demography</p> <ul style="list-style-type: none"> · Gender: Female · Household size: One person · Age: 75 and older
$---\rightarrow+$ Type	<p>Socio-demography</p> <ul style="list-style-type: none"> · Gender: Female · Household size: Two persons <p>Seven Critical Element Model of Life Recovery</p> <ul style="list-style-type: none"> · <i>Community involvement</i>: Having active neighborhood representatives · <i>Physical/Mental stress management</i> : Strong physical/mental stress, No one in family have health problem · <i>Relation to government</i> : Paternalism and liberalism
$---\rightarrow---$ Type	<p>Socio-demography</p> <ul style="list-style-type: none"> · Household size: One person · Age: 75 and older · House damage: Full house damage <p>Seven Critical Element Model of Life Recovery</p> <ul style="list-style-type: none"> · <i>Social ties</i> : Abundant private connections with people before the GEJE, lacking in private connections after the GEJE · <i>Community involvement</i> : Lacking in public connections among citizens · <i>Physical/Mental stress management</i> : Strong physical/mental stress, Someone in family have health problem · <i>Livelihood</i> : Less financial leeway

3.2 Discussion

Based on the results shown above, the differences between $---\rightarrow---$ Type and the other four types are examined below to discuss who requires special support from DCM.

There were complete opposite tendencies in social ties, *community involvement*, and *physical/mental stress management* between $++\rightarrow++$ Type and $---\rightarrow---$ Type. These distinctions suggest that social capital as both private and public goods (Patnum 2000) and stressfulness of individuals' lives are closely related to life recovery.

Comparison between +→+Type and -→-→-Type showed a similarity in *community involvement* but exhibited distinctions in age, *physical/mental stress management*, and *livelihood*. Although ++→++Type characteristics exhibited that social capital matter in promoting life recovery, abundant social capital were not observed in both +→+Type and -→-→-Type. However, +→+Type survivors are assumed to live independent lives because it is likely that they are working-age adults and thus are in good financial shape even if the communities where they live are not vitalized. On the contrary, -→-→-Type sufferers have already retired from their job and thus are likely to be on tight budgets. These points regarding financial situation can explain the reasons they cannot feel life recovery.

Both of +→-Type and -→-→-Type were typically characterized as isolated elderly people. Since both types had undergone slight decreases in sense of life recovery, they are considered to have difficulty reconstructing their lives particularly. As the demographic factors such as age and household size can be grasped even before a disaster, the features shown above can be used as easy criteria for providing personal support at an early stage.

-→-→+Type and -→-→-Type differed in household size and *community involvement*. As for *physical/mental stress management*, these types were found to have the same feature in personal stress but had adverse tendencies in family health. Despite the low-level life recovery of both types as of Fy2014, the transitions diverged from each other later on. -→-→+Type survivors can be included in the communities societally through the helps from neighborhood representatives, whereas -→-→-Type survivors are not in environments where they have opportunities to socialize with other citizens. In regard to their families, -→-→+Type victims are considered to have bonds with family members as they are typically families of two. Also, -→-→+Type's families do not have health problems even though -→-→+Type themselves feel strong stress. Therefore, it is likely that they are assisted by their families and bounce back from hardships thanks to them. These factors concerning social bonds with others can account for the directional difference between -→-→+Type and -→-→-Type.

In summary, survivors who cannot feel life recovery to the end (-→-→-Type) do not have connections with family, are lacking in social capital as both private and public goods, have physical and mental health problems in both themselves and their family, and cannot be better off compared to pre-earthquake days because of retirement. It should be noted that a feature of -→-→-Type also showed full house damage, which are regarded as demanding relief in many existing support systems. In this respect, the current systems appear to be valid to a certain extent. Nonetheless, various traits besides house damage were observed in socio-demography and SCEM. As Sugano (2015) indicates, it suggests that the existing assistance methods might have limitations in providing support to those who particularly suffered without missing them. Therefore, the characteristics other than house damage should be also utilized as criteria for evaluating victims' life situations in the screening phase of DCM.

4 Study 2: Verification of Personal Support Provided to Survivors

Since the features of those who especially demands relief from supporters were specified in the previous section, DCM support for survivors can be offered by assessments with the criteria, not only by house damage-based judgment. Thus, it is necessary to confirm whether actual personal support is provided appropriately in terms of the criteria. In order to verify the validity of DCM screening, personal support that implemented in Natori city was scrutinized. DCM in Natori city is offered by Personal Support Center (PSC), which is a general incorporated association. By exploring the data of those who received assistance from PSC (PSC-case), it was analyzed whether the characteristics of PSC-case and those of \rightarrow -Type are overlapped to see if personal support in Natori city reaches the victims who have been suffered particularly.

4.1 Result

24 PSC-cases were included within the 510 respondents who were analyzed above. In order to examine both \rightarrow -Type and PSC-case with the same criteria, two logistic regression analyses was conducted to predict \rightarrow -Type and PSC-case based on socio-demography and SCEM variables which are the identical independent variables to the last analyses except for house damage. Although \rightarrow -Type has already considered above, it was reanalyzed to clarify the differences between the dependent variables. Binary variables (\rightarrow -Type=1, the other four types=0, PSC-case=1, non-PSC-case=0) were set for the dependent variables. Table 5 exhibits the results of the two analyses on 448 samples that have complete sets of variables.

First, the characteristics of \rightarrow -Type were explored. Despite the exception of the house damage variables, statistically significant differences were found between \rightarrow -Type and the other types in the same variable other than house damage. Since each factor have an almost equivalent effect to that founded in the last analysis, only the traits observed are shown in this section (see the first row of Table 6).

Second, the features of PSC-case were examined. There were statistically significant differences between PSC-case and non-PSC-case in gender, household size, and age from socio-demography and *social ties* from SCEM. 1) Gender: Being male demonstrated a significant tendency that it has a positive effect ($p < .10$) upon PSC-case in contrast with being female. 2) Household size: Two-person households was a significantly negative predictor ($p < .05$) and three-or-more-person households tended to have a negative impact ($p < .10$) when compared to single households. 3) Age: Being 40s displayed a significant tendency that it yields a positive effect ($p < .10$) in comparison with being over 75. 4) *Social ties*: To have abundant social connections as of Fy2014 tended to show a positive effect ($p < .10$). The second row of Table 6 summarizes the results of PSC-case analysis.

Table. 5 Logistic regression analyses on ---Type and PSC-case results

Independent variables (Reference)		---Type				PSC-case			
		β	SE	OR	p	β	SE	OR	p
DEMOGRAPHY									
Gender (Female)	Male	.346	.273	1.413		.908	.541	2.480	*
Household size (One person)	Two persons	-.203	.343	.817		-1.378	.625	.252	**
	Three persons	-.774	.394	.461	**	-1.241	.654	.289	*
Age (75 and older)	39 and younger	-3.192	1.126	.041	***	1.283	1.299	3.609	
	40-49	-.437	.581	.646		2.155	1.207	8.625	*
	50-64	-.298	.467	.743		.751	1.156	2.119	
	65-74	-.205	.482	.815		.249	1.231	1.283	
HOUSING									
Temporary housing types (DTH)	PTH	.026	.297	1.027		.922	.580	2.513	
SOCIAL TIES									
Social ties score	Social ties (optimal scaling score) (before)	.475	.165	1.608	***	-.272	.348	.762	
Social ties score	Social ties (optimal scaling score) (Fy2014)	-.495	.175	.609	***	.642	.334	1.900	*
COMMUNITY INVOLVEMENT									
Community outlook (Residents do not socialize with each other and live by themselves)	Residents do not socialize but neighborhood representatives seem to be more or less active	-.011	.428	.989		-1.721	1.190	.179	
	Residents socialize to a certain degree and some greet each other	-.580	.314	.560	*	-.670	.666	.512	
	Residents socialize very often and participate well in events	-1.210	.542	.298	**	.348	.778	1.416	
PHYSICAL/MENTAL STRESS MANAGEMENT									
Physical and mental stress scale	Physical and mental stress (total score)	.071	.026	1.074	***	.053	.048	1.055	
Family health score	Family health (optimal scaling score)	-.500	.147	.607	***	-.002	.279	.998	
PREPAREDNESS									
Concerns for future disaster risk	High concerns for future disaster risk (dummy variable)	-.209	.271	.811		-.455	.507	.635	
LIVELIHOOD									
Financial leeway score	Household financial leeway (optimal scaling score)	-.432	.154	.649	***	-.151	.290	.860	
RELATION TO GOVERNMENT									
Relation to government scale	Paternalistic vs. Communitarian attitude score (optimal scaling score)	-.142	.143	.868		.266	.280	1.305	
	Liberal attitude score (optimal scaling score)	.194	.141	1.214		-.093	.246	.911	
Intercept		-1.424	.669	.241	**	-4.459	1.394	.012	***
N=448		Nagelkerke R ² =.344				Nagelkerke R ² =.208			
*** p<.01, ** p<.05, * p<.10, SD: Standard error, OR: Odds ratio									

Table. 6 Overview of the characteristics of ---Type and PSC-case

Type	Characteristic
---Type	Socio-demography
	• Household size: One person
	• Age: 75 and older
	Seven Critical Element Model of life recovery
	• <i>Social ties</i> : Abundant private connections with people before the GEJE, lacking in private connections after the GEJE
• <i>Community involvement</i> : Lacking in public connections among citizens	
• <i>Physical/Mental stress management</i> : Strong physical/mental stress, Someone in family have health problem	
• <i>Livelihood</i> : Less financial leeway	
PSC-case	Socio-demography
	• Gender: Male
	• Household size: One person
	• Age: 40s
	Seven Critical Element Model of Life Recovery
• <i>Social ties</i> : Abundant private connections with people after the GEJE	

4. 2 Discussion

The analyses above showed that ---Type and PSC-case were not congruent with one another in terms of their traits. It follows that those who had been suffered and those who actually received DCM support were not completely overlapped in this study.

It should be noted that the features observed in *social ties* were opposite; that is, Type 1 victims do not have abundant social capital, while PSC-case victims have abundant ones. This reverse tendency can explain why these two groups were not corresponded. To have abundant social capital indicates that they are likely to be introduced to PSC by neighbors or acquaintances and PSC can easily reach out to them. In fact, there was a case where a citizen informed PSC about a survivor who seemingly demanded special assist. On the other hand, being isolated from a community means there is little chance of them being introduced to PSC and thus PSC can fail finding them. Therefore, it is possible that PSC-case were assisted due to their rich connections, whereas Type 1 victims were not supported as a whole even though they requires relief.

As a result of the verification, it was confirmed that personal support that had been conducted in Natori city were somewhat focused on disaster victims who were socially included. It is true that single household is a common feature, which implies that they both do not hold family bonding. However, other traits related to poor connections were found only in Type 1. The fact demonstrates that support was not provided to those who live alone, have poor social interactions, and live in a unvitalized community. In other words, DCM in Natori was not fully valid because it missed the survivors who were truly alienated from society.

5 Conclusion and Future Research

In this paper, the survivors who have been suffered continuously Type 1 were identified and were also verified whether they actually received personal support by DCM using Natori Life Recovery Population Panel Survey data. The results and discussions can be summarized as follows: 1) Degrees of house damage were not the single criterion in order to pinpoint Type 1 victims at an early phase of life recovery. Rather, household size, age, social interactions with others, community vitality, individual physical/mental stress, family's physical/mental health, and household finances are the keys to identifying them at the screening stage in DCM. Specifically, the survivors who demand major assistance were characterized as senior citizens who live by themselves, experienced full house damage, had abundant social connections before a disaster but have less ones after that, live in an unlively community, feel immense physical/mental stress, have physically/mentally unhealthy family members, and suffer strained household finances. 2) Those who had the features exhibited in 1) above and those who are provided with personal support by DCM were not totally overlapped. Rather, it turns out that survivors who have wide social networks are likely to be assisted. Conversely, those who are socially excluded, which is a typical trait of Type 1, were not relieved by personal support.

5. 1 Policy Implication for Disaster Victim Assistance

The results above propose the demands of policies on especially social networks to pinpoint the survivors who need special support. A disaster can cause disparities in many aspects without proactive assist policies. For example, once a victim falls into poverty because a calamity deprived them of the lives in pre-disaster days, they could have trouble grasping various opportunities such as education, employment, medical care, and so on. This example suggests that the needs of sufferers should be comprehended promptly before the gaps would be increasingly widened afterward. However, as shown in the results above, those who requires special relief (Type) had lost the societal relationships that they had before a disaster. It follows that they were driven to the periphery of society, which means they cannot be contacted directly by supporters so easily. Also, less social connections become problematic when sufferers do not recognize the needs of relief or cannot request assistance voluntarily, because they are not likely to rely on anyone and also be introduced to assistance institutions. Since less social ties make it troublesome to clarify what they demand either in direct or indirect ways, it is necessary to maintain the social inclusions that are not exterminated even after a huge shock. The screening criteria displayed above can be useful to determine who ought to be socially included on a continuing basis. It would be effective to create opportunities to connect with people and to involve them in a community, which could contribute to the improvement of life qualities and stem the disparities that might be emerged after a catastrophe.

5. 2 Directions for Future Studies

Although some findings were shown in this study, there are a couple of limitations that should be noted for future research. First, though the analyses above were conducted on the assumption that the Type are the survivors who need to be assisted through personal support, this hypothesis cannot be considered completely correct. As life recovery score is based on subjective evaluation of their own lives, it cannot be asserted that Type requires special relief only because the scores remained at a low level. Therefore, it is necessary to examine both whether PSC supplied assistance properly, and whether the assumption above was acceptable in terms of its appropriateness. Second, the subjects of investigation are restricted to those who resided in Natori city. It should be further explored whether the Type characteristics observed in this study can be generalized as the screening criteria for DCM. Thus, external validity needs to be verified by comparing with other DCM practical cases implemented in different disaster-hit areas. The future research projects have to overcome these limitations and establish method and criteria that can allow supporters to judge legitimately when identifying the survivors who really need to be relieved.

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