ORIGINAL RESEARCH

Pregnant Women's Awareness of Social Capital in the Great East Japan Earthquake-Affected Areas of Miyagi Prefecture: The Japan Environment and Children's Study

Hidekazu Nishigori, MD, PhD; Toshie Nishigori, PhD; Kasumi Sakurai; Satoshi Mizuno; Taku Obara, PhD; Hirohito Metoki, MD, PhD; Zen Watanabe, MD; Noriyuki Iwama, MD, PhD; Mami Ishikuro, PhD; Nozomi Tatsuta, PhD; Ichiko Nishijima, PhD; Junichi Sugawara, MD, PhD; Shinichi Kuriyama, MD, PhD; Ikuma Fujiwara, MD, PhD; Takahiro Arima, MD, PhD; Kunihiko Nakai, PhD; Fumiaki Takahashi, PhD; Nobuo Yaegashi, MD, PhD; and the Japan Environment & Children's Study Group

ABSTRACT

Objective: We aimed to clarify the correlation between the 2011 Great East Japan Earthquake and pregnant women's awareness of social capital 3 to 9 months after the tsunami disaster.

Methods: We analyzed data on responses to a questionnaire by 7451 pregnant women in their second to third trimesters. The proportions of social capital–related items were calculated in the north and south coastal areas of Miyagi Prefecture and were compared with national samples. The factors associated with social capital were estimated by use of multivariate logistic regression analyses.

Results: The proportion of women feeling that they had helpful neighbors was higher (69.0% vs 56.7%, $P = 0.0005$), the proportion of women regarding their communities as safe and secure was lower (51.7% vs 62.4%, $P = 0.002$), and the proportion of women feeling that most people were trustworthy was lower (23.7% vs 32.9%, $P = 0.006$) in the north coastal area than nationwide. Such differences were not observed in the less severely affected south coastal area. Age of 35 years or older, extended family, college or university graduation, and being multiparous were associated with the feeling of having helpful neighbors.

Conclusion: The current status of pregnant women's awareness of social capital in disaster-affected areas was revealed. Continuous monitoring and support may be necessary to address this issue. (*Disaster Med Public Health Preparedness*. 2017;11:355-364)

Key Words: tsunamis, social capital, psychological warfare

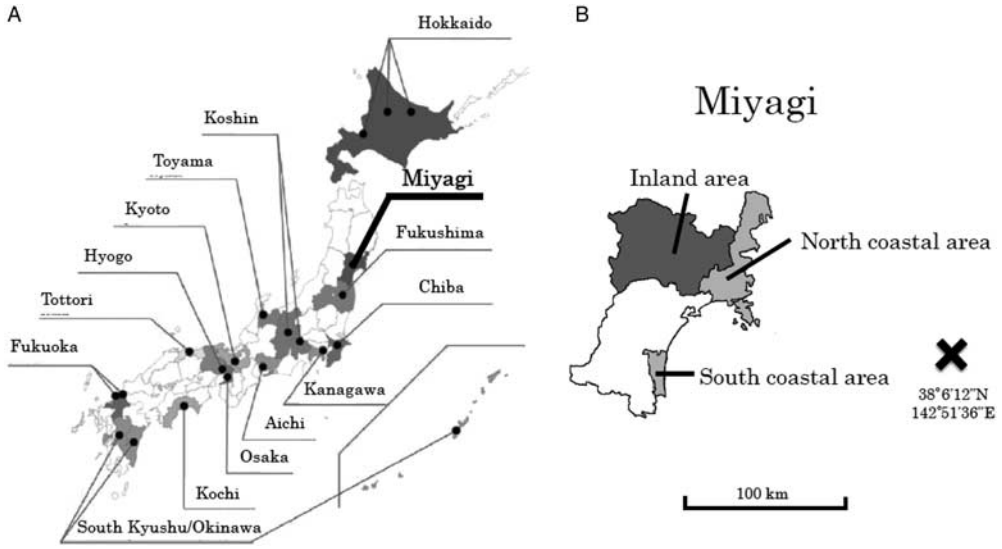
The Ministry of the Environment launched a large-scale cohort epidemiological research project titled the Japan Environment and Children's Study (JECS) in January 2011[1] that involved 100,000 children and their parents and targeted municipalities located in the inland (Tome City, Kurihara City, Osaki City, Shikama-cho, Yakuya-cho, and Misato-machi), north coastal (Kesennuma City, Minamisanriku-cho, Ishinomaki City, and Onagawa-cho), and south coastal (Iwanuma City, Watari-cho, and Yamamoto-cho) areas of Miyagi Prefecture (Figure 1).

The Great East Japan Earthquake with a magnitude of 9.0 occurred on March 11, 2011. The epicenter was located 130 km off the coast, and the maximum height of the tsunami reached nearly 40 m, mainly affecting the coastal areas of East Japan. The earthquake and tsunami resulted in approximately 18,400 individuals losing their lives or being listed as missing and the complete or partial destruction of approximately 400,000 buildings.[2] In Miyagi Prefecture (approximate pre-disaster population: 2,346,800), approximately 12,000 (0.5%) people died or went missing and approximately 238,000 buildings were destroyed.[2] In the north coastal area of the prefecture (approximate pre-disaster population: 264,000), approximately 7000 (2.7%) died or went missing and approximately 55,300 buildings were completely or partially destroyed.[3-6] In the south coastal area (92,700), approximately 1100 (1.2%) died or went missing and approximately 11,000 buildings were completely or partially destroyed.[7-9] The authors previously reported an increased incidence of perinatal depression and psychological distress in areas affected by the Great East Japan Earthquake.[10-13]

Natural disasters destroy social networks and community relationships. This loss of community also results in secondary emotional trauma and depression.[14]

FIGURE 1

(A) Location of the Japan Environment and Children's Study (JECS) Unit Centers. (B) Location of the JECS Area in Miyagi Prefecture.



In B, the epicenter of the Great East Japan Earthquake is indicated by the X.

Social capital helps to rebuild communities that have been the victim of natural disasters,[15-17] and it likely improves the mental and physical health of individuals following the disaster.[18-23] Social capital has been defined by some researchers as trust or the rule of reciprocity with social networks, promoting cooperative relationships among individuals.[24] On the other hand, some regard social capital as a characteristic of the structure of a society, promoting the actions of individuals belonging to it and comprising binding trust, clear information channels, and divertible social systems.[25,26]

Despite the importance of correlation between social capital and improved health following disasters, the current state of social capital for pregnant women in regions affected by the Great East Japan Earthquake has not been reported. Social capital for pregnant women is particularly important not only for their own mental and physical health but also for that of their children.[27,28]

According to various reports, those affected by the Great East Japan Earthquake adopted caring behavior by comforting each other and showing communal understanding during the disaster, which increased the focus on the word *kizuna* in Japanese. *Kizuna* is translated to "social bonds" in English.

In Miyagi Prefecture, the JECS was interrupted by the Great East Japan Earthquake, but it resumed after 3 months and was in progress at the time of the present study. In the present study, JECS-related data collected through a survey on pregnant women's awareness of social capital in the target areas of Miyagi Prefecture after the disaster were analyzed with a particular focus on the "*kizuna*/social bonds" that have been attracting increasing attention.

METHODS

Study Settings and Subjects

For the JECS, participants were recruited through 15 unit centers located in Hokkaido, Miyagi, Fukushima, Chiba, Kanagawa, Koshin, Toyama, Aichi, Kyoto, Osaka, Hyogo, Tottori, Kochi, Fukuoka, and South Kyushu and Okinawa and the Core Center. The Miyagi Unit Center recruited participants living in municipalities located in the previously mentioned inland area, north coastal area, and south coastal area of Miyagi Prefecture (Figure 1).

The present study was based on the data set jecs-ag-ai-20131008, which was released in October 2013.[29] Registration for the JECS was initiated in January 2011 on a nationwide basis, and the primary fixed data were created, which involved 10,129 pregnant women who had given birth up to December 2011. The JECS protocol was approved by the Ministry of the Environment and the relevant ethics committee.[1,29] We administered JECS questionnaires to enrolled participants. The JECS questionnaire for women in the second to third trimester period (MT2), women in the first trimester period (MT1), and husbands of women in the first trimester period (FT1) were self-reported by participants.

Data Collection

The present study analyzed 7451 of the 10,129 pregnant women who had provided the primary fixed data, excluding

https://doi.org/10.1017/dmp.2016.150 Published online by Cambridge University Press

those who had been recruited at the Fukushima Unit Center; those recruited at the Miyagi Unit Center, but based in Fukushima Prefecture; those who had not completed the JECS questionnaire for women during the second to third trimester period (MT2) between June and December 2011; and those who had not answered the social capital–related questions (MT2 questions 114 to 121; see the Appendix).

The Great East Japan Earthquake, which occurred on March 11, 2011, interrupted the JECS in Miyagi Prefecture, but the project resumed in May in the inland area and in June in the north and south coastal areas. To avoid response bias, the present study targeted pregnant women who had answered the social capital–related questions as part of the MT2 between June 1 and December 31, 2011.

Social Capital–Related Questions

To focus on positive answers regarding social capital–related questions in MT2, we assigned specific responses from the original response options for each question as positive answers (Appendix). Specifically, for questions 114, 115, and 116, the answers "Always" and "Frequently" were considered to indicate a positive answer. For question 117, the answer "3 or more" was considered to indicate a positive answer. For questions 118-1 and 118-2, the answers "I agree" and "I generally agree" were considered to indicate a positive answer. For question 119, the answer "Yes" was considered to indicate a positive answer. For questions 120 and 121, answers 1 through 3 were considered to indicate a positive answer.

Basic Attributes

Based on the MT2, MT1, and FT1 questions, the frequency and proportion of pregnant women and husbands in each area were calculated, with a focus on the following items: social factors (age, marital status, family structure at the time of registration, academic history, employment, and household income), lifestyle factors (body mass index [kg/m^2] and smoking and drinking habits), and stress experienced within the past year (stress related to the death of someone close [parent, spouse, child, or a close friend], the presence of disease [parent, spouse, or child] or injury [spouse or child], dismissal [spouse or the respondent], large debt, relationship discord, divorce or changes in the family structure [the necessity of living with grandparents, etc], or changes in the place of residence). The presence of mood or anxiety disorders was examined by using the Kessler 6-item (K6) psychological distress scale score. The highest score for this scale is 24 and a score of 13 or higher is regarded as indicating the presence of mood or anxiety disorders.[30-32] Pregnancy- and delivery-related items examined the mothers' emotions when the pregnancy had been confirmed, unplanned pregnancies (leading to confusion or difficulties), delivery history, spontaneous abortions, complications or mental disorders during pregnancy, intrauterine fetal deaths, placental abruptions, and the child's birth weight. Data for the participant's husband were academic background, present smoking habits, and participation in the JECS questionnaire using the FT1.

To assess the homogeneity of these demographic factors across the 4 areas: the inland, north coastal, and south coastal areas of Miyagi Prefecture and nationwide (the 13 unit centers and the Core Center, excluding those in Miyagi and Fukushima Prefectures), analysis of variance was used for the continuous data and chi-square test was used for the categorical data.

Comparison of Nationwide Results With Those in Miyagi Prefecture

The proportions of positive answers to the social capital–related questions in the 4 target areas (the inland, north coastal and south coastal areas of Miyagi Prefecture, and nationwide [13 unit centers and Core Center, excluding those in Miyagi and Fukushima Prefectures]) were calculated and a chi-square test was conducted for comparison.

Multivariate Logistic Regression Analysis

Because of the difficulty in analyzing the factors associated with social capital owing to the small target numbers in each area of Miyagi Prefecture, the frequency and proportion of pregnant women who selected the positive answer for question 118-2 were calculated on a prefecture-wide basis. A univariate logistic regression analysis of the responses regarding the study items listed was conducted for the inland, north coastal, and south coastal areas. Items that showed a close association at a significance level of 0.10 were extracted and a multivariate logistic regression analysis was conducted, with the areas being included as adjustment items. SAS version 9.3 (SAS Institute Inc, Cary, NC) was used for the statistical analysis.

RESULTS

Basic Attributes

Basic attributes of the frequency and proportion of pregnant women in each area were calculated and are shown in Table 1.

Comparison of Nationwide Results With Those in Miyagi Prefecture

For the primary fixed data, data from 7451 pregnant women were analyzed (Figure 2). Table 1 and Figure 3 show the basic attributes of the pregnant women and their answers to the social capital–related questions in the inland, north coastal, and south coastal areas compared with nationwide (excluding Miyagi and Fukushima Prefectures). The comparison between the nationwide results and the 3 prefectural areas was done by chi-square test. The percentage of women answering positively to question 114 was significantly lower for the inland area (54.6%) than nationwide (61.0%; $P = 0.001$).

https://doi.org/10.1017/dmp.2016.150 Published online by Cambridge University Press

TABLE 1

Characteristics of the Subjects (n = 7451)[a]

	Total (n = 7451), No. (%)	Miyagi Prefecture: Inland Area (n = 668), No. (%)	Miyagi Prefecture: North Coastal Area (n = 203), No. (%)	Miyagi Prefecture: South Coastal Area (n = 127), No. (%)	Nationwide (n = 6453), No. (%)	P[b]
Positive Answer to the Social Capital–Related Question						
Question 114: Are there any contactable persons who show love and affection to you?, "yes"	4494 (60.3)	365 (54.6)	120 (59.1)	72 (56.7)	3937 (61.0)	0.01
Question 115: Are there any persons who mentally support you, such as providing consultation to resolve problems and helping with difficult decision-making?, "yes"	5254 (70.5)	438 (65.6)	146 (71.9)	87 (68.5)	4583 (71.0)	0.03
Question 116: Do you contact persons who are familiar to you and trustworthy as frequently as you desire?, "yes"	3426 (46.0)	254 (38.0)	93 (45.8)	55 (43.3)	3024 (46.9)	0.0002
Question 117: How many relatives or friends whom you can freely consult do you have?, "3 or more"	4479 (60.1)	381 (57.0)	114 (56.2)	70 (55.1)	3914 (60.7)	0.11
Question 118-1: Your neighbors trust each other, "agree"	4250 (57.0)	401 (60.0)	121 (59.6)	74 (58.3)	3654 (56.6)	0.32
Question 118-2: Your neighbors help each other, "agree"	4322 (58.0)	445 (66.6)	140 (69.0)	77 (60.6)	3660 (56.7)	<.0001
Question 119: Do you regard your community as safe and secure?, "yes"	4650 (62.4)	446 (66.8)	105 (51.7)	72 (56.7)	4027 (62.4)	0.001
Question 120: How trustworthy are most people?, "trustworthy"	2394 (32.1)	186 (27.8)	48 (23.7)	37 (29.1)	2123 (32.9)	0.002
Question 121: How altruistic are most people?, "altruistic"	1488 (20.0)	127 (19.0)	35 (17.2)	29 (22.8)	1297 (20.1)	0.56
Social Variables						
Age						
Mean ± SD, years	31.0 +/– 5.0	29.7 +/– 5.2	30.0 +/– 5.5	30.0 +/– 5.1	31.2 +/– 4.9	<.0001
≤24 years	752 (10.1)	113 (16.9)	31 (15.3)	21 (16.5)	587 (9.1)	<.0001
25-34 years	4686 (62.9)	428 (64.1)	129 (63.6)	80 (63.0)	4049 (62.8)	
≥35 years	1921 (25.8)	125 (18.7)	41 (20.2)	26 (20.5)	1729 (26.8)	
No answer	92 (1.2)	2 (0.3)	2 (1.0)	0 (0.0)	88 (1.4)	
Marital status						
Married, common-law marriage	7070 (94.9)	621 (93.0)	195 (96.1)	119 (93.7)	6135 (95.1)	0.009
Unmarried, divorce, lost	305 (4.1)	43 (6.4)	8 (3.9)	8 (6.3)	246 (3.8)	
No answer	76 (1.0)	4 (0.6)	0 (0.0)	0 (0.0)	72 (1.1)	
Family structure						
Extended family	1774 (23.8)	343 (51.4)	103 (50.7)	41 (32.3)	1287 (19.9)	<.0001
Nuclear family	5662 (76.0)	324 (48.5)	100 (49.3)	86 (67.7)	5152 (79.8)	
No answer	15 (0.2)	1 (0.2)	0 (0.0)	0 (0.0)	14 (0.2)	
Academic history						
Junior high school	385 (5.2)	42 (6.3)	17 (8.4)	3 (2.4)	323 (5.0)	<.0001
Senior high school	2345 (31.5)	323 (48.4)	101 (49.8)	54 (42.5)	1867 (28.9)	
College, university	4692 (63.0)	301 (45.1)	85 (41.9)	70 (55.1)	4236 (65.6)	
No answer	29 (0.4)	2 (0.3)	0 (0.0)	0 (0.0)	27 (0.4)	
Employment						
Yes	3546 (47.6)	369 (55.2)	79 (38.9)	52 (40.9)	3046 (47.2)	<.0001
No	3850 (51.7)	298 (44.6)	122 (60.1)	75 (59.1)	3355 (52.0)	
No answer	55 (0.7)	1 (0.2)	2 (1.0)	0 (0.0)	52 (0.8)	
Household income ($\times 10^6$)						
<4 yen	2908 (39.0)	290 (43.4)	89 (43.8)	66 (52.0)	2463 (38.2)	<.0001
>4 yen and <6 yen	2304 (30.9)	173 (25.9)	60 (29.6)	42 (33.1)	2029 (31.4)	
≥6 yen	1811 (24.3)	136 (20.4)	39 (19.2)	17 (13.4)	1619 (25.1)	
No answer	428 (5.7)	69 (10.3)	15 (7.4)	2 (1.6)	342 (5.3)	
Lifestyle Variables						
BMI						
<18.5 kg/m^2	5257 (70.6)	474 (71.0)	139 (68.5)	94 (74.0)	4550 (70.5)	<.0001
≥18.5 and <25 kg/m^2	1215 (16.3)	90 (13.5)	35 (17.2)	16 (12.6)	1074 (16.6)	
≥25 kg/m^2	777 (10.4)	102 (15.3)	27 (13.3)	15 (11.8)	633 (9.8)	
No answer	202 (2.7)	2 (0.3)	2 (1.0)	2(1.6)	196 (3.0)	
Present smoking habits						
No	6986 (93.8)	613 (91.8)	178 (87.7)	118 (92.9)	6077 (94.2)	<.0001
Yes	408 (5.5)	52 (7.8)	25 (12.3)	7 (5.5)	324 (5.0)	
No answer	57 (0.8)	3 (0.5)	0 (0.0)	2 (1.6)	52 (0.8)	
Present drinking habits						
No	7123 (95.6)	643 (96.3)	188 (92.6)	123 (96.9)	6169 (95.6)	0.30
Yes	284 (3.8)	23 (3.4)	12 (5.9)	3 (2.4)	246 (3.8)	
No answer	44 (0.6)	2 (0.3)	3 (1.5)	1 (0.8)	38 (0.6)	
Stress Variables						
Death of someone close, "yes"	282 (3.8)	32 (4.8)	41 (20.2)	8 (6.3)	201 (3.1)	<.0001
Disease or injury of someone close, "yes"	1038 (13.9)	84 (12.6)	14 (6.9)	17 (13.4)	923 (14.3)	0.02
Dismissal, Large debts, "yes"	269 (3.6)	33 (4.9)	20 (9.9)	8 (6.3)	208 (3.2)	<.0001
Relationship discord, divorce, "yes"	755 (10.1)	59 (8.8)	31 (15.3)	10 (7.9)	655 (10.2)	0.049

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TABLE 1

Continued

	Total (n = 7451), No. (%)	Miyagi Prefecture: Inland Area (n = 668), No. (%)	Miyagi Prefecture: North Coastal Area (n = 203), No. (%)	Miyagi Prefecture: South Coastal Area (n = 127), No. (%)	Nationwide (n = 6453), No. (%)	P[b]
Changes in the family structure, "yes"	351 (4.7)	66 (9.9)	22 (10.8)	9 (7.1)	254 (3.9)	<.0001
Changes in the place of residence, "yes"	709 (9.5)	72 (10.8)	31 (15.3)	19 (15.0)	587 (9.1)	0.002
The Presence of Mood or Anxiety Disorder						
K6 score						
<13 points	7189 (96.5)	637 (95.4)	191 (94.1)	121 (95.3)	6240 (96.7)	0.03
≥13 points	243 (3.3)	31 (4.6)	12 (5.9)	6 (4.7)	194 (3.0)	
No answer	19 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	19 (0.3)	
Pregnancy- and Delivery-Related Items						
Unplanned pregnancy						
No	6768 (90.8)	599 (89.7)	168 (82.8)	113 (89.0)	5888 (91.2)	<.0001
Yes	619 (8.3)	65 (9.7)	35 (17.2)	14 (11.0)	505 (7.8)	
No answer	64 (0.9)	4 (0.6)	0 (0.0)	0 (0.0)	60 (0.9)	
Parity						
Primipara	2676 (35.9)	237 (35.5)	75 (37.0)	59 (46.5)	2305 (35.7)	<.0001
Multipara	4380 (58.8)	429 (64.2)	125 (61.6)	67 (52.8)	3759 (58.3)	
No answer	395 (5.3)	2 (0.3)	3 (1.5)	1 (0.8)	389 (6.0)	
Histories of spontaneous abortion						
No	5831 (78.3)	556 (83.2)	138 (68.0)	105 (82.7)	5032 (78.0)	<.0001
Yes	1329 (17.8)	106 (15.9)	38 (18.7)	19 (15.0)	1166 (18.1)	
No answer	291 (3.9)	6 (0.9)	27 (13.3)	3 (2.4)	255 (4.0)	
Complications disorder during pregnancy						
No	6296 (84.5)	595 (89.1)	181 (89.2)	100 (78.7)	5420 (84.0)	0.002
Yes	934 (12.5)	63 (9.4)	16 (7.9)	20 (15.8)	835 (12.9)	
No answer	221 (3.0)	10 (1.5)	6 (3.0)	7 (5.5)	198 (3.1)	
Mental disorder during pregnancy						
No	7317 (98.2)	666 (99.7)	201 (99.0)	127 (100.0)	6323 (98.0)	0.04
Yes	64 (0.9)	1 (0.2)	1 (0.5)	0 (0.0)	62 (1.0)	
No answer	70 (0.9)	1 (0.2)	1 (0.5)	0 (0.0)	68 (1.1)	
Intrauterine fetal death						
No	7374 (99.0)	666 (99.7)	202 (99.5)	127 (100.0)	6379 (98.9)	0.27
Yes	7 (0.1)	1 (0.2)	0 (0.0)	0 (0.0)	6 (0.1)	
No answer	70 (0.9)	1 (0.2)	1 (0.5)	0 (0.0)	68 (1.1)	
Placental abruption						
No	7351 (98.7)	664 (99.4)	201 (99.0)	127 (100.0)	6359 (98.5)	0.27
Yes	30 (0.4)	3 (0.5)	1 (0.5)	0 (0.0)	26 (0.4)	
No answer	70 (0.9)	1 (0.2)	1 (0.5)	0 (0.0)	68 (1.1)	
Premature delivery						
No	6905 (92.7)	622 (93.1)	193 (95.1)	117 (92.1)	5973 (92.6)	0.25
Yes	470 (6.3)	44 (6.6)	9 (4.4)	10 (7.9)	407 (6.3)	
No answer	76 (1.0)	2 (0.3)	1 (0.5)	0 (0.0)	73 (1.1)	
Child's birth weight						
≥2500 g	6636 (89.1)	611 (91.5)	186 (91.6)	118 (92.9)	5721 (88.7)	0.049
<2500 g	724 (9.7)	55 (8.2)	16 (7.9)	9 (7.1)	644 (10.0)	
No answer	91 (1.2)	2 (0.3)	1 (0.5)	0 (0.0)	88 (1.4)	
Regarding the Participants' Husbands						
Academic history of husband						
Junior high school	606 (8.1)	69 (10.3)	35 (17.2)	5 (3.9)	497 (7.7)	<.0001
Senior high school	2743 (36.8)	334 (50.0)	108 (53.2)	67 (52.8)	2234 (34.6)	
College, university	4041 (54.2)	253 (37.9)	57 (28.1)	55 (43.3)	3676 (57.0)	
No answer	61 (0.8)	12 (1.8)	3 (1.5)	0 (0.0)	46 (0.7)	
Present smoking habits						
No	3833 (51.4)	262 (39.2)	62 (30.5)	56 (44.1)	3453 (53.5)	<.0001
Yes	3483 (46.8)	394 (59.0)	137 (67.5)	70 (55.1)	2882 (44.7)	
No answer	135 (1.8)	12 (1.8)	4 (2.0)	1 (0.8)	118 (1.8)	
Participation in a JECS, "yes"	4263 (57.2)	368 (55.1)	127 (62.6)	72 (56.7)	3696 (57.3)	0.30

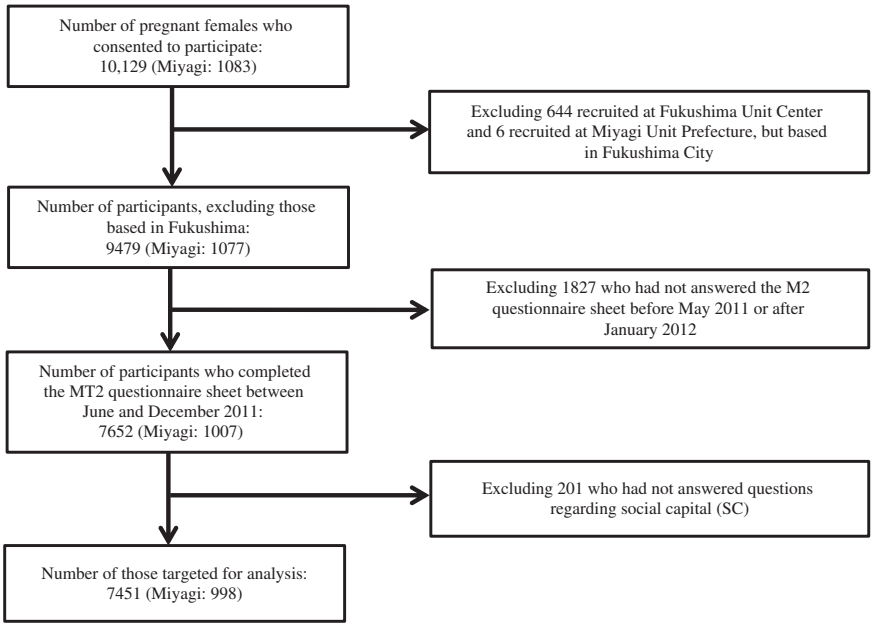
[a]Abbreviations: BMI, body mass index (in kg/m^2; calculated from length and weight measured at enrolment); JECS, The Japan Environment and Children's Study; K6, the Kessler 6-item psychological distress scale (total point scores ranged from 0 to 24; we classified individuals with scores of ≥13/24 as having psychological distress). 13 unit centers and Core Center, excluding Miyagi and Fukushima unit center (Nationwide).

[b]Comparison between 4 groups (Inland area, North coastal area, South coastal area, and Nationwide).

https://doi.org/10.1017/dmp.2016.150 Published online by Cambridge University Press

FIGURE 2

The Study Analyzed 7451 (Miyagi Unit Center: 998) of 10,129 Pregnant Women Between January 1 and December 31, 2011, and Provided Primary Fixed Data for the Japan Environment and Children's Study (JECS).



The number of targeted pregnant women at each center was as follows: 15 regional centers (Hokkaido, 595; Miyagi, 998; Chiba, 484; Kanagawa, 403; Koshin, 605; Toyama, 518; Aichi, 373; Kyoto, 139; Osaka, 755; Hyogo, 411; Tottori, 248; Kochi, 568; Fukuoka, 744; South Kyusyu/Okinawa, 574) and Core Center, 36.

For question 115, the percentage of women answering positively was markedly lower in the inland area (65.6%) than nationwide (71.0%; $P = 0.003$), and for question 116, the percentage of women answering positively was also significantly lower in the inland area (38.0%) than nationwide (46.9%; $P < 0.0001$).

In contrast, the frequency of a positive answer for question 118-2 was markedly higher in the north coastal (69.0%, $P = 0.0005$) and inland (66.6%, $P < 0.0001$) areas than nationwide (56.7%), and the frequency of a positive answer for question 119 was significantly lower in the north coastal area (51.7%, $P = 0.002$) but higher in the inland area (66.8%, $P = 0.03$) than nationwide (62.4%). The frequency of a positive answer for question 120 was markedly lower in the north coastal (23.7%, $P = 0.006$) and inland (27.8%, $P = 0.008$) areas than nationwide (32.9%).

Multivariate Logistic Regression Analysis

Multivariate logistic regression analysis was performed on the answers by pregnant women who selected a positive response for question 118-2: Your neighbors help each other. The total number of pregnant women was 445 from the inland are, 140 from the north coastal area, and 77 from the south coastal area (Table 1), and of these 998 respondents, 662 (66.3%) selected the positive answer. The multivariate logistic regression analysis with adjustment factors extracted the results based on significant differences (significance level: 0.10; Table 2). To correct differences among the areas, a univariate logistic regression was conducted on each of the basic attribute-related items. The following factors showed close association: age of 35 years or older (odds ratio [OR]: 1.976; 95% confidence interval (CI): 1.177–3.319), an extended family (at the time of registration; OR: 3.524; 95% CI: 2.600–4.776), graduation from a college or university (OR: 1.513; 95% CI: 1.114–2.056), and being multiparous (OR: 1.569; 95% CI: 1.164–2.115).

DISCUSSION

Because the JECS was not designed to consider the effects of disasters, the present study did not examine the level of damage due to the Great East Japan Earthquake. In the analysis of responses to the stress-related questions, the incidence of stress associated with the death of someone close was found to be 20.2% in the north coastal area, 6.3% in the south coastal area, and 4.8% in the inland area of Miyagi Prefecture, whereas it was 3.1% nationwide (Table 1). This finding suggests the possibility of such stress being a useful index to examine the status of disaster-affected individuals.

In the north coastal area, which was directly affected by the primary tsunami, the proportion of pregnant women who

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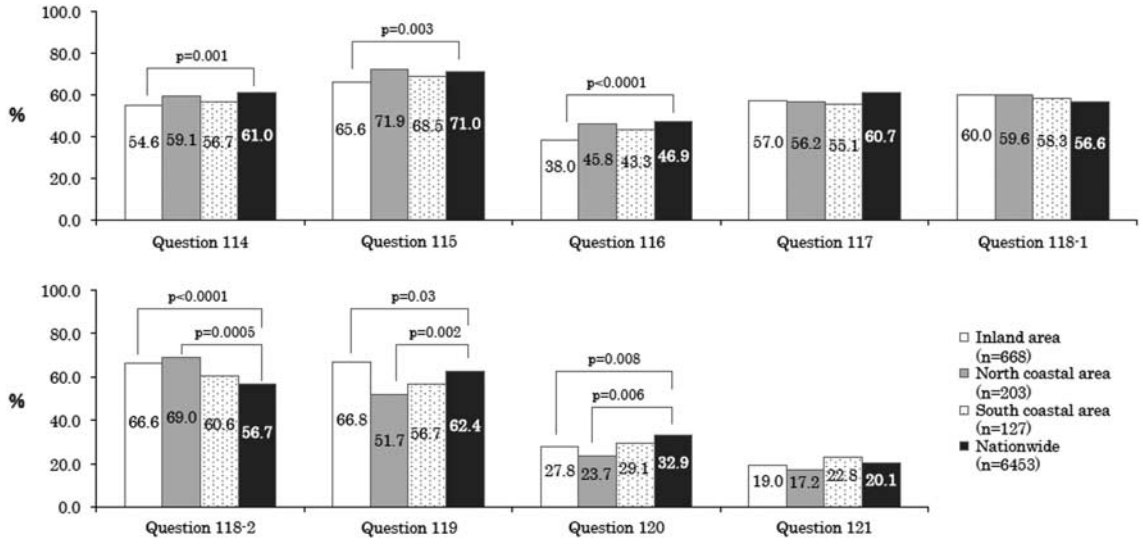
FIGURE 3

Comparison of the Proportion of Positive Responses to the Social Capital–Related Questions.



The *P* value is for the comparison between each area (Inland, North coastal, South coastal) and nationwide (13 unit centers and Core Center, excluding Miyagi and Fukushima unit center). The questions are listed in the Appendix.

regarded their communities as safe and secure and most people as being trustworthy was significantly lower, but the proportion who felt that their neighbors helped each other was markedly higher than the nationwide results (excluding Miyagi and Fukushima Prefectures). There were no significant differences in the remaining items. In contrast, the south coastal area, which was similarly affected by the tsunami, did not show marked differences from the nationwide values for any item.

In the inland area, which suffered no direct damage from the tsunami, the proportion who felt that their neighbors helped each other and that their communities were safe and secure was markedly higher than nationwide.

The results of this study have revealed variations in the awareness of social capital in Miyagi Prefecture approximately 3 to 9 months after the Great East Japan Earthquake. Owing to the unavailability of pre-disaster data, it was not possible to clarify the influence of the disaster on the results. Disasters also destroy social networks and community relationships. The stages following a disaster event have been divided into response, relief, and recovery.[33] Thus, pregnant women's awareness of social capital as suggested in this survey may change in comparison with before the disaster and is also assumed to change over time following disaster.

Inaba[34] compared social capital for the general public in various areas before and after the Great East Japan Earthquake and reported that the disaster negatively influenced the affected areas, particularly communication with close persons, but promoted participation in group activities in unaffected areas. This increased the difference in social capital between the affected and unaffected areas, leading to increased feelings of social isolation and the destruction of communities.[34]

However, it is necessary to carefully interpret these findings in consideration of factors required for the establishment of social capital, such as the time needed to develop long-term personal networks and the historical, cultural, and social changes that tend to function as "bonds." The development of a sense of confidence within a society, as well as the development of the rule of reciprocity in family and educational environments also takes time.[35] Furthermore, regional influences, such as the degree of urbanization or suburbanization, residential environments, and community history should also be considered.[35]

Limitations

Comparisons before and after the Great East Japan Earthquake were not possible because pre-disaster data were not available. The JECS questionnaire did not contain items related to disaster-related damage; therefore, information on the degree of disaster-related damage was not provided. This study targeted only those who had participated in the JECS, rather than covering all pregnant women living in the target areas. Furthermore, there were no data showing the targets as a proportion of the overall population. For reference, the number of pregnant women registered between January 2011 and March 2014 as a proportion of the population in each area of Miyagi Prefecture based on the number of issued maternal record books was as follows (numbers of registrations/books): inland: 70.3% (5706/8117), north coastal

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TABLE 2

Multivariate Logistic Regression Analysis for Social Capital About Mutual Help in Miyagi (n = 998)[a]

		Question 118-2: Your neighbors help each other, "agree" (n = 662)					
	Total (n = 998), No.	No	%	OR	95% CI	AOR[b]	95% CI
Miyagi Prefecture							
Inland area	668	445	66.6	1		1	
North coastal area	203	140	69.0	1.114	0.794-1.562	1.165	0.813-1.671
South coastal area	127	77	60.6	0.772	0.522-1.141	0.968	0.637-1.472
Age							
<24 years	637	416	65.3	0.797	0.561-1.133	1.181	0.786-1.774
25-34 years	165	99	60.0	1		1	
≥35 years	192	144	75.0	1.593	1.106-2.295	1.976	1.177-3.319
No answer	4	3	75.0	1.593	0.165-15.406	2.023	0.169-24.165
Family structure							
Extended family	487	383	78.6	3.073	2.327-4.059	3.524	2.600-4.776
Nuclear family	510	278	54.5	1		1	
No answer	1	1	100.0	>999.999	<0.001->999.999	>999.999	<0.001->999.999
Academic history							
Junior high school	62	37	59.7	0.863	0.502-1.481	0.950	0.530-1.706
Senior high school	478	302	63.2	1		1	
College, university	456	322	70.6	1.400	1.065-1.842	1.513	1.114-2.056
No answer	2	1	50.0	0.583	0.036-9.376	0.387	0.016-9.405
Household income ($\times 10^6$)							
<4 yen	445	267	60.0	0.648	0.471-0.893	0.743	0.526-1.049
≥4 yen and <6 yen	275	192	69.8	1		1	
≥6 yen	192	141	73.4	1.195	0.792-1.802	0.986	0.638-1.522
no answer	86	62	72.1	1.117	0.653-1.910	0.859	0.480-1.537
Dismissal, large debts							
No	937	629	67.1	1		1	
Yes	61	33	54.1	0.577	0.343-0.972	0.669	0.380-1.179
Changes in the place of residence							
No	876	591	67.5	1		1	
Yes	122	71	58.2	0.671	0.456-0.988	0.698	0.461-1.057
Parity							
Primipara	371	226	60.9	1		1	
Multipara	621	432	69.6	1.467	1.120-1.920	1.569	1.164-2.115
No answer	6	4	66.7	1.283	0.232-7.096	1.846	0.283-12.039

[a]Abbreviations: AOR, adjusted odds ratio; OR, odds ratio; CI, confidence interval.
[b]Adjusted for all the items listed in Table 2.

area: 68.9% (2555/3709), and south coastal area: 52.2% (959/1837) (data not published).

CONCLUSION

The presence of *kizuna* or social bonds has been a strong focus since the Great East Japan Earthquake. In the present study conducted 3 to 9 months after the disaster, the proportion of pregnant women who felt that that their neighbors helped each other was reasonably high. However, the proportion of those who regarded their communities as safe and secure and considered most people to be trustworthy was lower in the north coastal area of Miyagi Prefecture than nationwide. In contrast, the south coastal area did not show significant differences in any item, thus revealing differences in the pregnant women's awareness of social capital in the affected areas. All subjects targeted by the Miyagi Unit Center were aged ≥35 years, had an extended family at the time of registration, had graduated from a college or university, and were multiparous. The current status of pregnant women's awareness of social capital in disaster-affected areas was revealed. Continuous monitoring and support may be necessary to address this issue.

About the Authors

Department of Obstetrics and Gynecology, Tohoku University Graduate School of Medicine, Miyagi, Japan (Drs H Nishigori, Watanabe, Iwama, Sugawara, Yaegashi); Environment and Genome Research Center, Tohoku University Graduate School of Medicine, Miyagi, Japan (Dr H Nishigori, Ms Sakurai, Mr Mizuno, Dr Metoki, Dr Obara, Dr Ishikuro, Dr Tatsuta, Dr Nishijima, Dr Kuriyama, Dr Fujiwara, Dr Arima, Dr Nakai, Dr Yaegashi); Tohoku Medical Megabank Organization, Tohoku University, Miyagi, Japan (Dr T Nishigori, Mr Mizuno, Dr Metoki, Dr Obara, Dr Ishikuro, Dr Nishijima, Dr Kuriyama, Dr Yaegashi); Pharmaceutical Science, Tohoku University Hospital, Miyagi, Japan (Dr Obara); Public Health and Hygiene, Tohoku Medical and Pharmaceutical University School of Medicine (Dr Metoki); International Research Institute of

https://doi.org/10.1017/dmp.2016.150 Published online by Cambridge University Press

Disaster Science, Tohoku University, Miyagi, Japan (Dr Kuriyama); Clinical Research, Innovation and Education Center, Tohoku University Hospital, Miyagi, Japan (Dr Takahashi).

Correspondence and reprint requests to Kasumi Sakurai, Environment and Genome Research Center, Tohoku University Graduate School of Medicine, 2-1 Seiryo Aoba Miyagi, Japan 980-8575 (e-mail: kasakurai69@gmail.com).

Acknowledgments

Members of the Japan Environment and Children's Study (JECS) as of 2015 (principal investigator, Toshihiro Kawamoto): Hirohisa Saito (National Center for Child Health and Development, Tokyo, Japan), Reiko Kishi (Hokkaido University, Sapporo, Japan), Nobuo Yaegashi (Tohoku University, Sendai, Japan), Koichi Hashimoto (Fukushima Medical University, Fukushima, Japan), Chisato Mori (Chiba University, Chiba, Japan), Fumiki Hirahara (Yokohama City University, Yokohama, Japan), Zentaro Yamagata (University of Yamanashi, Chuo, Japan), Hidekuni Inadera (University of Toyama, Toyama, Japan), Michihiro Kamijima (Nagoya City University, Nagoya, Japan), Ikuo Konishi (Kyoto University, Kyoto, Japan), Hiroyasu Iso (Osaka University, Suita, Japan), Masayuki Shima (Hyogo College of Medicine, Nishinomiya, Japan), Toshihide Ogawa (Tottori University, Yonago, Japan), Narufumi Suganuma (Kochi University, Nankoku, Japan), Koichi Kusuhara (University of Occupational and Environmental Health, Kitakyushu, Japan), Takahiko Katoh (Kumamoto University, Kumamoto, Japan).

Funding

The Japan Environment and Children's Study was funded by the Ministry of the Environment, the Government of Japan. This research was also supported by Research Promotion and Practical Use for Women's Health, AMED. The findings and conclusions of this article are solely the responsibility of the authors and do not represent the official views of the above government.

Published online: January 17, 2017.

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APPENDIX

The social capital–related questions.

Question 114
Are there any contactable persons who show love and affection to you?
Select one of the 5 answer choices:
☐ Never ☐ Rarely ☐ Sometimes ☐ Frequently ☐ Always

Question 115
Are there any persons who mentally support you by providing consultation to resolve problems and helping with difficult decision-making?
Select one of the 5 answer choices:
☐ Never ☐ Rarely ☐ Sometimes ☐ Frequently ☐ Always

Question 116
Do you contact persons who are familiar and trustworthy as frequently as you desire?
Select one of the 5 answer choices:
☐ Never ☐ Rarely ☐ Sometimes ☐ Frequently ☐ Always

Question 117
How many relatives or friends do you have who you can freely consult?
Select one of the 3 answer choices:
☐ None ☐ 1 to 2 ☐ 3 or more

Question 118-1
Your neighbors trust each other.
Select one of the 4 answer choices:
☐ I agree ☐ I generally agree ☐ I generally disagree ☐ I disagree

Question 118-2
Your neighbors help each other.
Select one of the 4 answer choices:
☐ I agree ☐ I generally agree ☐ I generally disagree ☐ I disagree

Question 119
Do you regard your community as safe and secure?
Select one of the 3 answer choices:
☐Yes ☐ No ☐ I do not know.

Question 120
How trustworthy are most people?
Rating on a 9-point scale: 1 to 9.

Mostly trustworthy — Difficult to answer — Untrustworthy

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

Question 121
How altruistic are most people? Do you regard them as egoistic?
Rating on a 9-point scale: 1 to 9.

Altruistic — Difficult to answer — Egoistic

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

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