Social Cohesion and Mortality: A Survival Analysis of Older Adults in Japan

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Objectives. We examined the association between social cohesion and mortality in a sample of older adults in Japan.

Methods. Data were derived from a cohort study of elderly individuals (65–84 years) in Shizuoka Prefecture; 14 001 participants were enrolled at baseline (1999) and followed up in 2002, 2006, and 2009. Among the 11 092 participants for whom we had complete data, 1427 had died during follow-up. We examined the association between social cohesion (assessed at both the community and individual levels) and subsequent mortality after control for baseline and time-varying covariates. We used clustered proportional hazard regression models to estimate hazard ratios (HRs) and confidence intervals (CIs).

Results. After control for individual characteristics, individual perceptions of community cohesion were associated with a reduced risk of all-cause mortality (HR = 0.78; 95% CI = 0.73, 0.84) as well as mortality from cardiovascular disease (HR = 0.75; 95% CI = 0.67, 0.84), pulmonary disease (HR = 0.66; 95% CI = 0.58, 0.75), and all other causes (HR = 0.76; 95% CI = 0.66, 0.89). However, no statistically significant relationship was found between community cohesion and mortality risk.

Conclusions. Among the elderly in Japan, more positive individual perceptions of community cohesion are associated with reduced risks of all-cause and cause-specific mortality. (*Am J Public Health.* 2013;103:e60–e66. doi:10.2105/AJPH.2013.301311)

A growing body of research has focused on social cohesion as a determinant of population health.[1] Higher levels of community social cohesion—characterized by closely knit social relationships among residents with strong mutual trust and reciprocity—have been linked to better health outcomes such as lower mortality rates and higher self-rated health.[1–10]

However, prospective studies of social cohesion and health remain sparse, and there is continuing debate about whether such associations are driven by individual residents' psychological perceptions about their communities or by the characteristics of the communities per se.[11] In other words, cohesive communities may be healthier either because residents are psychologically healthier and express trust toward their neighbors (a compositional effect) or because the community social environment promotes health via group-level processes such as the ability to undertake collective action, for example mobilizing local volunteers to participate in health promotion activities (a contextual effect).

Multilevel analytical techniques are required to tease out the compositional effects of community cohesion from its contextual effects. To date, there has been stronger empirical support for an association between individual-level perceptions of social cohesion and health outcomes and less evidence for a community-level contextual effect.[11]

Japanese society has historically been characterized by high levels of social cohesion. The reasons for this include the roughly 2 centuries of isolationism (from 1633 until 1853) enforced by the Tokugawa *shogunate* (a feudal Japanese military government), as well as the comparative ethnic homogeneity of the Japanese population.[12] Recent multilevel studies conducted in Japan suggest an association between community social cohesion and improved health outcomes, including higher self-rated health,[13] a lower risk of depression,[14] and a lower incidence of functional disabilities.[15] Two of these studies were conducted among older Japanese people.[13,15] However, according to a systematic review of multilevel studies of income inequality, prospective studies remain sparse, and more evidence is needed to establish the robustness of the association between income inequality and population health.[11]

With few exceptions, the empirical evidence linking community social cohesion to health has been based on cross-sectional study designs, and there is a dearth of longitudinal evidence. We examined the long-term associations between social cohesion and mortality in a sample of older Japanese adults.

METHODS

Individual data were collected from participants in the Shizuoka elderly cohort study, a population-based study conducted in Shizuoka Prefecture, Japan. The primary purpose of the original cohort study was to evaluate the longitudinal associations between clinical, environmental, and behavioral factors and health conditions. After stratifying the sample according to gender and age group (65–74 and 75–84 years), we randomly selected 300 residents from each of the 74 municipalities in Shizuoka Prefecture. A total of 22 200 people were selected.

In December 1999, 14 001 of these randomly selected individuals completed and returned a questionnaire that had been sent to them by mail (response rate = 63%). The self-administered questionnaire included several items focusing on interpersonal behavior and community involvement. Items also inquired about age, gender, body weight, height, smoking habits, alcohol consumption habits, socioeconomic status, social engagement, working status, and disease conditions. Repeat surveys were then mailed to the same participants in December 2002, March 2006, and March 2009.

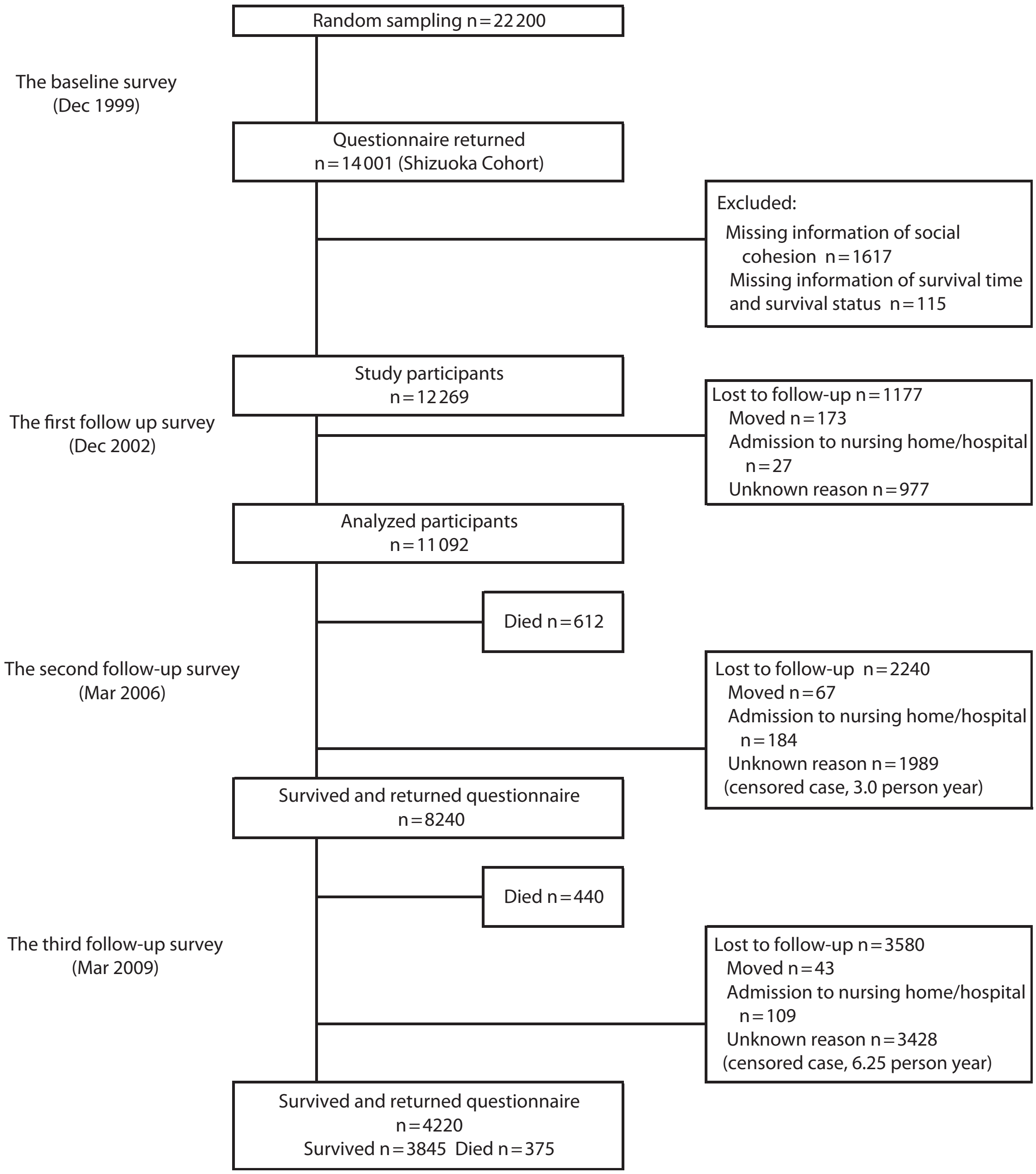

FIGURE 1—Selection flow diagram: Shizuoka cohort participants, Japan, 1999–2009.

The 14 001 baseline respondents were defined as the Shizuoka cohort (Figure 1). We excluded 1617 members of this cohort who had missing social cohesion data at baseline, and an additional 1177 were lost to follow-up before the first repeat survey in December 2002. During the analysis stage, a further 115 participants were excluded because they had missing data on survival time at the final follow-up in 2009. Thus, the final analytical sample comprised 11 092 individuals.

Among these 11 092 participants, 2240 were lost at the second follow-up in 2006, and 3580 were lost at the third follow-up in 2009. Reasons for loss to follow-up included relocation and hospitalization, but in most cases the reason was not known. We treated these censored participant groups as 3-year and 6.25-year survival cases. In the 2002, 2006, and 2009 follow-up waves, we identified 612, 440, and 375 participant deaths, respectively, from linkage to official vital statistics. For each study participant, person-years were calculated from baseline to the exact date of death or to the date of censorship, whichever occurred first.

Social Cohesion

We constructed a social cohesion index from the Shizuoka cohort survey. In the original questionnaire, we included 5 items regarding different types of relationships considered as relevant to social cohesion. One of these items pertained to intrafamily relationships, which we did not consider appropriate for a community social cohesion scale. We therefore gathered information on individuals' perceptions of social cohesion from the remaining 4 items: Do you get along with people around you? Are you satisfied with your friendships? Do you have someone who you can ask for a favor? and Are you satisfied with your relationships with the people around you? For each question, participants answered either yes (coded as 1) or no (0).

We summed the 4 items to create our social cohesion index, which had a theoretical score range of 0 to 4 (with higher scores indicating higher levels of social cohesion). The Cronbach alpha coefficient for the overall index was acceptable (0.90). Because social cohesion was considered to be a community-level variable, individual-level baseline cohesion scores were then aggregated to the 74 administrative districts. The same questions asked on the baseline survey were repeated at the follow-up waves in 2002, 2006, and 2009 (3 years, 6.25 years, and 9.25 years, respectively, after the original baseline survey). In our clustered proportional hazards regression models, social cohesion was treated as time varying; that is, the values were allowed to change from one survey wave to the next, and events (deaths) were assigned to the exposure status (level of cohesion) assessed at the wave immediately preceding the event.

Mortality

The primary outcome in this study was mortality. We combined the mortality and survival time information for each individual in the Shizuoka cohort. Survival time was calculated from the beginning to the end of the final follow-up period, or up to the time the participants died. In addition to all-cause mortality, we examined the relationships between social cohesion and cause-specific mortality, including deaths from cancer, cardiovascular disease, pulmonary disease, and all other causes. Disease classifications were based on *International Classification of Diseases, 10th Revision* (*ICD-10*)[16] codes obtained from the national vital records to which the participants were matched. The *ICD-10* codes for cancer, cardiovascular disease, and pulmonary disease were C00–D48, I00–I99, and J00–J99, respectively.

Covariates

We considered the following variables to be potential confounders: gender, age (continuous), marital status (married vs not married), smoking status (current smoker vs never/former smoker), alcohol use (no vs yes), body mass index (BMI, defined as weight in kilograms divided by the square of height in meters; continuous), disease status (has vs does not have a disease), employment status (not working, working ≤ 1 day a week, working 2–4 days a week, working ≥ 5 days a week), frequency of performing housework (never, ≤ 1 time a week, 2–4 times a week, ≥ 5 times a week), and financial status (an index ranging from 0–3). All information was obtained from the baseline survey (1999) and was updated at each follow-up wave.

With respect to disease status, participants were asked whether or not they had been diagnosed with a stroke, hypertension, heart disease, cancer, diabetes, fractures, gastrointestinal disease, pulmonary or bronchus disease, joint disease, or other diseases. We categorized them as having a disease if they indicated that they had been diagnosed with at least one of these conditions. With regard to working status and performance of housework, linear associations of these variables with mortality were derived from simple survival analyses (data not shown).

Information on financial status was collected via the following 3 questions: Can you afford to pay for the activities in your daily life? Are you satisfied with your amount of disposable income? and Do you have savings for an emergency situation? Participants answered either yes (coded as 1) or no (0) to each of these questions, and thus summed values ranged from 0 to 3. The Cronbach alpha coefficient for the resulting index was 0.79. We used the financial index as a proxy for socioeconomic status, a variable that can confound the association between social cohesion and mortality.

Statistical Analysis

Initially, we conducted a descriptive analysis of the demographic characteristics and lifestyles of the study participants. Next, we constructed a proportional hazard regression model (with sandwich variance estimators) to estimate hazard ratios (HRs) and 95% confidence intervals (CIs) for the associations between social cohesion and mortality. We performed a clustered survival analysis that comprised 3 models. Model 1 included individual-level perceptions of community cohesion along with age; gender; BMI; marital status; alcohol use; smoking, disease, financial, and employment status; and performance of housework. In model 2, we examined the association between community-level cohesion and mortality, adjusting for the same covariates as in model 1. Finally, in model 3, we simultaneously included individual-level cohesion and community-level cohesion after adjustment for potential confounders. Individual-level cohesion and the community-level cohesion index were used as time-varying covariates as well as potential confounders in each of the models.

We undertook a sensitivity analysis to evaluate the influence of missing values at baseline via multiple imputation. The number of imputations was 5, and the Markov chain Monte Carlo method was used. We estimated hazard ratios and 95% confidence intervals with the imputed data. We used SPSS version 20.0 (IBM, Tokyo, Japan) for data management and descriptive analyses and SAS version 9.3 (SAS Institute, Cary, NC) for statistical analyses.

RESULTS

Participants' demographic characteristics are shown in Table 1. Relative to the individuals who took part in the study, those who were excluded (i.e., those who were lost at the first follow-up) were more likely to be older and single, to have a disease, to have a lower BMI, to not smoke or consume alcohol, and to have less social cohesion. Among the 11 092 participants included in the final analysis, men were more likely than women to have died during follow-up. Participants with a low BMI, participants with a disease of any type, former smokers, and current smokers were

TABLE 1—Demographic Characteristics of the Study Participants at Baseline: Shizuoka Cohort, Japan 1999

	Participants Included in the Analysis (n = 11 092)			Excluded Participants (n = 1177)			Specific Cause of Mortality[a]			
Characteristic	Alive, No. (%)	Deceased, No. (%)	Total No.	No. (%)[b]	P^c: Lost to Follow-Up vs Alive at Follow-Up	P^c: Lost to Follow-Up vs Deceased at Follow-Up	Cancer, No.	Cardiovascular Disease, No.	Pulmonary Disease, No.	Other, No.
Age, y					<.01	<.01				
< 69	2952 (94.3)	178 (5.7)	3130	246 (7.7)			80	42	22	34
70–74	2582 (90.3)	277 (9.7)	2859	247 (8.7)			111	77	38	51
75–79	2692 (85.3)	465 (14.7)	3157	395 (12.8)			161	140	83	81
> 80	1439 (73.9)	507 (26.1)	1946	289 (16.7)			111	187	98	111
Gender					.82	<.01				
Male	4721 (82.9)	975 (17.1)	5696	579 (10.9)			358	258	185	174
Female	4944 (91.6)	452 (8.4)	5396	598 (10.8)			105	188	56	103
Marital status					<.01	<.01				
Married	2610 (87.3)	378 (12.7)	2988	364 (12.2)			91	142	59	183
Not married	6706 (86.9)	1014 (13.1)	7720	749 (10.0)			363	294	174	86
Disease status					<.01	<.01				
Does not have a disease	2416 (91.8)	216 (8.2)	2632	225 (8.5)			86	47	42	41
Has a disease	6519 (85.5)	1106 (14.5)	7625	838 (11.4)			336	375	182	213
Body mass index, kg/m^2					<.01	<.01				
< 17.9	1019 (77.5)	295 (22.5)	1314	193 (15.9)			71	88	74	62
18.0–24.9	6950 (88.5)	900 (11.5)	7850	748 (9.7)			318	279	138	165
> 25.0	1373 (90.4)	145 (9.6)	1518	139 (9.2)			55	48	13	29
Alcohol use					<.01	<.01				
No	6297 (87.3)	917 (12.7)	7214	802 (11.3)			258	321	149	189
Yes	3117 (62.6)	478 (37.4)	3595	324 (27.4)			192	115	88	83
Smoking status					<.01	<.01				
Does not smoke	7894 (70.7)	1088 (29.3)	8982	886 (19.9)			320	375	179	214
Smokes	1475 (83.4)	293 (16.6)	1768	236 (13.8)			128	59	53	53
Individual-level cohesion score					<.01	.56				
0	85 (73.9)	30 (26.1)	115	28 (24.8)			10	9	7	4
1	165 (76.4)	51 (23.6)	216	43 (20.7)			5	24	16	6
2	355 (80.3)	87 (19.7)	442	66 (15.7)			15	29	24	19
3	973 (86.4)	153 (13.6)	1126	157 (13.9)			41	54	23	35
4	8087 (88.0)	1106 (12.0)	9193	883 (9.8)			392	330	171	213

Note. Baseline information was used for all descriptive analyses. The sample size was n = 12 269.
[a]Among those who died.
[b]Percentages were calculated for each participant category (n = 12 269).
[c]*P* values determined by *t* test and χ^2 test.

also more likely to have died. By contrast, there was no association between survival and alcohol consumption or marital status.

A clustered, proportional hazard regression model was used to evaluate the relationships between individual- and community-level cohesion and mortality (Table 2). Adjusted hazard ratios were calculated with the robust sandwich variance estimator. In model 1, the results showed that higher individual-level cohesion was associated with lower all-cause mortality (HR = 0.79; 95% CI = 0.74, 0.84), cardiovascular disease mortality (HR = 0.75; 95% CI = 0.67, 0.83), pulmonary disease mortality (HR = 0.67; 95% CI = 0.59, 0.76), and all other causes of mortality (HR = 0.77; 95% CI = 0.67, 0.89). We did not identify an association between individual perceptions of cohesion and cancer.

In model 2, we found no statistically significant association between community-level cohesion and any type of mortality. Although the point estimate of the hazard ratio for cardiovascular disease mortality (0.44) suggested a protective association, the 95% confidence intervals were wide.

In model 3, results similar to those from model 1 were found with respect to individual-level cohesion, that is, protective associations for all-cause mortality (HR = 0.78; 95% CI = 0.73, 0.84), cardiovascular disease mortality (HR = 0.75; 95% CI = 0.67, 0.84), pulmonary disease mortality (HR = 0.66; 95% CI = 0.58, 0.75), and all other causes of mortality (HR = 0.76; 95% CI = 0.66, 0.89). After control for individual-level perceptions of social cohesion, none of the hazard ratio estimates for community cohesion reached statistical significance.

In sensitivity analyses, the relationships between individual-level cohesion and mortality (i.e., the hazard ratios and 95% confidence intervals) were similar to the main results including missing values (Table A, available as a supplement to this article at http://www.ajph.org). Relationships with community-level cohesion were also similar to the main results with missing values.

DISCUSSION

Our results showed that higher levels of individual-level cohesion were related to a lower risk of all-cause mortality as well as

TABLE 2—Hazard Ratios Between Perceptions of Individual- or Community-Level Cohesion and Mortality: Shizuoka Cohort, Japan, 1999–2009

Variable	Model 1,[a] HR (95% CI)	Model 2,[b] HR (95% CI)	Model 3,[c] HR (95% CI)
All-cause mortality			
Perception of cohesion			
Individual level	0.79 (0.74, 0.84)		0.78 (0.73, 0.84)
Community level		1.14 (0.50, 2.60)	1.59 (0.68, 3.69)
Gender			
Male (Ref)	1.00	1.00	1.00
Female	0.44 (0.37, 0.53)	0.43 (0.36, 0.52)	0.44 (0.37, 0.53)
Age	1.10 (1.08, 1.12)	1.10 (1.08, 1.12)	1.10 (1.08, 1.12)
Marital status			
Married (Ref)	1.00	1.00	1.00
Not married	0.93 (0.78, 1.11)	0.97 (0.81, 1.15)	0.94 (0.78, 1.12)
Body mass index	0.90 (0.88, 0.93)	0.90 (0.88, 0.92)	0.90 (0.88, 0.93)
Disease status			
Does not have a disease (Ref)	1.00	1.00	1.00
Has a disease	1.78 (1.41, 2.24)	1.81 (1.44, 2.27)	1.77 (1.41, 2.24)
Alcohol use			
No (Ref)	1.00	1.00	1.00
Yes	0.68 (0.56, 0.82)	0.66 (0.55, 0.80)	0.68 (0.56, 0.82)
Smoking status			
Does not smoke (Ref)	1.00	1.00	1.00
Smokes	1.18 (0.98, 1.43)	1.16 (0.96, 1.40)	1.18 (0.98, 1.43)
Employment status	0.86 (0.77, 0.95)	0.84 (0.75, 0.93)	0.86 (0.77, 0.95)
Performance of housework	0.69 (0.65, 0.72)	0.66 (0.63, 0.70)	0.68 (0.65, 0.72)
Financial status	1.01 (0.99, 1.02)	1.01 (0.99, 1.02)	1.01 (0.99, 1.02)
Cancer mortality			
Perception of cohesion			
Individual level	1.10 (0.91, 1.34)		1.09 (0.90, 1.32)
Community level		2.38 (0.55, 10.33)	2.21 (0.52, 9.48)
Cardiovascular disease mortality			
Perception of cohesion			
Individual level	0.75 (0.67, 0.83)		0.75 (0.67, 0.84)
Community level		0.44 (0.11, 1.79)	0.68 (0.17, 2.78)
Pulmonary disease mortality			
Perception of cohesion			
Individual level	0.67 (0.59, 0.76)		0.66 (0.58, 0.75)
Community level		1.68 (0.35, 8.09)	3.26 (0.60, 17.81)
Other-cause mortality			
Perception of cohesion			
Individual level	0.77 (0.67, 0.89)		0.76 (0.66, 0.89)
Community level		1.33 (0.21, 8.29)	1.98 (0.30, 13.14)

Note. CI = confidence interval; HR = hazard ratio. Analyses of mortality from cancer, cardiovascular disease, pulmonary disease, and other causes were adjusted for the same potential confounders as all-cause mortality (gender, age, marital status, body mass index, disease status, employment status, performance of housework, financial status, alcohol use, smoking status). Community-level social cohesion was calculated according to the averaged value of the individual-level cohesion index in each district.

[a]Included individual-level perceptions of community cohesion as well as age, gender, marital status, body mass index, smoking status, alcohol use, disease status, financial status, performance of housework, and employment status.

[b]Included community-level cohesion and mortality, with adjustment for the same covariates as in model 1.

[c]Included both individual-level cohesion and community-level cohesion, with adjustment for the same potential confounders as in model 1.

lower risks of death from cardiovascular disease, pulmonary disease, and all other causes. Individual-level cohesion was not related to cancer mortality. By contrast, community-level cohesion was not statistically associated with any category of mortality.

Individual Cohesion vs Community Cohesion

We draw several conclusions from our analysis. One is that there is an association between individual perceptions of social cohesion and lower mortality risk but no corresponding protective association with community cohesion (model 2). Thus, the relationship between cohesion and mortality appears to reflect predominantly a compositional effect of social cohesion; that is, the health of cohesive communities appears to be more a reflection of the psychological perceptions of their residents than an attribute of the collective. At the individual level, our questions about social cohesion may have been "contaminated" by the psychological well-being of respondents (e.g., their satisfaction with their social relationships) at the time of the survey; thus, we cannot conclude that our findings reflect an accurate assessment of the community's characteristics. By aggregating survey responses to the level of the community, we smoothed out intraindividual differences in perceptions, thereby reducing measurement error. Nonetheless, community-level cohesion was not a predictor of mortality.

It is possible that the administrative units (municipalities) we used to define the community were too broad,[12,13,17] and this may have diluted associations between community cohesion and mortality. Alternatively, we may have lacked sufficient variability across areas to detect an association (i.e., the problem of restricted exposure ranges).

Consistent with the results of our study, Wen et al. reported that community-level social interventions based on social capital models are not likely to achieve beneficial results in terms of mortality in the absence of efforts to improve the socioeconomic and health care status of older people.[10] Meijer et al. recently performed a meta-analysis of neighborhood effects on mortality.[18] They reported that there was an association between individual-level perceptions of social cohesion and mortality, but they found no evidence for a clear association at the area level. Because individual perceptions of cohesion may reflect the quality of closer, more intimate relationships rather than the wider range of weak community ties, this may partially explain why we found protective associations between individual-level cohesion and mortality. Our social cohesion index also did not directly capture community-level processes such as collective efficacy and informal social control, which have been used in other surveys attempting to assess community social cohesion.[1]

Our results were inconsistent with the findings of 2 previous studies involving older Japanese residents.[13,15] In multilevel analyses, Ichida et al.[13] and Aida et al.[15] reported that community social cohesion had a protective association with the incidence of functional disabilities and self-rated health, respectively. There are at least 2 possible explanations for the discrepancy between our findings and those of these earlier reports. First, the association of community income inequality with health may vary according to outcome (i.e., we examined mortality, whereas the earlier studies examined self-rated health and disability). Second, the association of income inequality with health may vary according to community context and unobserved local factors. Also, our study was conducted in a different part of Japan (Shizuoka Prefecture) than the earlier reports.

Cause-Specific Mortality

Overall, cohesion was not associated with cancer mortality either at the individual level or at the community level. Some studies have shown that social support and social relationships have a protective effect on survival among patients with cancer.[19] However, we were not specifically able to test survival after a cancer diagnosis, and we were unable to tease out cancer incidence from cancer survival. Our results showed that individual-level cohesion was related to decreased cardiovascular disease mortality. Sundquist et al. suggested that low levels of social participation are associated with an increased risk of coronary heart disease.[20] However, our social capital index did not directly focus on social participation.

Scheffler et al. investigated the effects of community-level social capital on acute coronary syndrome and found that community social cohesion may have a protective effect on recurrence of this condition.[21] Clark et al. reported that neighborhood-level social cohesion was protective against stroke mortality.[22] Chaix et al. also reported that neighborhood social interactions might influence survival after an acute myocardial infarction.[23]

Our data included information on all cardiovascular diseases, including stroke, acute coronary syndrome, and acute myocardial infarction, and we examined their associations with community-level cohesion. However, in contrast to the studies just described, we found no relationship between community-level cohesion and cardiovascular disease. The sources of the discrepancy are not clear, but they may be based on differences in the indicators used to measure social capital, heterogeneity in the populations studied (our sample was exclusively elderly), or cultural differences in the ways in which social cohesion influences health outcomes across different societies.

Finally, we found that individual cohesion was associated with mortality caused by pulmonary disease. To our knowledge, few studies have investigated this relationship.

Strengths and Limitations

The strengths of this study include the longitudinal design, the duration of the follow-up (10 years), the large sample, and examination of a "hard" outcome (mortality) as opposed to self-reported health status. The study population (individuals older than 65 years) and study setting (a single prefecture in Japan) also addressed gaps in the literature. However, the study involved some limitations as well. For example, because of the social cohesion index we used, it is difficult to make comparisons with the results of previous studies. We did not assess information on social participation, trust, or community-level processes associated with social cohesion (e.g., collective efficacy or informal social control).

Furthermore, the Japanese people exhibit a high level of social cohesion, thereby limiting the generalizability of our results. Also, 2240 and 3580 participants were censored in 2006 and 2009, respectively. Although we treated them as 3-year and 6.25-year survivors, respectively, which is a strength of our survival analysis, some of these individuals were unable to respond to the questionnaire owing to health issues (e.g., being bedridden or having blurred vision). The possibility of selective withdrawal from follow-up needs to be considered.

A total of 1177 participants were lost at the first follow-up in 2002. We used the *t* test and χ^2 test to compare the characteristics of survivors, those who died, and those lost to follow-up (Table 1). The participants lost at the first follow-up wave were more likely to have one of the diseases assessed and to report less social cohesion. This pattern indicates that there may have been a systematic selection bias that resulted in a healthier study cohort (Table A). However, use of information on mortality from the national demographic database allowed us to identify participants who had died between 1999 and 2009, and we did not omit these individuals even if they had been censored during follow-up. This may have helped to reduce bias.

Conclusions

In this sample of older Japanese adults, individual perceptions of social cohesion were associated with a lower risk of mortality, but community cohesion was not. It is unclear from our results whether boosting individual perceptions of community social cohesion can improve population health. At the same time, we cannot conclusively rule out a health-promoting effect of community cohesion. There is a need for further longitudinal research that includes assessments of community-level constructs relevant to social cohesion, such as collective efficacy and informal social control. ■

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Contributors

S. Inoue designed the study, performed the data analyses, and drafted the initial article. T. Yorifuji and H. Doi were involved in data acquisition and reviewed and revised the article. S. Takao and I. Kawachi supervised the study and critically reviewed and revised the article.

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Human Participant Protection

The institutional review board at Okayama University approved this study. Participants provided informed consent.

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