Table 1
Existing indices/measures of social exclusion.

Study	Domain (Dimension)	
European Commission (2002) "non-monetary indicators from EUROSTAT"	(1) Enforced lack of desired possessions (2) Absence of basic housing facilities (3) Problems with accommodation and the environment (4) Lack of ability to afford most basic requirements (5) Inability to meet payment schedules	
Bradshaw, Williams, and Levitas (2000)	(1) Poverty / Lack of socially perceived necessities (2) Exclusion from the labor market (3) Service excluded (4) Exclusion from social relations	
Burchardt, Grand, and Piachaud (2002)	(1) Consumption (2) Production	(3) Political engagement (4) Social interaction
Choffe (2001)	(1) Income exclusion (2) Employment (3) Housing	(4) Health (5) Family exclusion (6) Cultural exclusion
Percy-Smith (2000)	(1) Economic (2) Social (3) Political (4) Neighborhood	(5) Individual (6) Spatial (7) Group
Tsakloglou (2003)	(1) Poverty (2) Amenities deprivation	(3) Durables deprivation (4) Necessities deprivation

focus on the overall impact of status for socially excluded individuals rather than the individual impact of each specific dimension. Scharf, Phillipson, and Smith (2004) conducted a cross-sectional survey in three socially deprived areas, and observed that older people who experienced multiple forms of social exclusion were significantly likely to rate their quality of life as poor or very poor. To our knowledge, there has been no large-scale cohort research that has assessed the relative and attributable impact of social exclusion on health among older Asian people. In addition, gender differences have not been well studied.

The issue of social exclusion may be of particular importance in Japan, where the population is currently the oldest in the world (Ikeda et al., 2011; United Nations, 2001). Older persons are likely to be financially vulnerable and at risk for being isolated (O'Rand, 1996). The Japanese government has recognized that 25%of older (aged 65 years or more) citizens live below the official poverty line, whereas the proportion is 16.0% among the general population (Cabinet Office of Japan, 2010a, 2010b). This is not a small proportion for a developed country (MHLW, 2011; OECD, 2005, 2011). However, social exclusion and other key socioeconomic determinants of health are rarely applied in health and social policy in Japan. The purpose of this study was to evaluate the relative and attributable impact of social exclusion on mortality among older Japanese adults.

Methods

Study subjects

We used data from a prospective Japanese cohort study, the Aichi Gerontological Evaluation Study (AGES). AGES was a mail survey of 29,374 people aged 65 or older who were randomly selected from the older residents of six municipalities in the Chita peninsula, Aichi prefecture, Japan (Kondo, 2010; Nishi, Kondo, Hirai, & Kawachi, 2011). Baseline information was gathered in 2003, with a response rate of 50.4%(n = 14,804). We used baseline data from 13,310 functionally independent respondents who did not have any problems with activities of daily living in terms of walking, toileting, and bathing. Information on mortality was obtained from the database of the public long-term care insurance system, which is run by the municipal government. The mean age of participants was 72.8 years (SD = 5.8), and 51.1% were women. Our study protocol and questionnaire procedure were approved by the Ethics Committee in Research of Human Subjects at Nihon Fukushi University. Written informed consent was assumed by voluntary return of the questionnaire.

Measurements

Evaluation of social exclusion

We used relative poverty, social isolation, and social inactivity due to inevitable reasons to measure social exclusion. Relative poverty was defined as below half of the median annual income; the threshold was 1.13 million Japanese yen. This definition of relative poverty was originally from OECD, which conceptually relies on the relative approach of the Luxembourg Income Study (Förster, 1994). We used annual household pre-tax income. For each response, we equivalized household income for household size, dividing income by the square root of the number of household members.

Townsend (1963) defined isolation as "having few contacts with family and community." In this study, we evaluated both face-to-face and non-face-to-face contacts using the following questions; "How often do you see your family members or relatives who are living apart?" and "How often do you make contact with your family members or relatives who are living apart by letter, telephone, or email?" We included six response options for the frequency of contact, ranging from "almost everyday" to "almost never." We also asked the same questions for contact with close friends. Respondents who selected "one or two times per month" or less with both relatives and close friends were considered as being "isolated."

Socially inactive people could be socially excluded, if they are inactive for inevitable reasons, which are reasons that are not easily changed by oneself or of personal choice. Our question about hobbies/activities included eight types of activities: sports, cultural, music, creative, horticulture, watching TV, traveling, and stock investments. For respondents who answered "no hobby", we asked about reasons for lack of participation in any hobbies/activities. Response options were: 1. "I don't have enough motivation," 2. "I discontinued for some reason," 3. "I cannot find anything interesting," 4. "I feel it troublesome to associate with people," 5. "I don't have enough money," 6. "I don't have enough time," 7. "I've had no opportunities," and 8. "Other." Respondents were recognized as having "no hobby due to inevitable reasons" if they selected options 5 or 7, because "no opportunity" and "no money" were clearly not based on individual choice. Although other options may also be inevitable reasons in certain contexts, we did not use these options in order to eliminate any possibility of nonparticipation due to personal choice. For example, those who selected option 2 and/or 6 may have discontinued their hobby or activity because they had other social obligations other than the hobby or activity (e.g. job or volunteer work).

According to these evaluations, we grouped our study participants into four categories: (a) not socially excluded, (b) living in relative poverty, (c) socially isolated and/or socially inactive, and (d) living in relative poverty and socially isolated/inactive. We created

these groups because social exclusion was a broader or extended concept of income/material poverty. In creating these groupings, we sought to evaluate the differential impact of "poverty" and extended "isolation and inactivity", as well as the overall impact of social exclusion.

In fact, the questions we used represented only three dimensions despite the existence of many phrases to explain the potential dimensions of social exclusion (see Table 1); however, our three questions represented the potential dimensions used in previous studies. Based on our theoretical reviews, we found that the dimensions of social exclusion used in preceding studies could be summarized into three categories: material deprivation (less income, goods, and access to services), isolation (physically and socially), and social inactivity (in terms of groups, politics, and economic activities).

Covariates

We used age, sex, educational attainment, marital status, and history of disease and impairment as covariates. These sociodemographic and health statuses are known to be strong predictors of subsequent health and they were used in many studies on social determinants of health (Moon, Kondo, Glymour, & Subramanian, 2011; Muller, 2002). Marital status was categorized as married, widowed/separated, unmarried, and other. Information on the history of disease and impairment was gathered using two questions about receiving medical treatment and the reasons for receiving medical treatment with 20 response options about diseases and/or impairments. From these questions, we created three categories, namely, no disease or impairment, only disease, and disease and/or impairment. We also considered the area of residence, adjusting for dummy variables of six municipalities (Handa, Tokoname, Agui, Taketoyo, Mihama, and Minami-chita) because a previous study using AGES data reported significant associations between regional characteristics, such as social capital and income inequality, and individual self-rated health (Ichida et al., 2009).

Statistical analysis

First, we calculated incidence rates (IRs) of mortality using baseline characteristics of respondents, and evaluated statistical differences using chi-square tests. Second, we used Cox's proportional hazard models to assess the effects of social exclusion on mortality, adjusting for potential multiple confounding factors. We graphically confirmed the proportionality of mortality hazards between the categories of social exclusion and sociodemographic variables, using Kaplane Meier survival curves. Finally, we calculated population attributable risk percentages (PAR%) in an older Japanese population. This estimation assumed that the adjusted relative risks truly reflected causal impact and that the AGES cohort represents the entire older Japanese population. Data on annual mortality of the population aged 65 or older was obtained from

Table 2
Baseline characteristics of respondents and incident rates of onset of mortality.[a]

Variable		n	IR	p	%		
					Total	Men	Women
Sex	Men	6508	0.028	<.000	48.9	e	e
	Women	6802	0.013		51.1	e	e
Age group	<70	4700	0.010	<.000	35.3	37.7	33.0
	70e74	3934	0.015		29.6	30.7	28.4
	75e79	2819	0.026		21.2	19.9	22.4
	80e84	1272	0.038		9.6	8.2	10.8
	85+	585	0.088		4.4	3.4	5.3
Educational attainment (years)	S13	1228	0.018	.000	9.2	13.6	5.0
	10e12	3714	0.017		27.9	27.0	28.8
	6e9	7017	0.021		52.7	51.0	54.3
	<6	561	0.037		4.2	2.4	6.0
	Unknown	790	0.023		5.9	6.0	5.9
Marital status[b]	Married	8973	0.018	.001	72.0	89.1	55.5
	Divorced/separated	3212	0.024		25.8	9.8	41.1
	Never married	222	0.021		1.8	0.6	2.9
	Other	62	0.021		0.5	0.5	0.5
Disease and/or impairment	No	2211	0.013	<.000	16.6	17.7	15.5
	Only disease	7156	0.019		53.8	53.7	53.8
	Disease and/or impairment	3280	0.029		24.6	24.7	24.6
	Unknown	663	0.015		5.0	3.8	6.1
Municipality of residence	Handa	2540	0.021	.045	19.1	21.2	17.1
	Tokoname	2356	0.022		17.7	16.6	18.7
	Agui	1944	0.018		14.6	14.9	14.3
	Taketoyo	2464	0.019		18.5	19.2	17.9
	Mihama	1789	0.018		13.4	13.0	13.9
	Minami-chita	2217	0.023		16.7	15.2	18.1
Relative poverty[b]	1.13 Million yen+	8925	0.019	.012	85.0	88.3	81.1
	<1.13 Million yen (A)	1576	0.024		15.0	11.7	18.9
Social isolation[b]	Not isolated	10,870	0.005	<.000	84.5	79.3	89.5
	Isolated (B)	1994	0.022		15.5	20.7	10.5
Social inactivity[b]	Having hobby	9341	0.017	<.000	77.7	80.1	75.3
	No hobby: evitable reason	1778	0.030		14.8	13.0	16.6
	No hobby: inevitable reasons (C)	902	0.025		7.5	6.9	8.1
Social exclusion[b]	None	6586	0.017	<.000	67.8	66.7	69.0
	Only (A)	992	0.020		10.2	7.1	13.9
	(B) and/or (C)	1736	0.025		17.9	22.2	12.6
	(A) and (B) and/or (C)	405	0.026		4.1	3.9	4.5

IR: incidence rate.
[a] Cumulative incidence = 1044 in 51,208 person-years. IR = 0.020.
[b] Unknown cases were eliminated.

governmental reports, i.e., 960,917 deaths in 2008 (MHLW, 2008). All p-values were two tailed. We used the computer software SPSS version 12.0J (SPSS Japan Inc., Japan).

Results

We observed 51,208 person-years. During the four years of follow up, 1044 participants (7.8%) died, of which 689 (66.0%) were men. IRs were 0.028 for men and 0.013 for women. At baseline, 11.8% of participants were relatively poor, 15.0% were social isolated, and 7.5% were socially inactive due to inevitable reasons. IRs of mortality significantly varied across age, educational attainment, health status, and all dimensions of social exclusion (Table 2).

All dimensions of social exclusion were associated with higher hazard ratio (HR) for mortality, even after adjusting for potential confounding factors (Table 3). The adjusted HR was 1.27 (95% CI: 1.06e 1.52), between those who were socially isolated and/or socially inactive, and those who were not socially excluded. The adjusted HR was 1.29 (95% CI: 0.93e 1.80) between those living in relative poverty and those who were social isolation/inactivity. On the other hand, the adjusted HR of those who were relatively poor but not socially isolated/inactive was relatively small: 1.09 (95% CI: 0.86e 1.40).

There was a gender difference in the magnitude of the association between social exclusion and mortality (Table 4). In men, the adjusted HR of living in relative poverty (HR= 1.24, 95% CI: 0.95e 1.56) and social inactivity (HR= 1.33, 95% CI: 1.00e 1.78) were statistically significant, whereas the adjusted HR of being socially isolated was larger for women (HR= 1.72, 95% CI: 1.31e 2.25). Relative impoverishment did not predict mortality of women, if they were not social isolated and/or inactive. Adjusted HR was 1.10 for women, whereas it was 1.24 for men. The impact of being relatively poor and socially isolated and or inactive was much stronger among women (HR= 1.73) than men (1.11).

PAR% for each domain of social exclusion ranged from 2.6% to 2.8% (Table 5). PAR was 0.9% for those who were only relatively poor, 4.6% for socially isolated and/or socially inactive, and 1.2% for relatively poor and socially isolated and/or inactive.

Discussion

Using prospective data from a large sample of older Japanese adults, our epidemiologic study demonstrated that social exclusion predicted premature mortality. Given the annual mortality of the older Japanese population, our estimates of PAR% indicated that about 9000e 44,000 premature deaths (1e 5% of all deaths) could be avoided annually, if there was less social exclusion. We also identified the differential gender patterns for the impact of social exclusion on mortality. For men, relative poverty had stronger impact on their health than women, while the impact of social isolation was much stronger for women than men. The overall impact of social exclusion on mortality was stronger among Japanese women than men.

Our study suggested gender differences in the impact of social exclusion on mortality. It is specifically important that relative poverty might not be a risk for mortality among females but their mortality risk largely increases once they are isolated and/or inactive in their community; while relative poverty seems to be an independent risk factor for mortality among older men. These findings suggest that the primary pathways explaining the link of social exclusion to health for women might be limited interactions with close family or friends, whereas for men it might be

Table 3
Proportional hazard models for mortality.

Variable		Model 1		Model 2		Model 3		Model 4	
		HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
Social exclusion	Relatively poor (A)	1.18	0.98e 1.42						
	Socially isolated (B)			1.19	1.02e 1.39				
	No hobby due to inevitable reasons (C)					1.34	1.07e 1.69		
	Only (A)[a]							1.09	0.86e 1.40
	(B) and/or (C)[a]							1.27	1.06e 1.52
	(A) and (B) and/or (C)[a]							1.29	0.93e 1.80
Sex	Men	2.61	2.20e 3.09	2.56	2.20e 2.97	2.68	2.29e 3.13	2.39	2.01e 2.87
Age group	< 70 (Ref)								
	70e 74	1.33	1.08e 1.64	1.31	1.07e 1.59	1.32	1.07e 1.63	1.26	1.01e 1.58
	75e 79	2.36	1.92e 2.90	2.37	1.96e 2.87	2.50	2.05e 3.06	2.35	1.90e 2.92
	80e 84	3.18	2.49e 4.06	3.48	2.81e 4.31	3.59	2.86e 4.51	3.37	2.61e 4.35
	85+	7.96	6.19e 10.23	8.12	6.48e 10.17	8.59	6.78e 10.90	8.27	6.35e 10.76
Educational attainment (years)	S 13 (Ref)								
	10e 12	1.09	0.84e 1.41	1.10	0.93e 1.48	1.10	0.85e 1.43	1.09	0.84e 1.43
	6e 9	1.20	0.94e 1.54	1.18	0.86e 1.41	1.14	0.59e 1.45	1.16	0.90e 1.50
	< 6	1.55	1.08e 2.23	1.48	1.06e 2.04	1.32	0.93e 1.87	1.42	0.97e 2.10
	Unknown	0.80	0.43e 1.47	0.95	0.60e 1.50	0.92	0.55e 1.53	0.72	0.35e 1.51
Marital status	Married (ref)								
	Divorced/separated	1.31	1.09e 1.57	1.27	1.08e 1.50	1.30	1.09e 1.55	1.31	1.07e 1.59
	Never married	1.24	0.66e 2.33	1.68	1.04e 2.70	1.69	1.04e 2.77	1.27	0.67e 2.39
	Other	1.40	0.82e 2.40	1.53	1.05e 2.24	1.38	0.89e 2.15	1.31	0.67e 2.53
Disease and/or impairment	No (ref.)								
	Only disease	1.58	1.24e 2.01	1.41	1.14e 1.73	1.49	1.19e 1.85	1.57	1.22e 2.02
	Disease and/or impairment	2.02	1.57e 2.59	1.70	1.37e 2.12	1.74	1.38e 2.19	1.98	1.52e 2.57
	Unknown	1.08	0.68e 1.70	1.00	0.69e 1.46	0.97	0.64e 1.46	0.98	0.58e 1.66
Municipality of residence	Handa (ref.)								
	Tokoname	0.97	0.78e 1.20	0.91	0.75e 1.11	0.90	0.74e 1.11	0.93	0.74e 1.17
	Agui	0.88	0.69e 1.12	0.85	0.68e 1.06	0.85	0.68e 1.07	0.87	0.69e 1.14
	Taketoyo	0.86	0.69e 1.08	0.94	0.77e 1.15	0.96	0.78e 1.19	0.88	0.69e 1.11
	Mihama	0.87	0.68e 1.11	0.87	0.70e 1.09	0.84	0.66e 1.06	0.89	0.69e 1.15
	Minami-chita	0.93	0.74e 1.18	1.06	0.87e 1.30	0.97	0.78e 1.20	0.93	0.72e 1.19

HR: hazard ratio, CI, confidence intervals.
Number of sample were as follows; Model 1 = 10,501, Model 2 = 12,864, Model 3 = 12,021 and Model 4 = 9719.
[a] Referent category is "neither (A), (B), nor (C)".

Table 4
Differences of hazard ratio for mortality between men and women.

	n	Men		Women	
		HR	95% CI	HR	95% CI
Relatively poor (A)	1576	1.24	0.95e 1.56	1.10	0.81e 1.49
Socially isolated (B)	1994	1.02	0.85e 1.24	1.72	1.31e 2.25
No hobby due to inevitable reasons (C)	902	1.33	1.00e 1.78	1.35	0.92e 2.00
Only (A)[a]	992	1.18	0.86e 1.62	0.99	0.67e 1.47
(B) and/or (C)[a]	1736	1.21	0.98e 1.48	1.46	1.03e 2.09
(A) and (B) and/or (C)[a]	405	1.11	0.72e 1.71	1.73	1.03e 2.90

HR: hazard ratio; CI, confidence intervals.
All estimates were controlled for age, educational attainment, marital status, disease and/or impairment, and municipality of residence.
[a] Referent category is neither (A), (B), nor(C).

psychosocial stresses due to poverty relative to others in their society, as well as material deprivation. Studies in Japan and Sweden have suggested that the health impacts of psychosocial stress due to relative deprivation might be stronger for men than women (Kondo, Kawachi, et al., 2009; Yngwe, Fritzell, Lundberga, Diderichsen, & Burström, 2003). In addition, interpersonal relationships among older women might have strong protective or buffering effects for psychosocial stress. In many cases older women are integrated into an extensive community network; thus the overlap of relative poverty and social isolation might strongly enhance social stress for older women, as such cases are rare among older women in the community. Nonetheless, study findings on the gender differences in the association between social relationships and health has been mixed. Berkman and Syme (1979), Orth-Gomér and Johnson (1987), and Forster and Stoller (1992) found that the differences in mortality rates between people with high and low social contact scores were greater for women than for men, whereas other studies reported stronger network effects for men (Kaplan et al., 1988; Schoenbach, Kaplan, & Fredman, 1986; Sugisawa, 1994).

The association between low income and poor health has been established in Japan and many other countries (Back & Lee, 2010; Ichida et al., 2009; Kondo, 2010; Oshio & Kobayashi, 2010). A recent meta-analysis of 148 studies revealed that the impact of social relationships and social support on health was similar to tobacco smoking, and individuals with adequate social relationships have a 50% greater likelihood of survival compared to those with poor or insufficient social relationships (Holt-Lunstad, Smith, & Layton, 2010). La Veist, Sellers, Brown, and Nickerson (1997) reported that extremely socially isolated older African American women, who were living alone and had no contact with family or friends in the 2 weeks prior to the survey, were 3 times more likely to die prematurely than non-isolated women. Similar evidence was provided in a 12-year follow-up study of 637 older Japanese people, Having fewer close friends (HR= 2.22) and group memberships (HR= 1.89) were associated with increased mortality in older men, but not in women (Sato et al., 2008). Moreover, there is abundant evidence for the link of social inactivity to poor health outcomes such as dementia (Takeda, Kondo, Hirai, & Murata, 2007; Wang, Karp, Winblad, & Fratiglinoi, 2002) and functional disability (Haga, Shibata, & Ueno, 1991; Kondo, Kazama, Suzuki, & Yamagata, 2008; Kondo, Minai, Imai, & Yamagata, 2007) in Japan.

Table 5
Estimated population attributable risks in Japan.

	n	%Exposed[a]	Mortality		
			HR	PAR[b]	
				%	n
Relatively poor (A)	1576	15.0	1.18	2.6	24,949
Socially isolated (B)	1994	15.5	1.19	2.8	27,068
Socially inactive due to inevitable reasons (C)	902	7.5	1.34	2.5	24,168
Only (A)	992	10.2	1.09	0.9	9126
(B) and/or (C)	1736	17.9	1.27	4.6	43,987
(A) and (B) and/or (C)	405	4.2	1.29	1.2	11,603

[a] These %exposed were in our study participants.
[b] PAR (%) = Pe(HR − 1)/Pe(HR − 1) + 1; Pe, the proportion of exposure in the target population; HR, hazard ratio.

Our study added new evidence on the gender-specific impact of multiple aspects of social exclusion on the mortality of older adults. One important finding is that the overall impact of social exclusion on mortality was stronger than a single dimension of social exclusion in women. Social exclusion could create multiple disadvantages for health including the lack of instrumental, emotional, and informational social support and access to health services. Santana (2002) conducted a cross-sectional study in Portugal and found that socially disadvantaged older adultsd in terms of socially excluded groups: living in poverty, long-term unemployment, and homelessnessd all showed lower utilization rates of health services.

Study limitations

Our study has several limitations. First, our evaluation of social exclusion did not cover the full range of dimensions that have been conceptualized in preceding studies. For example, information on material deprivation such as housing conditions was lacking. However, it is likely that the impact of material deprivation on health can be largely reflected by the effect of relative financial poverty, which was formally evaluated in our analyses. Second, we could not model temporal changes in social exclusion, the dynamic link between social exclusion and health deserves further study (Berghman, 1995). Third, caution is needed when interpreting our estimation of attributable risks as it requires a somewhat strong assumption that the data we used for this analysis are generalizable to the entire Japanese population, although our study participants were from six rural and suburban municipalities. Fourth, the response rate was not high (50.4%). The impact of this moderate response rate on the internal validity of this perspective study may be limited, however, and our findings might actually be underestimated. The responses that we obtained could be skewed toward social inclusion and the participants, themselves, may be healthier individuals, because people who were socially excluded might less be likely to participate in a social survey. In addition, we did not account for potential confounding factors that were not measured in this study. For example, contextual determinants of social exclusion (e.g., built environment for promoting social interactions and region-specific social security measures for older adults) are important factors potentially affecting both social exclusion and health, which deserve further study.

Conclusion

Worldwide, the population has been aging at an unprecedented pace (United Nations, 2001). In this study in Japan, where the society is the oldest in the world, we have revealed that there is a considerable proportion of the older population that is socially excluded and the attributable risk is large. Thus, policy intervention to promote social inclusion of the population, along with effective social security to support economically disadvantaged older adults should be required in Japan and many other countries. Numerous studies have suggested that older men tend to have narrower interpersonal relationships than women and they are more likely to experience social isolation (Saito et al., 2010; Tunstall, 1966). In fact, we found that the prevalence of social isolation was two times higher among men than women (20.7% vs. 10.5%). On the other hand, although most women are likely to have richer social networks than men, their health risks could be larger, if they lose

their networks. Therefore, community activities aiming to promote social inclusion should be designed with a good understanding of these gender-specific factors of social exclusion. Future important research tasks might be to clarify the mechanisms of these gender differences and to develop effective gender-specific approaches for the issue of social exclusion of older adults.

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Income inequality, social capital and self-rated health and dental status in older Japanese

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The erosion of social capital in more unequal societies is one mechanism for the association between income inequality and health. However, there are relatively few multi-level studies on the relation between income inequality, social capital and health outcomes. Existing studies have not used different types of health outcomes, such as dental status, a life-course measure of dental disease reflecting physical function in older adults, and self-rated health, which reflects current health status. The objective of this study was to assess whether individual and community social capital attenuated the associations between income inequality and two disparate health outcomes, self-rated health and dental status in Japan.

Self-administered questionnaires were mailed to subjects in an ongoing Japanese prospective cohort study, the Aichi Gerontological Evaluation Study Project in 2003. Responses in Aichi, Japan, obtained from 5715 subjects and 3451 were included in the final analysis. The Gini coefficient was used as a measure of income inequality. Trust and volunteering were used as cognitive and structural individual-level social capital measures. Rates of subjects reporting mistrust and non-volunteering in each local district were used as cognitive and structural community-level social capital variables respectively. The covariates were sex, age, marital status, education, individual- and community-level equivalent income and smoking status. Dichotomized responses of self-rated health and number of remaining teeth were used as outcomes in multi-level logistic regression models.

Income inequality was significantly associated with poor dental status and marginally significantly associated with poor self-rated health. Community-level structural social capital attenuated the covariate-adjusted odds ratio of income inequality for self-rated health by 16% whereas the association between income inequality and dental status was not substantially changed by any social capital variables. Social capital partially accounted for the association between income inequality and self-rated health but did not affect the strong association of income inequality and dental status.

Introduction

A recent meta-analysis showed that income inequality affects mortality and self-rated health (Kondo, Sembajwe, et al., 2009). There are several possible pathways linking income inequality and health (Kawachi, Fujisawa, & Takao, 2007). First, societies with high levels of income inequality have higher proportions of people living in poverty, and poverty is harmful for health (Shaw, Dorling, & Smith, 2006). Second, more unequal societies have higher levels of psychological stress caused by social comparisons, which in turn may have detrimental effects on health. Indeed, social-evaluative threats, one of the main causes of stress (Dickerson & Kemeny, 2004), are more common in more unequal societies (Wilkinson & Pickett, 2009). Third, income inequality erodes social capital and social capital is associated to health (Kawachi, Kennedy, Lochner, & Prothrow-Stith, 1997).

Although there is a growing body of evidence that social capital is associated with various health outcomes (Islam, Merlo, Kawachi, Lindstrom, & Gerdtham, 2006; Kim, Subramanian, & Kawachi, 2008), only a few non-ecological studies have examined the

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contribution of social capital to the association between income inequality and health, whilst considering contextual effects and undertaking multi-level analysis (Celeste, Nadanovsky, Ponce de Leon, & Fritzell, 2009; Ichida et al., 2009; Kim & Kawachi, 2007; Subramanian, Kawachi, & Kennedy, 2001). Social capital is defined as those features of social organizations, such as civic participation, norms of reciprocity, and trust in others, which facilitate cooperation for mutual benefit (Putnam, 1993). Social capital is embedded in communities and individuals (Kawachi et al., 1997). Multilevel modeling has been used to evaluate contextual community-level effects of social capital, controlling for compositional (individual-level) effects of social capital (Kawachi, Subramanian, & Kim, 2008). Of the previous studies assessing the relative effects of social capital and income inequality on health, most have used only community-level social capital (Celeste et al., 2009; Kim & Kawachi, 2007; Subramanian et al., 2001). In addition, a study by Ichida et al. (2009) evaluated community-level contextual effects of social capital adjusting for individual-level compositional effects, though it used only cognitive social capital.

Most of the cross-sectional studies on social capital and health have used self-rated health as an outcome variable. Few studies have used physical indicators of health as an outcome (Islam et al., 2006; Kim et al., 2008). In terms of function of older people, the number of remaining teeth is an important indicator of physical health. Dental health among older people is associated with impacts on daily living, particularly eating difficulties and nutritional deficiencies (Locker, 1992; Nowjack-Raymer & Sheiham, 2003, 2007; Sahyoun, Lin, & Krall, 2003; Sheiham et al., 2001; Tsakos, Herrick, Sheiham, & Watt, 2010; Walls & Steele, 2004) while periodontal disease and tooth loss are associated with mortality (Abnet et al., 2005; Appollonio, Carabellese, Frattola, & Trabucchi, 1997; Shimazaki et al., 2001) and chronic conditions such as hypertension (Franek et al., 2009; Tsakos, Sabbah, et al., 2010; Volzke et al., 2006), cardiovascular disease (Buhlin, Gustafsson, Pockley, Frostegard, & Klinge, 2003; D'Aiuto et al., 2006; Holmlund, Holm, & Lind, 2006; Meurman, Sanz, & Janket, 2004) and metabolic syndrome (D'Aiuto et al., 2008; Shimazaki et al., 2007).

The number of remaining natural teeth and self-rated health can be considered as complementary measures of health in older people as they reflect past and current exposures to health risks. Self-rated health, a key measure of health in older people has been used in epidemiological studies because it predicts future health outcomes (Moller, Kristensen, & Hollnagel, 1996) including mortality (Idler & Benyamini, 1997). Current self-rated health reflects current health status (Solomon, Kirwin, Ness, O'Leary, & Fried, 2010). On the other hand, the number of remaining natural teeth is a historical measure of health and reflects the accumulation of exposures to social determinants of dental health throughout the life-course (Poulton et al., 2002). No previous studies on the association of health with social capital or income inequality have simultaneously used self-rated health and dental status.

This study was therefore planned with the objective of examining whether individual- and community-level social capital attenuated the associations between income inequality and two disparate health outcomes, self-rated health and dental status (number of remaining natural teeth).

Methods

Study population

The present analysis is based on data from the Aichi Gerontological Evaluation Study Project (the AGES Project), an ongoing Japanese prospective cohort study (Aida et al., 2009; Kondo, 2010; Kondo, Kawachi et al., 2009). The AGES Project investigates factors associated with health related to functional decline or cognitive impairment among individuals aged 65 years or over. The AGES Project sample was restricted to people who did not already have physical or cognitive disability, defined as receiving a public long-term care insurance benefit. In 2003, a baseline mailed questionnaire survey was conducted on a random sample of community-dwelling individuals residing in 15 municipalities in 3 prefectures in Japan. In 2010, 10 municipalities located in Aichi prefecture approved the use of detailed area identification, so the participants from these areas could be assigned to a local district, according to their place of residence. There were 79 local districts in the 10 municipalities and all community-level variables were calculated on the basis of these districts (Hanibuchi et al., 2009). We used three sections of the questionnaire: dementia, oral health, and abuse of older people. The questionnaires containing questions about oral health were distributed to 11,455 older people in the 10 municipalities and their responses formed the basis for this research. Responses were obtained from 5715 subjects (49.5%). Because subjects were older people and self-complete questionnaires were used, there were several questionnaires with missing data, especially in relation to the question on income. After excluding respondents with missing data, data on 3451 were included in the analysis. The mean number of analyzed respondents per district in the 79 local districts was 44.4 (SD = 42.9, minimum = 7, maximum = 220, 25th percentile = 15, 50th percentile = 30, 75th percentile = 62).

The Ethics Committee on Research of Human Subjects at Nihon Fukushi University approved the AGES Project protocol.

Outcome variables

Self-rated health and number of remaining natural teeth were used as outcomes. Self-rated health was measured through the question "What is your current health status: excellent, good, fair, or poor?" For analysis purposes, this variable was dichotomized in the manner similar to that used by Ichida et al. (2009), Kim and Kawachi (2007) and Subramanian et al. (2001) as follows: (i) good ("excellent/good") and (ii) poor ("fair/poor"). To obtain data on dental status, respondents were asked to classify their dental status as having 20 or more teeth, having 19 or less teeth with dentures, having 19 or less teeth without any dentures, having very few teeth with dentures, or having very few teeth without any dentures. Retention of a minimum of 20 functional natural teeth at ages of 65 years and over was an oral health goal specified by the WHO and Federation Dentaire Internationale "Global Goals for Oral Health in the year 2000" (Federation Dentaire Internationale, 1982). The goal for an acceptable level of oral health set by the Japan Dental Association was retention of a minimum of 20 functional teeth at the age of 80. Previous research indicated that older people with 20 or more teeth had better nutritional intake than people with 19 or less teeth (Yoshihara, Watanabe, Nishimuta, Hanada, & Miyazaki, 2005). Therefore, dental status was used as a dichotomous variable: (i) having 20 or more teeth and (ii) having 19 or less teeth.

Main predictors

The Gini coefficient for the 79 local districts was used as an indicator of income inequality (De Maio, 2007). The Gini coefficient was used as a continuous variable ranging from 0 - completely equal distribution of equivalent income, to 1 - completely unequal distribution of equivalent income.

There are two distinct components of social capital: cognitive and structural (Islam et al., 2006). Cognitive social capital refers to

what people feel and structural social capital to what people do (Harpham, 2008). We used both trust (cognitive social capital) and volunteer participation (structural social capital) as measures of social capital.

Trust was measured by the following question; "Generally speaking, would you say that most people can be trusted?" (response alternatives: "yes", "depends" and "no"). The responses "yes" and "depends" were grouped together for analysis. Respondents were also asked whether they belonged to a volunteer group (responses: "yes" or "no").

A community-level social capital variable was created by aggregating individual-level data (Kawachi et al., 2008). Rates of subjects reporting mistrust and non-volunteering in each 79 local district were used as cognitive and structural community-level social capital variables.

Covariates

Several previous studies that have assessed the association between income inequality and self-rated health used only socio-demographic covariates (Ichida et al., 2009; Kim & Kawachi, 2007; Subramanian, Delgado, Jadue, Vega, & Kawachi, 2003). Some studies also adjusted for lifestyle variables, such as smoking (Lopez, 2004; Xi, McDowell, Nair, & Spasoff, 2005, pp. 31e45) and exercise (Xi et al., 2005). Smoking is an important lifestyle variable because it is a common risk factor for poor dental status and poor self-rated health. Sex, age group (65e69 years, 70e74, 75e79, 80e84 and 85 years or older), marital status (married, separated/divorced, never married), educational attainment (years, <6, 6e9, 10e12 or ≥13), smoking status (never, ever, or current), individual- and community-level equivalent income were used as covariates in this study. Calculation of equivalent income took into account household income and number of household members. The income question had 14 categories, and the midpoints were set as household income in each category. We adjusted household income for household size, dividing the income by the square root of the number of people in that household. As the association between health and income has been suggested to be non-linear (Kawachi, 2000; Rodgers, 1979), the individual-level equivalent income was used as a categorical variable (ten thousand Yen, <150, 150e199, 200e249, 250e299, 300e349, 350e399, 400e449, 450e499, ≥500). The mean individual-level equivalent income in each of the 79 local districts determined the community-level income variable.

Analysis

In the data set, individuals (first-level) were nested in local districts (second-level). The analysis framework anticipated that the individual health outcomes would be partly dependent on the districts where individuals live. We used multi-level models to estimate the variation of the outcomes between districts (random effects) and the effect of community-level variables on the outcomes with adjustment for individual compositional characteristics (fixed-effects). Since the outcomes were dichotomous, multi-level logistic regression models with random intercepts and fixed slopes were applied using the MLwiN 2.20 software package (Centre for Multilevel Modelling, University of Bristol, UK). Self-rated health and number of remaining teeth were used as the outcome variables. Odds ratios were calculated for: a) having poor self-rated health and b) 19 or less teeth. Odds ratios were calculated for 0.1 point difference in the community-level mistrust and non-volunteering rates. We also calculated odds ratios associated with 0.1 point difference in Gini coefficient, while the odds ratios calculated for community-level equivalent income referred to 100 thousand-yen difference.

Univariate multi-level odds ratios were calculated to show crude associations of all variables with each outcome. To test our hypothesis, we used the following models. To distinguish the individual-level compositional effect and community-level contextual effect of social capital on outcomes, individual- and community-level social capital variables were separately added into the models. Model 1 was used to assess the association between outcomes and income inequality (Gini coefficient), adjusted for sex, age, marital status, educational attainment, smoking status, individual- and community-level income. In Model 2, to check the attenuation of the association between Gini and outcome by community-level structural social capital, we added community-level volunteering. In Model 3, to check on the attenuation of the association between Gini and outcome by both individual- and community-level structural social capital, individual-level volunteering was added to Model 2. Model 4 was similar to Model 1 but additionally adjusted for community-level trust to assess whether community-level cognitive social capital attenuates the association between outcomes and income inequality. In Model 5, to check the attenuation of the association between Gini and outcome by both individual- and community-level cognitive social capital, individual-level trust was added to the Model 4. In Models 3 and 5, individual-level volunteering and trust were centered around the local district mean to make them orthogonal, thus addressing the issue of collinearity between individual- and community-level social capital indicators (Kawachi et al., 2008).

Parameters were estimated using Markov Chain Monte Carlo methods with chain length 50,000 burn in 5000. We calculated median odds ratios (MORs) to evaluate the community-level variances in different outcomes (Merlo et al., 2006). If the median odds ratio is 1, there is no variation between communities. If there is a substantial community-level variation, the median odds ratio will be large. The measure is directly comparable with fixed-effects odds ratios. The Deviance Information Criterion was used to compare the goodness-of-fit of each model.

Results

Table 1 shows the demographic distribution and univariate association between self-rated health, number of remaining teeth and covariates. Communities with higher income inequality had increased risks of poor self-rated health (OR = 1.39) and poor dental status (OR = 1.86). Community level mistrust was not significantly associated with self-rated health and dental status. Communities with higher levels of non-volunteering had increased risks of poor self-rated health (OR = 1.57) and poor dental status (OR = 1.42). Individual subjects reporting mistrust and who were non-volunteers had relatively poor self-rated health (OR = 1.94 and OR = 1.95, respectively) and poor dental status (OR = 1.52 and OR = 1.58, respectively).

There were variations in self-rated health and dental status between communities in the intercept-only models (community-level variance (SE); 0.018 (0.017) for self-rated health and 0.037 (0.026) for dental status), which showed pure community-level variations in the outcomes. Variation of dental status between communities was larger than that for self-rated health (MOR = 1.20, 95% CI = 1.05e1.35 and MOR = 1.14, 95% CI = 1.03e1.27, respectively). These figures indicated that if a person moved to another area with a higher probability of poor dental status, their median risk of poor dental status would increase by 1.20 times; similarly, if a person moved to an area with a higher probability of poor self-rated health, their median risk of poor self-rated health would increase by 1.14 times.

Variations in dental status between communities were substantially explained by the Gini coefficient. When Gini

Table 1
Univariate associations between self-rated health, dental status and explanatory variables: The Aichi Gerontological Evaluation Study, Aichi, Japan, 2003 (N = 3451).

		N	Self-rated health			Dental health		
			Good (%)	Poor (%)	Univariatee multilevel odds ratio	20 or more (%)	19 or less (%)	Univariatee multilevel odds ratio
Categorical variables								
Sex	Male	1861	70.4	29.6	Reference	34.0	66.0	Reference
	Female	1590	73.5	26.5	0.86 (0.74 e 0.99)	33.1	66.9	1.03 (0.90 e 1.19)
Age	65e 69	1370	78.2	21.8	Reference	45.4	54.6	Reference
	70e 74	1042	71.7	28.3	1.42 (1.17 e 1.71)	33.1	66.9	1.69 (1.43 e 2.00)
	75e 79	660	61.7	38.3	2.23 (1.83 e 2.74)	21.5	78.5	3.06 (2.47 e 3.79)
	80e 84	252	64.7	35.3	1.97 (1.47 e 2.63)	16.7	83.3	4.21 (3.00 e 6.03)
	≥85	127	70.9	29.1	1.46 (0.97 e 2.19)	6.3	93.7	13.14 (6.52 e 30.2)
Marital status	Married	2678	71.5	28.5	Reference	35.5	64.5	Reference
	Separated/ divorced	723	73.0	27.0	0.93 (0.77 e 1.12)	26.1	73.9	1.56 (1.30 e 1.88)
	Never married	50	68.0	32.0	1.17 (0.63 e 2.12)	38.0	62.0	0.89 (0.50 e 1.63)
Educational attainment (years)	<6	122	60.7	39.3	2.28 (1.47 e 3.55)	14.8	85.2	4.15 (2.46 e 7.29)
	6e 9	1744	68.6	31.4	1.60 (1.25 e 2.09)	30.3	69.7	1.61 (1.29 e 2.01)
	10e 12	1162	75.7	24.3	1.12 (0.86 e 1.47)	37.7	62.3	1.17 (0.92 e 1.48)
	≥13	423	77.5	22.5	Reference	41.4	58.6	Reference
Individual-level equivalent income (ten thousand Yen)	<150	774	68.1	31.9	1.88 (1.27 e 2.88)	26.2	73.8	1.50 (1.04 e 2.13)
	150e 199	605	69.1	30.9	1.79 (1.20 e 2.76)	32.6	67.4	1.11 (0.77 e 1.60)
	200e 249	776	71.9	28.1	1.57 (1.05 e 2.41)	36.7	63.3	0.92 (0.64 e 1.31)
	250e 299	226	76.5	23.5	1.21 (0.75 e 1.97)	33.2	66.8	1.08 (0.70 e 1.65)
	300e 349	360	71.4	28.6	1.60 (1.03 e 2.55)	37.2	62.8	0.91 (0.61 e 1.34)
	350e 399	283	75.3	24.7	1.32 (0.83 e 2.13)	35.0	65.0	1.00 (0.66 e 1.51)
	400e 449	163	73.0	27.0	1.48 (0.88 e 2.50)	38.7	61.3	0.85 (0.54 e 1.34)
	450e 499	101	82.2	17.8	0.85 (0.44 e 1.60)	45.5	54.5	0.63 (0.38 e 1.05)
	≥500	163	79.8	20.2	Reference	35.0	65.0	Reference
Smoking status	Non	1971	73.3	26.7	Reference	36.2	63.8	Reference
	Past	969	68.2	31.8	1.29 (1.09 e 1.52)	31.8	68.2	1.22 (1.04 e 1.44)
	Current	511	72.8	27.2	1.03 (0.83 e 1.28)	27.0	73.0	1.54 (1.24 e 1.93)
Individual trust	Trust	3193	72.9	27.1	Reference	34.2	65.8	Reference
	Mistrust	258	58.1	41.9	1.94 (1.48 e 2.52)	25.6	74.4	1.52 (1.14 e 2.03)
Individual volunteering	Yes	389	82.3	17.7	Reference	43.2	56.8	Reference
	No	3062	70.5	29.5	1.95 (1.50 e 2.57)	32.4	67.6	1.58 (1.29 e 1.95)
Continuous variables (mean (SD))								
Community-level equivalent income (ten thousand Yen)[a]			244.8 (21.1)	243.2 (21.7)	0.96 (0.93 e 1.00)	246.4 (20.6)	243.3 (21.5)	0.93 (0.90 e 0.96)
Gini coefficient[b]			0.300 (0.030)	0.304 (0.035)	1.39 (1.10 e 1.70)	0.297 (0.029)	0.303 (0.033)	1.86 (1.46 e 2.29)
Rate of mistrust[b]			0.095 (0.022)	0.096 (0.022)	1.20 (0.83 e 1.69)	0.095 (0.022)	0.096 (0.022)	1.25 (0.86 e 1.79)
Rate of none volunteering[b]			0.896 (0.028)	0.899 (0.028)	1.57 (1.27 e 2.00)	0.895 (0.027)	0.898 (0.028)	1.42 (1.13 e 1.82)

[a] Odds ratios for 100 unit difference in community-level equivalent income are shown.
[b] Odds ratios for 0.1 unit difference in Gini coefficient, rate of mistrust and rate of non-volunteering are shown.

coefficient was added into the intercept-only model the median odds ratio for number of remaining teeth was reduced by 50% (MOR = 1.10, 95%CI = 1.02e1.22). On the other hand, the median odds ratio associated with self-rated health did not substantially change (MOR = 1.12, 95%CI = 1.03e1.23).

Table 2 shows the multivariate association with self-rated health and explanatory variables. After adjusting for sex, age, marital status, educational attainment, individual- and community-level equivalent income and smoking status, the multi-level odds ratio of Gini coefficient for poor self-rated health attenuated by 35.9% (from 1.39 to 1.25) and became non-significant (Model 1). After community-level non-volunteering was added to the model (Model 2), the odds ratio of income inequality was attenuated by 16.0% (OR = 1.21). When individual-level volunteering was also controlled for, the odds ratio of income inequality remained unchanged (Model 3). Individual- and community-level mistrust did not attenuate the association between income inequality and self-rated health (Models 4 and 5).

Table 3 shows the multivariate association for dental status and predictors. After adjusting for all covariates, higher income inequality was still associated with poor dental status (OR = 1.54). Individual- and community-level non-volunteering and mistrust did not substantially reduce the odds ratio of Gini coefficient, Deviance Information Criterion and median odds ratio (Models 2e5).

Discussion

This study showed that income inequality in communities was significantly associated with poor self-rated health (OR = 1.39) and poor dental status (OR = 1.86) of older Japanese. Income inequality was a major contributor to the variation in dental status between communities (50% reduction of MOR), but not to self-rated health. The association between income inequality and dental status remained significant when social capital variables were included in the analyses. On the other hand, the association between income inequality and self-rated health was attenuated when community-level structural social capital was included in the model.

Living in an area with 0.1 point higher Gini coefficient was associated with a 39% higher risk of having poor self-rated health and with 86% higher risk of having 19 or fewer teeth. For dental status, the association was still significant, even after adjusting for individual equivalent income, community mean equivalent income, sex, age, marital status, educational attainment and smoking status. An important point to consider is that these contextual effects affect not only poor people but also residents in communities with rich people. These results were consistent with previous studies. A meta-analysis showed that the overall odds ratio for poor self-rated health was 1.04 (95%CI = 1.02e1.06) per 0.05 unit increase in Gini coefficient (Kondo, Sembajwe et al., 2009). In our results, the adjusted odds ratio for poor self-rated

Table 2
Multilevel odds ratios (95% CI) for poor self-rated health among older Japanese: The Aichi Gerontological Evaluation Study, Aichi, Japan, 2003 (N = 3451).

		Model 1	Model 2	Model 3	Model 4	Model 5
Fixed effects						
Individual level variables						
Sex	Female	0.94	0.93	0.93	0.94	0.93
		(0.76 e 1.17)	(0.75 e 1.15)	(0.74 e 1.16)	(0.75 e 1.16)	(0.75 e 1.17)
Age	70e 74	1.39	1.39	1.37	1.39	1.37
		(1.15 e 1.68)	(1.15 e 1.67)	(1.13 e 1.66)	(1.15 e 1.68)	(1.13 e 1.65)
	75e 79	2.26	2.25	2.20	2.26	2.23
		(1.83 e 2.81)	(1.82 e 2.79)	(1.78 e 2.73)	(1.83 e 2.79)	(1.81 e 2.74)
	80e 84	1.92	1.91	1.85	1.92	1.90
		(1.42 e 2.60)	(1.41 e 2.60)	(1.37 e 2.50)	(1.42 e 2.59)	(1.39 e 2.58)
	≥85	1.43	1.42	1.36	1.43	1.40
		(0.92 e 2.21)	(0.91 e 2.17)	(0.87 e 2.12)	(0.91 e 2.20)	(0.90 e 2.17)
Marital status	Separated/divorced	0.82	0.82	0.82	0.82	0.83
		(0.66 e 1.01)	(0.67 e 1.02)	(0.66 e 1.01)	(0.66 e 1.01)	(0.67 e 1.03)
	Never married	1.10	1.10	1.07	1.10	1.10
		(0.57 e 2.03)	(0.58 e 2.04)	(0.56 e 1.99)	(0.58 e 2.05)	(0.58 e 2.02)
Educational attainment (years)	<6	2.01	2.00	1.91	2.00	1.93
		(1.25 e 3.22)	(1.25 e 3.20)	(1.19 e 3.07)	(1.27 e 3.19)	(1.21 e 3.13)
	6e 9	1.48	1.47	1.41	1.47	1.46
		(1.13 e 1.94)	(1.14 e 1.91)	(1.08 e 1.84)	(1.13 e 1.94)	(1.13 e 1.94)
	10e 12	1.08	1.07	1.05	1.07	1.07
		(0.81 e 1.43)	(0.82 e 1.41)	(0.79 e 1.38)	(0.81 e 1.43)	(0.82 e 1.43)
Individuale level equivalent income	<150	1.59	1.58	1.52	1.55	1.55
		(1.04 e 2.50)	(1.05 e 2.40)	(1.00 e 2.35)	(1.03 e 2.39)	(1.00 e 2.43)
	150e 199	1.62	1.61	1.56	1.59	1.60
		(1.05 e 2.58)	(1.07 e 2.46)	(1.01 e 2.43)	(1.06 e 2.44)	(1.03 e 2.54)
	200e 249	1.41	1.40	1.35	1.38	1.41
		(0.93 e 2.21)	(0.93 e 2.12)	(0.89 e 2.08)	(0.92 e 2.13)	(0.90 e 2.23)
	250e 299	1.17	1.17	1.12	1.15	1.17
		(0.71 e 1.95)	(0.72 e 1.91)	(0.68 e 1.85)	(0.70 e 1.90)	(0.70 e 1.95)
	300e 349	1.47	1.46	1.41	1.43	1.47
		(0.93 e 2.34)	(0.94 e 2.30)	(0.89 e 2.24)	(0.93 e 2.27)	(0.92 e 2.38)
	350e 399	1.22	1.22	1.19	1.19	1.22
		(0.75 e 2.01)	(0.77 e 1.96)	(0.74 e 1.96)	(0.75 e 1.92)	(0.75 e 2.02)
	400e 449	1.27	1.25	1.24	1.23	1.26
		(0.74 e 2.17)	(0.74 e 2.11)	(0.73 e 2.13)	(0.74 e 2.09)	(0.73 e 2.18)
	450e 499	0.90	0.89	0.88	0.88	0.90
		(0.46 e 1.73)	(0.45 e 1.69)	(0.45 e 1.71)	(0.46 e 1.68)	(0.46 e 1.73)
Smoking status	Past	1.23	1.21	1.21	1.23	1.25
		(0.99 e 1.54)	(0.97 e 1.53)	(0.96 e 1.52)	(0.98 e 1.54)	(1.00 e 1.57)
	Current	1.02	1.00	0.98	1.01	1.03
		(0.78 e 1.32)	(0.76 e 1.31)	(0.75 e 1.29)	(0.77 e 1.31)	(0.79 e 1.35)
Mistrust						1.80
						(1.37 e 2.37)
No-volunteering				1.62		
				(1.23 e 2.14)		
Community level variables						
Gini coefficient[a]		1.25	1.21	1.21	1.32	1.36
		(0.98 e 1.55)	(0.92 e 1.66)	(0.92 e 1.57)	(1.00 e 1.79)	(1.00 e 1.89)
Rate of mistrust[a]					0.84	0.81
					(0.54 e 1.28)	(0.53 e 1.24)
Rate of non volunteer[a]			1.08	1.16		
			(0.75 e 1.34)	(0.85 e 1.56)		
Community-level equivalent income[b]		0.99	0.99	0.99	0.99	0.99
		(0.96 e 1.03)	(0.95 e 1.03)	(0.95 e 1.03)	(0.96 e 1.03)	(0.95 e 1.03)
Random effects						
Community-level variance (SE)		0.020	0.021	0.021	0.020	0.022
		(0.017)	(0.019)	(0.018)	(0.017)	(0.019)
Median odds ratio (MOR)		1.14	1.15	1.15	1.15	1.15
		(1.03 e 1.27)	(1.03 e 1.29)	(1.03 e 1.28)	(1.03 e 1.27)	(1.03 e 1.29)
DIC		4022.3	4022.9	4013.2	4023.3	4009.0

[a] Odds ratios for 0.1 unit difference in Gini coefficient, rate of mistrust and rate of non-volunteering are shown.
[b] Odds ratios for 100 unit difference in community-level equivalent income are shown.

health was 1.12 (95% CI = 0.99e 1.24) per 0.05 unit increase in Gini coefficient. Celeste et al. (2009) showed that the adjusted multilevel odds ratio of 0.1 unit increase in Gini coefficient for having one or more missing teeth among 15e 19 year old Brazilians was 1.19 (95% CI = 1.05e 1.35). The present study on individual subjects showed similar results to previous ecological studies in wealthy countries. Income inequalities had a stronger association with periodontal disease (Sabbah, Sheiham, & Bernabe, 2010) and dental caries (Bernabe & Hobdell, 2010; Bernabe, Sheiham, & Sabbah, 2009) than absolute income.

Previous studies showed that contextual social capital attenuated the association between health-related quality of life and income inequality (Kim & Kawachi, 2007). Subramanian et al. (2001) found that self-rated health was significantly associated with contextual social capital but not income inequality. In the present study, associations between income inequality and self-rated health

Table 3
Multilevel odds ratios (95% CI) for poor dental status among older Japanese: The Aichi Gerontological Evaluation Study, Aichi, Japan, 2003 (N = 3451).

		Model 1	Model 2	Model 3	Model 4	Model 5
Fixed effects						
Individual level variables						
Sex	Female	1.41 (1.14 e 1.75)	1.41 (1.14 e 1.74)	1.41 (1.14 e 1.75)	1.41 (1.15 e 1.75)	1.41 (1.14 e 1.74)
Age	70e 74	1.69 (1.41 e 2.01)	1.70 (1.43 e 2.01)	1.68 (1.41 e 2.00)	1.69 (1.42 e 2.01)	1.68 (1.41 e 1.99)
	75e 79	3.19 (2.55 e 4.01)	3.20 (2.56 e 4.00)	3.15 (2.53 e 3.96)	3.20 (2.57 e 4.01)	3.18 (2.54 e 3.98)
	80e 84	4.05 (2.82 e 5.85)	4.05 (2.82 e 5.82)	4.01 (2.81 e 5.83)	4.07 (2.87 e 5.87)	4.07 (2.86 e 5.88)
	≥85	12.72 (6.28 e 29.18)	12.76 (6.35 e 28.82)	12.45 (6.13 e 28.13)	12.75 (6.19 e 28.87)	12.70 (6.21 e 28.49)
Marital status	Separated/divorced	1.05 (0.85 e 1.31)	1.06 (0.86 e 1.31)	1.06 (0.85 e 1.30)	1.06 (0.86 e 1.31)	1.06 (0.86 e 1.32)
	Never married	0.76 (0.41 e 1.42)	0.76 (0.41 e 1.43)	0.75 (0.41 e 1.41)	0.76 (0.41 e 1.42)	0.76 (0.41 e 1.45)
Educational attainment (years):	< 6	1.72 (0.97 e 3.12)	1.77 (1.00 e 3.22)	1.70 (0.95 e 3.08)	1.74 (0.98 e 3.19)	1.69 (0.96 e 3.07)
	6e 9	1.31 (1.03 e 1.67)	1.34 (1.06 e 1.69)	1.30 (1.02 e 1.65)	1.33 (1.04 e 1.69)	1.33 (1.04 e 1.68)
	10e 12	1.05 (0.82 e 1.34)	1.07 (0.84 e 1.36)	1.05 (0.82 e 1.34)	1.06 (0.83 e 1.36)	1.06 (0.82 e 1.35)
Individuale level equivalent income:	< 150	1.25 (0.85 e 1.88)	1.27 (0.85 e 1.88)	1.24 (0.83 e 1.82)	1.27 (0.86 e 1.88)	1.24 (0.83 e 1.81)
	150e 199	1.11 (0.75 e 1.68)	1.13 (0.76 e 1.69)	1.11 (0.74 e 1.63)	1.13 (0.76 e 1.68)	1.10 (0.74 e 1.63)
	200e 249	0.87 (0.60 e 1.29)	0.89 (0.61 e 1.31)	0.87 (0.59 e 1.25)	0.89 (0.60 e 1.29)	0.87 (0.59 e 1.26)
	250e 299	1.09 (0.69 e 1.72)	1.10 (0.70 e 1.73)	1.08 (0.68 e 1.69)	1.11 (0.70 e 1.74)	1.09 (0.69 e 1.70)
	300e 349	0.87 (0.58 e 1.33)	0.89 (0.58 e 1.36)	0.87 (0.57 e 1.29)	0.89 (0.58 e 1.34)	0.87 (0.58 e 1.31)
	350e 399	0.98 (0.64 e 1.52)	0.99 (0.65 e 1.54)	0.98 (0.64 e 1.50)	1.00 (0.65 e 1.53)	0.98 (0.64 e 1.50)
	400e 449	0.67 (0.41 e 1.10)	0.67 (0.42 e 1.09)	0.67 (0.41 e 1.08)	0.68 (0.42 e 1.10)	0.67 (0.42 e 1.09)
	450e 499	0.68 (0.40 e 1.17)	0.68 (0.40 e 1.17)	0.68 (0.40 e 1.17)	0.69 (0.40 e 1.18)	0.68 (0.40 e 1.16)
Smoking status:	Past	1.66 (1.33 e 2.07)	1.66 (1.33 e 2.07)	1.65 (1.33 e 2.06)	1.68 (1.34 e 2.09)	1.67 (1.34 e 2.09)
	Current	2.25 (1.73 e 2.95)	2.25 (1.74 e 2.93)	2.23 (1.72 e 2.91)	2.26 (1.74 e 2.94)	2.26 (1.73 e 2.95)
Mistrust						1.41 (1.04 e 1.93)
No-volunteering				1.21 (0.96 e 1.51)		
Community level variables						
Gini coefficient[a]		1.54 (1.14 e 2.14)	1.56 (1.15 e 2.07)	1.54 (1.17 e 1.96)	1.71 (1.16 e 2.21)	1.67 (1.26 e 2.29)
Rate of mistrust[a]					0.76 (0.51 e 1.13)	0.74 (0.48 e 1.17)
Rate of non volunteer[a]			1.39 (1.13 e 1.80)	1.07 (0.84 e 1.38)		
Community-level equivalent income[b]		0.97 (0.93 e 1.02)	0.99 (0.95 e 1.03)	0.98 (0.94 e 1.01)	0.97 (0.93 e 1.01)	0.97 (0.92 e 1.03)
Random effects						
Community-level variance (SE)		0.010 (0.012)	0.012 (0.013)	0.009 (0.011)	0.013 (0.014)	0.011 (0.012)
Median odds ratio (MOR)		1.10 (1.02 e 1.22)	1.11 (1.03 e 1.23)	1.10 (1.02 e 1.21)	1.11 (1.03 e 1.24)	1.11 (1.02 e 1.23)
DIC		4122.8	4124.3	4121.3	4122.6	4120.0

[a] Odds ratios for 0.1 unit difference in Gini coefficient, rate of mistrust and rate of non-volunteering are shown.
[b] Odds ratios for 100 unit difference in community-level equivalent income are shown.

were attenuated by the contextual structural social capital variable. The previous studies used only community-level variables as social capital estimates and did not consider individual-level social capital. When considering only community-level social capital (univariate analysis in Table 1), our results were similar to those in previous studies, namely, a significant association of contextual social capital with self-rated health. A dental study in Brazil used homicide rate as a proxy for social capital. That did not considerably reduce the association between income inequality and dental health (Celeste et al., 2009). Similarly, in the present study, both individual- and community-level social capital did not attenuate the effects of income inequality on dental status. Multicollinearity between Gini coefficient and community-level trust was suggested in the present study (Tables 2 and 3, model 4 and 5). Another AGES Project study in some of the same areas and subjects as for our study, indicated similar multicollinearity (Ichida et al., 2009).

There are several plausible pathways linking social capital to health outcomes (Kawachi & Berkman, 2000). First, social capital may affect individual health by influencing health-related behaviors through promotion of more rapid diffusion of health information and by exerting social control over health compromising behaviors. Second, social capital may affect health by improving access to local service and amenities. Third, community social capital may promote mental health by reducing psychological distress. Fourth, communities with higher social capital produce more egalitarian patterns of political participation resulting in the implementation of policies that ensure the security of all their members.

Income inequality had a stronger association with dental status than with self-rated health. On the other hand, social capital was more strongly associated with self-rated health than with dental status. It is unclear why dental status was strongly affected by income inequality and weakly affected by social capital. The effects of social environment over the life-course are a possible explanation of the present results. The number of remaining teeth is a reflection of lifetime exposure to determinants, particularly in early life, and cannot be reduced by positive changes in circumstances later in life. In fact, our results showed that the effect of educational attainment was stronger for dental status than for self-rated health. More educated people have better health (Grossman, 1972; Thrane, 2006). Usually, people receive education when they are young. Experience of education in younger life could affects dental status throughout the life-course. Similarly, dental status among older people reflects lifetime exposure to income inequality. On the other hand, self-rated health reflects current health status (Solomon et al., 2010) and could be affected by current social capital. These probable differences in exposures over the life-course may partially explain our results. Because this study used only cross-sectional data, further studies using longitudinal data are needed to determine effects of the social environment on dental health across the life-course. Another explanation is that dental status could be affected more by the stress pathway caused by social comparisons than by a social capital pathway. Psychological stress affects periodontal disease (Boyapati & Wang, 2007), the second highest cause of tooth loss in Japan (Aida et al., 2006).

There were some limitations to the study. First, it is cross-sectional, therefore reverse causation cannot be ruled out. Longitudinal studies are needed to measure the effects of income inequality and social capital over the life-course. Second, there is a remote possibility that immigration affected the results. However, analyses were repeated by adding years of residence into the models and the results were not substantially affected (data not shown). In addition, the ethnicity of the respondents was not recorded because almost all were considered to be Japanese. In 2005, only 1.2% of people living in Japan were of non-Japanese ethnicity. Only 6.8% of those were 65 years or older. Third, the measurements used were based on a self-administered questionnaire, and as such they are subject to response bias by social desirability or social approval (Hebert, Clemow, Pbert, Ockene, & Ockene, 1995). However, previous studies showed that self-rated health predicted future health outcomes (Idler & Benyamini, 1997; Moller et al., 1996) even among older Japanese (Ishizaki, Kai, & Imanaka, 2006). Although self-reported estimates of the number of remaining teeth accurately reflected clinical dental status (Pitiphat, Garcia, Douglass, & Joshipura, 2002), validation among Japanese elderly is needed. In addition, while a recognized measure of social capital was used, different measures of income inequality may show different results. A study that compared six income inequality measurements showed that measures were highly correlated and the association on US state-level mortality was also highly correlated (Kawachi & Kennedy, 1997). This study has also strengths. Different types of health outcomes, namely, dental status and self-rated health, were used. In addition, we employed different levels and types of social capital indices with appropriate statistical models. As a result, we found different associations of income inequality and social capital on self-rated health and dental status.

In conclusion, among older Japanese, community-level structural social capital (volunteering) attenuated the association between income inequality and poor self-rated health, whereas social capital had no effect on the association between income inequality and poor dental status.

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特集 住民の底力(ソーシャル・キャピタル)を支援する

公衆衛生における地域の力(ソーシャル・キャピタル)の醸成支援

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ソーシャル・キャピタルが注目を浴びるなか，公衆衛生活動としてその醸成を支援することが期待されている。その理由と公衆衛生専門職が果たす役割について述べていただいた。

わが国の地域保健を中核とする公衆衛生分野でも「ソーシャル・キャピタル」が注目を浴びるようになった。「健康日本21(第2次)」や「地域保健対策の推進に関する基本的な指針」などにその言葉が登場し，その活用が謳われたからである。

本稿では，ソーシャル・キャピタルがなぜ着目されるようになったのか，ソーシャル・キャピタルとは何か，地域保健においてどのように活用しうるのか，活用するために公衆衛生専門職が果たすべき役割は何か，などについて考えたい。

なぜ着目されるようになったのか

「健康日本21(第2次)」で，図1[1]に示すように，「健康格差の縮小」や「社会環境の質の向上」が謳われるようになった。その背景には，非正規雇用の増加など，雇用基盤の変化，孤立化・無縁社会化する家族形態や地域の変化などがある。一方，WHOや多くの研究によって，地域，職業，経済力などによる健康状態の差(健康格差)や，その要因となる生活習慣の差が報告されている(表1)[2]。社会経済的に不利な層，保健医療サービスへのアクセスが悪い層などへのアプローチは十分行われてきたとは言えず，健康格差が今後深刻化することが危惧される。底辺層を底上げすることなしに，国民全体の健康水準も上がらないことが明らかになってきたのである。

こうした課題は，個人への対策だけでは解決できない。また，社会環境と健康(行動)との関連が徐々に実証されるにつれ，健康に優しい地域社会づくりに取り組むことの重要性が認識されるようになった。そして今後整備すべき社会環境の1つの要素として着目されたのが，ソーシャル・キャピタルである。それを活用することで，より多くの人が参加でき，健康づくりの資源にアクセスできる社会づくりをめざすという戦略である[1]。

ソーシャル・キャピタルとは何か

ソーシャル・キャピタルは，政治学，社会学，経営学，国際開発学，地域福祉学など，学際的に研究されてきた。そのため，社会的サポ

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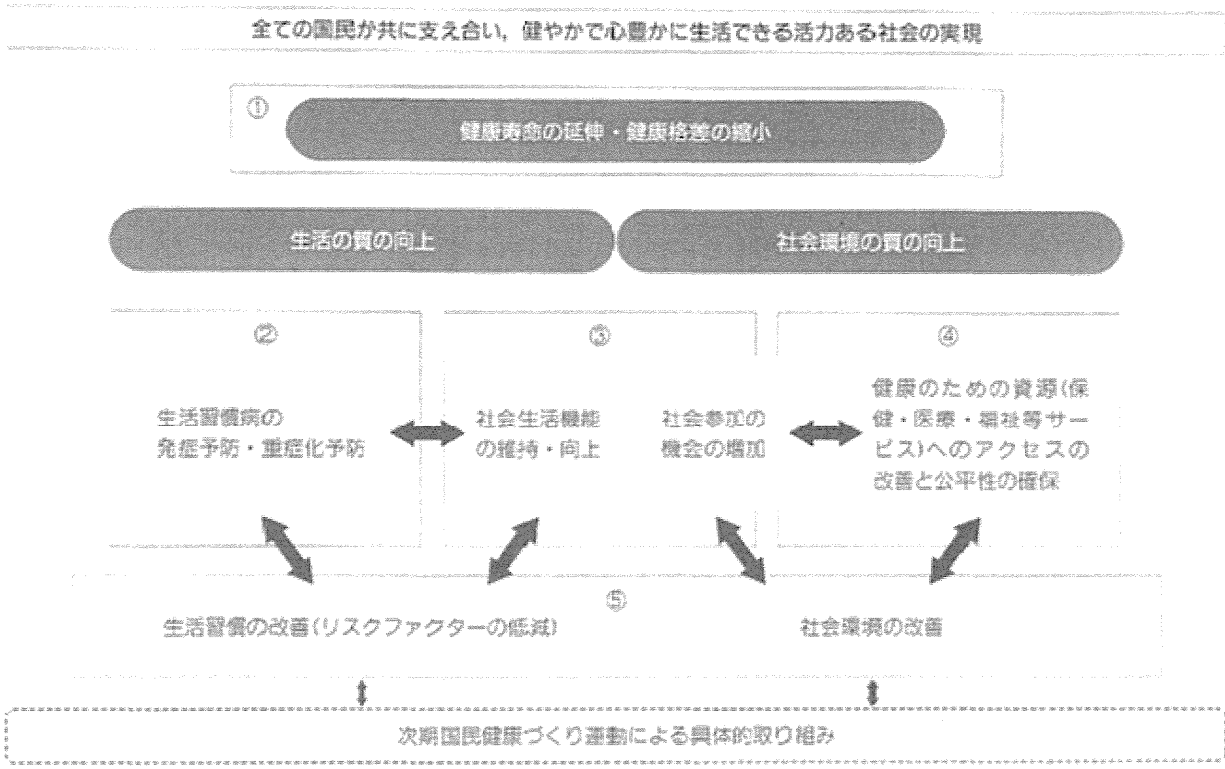
図1　健康日本21(第2次)の概念図[3]



次期国民健康づくり運動プラン策定専門委員会：健康日本21(第2次)の推進に関する参考資料より
http://www.mhlw.go.jp/stf/shingi/2r9852000002ddhl-att/2r9852000002ddxn.pdf

表1　健康格差が見られる主な疾患・健康状態

・子どもの問題行動	・うつ
・メタボリックシンドローム	・認知症
・がん	・転倒・骨折
・冠動脈疾患	・高齢者の低栄養
・脳卒中	・歯科疾患
・慢性腎臓病	・ライフコース疫学
・糖尿病	・ソーシャル・キャピタルと健康
・自殺	・医療アクセス

近藤克則編：健康の社会的決定要因―疾患・状態別「健康格差」レビュー，日本公衆衛生協会，2013の目次より抜粋

ートなど個人レベルに着目するものや地域や組織レベルの特徴に着目するものなど，その定義にもいろいろある。公衆衛生に関わる領域では，『人々の協調行動を活発にすることによって，社会の効率性を高めることのできる，「信頼」「規範」「ネットワーク」といった社会組織の特徴』[3]という，社会組織や地域レベルに着目したパットナムの定義が用いられることが多い。「助け合い」「つながり」などから生み出される，「住民の底力」や「地域の力」「絆の力」などと表現されているものである。

人々のつながりや絆にもいろいろな側面があり，つながりの多さという量的な側面だけでも3つはある。第1に，出会ったり話したりする「社会的ネットワーク」，第2に，ネットワークを提供してくれる場としての「(地域)組織への参加」，第3に，実際に困ったときに助けてもらえるような「社会的サポート」である。

つながりの質的な側面に着目すると，地域組織で言えば，趣味・スポーツの会など，対等で平等な関係が中心の水平的な組織・関係もあれば，上下関係が明らかで対等とは言えない垂直的な組織・関係もある。パットナムは垂直的組織の例としてカソリック教会をあげている[3]。さらに利害を共有する地縁や血縁，排他的な組

図2 転倒率とスポーツ組織参加率(小学校区別)

【対象】6保険者(9市町村)の要介護認定を受けていない人への郵送調査に回答した2万9072人(回収率62.4%)のうち、65~74歳の者(1万6713人)に限定

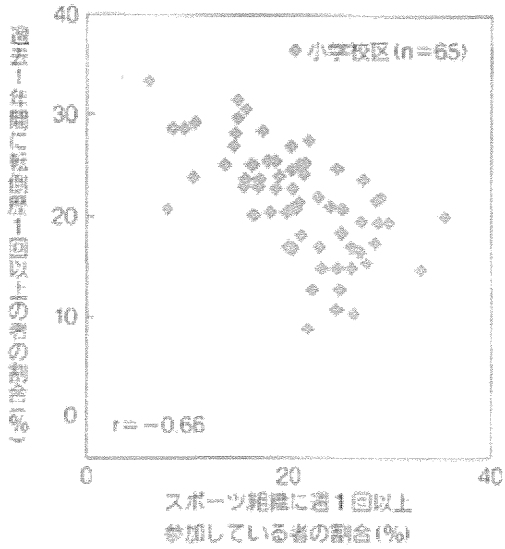
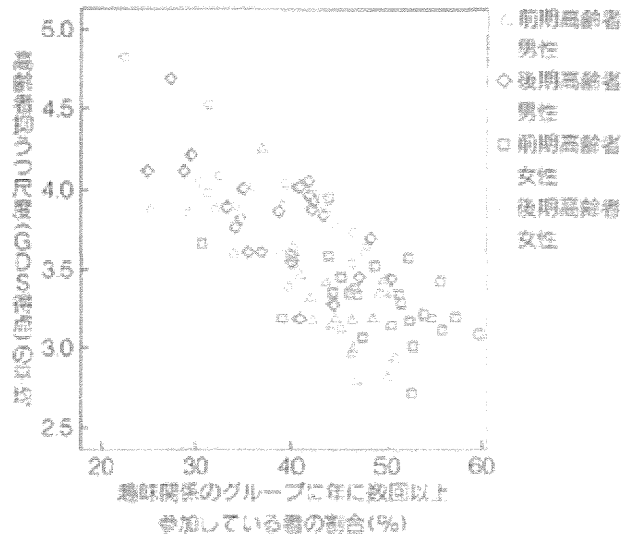


図3 メンタルヘルスと趣味関係のグループへの参加割合

【対象】JAGESの参加25自治体



織などのように内向きで閉じた「結束型」の関係か，それとも利害の異なる異質な人ともつながり外に開かれた「橋渡し型」の関係か，などである。これらの下位分類は確立したものではないが，そのどれかによって健康との関連の強さが異なるのではないかという仮説が提示され，検証作業が進められている。

ソーシャル・キャピタルと健康

スポーツ組織と転倒，趣味の会とメンタルヘルスの関係

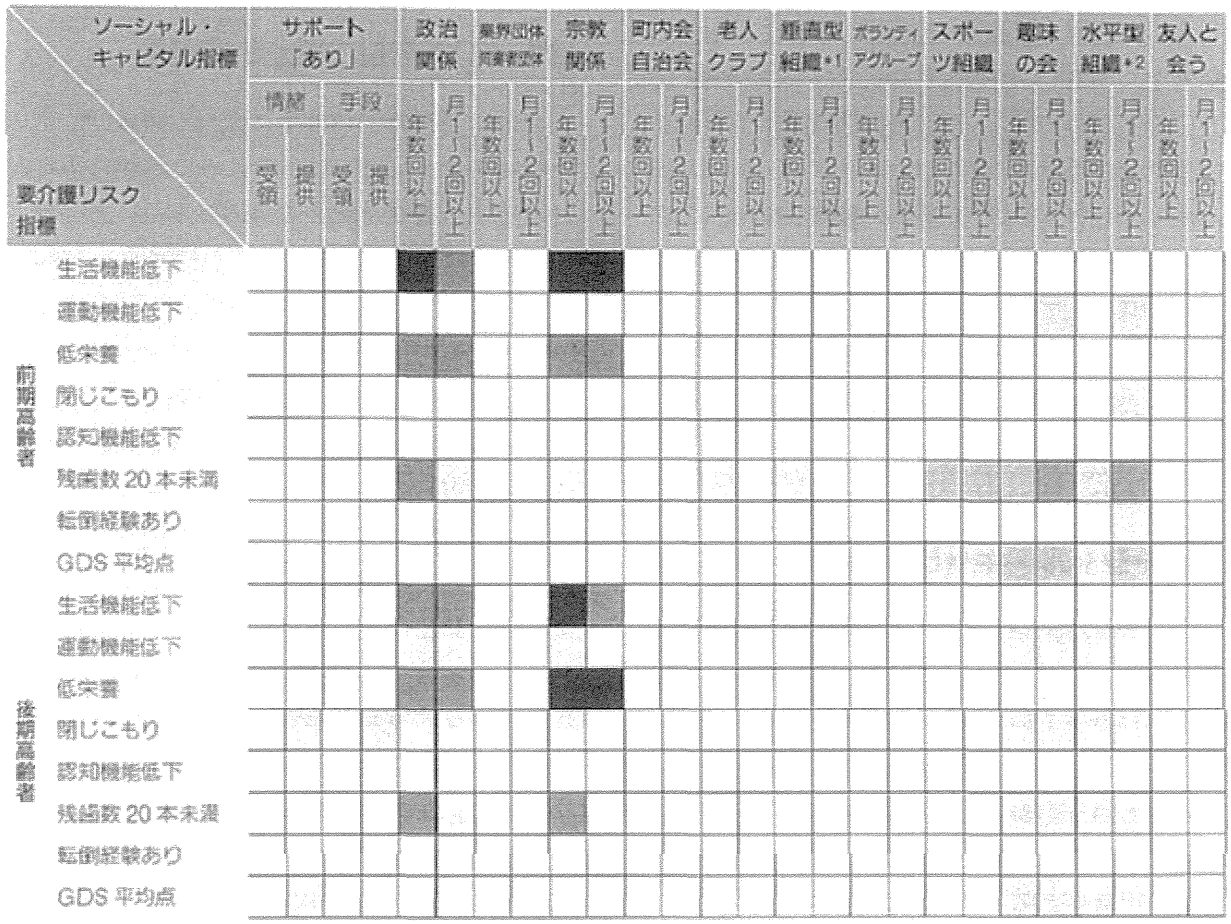
これらのうち，地域組織への参加と健康指標との関連を図2，3に示した。どちらも，筆者が関わっているJAGES(Japan Gerontological Evaluation Study，日本老年学的評価研究)プロジェクトのデータである[4,5]。2010~2011年度に全国31自治体にご協力いただき，要介護認定を受けていない高齢者約11万人の回答を得た(回収率67%)。両図は，そのデータの一部を用いた分析結果である。

65~74歳の前期高齢者1万6713人に限定し，過去1年間の転倒率を尋ね，65の小学校区単位で集計したところ，校区間に11.8%~33.9%の差を認めた。実に約3倍も「転びやすい小学校区」があるのである。それの関連要因を探索したところ，図2の横軸に示す「スポーツ組織に週に1回以上参加している者の割合」との相関(r=0.66)を認めた[6]。

自治体が行っている転倒予防教室も多くは週に1回である。それに効果があるのなら，週に1回以上スポーツ組織に参加している人が1割未満である校区に比べ，2割を超えるほど転倒経験者が少なくなるというのはうなずける。

スポーツ組織に参加したい個人がいたとしても，その人が住んでいる地域にスポーツ組織がなければ参加できない。つまり，参加率が高い校区というのは，「スポーツへの関心が高い」個人の特徴という側面だけでなく，「スポーツ組織という資源が多く参加しやすい」という地域の特徴，ソーシャル・キャピタルでもある。そして，それが豊かな校区では，転倒が少ないのである。

表2　ソーシャル・キャピタル指標と要介護リスク指標の相関(校区レベル)



●健康によい関連($p<0.05$)
■ $r \geqq 0.5$　▣ $r \geqq 0.4$　□ $r \geqq 0.3$　□ $r < 0.3$　□ n.s.($p \geqq 0.05$)
●健康に悪い関連($p<0.05$)
■ $r \geqq 0.5$　▣ $r \geqq 0.4$　□ $r \geqq 0.3$　□ $r < 0.3$　□ n.s.($p \geqq 0.05$)
*1：政治関係，業界・同業者団体，宗教関係，町内会・自治会，老人クラブの5つの組織
*2：ボランティアグループ，スポーツ組織，趣味の会の3つの組織

図3[3]には，趣味関係のグループへの参加割合と高齢者抑うつ尺度(GDS 15項目版)の平均点との関連を，自治体単位で集計して示した。前期高齢者でも後期高齢者でも，男性でも女性でも，趣味の会に参加している高齢者が多い市町村ほど，うつ得点が低くメンタルヘルスがよいことを示唆している。

ソーシャル・キャピタル26指標と高齢者の健康

このような地域組織への参加割合などのソーシャル・キャピタル26指標と，8つの健康指標との間の相関係数を，前期・後期高齢者別に，小学校区レベルで求め，一覧表にしたのが**表2**である。

総じて，水平的と見なせる組織(ボランティア，スポーツ，趣味の会)では，健康に保護的な関連が認められた。一方，垂直的と見なせる組織(政治，宗教，老人クラブなど)では，それらに参加している人が多い校区ほど健康指標が悪いという逆の相関を認めた。地域相関分析なので仮説に留まるが，地域組織への参加ならなんでもよいのではなく，場合によっては義務感や負担など，社会関係にも負の側面がありうる

ことを示唆している。

また，社会的サポート指標については前期高齢者で，あるいは社会的ネットワーク指標(友人と会う頻度)で，一部の健康指標との間には有意な相関係数が得られなかった。ソーシャル・キャピタルのどの側面・要素に着目するのか，どの健康指標を用いるのかで，関連に強弱や負の側面まであることに留意が必要である。

ソーシャル・キャピタルはどのように活用しうるのか

■ソーシャル・キャピタルの新しさ

ソーシャル・キャピタルに対する指摘や批判の1つに，「地域の絆や地域力が重要なことは，昔からわかっていた。ソーシャル・キャピタルという，もの珍しい名前をつけただけで，何が新しいというのか」というものがある。これに対し，筆者は，少なくとも3つの点で，新しさ，有用性があると考えている。

第1に，これまでは異なる学術や実践分野で，異なる言葉で扱われていたものに，共通の名前をつけたことで，互いに学び合えるようになったことである。異なる学術や実践分野の人たちとの間で論議が促進され，互いに概念や理論，方法論を学びあうことで，認識が深まった。

第2に，その成果として，計量的に測定・分析する工夫と努力によって「見える化」が進み，科学的な研究によるエビデンスが蓄積されはじめたことである。ベテランの経験談だけでなく，新人にも「見える」形で論議やモニタリングができる可能性が広がった[7]。

第3に，分野を超えてその重要性が認識され始めたこと，「見える化」が進んだことによって，財政当局や議員など政策形成に関わる者から現場の専門職，NPOなどを含む実践家にまで説明と理解ができるようになり，現実社会への応用が進みやすくなったことである。

■1～3次予防における活用例

では，公衆衛生や健康に関わる領域で，ソーシャル・キャピタルはどのように活用しうるのだろうか。表3をもとに考えてみたい。

表3は，1次から3次予防を横軸に，縦軸に予防医学の2つの戦略(ハイリスクとポピュレーション)を配置したマトリックスである。健康な人を対象にする1次予防の例としては，発病する可能性が高いハイリスク者を対象とする予防接種があり，ソーシャル・キャピタルが豊かなところでは，ネットワークを通じた口コミなどで予防接種率が高まることが期待できる。同じように，図2，3に示したような住民自らによる健康によい取り組みは，その中心となるボランティア・リーダーが多いなどソーシャル・キャピタルが豊かな地域ほど活発だろう。

早期発見・早期治療にあたる2次予防の例としては，たとえば社会的ネットワークや「助け合いが大切」という社会的サポートが豊かなところでは，虐待が危惧されるようなケースの情報が，早い段階で保健・福祉関係者のもとに持ち込まれると考えられる。一方，ハイリスク者を発見する健診で言えば，ソーシャル・キャピタルが豊かな地域ほど，住民が誘い合って健診を受診したり，ボランティアが多ければ健診会場が増設されたり，市民運動などの成果として健診費用の無料化や低額化などの施策があったりして，健診受診率は高くなると期待される。

発症後の重篤化や機能低下などの(3次)予防で言えば，その対象となる人に介護予防教室などの情報を届けてくれたり，会場への送迎をしてくれる人がいたり，機能訓練をできる医療・福祉施設を地域内に増やしたりするうえでもソーシャル・キャピタルが力を発揮しうると考えられる。パットナムはイタリアにおいて，ソーシャル・キャピタルが豊かな地域ほど，家庭医

表３　1~3次予防とポピュレーション戦略とソーシャル・キャピタル

項目	1次予防	2次予防	3次予防
対象とするフェーズ	健康時(発病・発症前)	発病後だが発症前	発症後
内容	健康増進，予防接種	早期発見・早期治療	合併症・重篤化予防，機能低下予防や機能回復，QOL向上
ハイリスク戦略	妊娠の可能性のある女性など，ハイリスク者向け風疹の予防接種など	ハイリスク者の発見	機能低下リスクの高い人を予測して介入
ポピュレーション戦略	ヘルスプロモーション，健康によい環境づくり	マスコミによる健診勧奨，受診無料化	リハビリテーションの重要性を知らせる。受けられる場所を増やす。
ソーシャル・キャピタル活用例	健康情報や健康体操の普及，ボランティア養成，行政への働きかけなど	住民ボランティアや口コミによる健診勧奨や健診会場の増設	医療機関やリハ・介護サービス誘致・開設や拡充を求める運動

予防接種など発病・発症予防を1次予防とし，健康増進を「0次予防」とするものや，3次予防を合併症や重篤化予防に限定し，リハビリなどによる機能回復あるいは終末期の緩和ケアを独立させて「4次予防」とするもの，言葉・恐怖・羞恥の予防を「無限予防」とするものなどがある。

や保育所などが増えたことを紹介している[9]。

このように考えると，ソーシャル・キャピタルは，1次予防におけるポピュレーション戦略との親和性が高く，それが典型的と言える一方で，2次予防でも3次予防でも，そしてハイリスク戦略においても力を発揮しうるのである。

必要なマネジメントの視点

ただし，ソーシャル・キャピタルの活用には2つの必要条件がある。1つは戦略的なマネジメントの視点であり，もう1つはプログラムという視点である。これらなしには，ソーシャル・キャピタルは見えないものだけに，漫然とした取り組みとなり，効果が見えなかったり，負の側面が出たりする危険性は高い。

ソーシャル・キャピタルは，公衆衛生専門職が生まれる前から存在し，コミュニティの歴史のなかで育まれ機能してきた。専門職の働きかけがなくとも，コミュニティ自身の力によって，より豊かになる場合もある。どの地域の，どの健康問題に対し，どのようなソーシャル・キャピタルのどの側面を活用することで，どのような変化を期待するのか，「選択と集中」を伴う戦略的なマネジメントの視点が必要である。

■「見える化」の推進と地域診断

マネジメントを進めるうえで重要なのが，「見える化」である。ソーシャル・キャピタルの担い手は多様であり，言い換えれば関わる者が多いので，その課題も，目標も，共有されることが望ましい。地域づくりや社会環境の質を一緒に考え追求するのであれば，その地域の特性や課題が関係者に「見える」必要がある。そのための作業が地域診断である。

数ある健康課題のなかで優先すべき課題は何か，あるいは自治体内でもっとも課題を抱える校区や地域はどこか，その地域にはどのような資源(の不足)があるのか，などが量的・質的な情報を元にアセスメントされることによって，マネジメント・サイクルは回りはじめる。また，マネジメント・サイクルで言えば，アセスメントやゴールだけでなく，モニタリングや実施後の評価結果も見えることが望まれる。

■ベンチマーク・システムの必要性

地域診断の必要性はよく語られるが，それを行っているところは少ない。その理由は，情報

を集めるのも，分析も，解釈(診断)も，簡単ではないからである。それらを進めやすくするものとして，他の自治体や校区，地域との比較ができるベンチマークがある。

転倒経験割合が12%とわかっても，それだけではそれが低いのか高いのか，課題とすべきなのかどうかを判断する材料がない。他の自治体や地域についても同じ指標が得られ，年齢で限定したり，調整されたりしていれば，その判断は容易になる。図2のような(一種のベンチマークで)他の小学校区との比較ができれば，前期高齢者の転倒率12%の小学校区は転倒が少ない地域であると容易に診断できる。

また，リスク要因だけを評価していたのでは，介入の手がかりとなるエビデンスを得ることはできない。たとえば，図2，3の横軸のような資源になりうるソーシャル・キャピタル指標も得てベンチマークする必要がある。加えて効率も評価するには，費用に関わるデータも収集しておく必要がある。さらに，介入効果を検証するには，まずは変化をとらえられる定点観測が必要である。しかも，時代による変化のみではないことを示すには，介入をしなかった他の地域との比較も必要である。

つまりベンチマークは，意図的に設計され，継続的に情報を集められるように，システム化されたものである必要がある。

プログラムの視点

ソーシャル・キャピタルの健康への効果が，比較的最近になるまで実証されなかった理由の1つは，ソーシャル・キャピタルが個人に与える影響が比較的小さいために，効果の検証に大規模データが必要だったことがある。言い換えれば，本質的な効果をもつ特効薬であれば数十人の患者集団で効果を実証できるが，ソーシャル・キャピタルの場合には，数百人レベルの多くの人に作用した場合に初めて効果を検証できる。1つの拠点で数十人規模の取り組みを行ったという報告は多いが，それを数か所～数十か所へと拡大して運営し，その効果を検証するシステムまで設計されたプログラムが必要である。

公衆衛生専門職が果たすべき役割

ここでは3点だけ指摘しておきたい。①研究者，②プログラム・マネジャー，③そのための「見える化」の推進者の3つの役割である。

①研究者

ソーシャル・キャピタルが健康によさそうだということは，直感的に理解され，緩やかな共通認識は形成されつつある。しかし，まだわかっていないことは多い。

たとえば，つながるネットワーク先の多さと会う頻度ではどちらが重要なのだろうか。社会的サポートにも，情緒的・心理的サポートや実際に手を差し伸べてくれる手段的なサポートなどいろいろあるが，どの要素が健康との関連が強いのだろうか。地域組織参加でも，組織の種類による違い，あるいは参加しているだけでも効果があるのか，それとも帰属感をもてる居場所や役割が重要なのか。ソーシャル・キャピタルはどのような経路を経て健康によい効果をもたらすのか。ソーシャル・キャピタルの負の側面はどのような場合に，なぜ表れ，どうすれば回避できるのか，など，実践上も重要な研究課題がたくさん残されている。

実践者が現場で見出した仮説や質的な研究，そして縦断追跡できるフィールド，さらに大規模データを統計学的に扱って仮説検証を進められる研究者との共同が，ソーシャル・キャピタル研究には不可欠である。研究者だけでなく，