Income Inequality, Social Capital and Health Status among the Urban Elderly in Japan: A Multilevel Analysis[1]

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Abstract

This study conducts a multilevel analysis to examine the association between community-level income inequality, social capital and health status among the urban elderly in Japan. An urban subsample of the *Japan Gerontological Evaluation Study* (JAGES) - a countrywide social epidemiological survey of community-dwelling and functionally-independent individuals aged 65 and over - is used for the analysis (n=7,527). The community-level social capital is measured by the proportion of the respondents who "generally trust others in the community". The ecological-level analysis finds significant community-level variations in income inequality and the social capital indicator, and they are correlated with the residents' self-rated health. The results of the multilevel analysis confirm that, controlling for individual-level demographic and socioeconomic characteristics, a greater extent of income inequality increases the likelihood of reporting poor health. It is further observed that living in a community with a higher level of social capital attenuates the association between income inequality and health status. These results imply the importance of facilitating social connectedness and enhancing social cohesion in dealing with elderly health issues under the combination of population ageing and growing socioeconomic inequality.

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Background

Social isolation of elderly people through erosion of social networks and social capital and its association with their socioeconomic and health status are of great concern in ageing societies. Analyzing US data, Kawachi *et al.* (1997) and Kawachi and Kennedy (2002) identify disruption of the social fabric, or the erosion of what has been termed "social capital" as a mechanism linking income inequality to community-level health. Kawachi and Kennedy (1999) also argued that widening social distance between the "haves" and "have-nots" lead to latent social conflict and increasing levels of mistrust between members of society, and that erosion of social capital negatively affects health through inegalitarian patterns of civic engagement and social policy-making processes, particularly those concerning the poorer. Since these pioneering work, the role of social networks and social capital in alleviating the negative impacts of socioeconomic inequality on health status and its mechanisms are a subject of intensive study in the fields of public health and social epidemiology research.

The context of Japan's elderly people, particularly those in urban areas, seems to provide an intriguing laboratory to test this hypothesis linking income inequality, health, and social capital. While it is well established that the Gini coefficient of household income – a standard measurement of economic inequality – is relatively high among the elderly, the ongoing population ageing process coincides with the growth in socioeconomic inequalities and disruption of local communities and social connectedness. Using an urban subsample of the *Japan Gerontological Evaluation Study* (JAGES) - a nationwide social epidemiological survey of community-dwelling and functionally-independent individuals aged 65 and older - this paper examines the association between community-level income inequality, social capital and health outcomes among the urban elderly in Japan.

Study population and data

The JAGES – *JApan Gerontological Evaluation Study* – project is an ongoing Japanese prospective cohort study (Kondo 2010), and was initially launched as the AGES – *Aichi Gerontological Evaluation Study* – project, of which first survey was conducted in Aichi Prefecture in 2003 following the pilot conducted and evaluated in 1999. With the sample being restricted those without physical or cognitive disability – defined as being not eligible to receive the public long-term care insurance benefit – the JAGES Project investigates factors associated with health related to functional decline or cognitive impairment among individuals aged 65 years or over. For the 2006 survey of the project, the survey fields were expanded to include those outside Aichi prefecture such as Nara prefecture. With the survey fields being further expanded to 31 municipalities ranging from Hokkaido to Okinawa in the 2010-2011 survey, the AGES project was re-titled as JAGES project with a total sample of 103,621 individuals from 577 communities. In addition to the original survey fields in Aichi prefecture, which comprise urban, semi-urban, and rural settings, the 2010-2011 survey fields include Kobe and Nagoya, which are among the country's largest urban municipalities in terms of population size. The current study uses data drawn from the 2011 JAGES Kobe Survey, which collected data from 9,311 individuals from 78 communities.

Self-rated health status has been identified as a solid predictor of elderly adult mortality (e.g., Idler and Benyamini 1997). The *JAGES* Survey asked respondents to rate their own health status on a 4-oint scale: “exceelent”, “good”, “rather poor” and “poor”. For the outcome variable, this outcome variable is dichotomized in the manner similar to that used by Ichida et al. (2009), Kim and Kawachi (2007) and Subramanian et al. (2001) as follows: good (“excellent” or “good”) / poor (“rather poor” or “poor”). Following the method demonstrated in Kawachi *et al.* (1997) to examine the linkage between social cohesion, income inequality, and health outcomes, the community-level social capital indicator is measured by the proportion of the respondents who “generally trust others in the community”. The Gini coefficient for each of the local communities (school district) is used as the income inequality indicator, and created by aggregating the individual-level equivalised household income.

Empirical strategy

Since the seminal work by Kawachi *et al.* (1997), there has been a growing body of evidence that social capital is associated with various health outcomes. Most of the existing research, however, is built upon ecological or aggregated-level observations. It has been pointed out that analysis based solely on ecological data often fails to explicitly capture the effects of individual-level variables such as variations in income, education, employment status, and household characteristics (Subramanian *et al.* 2001). In addition, measurement of ecological concepts such as social cohesion and social capital is susceptible to the ecological fallacy, the measurement error where group-level correlations may not apply to individual risks (Susser 1994; Diez-Roux 1998; Kawachi *et al.* 1999). To address this issue explicitly, more recent studies have introduced the multi-level analytical method to examine the contextual effects social capital and income inequality on individual health (e.g., Kim and Kawachi 2007; Ichida *et al.* 2009; Aida *et al.* 2011; Han *et al.* 2012).

While allowing for analysis to distinguish the effects of contextual- or ecological-level factors and individual-level factors, the multilevel method poses intensive data demand: it requires data in the form of individual-level health outcomes, sets of individual-level socioeconomic predictors, and area-level income inequality measures (Subramanian *et al.* 2001). In measuring the contextual effect such as community-level social capital or social cohesion, in addition, the definition of "community unit" – municipality / school district / neighbourhood – is always a controversial issue. The current study takes advantage of the two-stage stratified feature of the JAGES data, and conducts a multilevel analysis to examine the association between community-level income inequality, social capital and health status with school district being as the "community" unit.

Following the ecological-level observations on correlations between income inequality, social capital and health status, multilevel logistic models for reporting "poor" health is conducted to examine whether individual- and community-level social capital attenuate the associations between income inequality and health status. Multilevel regression procedures with random intercept models were employed to model a two-level structure of individuals nested within 78 communities surveyed. The multilevel model can be defined as:

$$\text{logit}\ \left(P_{ij}\right) = \beta_1 + \beta_2 X_{ij} + \beta_3 Z_i + \mu_{ij}$$

X_{ij} is a vector of individual-level characteristics of respondent i in community j and

Z_j indicates a vector of community-level characteristics with μ_i denoting the random part. An empty model with no covariates is estimated first as it provides a baseline for examining the community-level variations in self-rated health (Model 1), followed by Model 2 that includes only the individual-level variables in the fixed part. Each of the community-level or contextual factors is added to Model 3 (Gini coefficient) and Model 4 (social capital) respectively. Descriptive statistics of the variables is presented in Table 1.

Results and Discussion

The ecological-level analysis finds significant community-level variance in income inequality and the social capital indicator, and they are correlated with the residents' self-rated health (Figures 1a, 1b, and 2). Table 2 shows the results of the multilevel analysis with the first model (Model 1) consisting of only a constant term with a community-level random parameter that accounts for the variation in health status across the communities. The random part between communities in Model 1 is estimated as 0.157 ($p < 0.05$), and this value can be used for following comparisons.

Model 2 estimates the association between individual-level demographic and socioeconomic characteristics and the likelihood of reporting poor health. All of the individual-level variables except marital status are observed to have a significant linkage to health status. For individual income categories, in particular, a significantly gradient relationship with the probability of reporting poor health is observed: those whose equivalised annual household income is under 100 million yen are 90% more likely to report poor health.

In Model 3, the community-level income inequality indicator – Gini coefficient – is included as a contextual factor in addition to the individual-level independent variables used in Model 2. The reduction in the variation across communities from Model 2 (0.083) to Model 3 (0.065) indicates the part of "between-community variation" explained by income inequality. The results of the multilevel analysis confirm that, controlling for individual-level demographic and socioeconomic characteristics, a greater extent of income inequality within the community increases the likelihood of reporting poor health at the statistically significant level. This finding indicates that community-level income inequality has negative effects on the residents' health status regardless of their individual income levels.

It is further observed that living in a community with a higher level of social capital attenuates the association between income inequality and health status (Model 3 and 4). These results imply the importance of facilitating social connectedness and enhancing social cohesion in dealing with elderly health issues under the combination of population ageing and growing socioeconomic inequality.

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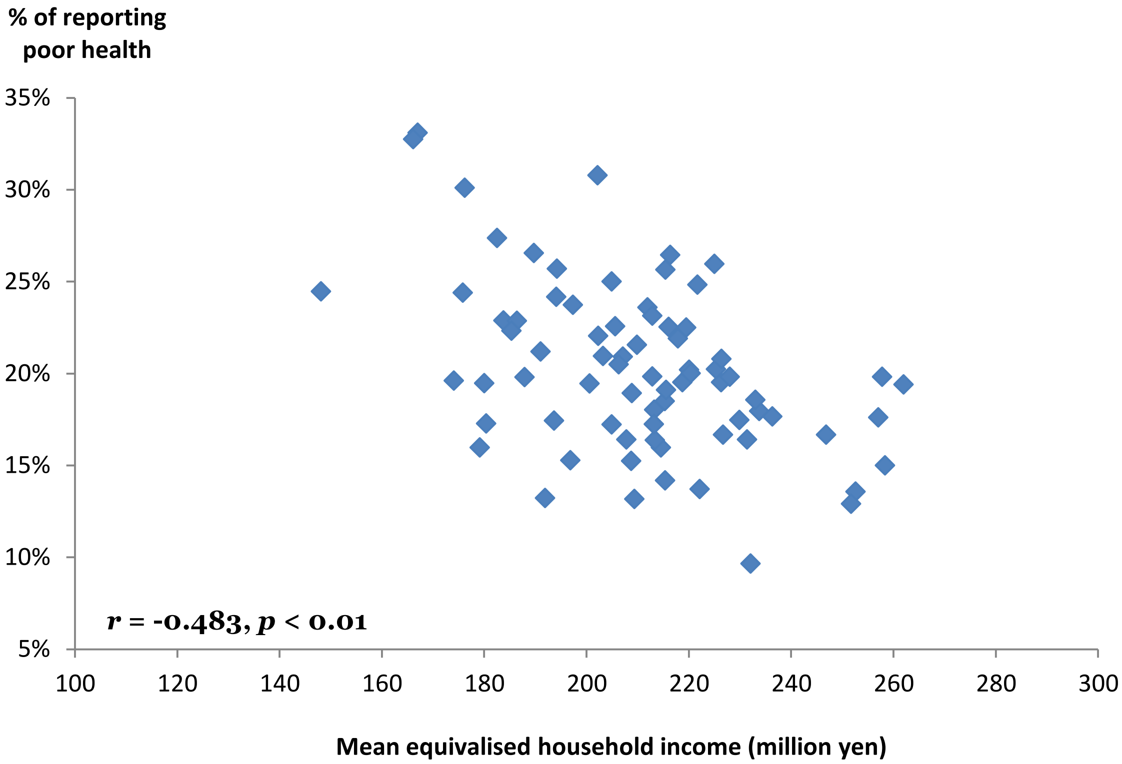
Table 1. Descriptive statistics of the variables in the multilevel model

Dependent variable			
Reporting “poor” health			
0: no	80.9%		
1: yes	19.1%		
Level 1: Individuals (n = 7,527)			
Sex		Years of education	
0: male	47.6%	< 6 years	1.3%
1: female	52.4%	6 – 9 years	26.3%
Age		10 – 12 years	40.8%
60-69	28.2%	13+ years	29.6%
70 – 74	30.7%	mis.	2.0%
75 – 79	23.6%	Marital status	
80 – 84	12.1%	Currently married	71.6%
85+	5.4%	Widowed	19.0%
Annual household equivalised income		Divorced	4.4%
< 100 million yen	16.6%	Never married	3.8%
100 – 199 million yen	37.5%	mis.	1.2%
200 – 299 million yen	25.3%	Level 2: Communities (n = 77)	
300 – 399 million yen	14.2%	Gini coefficient*100	mean: 29.8
400+ million yen	6.4%	Social capital (% of trust)	mean: 66.2

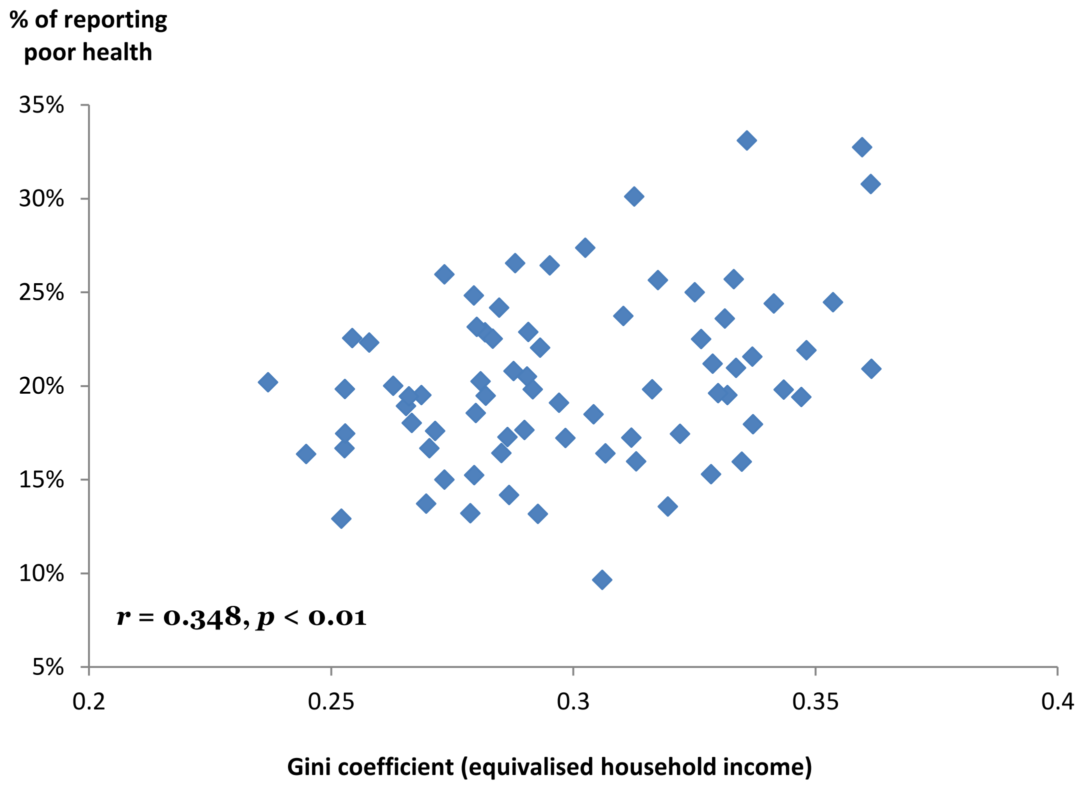
Data: *JAGES* Kobe Survey 2011.

Figure 1a. Community-level correlation: average household income and health status



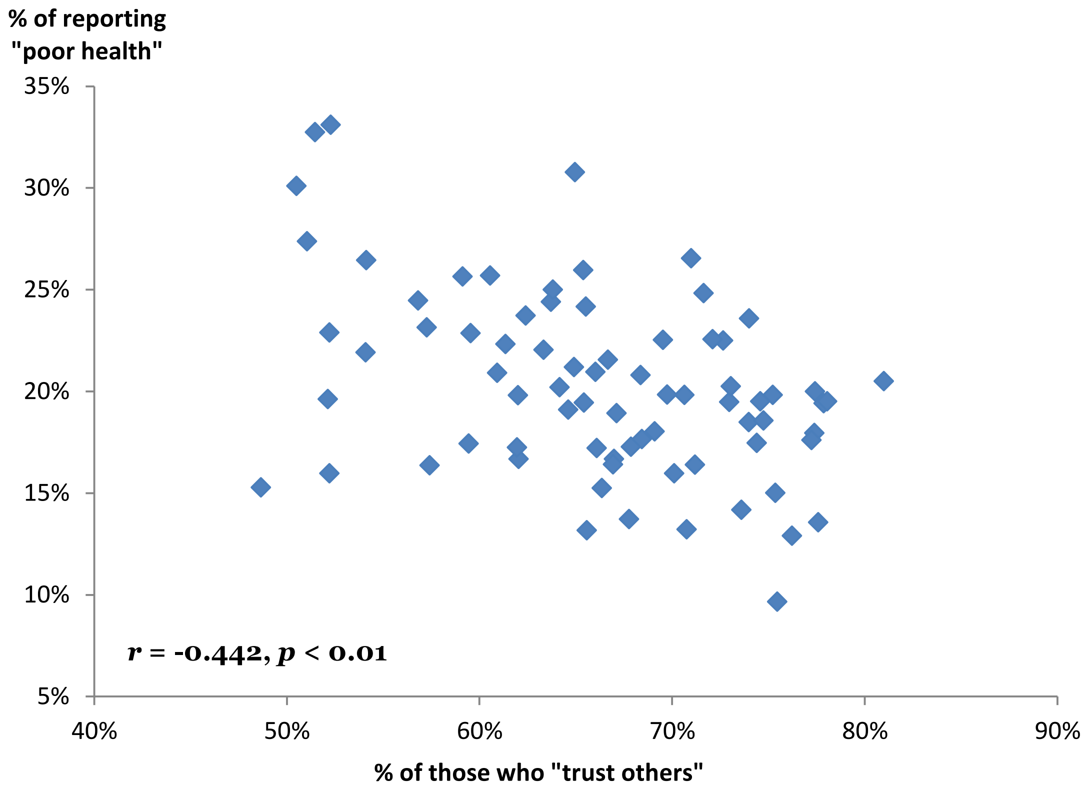
Data: *JAGES* Kobe Survey 2011.

Figure 1b. Community-level correlation: income inequality and health status



Data: *JAGES* Kobe Survey 2011.

Figure 2. Community-level correlation: social capital and health status



Data: *JAGES* Kobe Survey 2011.

Table 2. Multilevel odds ratio for reporting poor self-rated health: The JAGES Kobe Survey 2011

	Model 1	Model 2	Model 3	Model 4	Model 5
Individual factors					
Constant	0.235 ***	0.115 ***	0.068 ***	0.235 ***	0.153 ***
Sex (male=0, female=1)		0.726 ***	0.726 ***	0.729 ***	0.729 ***
Age (ref: 60-69)					
70 – 74		0.869 *	0.869	0.873	0.873
75 – 79		1.379 ***	1.379 ***	1.389 ***	1.387 ***
80 – 84		2.092 ***	2.090 ***	2.119 ***	2.114 ***
85+		2.110 ***	2.110 ***	2.134 ***	2.132 ***
Annual equivalised income					
(ref. 400+ million yen)					
< 100 million		1.893 ***	1.894 ***	1.865 ***	1.868 ***
100 – 199 million		1.871 ***	1.893 ***	1.845 **	1.863 ***
200 – 299 million		1.414 **	1.438 **	1.408 *	1.425 **
300 – 399 million		1.112	1.124	1.107	1.116
Years of education					
(ref. 13+ years)					
< 6 years		1.934 ***	1.906 ***	1.860 ***	1.849 ***
6 – 9 years		1.600 ***	1.591 ***	1.563 ***	1.560 ***
10 – 12 years		1.218 **	1.216 **	1.207 **	1.207 **
mis.		1.907 ***	1.901 ***	1.893 ***	1.890 ***
Marital status					
(ref. currently married)					
widowed		0.835 **	0.830 **	0.829 **	0.826 **
divorced		1.153	1.141	1.130	1.124
never married		1.130	1.115	1.102	1.095
mis.		1.481	1.477	1.441	1.442
Contextual factors					
Gini coefficient (10% / unit)			1.192 *		1.122
% Trust (10% / unit)				0.901 ***	0.912 **
Random Effects (Level 2)					
Between-district variation	0.157 **	0.083	0.065	0.039	0.021
(S.E.)	(0.047)	(0.073)	(0.089)	(0.142)	(0.202)
Intra-crass correlation	0.007	0.002	0.001	0.001	0.001
Number of Cases	n = 7,527	n = 7,527	n = 7,527	n = 7,527	n = 7,527
Degree of freedom	2	19	20	20	21
Log likelihood	-3574.313	-3445.846	-3444.415	-3442.633	-3442.023

*** $p < 0.01$, ** < 0.05, * < 0.10