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Do social comparisons explain the association between income inequality and health?: Relative deprivation and perceived health among male and female Japanese individuals

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Abstract

Relative deprivation has been hypothesized as one of the pathways accounting for the link between income inequality and health. We tested this hypothesis in a large national sample of men and women in Japan. Our survey included a probability sample of 22,871 men and 24,243 women aged 25–64, from whom information was gathered on demographic variables, household income, occupation or employment status, and self-rated health. Our measure of relative deprivation was the Yitzhaki Index, which calculates the deprivation suffered by each individual as a function of the aggregate income shortfall for each person relative to everyone else with higher incomes in that person's reference group. We modeled several alternative reference groups, including others with the same occupation, others of the same age group, and others living in the same geographic area (prefecture), as well as combinations of these. Generalized estimating equations demonstrated that higher relative deprivation was associated with worse self-rated health. Even after controlling for absolute income as well as other sociodemographic factors, the odds ratio and its 95% confidence intervals (CI) for poor health ranged from 1.09 (95% CI: 1.02–1.16) to 1.18 (95% CI: 1.11–1.26) for men and from 1.10 (95% CI: 1.04–1.16) to 1.16 (95% CI: 1.09–1.23) for women per 1 million increase in the Yitzhaki Index. As such, relative income deprivation is associated with poor self-rated health independently of absolute income, and relative deprivation may be a mechanism underlying the link between income inequality and population health.

Keywords

Japan; Psychosocial deprivation; Relative deprivation; Income inequality; Pathways

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Introduction

It is widely accepted that income poverty or lower absolute income adversely affects health (Lynch & Kaplan, 2000; Marmot & Wilkinson, 2005). Although controversial, many papers have also suggested that income inequality or relative income affects health (Subramanian & Kawachi, 2004; Wilkinson & Pickett, 2006). The empirical evidence linking income inequality to health outcomes is strongest in the case of U.S. state level analyses (Backlund, Rowe, Lynch, Wolfson, Kaplan, & Sorlie, 2007; Lochner, Pamuk, Makuc, Kennedy, & Kawachi, 2001). Outside the United States, the evidence showing a link between income inequality and population health is less secure, with some positive studies (Larrea & Kawachi, 2005; Subramanian, Delgado, Jadue, Vega, & Kawachi, 2003; Subramanian, Kawachi, & Smith, 2007), but also several null studies (Blakely, Kawachi, Atkinson, & Fawcett, 2004; Gerdtham & Johannesson, 2004; Osler, Prescott, Gronbak, Christensen, Due, & Engholm, 2002). In Japan, Shibuya, Hashimoto, and Yano (2002) previously reported that prefectural level income inequality in that country was not associated with poor self-rated health ("prefecture" refers to the geographical/administrative unit of local government in Japan). On the other hand, they found that a measure of relative income (calculated as the difference between an individual's income and median prefectural income) was associated with worse health status. The problem, however, is that this measure of relative income is collinear with absolute income.

Until relatively recently, few studies have attempted to tease out the mechanisms underlying the relationship between income inequality and health. Two distinct pathways have been proposed through which income inequality is believed to affect population health: a macro policy-related pathway and an individual-level psychosocial pathway (Kawachi, Fujisawa, & Takao, 2007). At the societal level, income inequality is believed to erode social cohesion, cooperation, and support for the provision of public goods (Kawachi & Kennedy, 2006). Recent evidence from experimental economics – in which income inequality was manipulated in the context of trust games – supports this mechanism (Anderson, Mellor, & Milyo, 2004). Alternatively, the psychosocial pathway positsthat income inequality will heighten individuals' sense of relative deprivation, resulting in frustration, shame, stress, and adverse health consequences (Wilkinson, 2001). The theory of social comparison, initially proposed by Festinger (1954), supports this hypothesized mechanism. Empirical support for this pathway was provided recently by studies in the United States, which examined individual relative deprivation as a predictor of increased risks of mortality, as well as smoking, obesity, and mental health services utilization (Eibner & Evans, 2005; Eibner, Sturn, & Gresenz, 2004). However, few other studies have been reported on the association between relative deprivation and health outside the United States (Gravelle & Sutton, in press; Jones & Wildman, 2008). Evidence is particularly sparse among Asian countries, even though the region has experienced widening income inequalities since the 1990s (Khang, Lynch, Yun, & Lee, 2004; Kondo, Subramanian, Kawachi, Takeda, & Yamagata, in press).

In the present study, we sought to provide a test of the association between relative deprivation and health in Japan. Although previous studies have not found an association between aggregated measures of prefecture-level income inequality and health in Japan (Nakaya & Dorling, 2005; Shibuya et al., 2002), this may be due to the timing of these studies, i.e., they may have presented a limited snapshot at an early stage of the surge in income inequality in Japan. The situation may change in the future. Meanwhile, we are not aware of a previous study that has formally tested the association between individual-level sense of relative deprivation and health in Japanese society.

Methods

Data

Data on demographic variables, household income, occupation, and perceived health status were obtained from the 2001 Comprehensive Survey of the Living Conditions of People on Health and Welfare (CSLC) conducted by the Japanese government (Ministry of Health, Labour and Welfare, 2001). Trained investigators visited households and interviewed all household members within census tracts which were randomly selected from all prefectures in the nation ($N = 47$). A health-related questionnaire was mailed to participants and collected by investigators at the time of home visiting. The survey was conducted across 5240 census tracts including 247,278 households (response rate = 87.4%), from which 31,871 households were further randomly selected and surveyed regarding income and savings (response rate = 79.5%). The total sample size available for our analyses was 22,871 men and 24,243 women, aged 25–64. Participants who completed the income questionnaire were on average 0.5 years older, 0.6% more likely to be women, and 1.0% more likely to be married compared to the group who did not provide income data (including both selected and not selected for income survey). This study was based on the secondary analysis of the data in which any individual identifiers were removed.

Relative deprivation

Following the recently adopted method by Eibner and colleagues (Eibner & Evans, 2005; Eibner et al., 2004), relative deprivation was operationalized in the present study using the Yitzhaki Index (Yitzhaki, 1979), which is itself based on the theory of relative deprivation articulated by Runciman (1966). In brief, relative deprivation for each individual is calculated as the aggregated shortfall in income between that individual and everyone else with higher incomes in that person's reference group.

$$\text{Yitzhaki Index}_i = \frac{1}{N}\sum_j (y_j - y_i) \quad \forall y_j > y_i$$

where the amount of relative deprivation for individual i is the sum of the income gap between individuals i and j ($y_j - y_i$, where j has higher income than i) divided by the total number of people in the reference group (N).

Since we cannot know the reference group for each individual (i.e., to whom each person compares him/herself), our approach is to fit alternative definitions of reference groups. For the present study, we used three different reference groups – others with the same occupation, others in the same age group, and others living in the same geographical area (prefecture) – as well as combinations of these. Occupations were categorized into the following groups: professional/technician, manager/administrator, sales/service/clerical workers, security/transportation/laboring workers, farming/fishery/forestry workers, and unknown jobs, as well as economically inactive including homemaker (female only) and unemployed. We categorized each subject into one of four age groups: 25–34, 35–44, 45–54, and 55–64 years old.

Self-rated health

The CSLC elicited respondents' self-rated health with the single item: "What is your current health status: excellent, very good, good, fair, or poor?". From this question, we created a dichotomous outcome measure with poor perceived health if the respondent answered fair or poor. It has been reported that self-rated health is associated with various objective health

measures and strongly predicts future onset of mortality (Idler & Benyamini, 1997; Kondo et al., 2005; Kopp, Skrabski, Rethelyi, Kawachi, & Adler, 2004).

Covariates

To demonstrate the independent contribution of relative deprivation on health, it is critical to control for absolute income. Household income was calculated by summing up the exact individual incomes of all household members. The income was pre-tax, included benefits and inheritances, and adjusted for household size (equivalence elasticity = 0.5). We used the continuous income variable in the multivariate model. A previous study reported on the sufficient reliability of CSLC income data (e.g., 1.3% standard error of median income) (Ishii & Furuya, 2005). In our regression models, we further controlled for age, marital status, and employment status. Marital status was categorized as married, never married, separated, or divorced. We did not include behavioral risk factors such as smoking, alcohol drinking, exercise habits, and health check-ups since we considered these variables as potentially mediating the association between relative deprivation and health status (Lynch & Kaplan, 2000).

Statistical analysis

All analyses were stratified by gender. To address potential clustering of data arising from the stratified sampling strategy, we used a multivariate generalized estimating equation approach with a logit link function (PROC GEN-MOD, the SAS statistical package version 9.1, SAS Institute Inc., Cary, NC, USA). Municipalities were selected as cluster units. We calculated odds ratio (OR) and 95% confidence intervals (CI) for reporting poor health according to the increase in relative deprivation adjusting for sociodemographic confounders (including absolute income). To evaluate the trend in the association between relative deprivation and self-rated health, we also divided Yitzhaki Index by quintile and carried out a trend test.

Results

Descriptive analysis showed that people in older age groups were more likely to report poor health. Perceived health status also varied across marital status and occupations (Table 1). The proportion of poor perceived health was higher in the lower absolute income categories (data not shown).

Univariate regression models demonstrated that higher relative deprivation was significantly associated with poor reported health (Table 2). ORs (95% CI) of poor health by 1 million increase in relative deprivation varied from 1.08 (1.03–1.13) to 1.27 (1.21–1.32) in men and from 1.08 (1.03–1.13) to 1.21 (1.16–1.26) in women, depending on the type of reference group that was fitted. Regardless of the reference group assumed, we found a statistically significant trend between increasing quintile of relative deprivation and higher ORs of poor self-rated health. When the models were further adjusted for potential confounding variables including absolute income, the trend between increasing relative deprivation and worse health remained statistically significant across all reference group comparisons. When prefecture of residence was used as a reference group, relative deprivation showed the strongest association with poor self-rated health. Adjusted OR (95% CI) of the deprivation by the increase in one million Japanese yen per person was 1.18 (1.11–1.26) in men and 1.16 (1.09–1.23) in women, while the ORs with other reference groups ranged from 1.11 to 1.16 in men and from 1.10 to 1.14 in women. We did not find clear gender differences.

Discussion

To date, empirical studies of income inequality and health have yielded mixed findings (Lynch et al., 2004; Subramanian & Kawachi, 2004). An association between income inequality and worse health (including mortality and poor self-rated health) has been reported most consistently in the United States when income distribution was measured at the state level (Wilkinson & Pickett, 2006). Studies carried out in countries that are more egalitarian than the U.S. – such as Sweden and Denmark – have failed to find an association between income inequality and mortality (Gerdtham & Johannesson, 2004; Osler et al., 2002). A possible explanation for this discrepancy is that states with strong welfare protections (such as the Nordic countries) have managed to buffer their citizens against the deleterious health consequences of inequality. Alternatively, the association between income inequality and poor health is non-linear, so that the adverse health impact of inequality becomes evident only when a certain threshold of inequality is exceeded (Subramanian & Kawachi, 2004).

The mixed findings of previous studies of income inequality and health in Japan could be explained by either or both of the foregoing scenarios. Thus Shibuya et al. (2002) found that there was no association between prefectural income inequality and poor self-rated health, using an earlier release (in 1995) of the CSLC (the same survey used in the present study). Their null findings could have been due to the relatively egalitarian distribution of incomes in Japan compared to the United States (the threshold hypothesis), and/or due to Japanese welfare protection policies (e.g., universal health care insurance coverage established in 1961). The Japanese situation is changing, however, due to the decade-long economic recession since the early 1990s following the collapse of the so-called bubble economy (Kondo et al., in press). Although income inequality at the prefecture level does not appear to be associated with poor self-rated health, the findings of the present study suggest that individual relative deprivation is associated with worse health status among working-age Japanese men and women, irrespective of absolute income. Relative deprivation is closely linked to income inequality to the extent that the Yitzhaki Index would be expected to rise as inequality grows even though individuals' absolute incomes do not change. Our study may be therefore viewed as a test of the individual-level psychosocial mechanism linking income inequality to health outcomes. The principal limitation of the relative deprivation approach is that we do not know which reference groups individuals choose in making their social comparisons. It is likely that individuals make several kinds of comparisons in their daily lives, including comparisons to co-workers in the same workplace, their neighbors, and parents at a similar stage in their life-course, as well as other people's lifestyles portrayed in the national media. Unfortunately, we lacked individual information about these bases of social comparison. Instead, we adopted the approach of modeling a series of reference groups based on data available within our survey, including others in the same occupation, others belonging to the same age group, and others residing in the same prefecture as the respondent. Each of our models could be interpreted as sensitivity analyses that test the theory of relative deprivation. As our results indicate, regardless of the reference group fitted, we found consistent evidence for an association between relative deprivation and poor health status. Moreover, when we defined relative deprivation by prefectures of residence, relative deprivation was most strongly associated with health, possibly supporting the importance of geographical proximity when social comparisons take a role in the pathway linking income inequality to health. However, because we have insufficient statistical support (i.e., overlapped confidence intervals), further confirmation is needed for the differences among reference groups.

Although our study did not address the specific mechanisms linking relative deprivation to poor health status, some clues are provided by the study by Eibner and colleagues (Eibner & Evans, 2005; Eibner et al., 2004), which found that relative deprivation in a U.S. sample was

linked to stress-related outcomes, including smoking, obesity, and mental health services utilization.

Recent evidence has also linked subjective social status with worse health outcomes (Adler, Epel, Castellazzo, & Ickovics, 2000; Singh-Manoux, Marmot, & Adler, 2005), where social position was assessed by the respondent's rating of where they stood on an imaginary 10-rung ladder of social hierarchy. Subjective social status may be interpreted as a gauge of relative deprivation. However, the ladder instrument does not have the same quantitative interpretation as the Yitzhaki Index. For example, if the incomes of all other people in the reference group rise relative to the respondent, the Yitzhaki Index is expected to increase. However, the response of the same person within the domain of subjective social status is unknown, since it has not been determined how individuals integrate information on the resulting income shortfall when they are asked to position themselves on the 10-rung ladder instrument.

Our study has limitations. Because of the cross-sectional design, we cannot rule out reverse causation. Even though we controlled for absolute income, it is nonetheless possible that the association between the Yitzhaki Index and poor self-rated health reflected the unmeasured influence of poor health on an individual's ability to earn income. The association between relative deprivation and health could also reflect other omitted variables such as individual variations in ability, temperament, and personality, which were not measured in our survey. In addition, we found mild variance inflation in some multivariate models based on quintiled Yitzhaki Index values when covariates (including absolute income) were added to the models: i.e., variance inflation factors (VIFs) between 2.0 and 3.3. This suggested the existence of collinearity between the two income-related variables. Although the models using continuous Yitzhaki Index allowed us to conclude that high relative deprivation was consistently associated with poor health throughout the reference groups tested, caution must be applied in interpreting the shape of the association between quintiles of the Yitzhaki Index and self-rated health. Future prospective investigations are warranted to test these ideas, including ideally, examining the association between exogenous changes in relative deprivation (for example, induced by economic shocks) and resulting changes in health status.

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Table 1

Percent reported poor health by the sociodemographic characteristics and summary of economic indicators in Japanese males and females, 2001 CLSC

Variable	Male (*n* = 22,871)		Female (*n* = 24,243)	
	Respondents (%)	No. (%) of poor self-rated health or median [25%, 75%]	Respondents (%)	No. (%) of poor self-rated health or median [25%, 75%]
Age group (years old)				
25–34	4913 (23.0)	334 (6.8)	5305 (23.4)	474 (8.9)
35–44	4905 (23.0)	435 (8.9)	5235 (23.1)	534 (10.2)
45–55	5690 (26.6)	601 (10.6)	5914 (26.0)	792 (13.4)
55–64	5856 (27.4)	762 (13.0)	6259 (27.6)	959 (15.3)
Marital status				
Married	17,295 (75.6)	1650 (10.1)	18,667 (77.0)	2126 (12.1)
Never married	4691 (20.5)	369 (8.7)	3321 (13.7)	302 (9.8)
Separated	244 (1.1)	28 (13.0)	992 (4.1)	135 (15.3)
Divorced	641 (2.8)	85 (14.5)	1263 (5.2)	196 (17.0)
Occupation/employment status				
Employed				
Professional/technician	4000 (17.5)	314 (8.2)	2328 (9.6)	245 (11.0)
Manager/administrator	1967 (8.6)	179 (9.4)	343 (1.4)	36 (11.0)
Sales/service/clerical	5879 (25.7)	501 (9.0)	7547 (31.1)	760 (10.7)
Security/transportation/labour	6853 (30.0)	575 (9.1)	2560 (10.6)	232 (9.6)
Farming/fishery/forestry	938 (4.1)	87 (10.2)	729 (3.0)	74 (11.3)
Unknown Job	1680 (7.4)	179 (11.7)	2461 (10.2)	295 (13.0)
Unemployed				
Homemaker[a]	–	–	7502 (31.0)	971 (13.8)
Unemployed	1554 (6.8)	297 (21.9)	773 (3.2)	146 (22.3)
Household income (10,000 Japanese Yen)		351.1 [231.5, 509.1]		334.0 [214.7, 490.8]
Relative income deprivation by the definition of reference group (10,000 Japanese yen)				
Prefecture of residence		121.1 [64.7, 195.1]		121.5 [66.0, 194.6]
Occupation		116.4 [61.2, 188.4]		118.6 [63.5, 191.9]
Age group		118.5 [61.9, 198.0]		120.3 [64.2, 196.4]
Prefecture and age		114.6 [57.6, 192.2]		116.4 [60.6, 191.8]
Occupation and age		109.6 [57.2, 184.3]		111.6 [57.5, 191.0]

CSLC: Comprehensive Survey of Living Condition of People on Health and Welfare.

[a]Male homemakers were categorized in unemployed due to the small number of male homemakers.

Table 2

Crude and adjusted odds ratio (95% confidence intervals) for reporting poor health by the level of relative deprivation in Japanese men and women, 2001 CLSC

	Reference group defined by				
	Prefecture of residence	**Occupation**	**Age group**	**Prefecture and age**	**Occupation and age**
Male					
Crude					
Continuous[a]	1.21 (1.15–1.27)	1.08 (1.03–1.13)	1.27 (1.21–1.32)	1.26 (1.21–1.32)	1.11 (1.07–1.17)
Top vs bottom quintile	1.53 (1.33–1.75)	1.20 (1.04–1.38)	1.75 (1.52–2.02)	1.73 (1.50–1.99)	1.35 (1.17–1.56)
p for trend	<0.0001	0.005	<0.0001	<0.0001	<0.0001
Model 1					
Continuous[a]	1.23 (1.17–1.29)	1.11 (1.06–1.16)	1.20 (1.15–1.26)	1.20 (1.15–1.26)	1.07 (1.02–1.12)
Top vs bottom quintile	1.62 (1.41–1.87)	1.30 (1.13–1.50)	1.54 (1.33–1.78)	1.53 (1.33–1.77)	1.22 (1.06–1.41)
p for trend	<0.0001	<0.0001	<0.0001	<0.0001	0.003
Model 2					
Continuous[a]	1.18 (1.11–1.26)	1.11 (1.04–1.19)	1.16 (1.08–1.24)	1.16 (1.09–1.23)	1.09 (1.02–1.16)
Top vs bottom quintile	1.37 (1.12–1.67)	1.22 (1.01–1.49)	1.25 (1.00–1.58)	1.25 (1.02–1.53)	1.26 (1.04–1.54)
p for trend	0.0008	0.006	0.04	0.01	0.01
Female					
Crude					
Continuous[a]	1.17 (1.12–1.22)	1.08 (1.03–1.13)	1.20 (1.15–1.25)	1.21 (1.16–1.26)	1.13 (1.09–1.18)
Top vs bottom quintile	1.39 (1.23–1.58)	1.15 (1.02–1.30)	1.61 (1.42–1.82)	1.58 (1.39–1.79)	1.43 (1.26–1.62)
p for trend	<0.0001	0.0008	<0.0001	<0.0001	<0.0001
Model 1					
Continuous[a]	1.16 (1.11–1.21)	1.08 (1.03–1.13)	1.13 (1.08–1.18)	1.15 (1.10–1.20)	1.07 (1.02–1.11)
Top vs bottom quintile	1.39 (1.23–1.58)	1.18 (1.04–1.34)	1.38 (1.21–1.57)	1.37 (1.20–1.56)	1.23 (1.08–1.40)
p for trend	<0.0001	0.0003	<0.0001	<0.0001	0.002
Model 2					
Continuous[a]	1.16 (1.09–1.23)	1.12 (1.06–1.19)	1.12 (1.05–1.19)	1.14 (1.08–1.21)	1.10 (1.04–1.16)
Top vs bottom quintile	1.30 (1.10–1.54)	1.24 (1.05–1.48)	1.28 (1.06–1.54)	1.27 (1.07–1.51)	1.33 (1.12–1.58)
p for trend	0.0004	0.0002	0.01	0.005	0.001

Model 1 was adjusted for age group and marital status and model 2 was adjusted for age group, marital status, absolute income, and employment status.

CSLC: Comprehensive Survey of Living Condition of People on Health and Welfare.

[a]Odds ratios by the increase in 1 million Japanese yen per person of relative deprivation.