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Associations of relative deprivation and income rank with depressive symptoms among older adults in Japan

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ABSTRACT

Introduction: Income is hypothesized to affect health not just through material pathways (i.e., the ability to purchase health-enhancing goods) but also through psychosocial pathways (e.g., social comparisons with others). Two concepts relevant to the psychosocial effects of income are: relative deprivation (for example expressed by the Yitzhaki Index, measuring the magnitude of difference in income among individuals) and Income Rank. This study examined whether higher relative deprivation and lower income rank are associated with depressive symptoms in an older population independently of absolute income.

Method: Using cross-sectional data of 83,100 participants (40,038 men and 43,062 women) in the Japan Gerontological Evaluation Study (JAGES), this study applied multiple logistic regression models to calculate the odds ratios (*OR*) of depression associated with relative deprivation/Income Rank. The Japanese Geriatric Depression Scale (GDS-15) was used to assess depressive symptoms, and subjects with a score of $\geq$5 were categorized as depressed. Reference groups for calculating the Yitzhaki Index and income rank were constructed based on same gender, age-group, and municipality of residence.

Results: The findings indicated that after controlling for demographic factors, each 100,000 yen increase in relative deprivation and 0.1 unit decrease in relative rank was associated with a 1.07 (95% *CI* = 1.07, 1.08) and a 1.15 (95% *CI* = 1.14, 1.16) times higher odds of depression, respectively, in men. The corresponding *ORs* in women were 1.05 (95% *CI* = 1.05, 1.06) and 1.12 (95% *CI* = 1.11, 1.13), respectively. After adjustment for other covariates and stratification by income quartiles, the results remained statistically significant. Women in the highest income quartile appeared to be more susceptible to the adverse mental health effects of low income rank, while among men the associations were reversed. Low income rank appeared to be more toxic for the poor.

Conclusion: Concepts of relative income appear to be relevant for mental health over and above the effects of absolute income.

1. Introduction

Income and health are robustly correlated; the more money people earn, the better their health, up to a certain point. That is, there is a ceiling on the level of health we can achieve, but there is no theoretical limit on how much money we can amass. Two hypotheses have been proposed to account for the association between income and health. The materialist tradition emphasizes the goods and services that money can purchase. By contrast, the psychosocial explanation focuses on the salience of social comparisons triggered by inequalities in income, which can result in feelings of unfairness, frustration, shame, stress, anxiety, and resentment (Kawachi et al., 2002; Marmot and Wilkinson, 2001; Wilkinson, 1996). In turn, these negative emotions are hypothesized to deleteriously affect mental health, and to increase negative coping responses including heavy alcohol consumption, smoking,

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and drug abuse (McEwen and Seeman, 1999). The psychosocial hypothesis thus implies that health is affected not only by an individual's absolute level of income, but also by the relative position conferred by one's level of income in the social hierarchy (Boyce et al., 2010; Daly et al., 2015; Wilkinson, 1997; Wood et al., 2012). Studies on subordinate social rank support this theory, both in primate and human experiments (Mendelson et al., 2008; Sapolsky, 2005).

Relative deprivation has been defined as "the extent of the difference between the desired situation and that of the person desiring it" (Runciman, 1966). Several measures have been proposed to evaluate relative deprivation. One such measure is the *Yitzhaki Index*, which calculates the aggregate differences between an individual's income and all other individuals earning higher incomes who belong to the same reference group (Adjaye-Gbewonyo and Kawachi, 2012; Yitzhaki, 1979). In past studies, the Yitzhaki Index has been demonstrated to be correlated with mortality, poor self-rated health, mental-health services utilization, functional disability, as well as smoking and obesity (Kawachi et al., 1999; Kondo et al., 2008, 2009, 2015; Subramanyam et al., 2009). In contrast to the Yitzhaki Index, *income rank* refers to an individual's *position* in the income hierarchy. The difference between the Yitzhaki Index and income rank can be illustrated as follows: If employee *X* receives an annual bonus whilst everyone else in the same workplace fails to receive a bonus, then the Yitzhaki Index for *X* will decline, even though his income rank will remain the same (i.e., assuming that the size of the bonus is not so large as to vault his earnings above his higher-paid co-workers). Therefore, if the effects of income rank on health are independent of the magnitude of difference in income between individuals (Yitzhaki Index), then current health policies targeted to reduce income inequality (e.g., money transfers) are insufficient to address the problem of relative rank (Eckersley, 2015). In the literature on the relative effects of income, few attempts have been made to distinguish between these two effects.

The concept of income rank is based on the notion that people usually do not know exactly how much others earn, and judgement is instead influenced by the rank conferred by income (Boyce et al., 2010). Income rank is thus analogous to the concept of positional rank in dominance hierarchies, which have been extensively studied in non-human primates such as macaque monkeys and baboons. In non-human primate societies there is no such thing as "income"; nonetheless, positional rank determines access to food, reproductive mates, and longevity. In human populations, lower income rank has been shown to correlate with worse self-rated health, allostatic load, obesity, mental distress, and suicidal ideation and attempts (Daly et al., 2015; Hounkpatin et al., 2016; Wetherall et al., 2015; Wood et al., 2012). It was also suggested that income rank might be a stronger and more consistent predictor of health when compared with other measures, such as the Yitzhaki Index (Hounkpatin et al., 2016).

The current study investigated the association between concepts of relative deprivation/income rank and mental health. In contrast to the majority of the existing literature, which has been conducted in western society settings, the focus of this study is on a sample of older adults in Japan. It was hypothesized that social comparisons based on income would be less salient in this population for two reasons: First, the age-group in our sample (65 years or older) consists of mostly retired individuals, thereby removing a major source of social comparison in people's daily lives – that is, income comparisons between co-workers in the same workplace. Secondly, traditional Japanese values have emphasized social cohesion, eschewing conspicuous displays of consumption even when income differences do exist. The origin of this concept dates back to the post-War period of rapid economic expansion (1950–1975) during which time the Japanese government espoused the "middle class consciousness of 100 million people" (一億総中流 – ichioku so chyuryu). Although income inequality has dramatically increased in the past twenty years, this consciousness is still embraced by Japanese people of this generation (i.e., those who were working during this period) (Kelly, 2002).

2. Method

2.1. Study population

The data come from the baseline survey of the Japan Gerontological Evaluation Study (JAGES), a nationwide cohort study established in 2010 to examine the predictors of healthy aging and functional disability (Fig. 1). Eligible participants aged 65 years or older were identified from the resident registry and long term care insurance databases of 31 municipalities in 12 prefectures throughout Japan. Between August 2010 and January 2012, the surveys were mailed to a random sample of 169,215 community-dwelling seniors who were free of documented disability. Out of the 112,123 respondents (national response rate: 66.3%), 102,869 individuals provided valid information on age, sex, and municipality of residence, and thus constituted the cohort baseline of the JAGES study (JAGES2010v3). This analysis was conducted among 83,100 subjects (40,038 men and 43,062 women) who provided valid information on depressive symptoms. The protocol for the study was approved by the ethics committee of Nihon Fukushi University.

2.2. Depressive symptoms

Depressive symptoms were assessed through the short version of the Japanese Geriatric Depression Scale (GDS-15); a self-administered survey consisting of 15 questions with a simple yes/no format (Appendix Table 1), where higher scores indicate higher depressive symptomatology (Burke et al., 1991; Wada et al., 2003). Using a predefined cut-off point, subjects with a GDS-15 score of 5 or more were categorized as depressed, and those with a GDS-15 score less than 5 as non-depressed (Lyness et al., 1997; Schreiner et al., 2003). Using the cut-off point of 5, GDS-15 has a sensitivity of 92% and a specificity of 81% for detecting major depression validated by using the Structured Clinical Interview for DSM-III-R (SCID) (Lyness et al., 1997). In this sample, the standardized Cronbach's α of the GDS-15 was 0.84.

2.3. Relative income measures

Two measures were examined to assess relative income. The first was the Yitzhaki Index, estimated with the following formula (Yitzhaki, 1979):

$$YitzhakiIndex_i = \frac{1}{N}\sum_j \left(y_j - y_i\right) I_{ij} \quad I_{ij} = \begin{cases} 1, & if\ y_i < y_j \\ 0, & if\ y_i \geq y_j \end{cases}$$

where y_i is the income of individual i, y_j is the incomes of all individuals j whose incomes are higher than individual i's, and N is the number of people in i's reference group. The Yitzhaki Index therefore calculates the average difference between an individual's income and the incomes of all individuals with higher income belonging to the same reference group. The survey did not inquire about people's reference groups (i.e., the basis of social comparisons in the space of income). Following previous studies, it was assumed that individuals compare their incomes to others based on similarity of sex, age-group, and municipality of residence (Ishida,