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Social Inequality in Health in Japan

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Abstract

This paper examines the relationship between job characteristics and workplace conditions on the one hand and health-related outcomes on the other in Japan. It analyzes the effect of changes in the work conditions and work arrangements on the subjective health, activity restriction, and depression symptoms, using the Japanese Life Course Panel Survey (JLPS). The first major conclusion from the analyses pertains to the finding that there are substantial changes in health-related outcomes between short periods of time. Although the distributions of health-related outcomes are very similar at two time points, it does not necessarily imply that the individuals did not experience the change of health conditions. On the contrary, our results suggest that there are substantial changes in health conditions between the two waves. Depression symptoms are most volatile, followed by self-reported health, and then activity restriction. Even with the activity restriction, about 40 percent of individuals changed their responses between the two waves.

The second major conclusion of this paper is that the effects of job characteristics depend on different health-related outcomes. Self-reported health is affected by a variety of job-related factors. Depression symptoms are also affected by a number of job-related characteristics. The atmosphere of helping each other and the control over the pace of work are two important factors which affect both depression and self-reported health. The change in income exerts an effect of reducing depression symptoms, while the possibility of unemployment tends to increase depression. Activity restriction is not much affected by job characteristics. In summary, all these findings suggest that the workplace conditions and job characteristics have profound influence on the workers' health.

1. INTRODUCTION

Japan is known as a country of longevity. The average life expectancy at birth has remained the highest in the world, recording 78.4 years for men and 85.3 years for women in 2002. The average healthy life expectancy is also highest in the world at 72.3 years for men and 77.7 years for women in Japan.[1] The infant mortality rate fell to four per thousand births in 2002, one of the lowest in the world (World Health Organization 2004). Japan's long average lifespan is often attributed to healthy diet and the national health system. Japan has a universal health insurance system which began in 1961. The system is believed to have created an excellent health and medical service that was indicated as one of the best in the world by the World Health Organization (World Health Organization 2002). In principle, all Japanese citizens are supposed to be enrolled in one of health insurance programs that ensure access to medical care.[2] The universal health insurance system is supposed to guarantee health care services to every citizen in the country, regardless of class, education, and income. Because of the universal coverage of health care, it is not surprising to find that many Japanese people assume equal access to health services and no apparent difference in health conditions by socio-economic ingredients.

The topic of socio-economic differentials in health has not received much attention in the academic disciplines until very recently. The absence of studies on social inequality of health, however, is closely related to the lack of empirical data to address the issue of inequality in health. There are a number of studies on health by medical profession and public health specialists. However, these studies concentrate mainly on biological and environmental factors in explaining health outcomes and do not pay direct attention to socio-economic factors. On the other hand, studies on social stratification in Japan have accumulated surveys and analyses of the Japanese stratification system. However, the surveys such as Social Stratification and Mobility National Surveys (SSM) which produced collections of studies on Japanese stratification did not include questions on health until 1995(see for example, Ishida 1993; Kosaka 1995; Sato 2000; Hara and Seiyama 2005). Only in 2005, did the SSM survey include a few questions regarding the health of the respondents. Therefore, national surveys which contained information on both health and socio-economic factors were mainly restricted to government surveys conducted primarily by the Ministry of Health, Labor, and Welfare.

Shibuya, Hashimoto, and Yano (2002) is one of few exceptions which utilized these government surveys. Using the comprehensive survey of the living conditions of people about health and welfare conducted by the former Ministry of Health and

Welfare, they found that people who lived in prefectures with higher medium income are more likely to report good self-reported health than people who lived in prefectures with lower medium income level. In addition, individual level characteristics affected self-perceived health. Women, people with lower income, and older persons were more likely to report ill-heath than men, people with higher income, and younger persons. However, they did not assess the effect of social class or education on health outcome, due to limitation of the data set. Kojima (2003) used the same survey conducted by the former Ministry of Health and Welfare and examined the relationship between income and subjective health among the elderly. He concluded: "there is no clear tendency for those in ill-health to be concentrated among the poor elderly and those in good-health to be concentrated among the wealthy elderly" (p. 89).

Yamazaki (1989) examined the mortality records of the administrative districts in large metropolitan areas and found that the districts with a high proportion of manual labor workers and self-employed tend to show high mortality rate and the districts with high proportion of professional, managerial, clerical workers, and farmers tend to show low mortality rate. Nakata (1999, 2001) reports based on his survey of elderly in a northern city that occupational prestige and individual income affect subjective health and depressive feelings.

Ishida (2004) presents the results of one of the first national surveys on health and social inequality. When he examined the onsets of chronic diseases, there was very little difference in social class or income or education. People who were not employed (including those who were retired and those who were unemployed) were more likely to have chronic diseases diagnosed by medical doctors, but among those who were working there was virtually no difference by the kinds of occupation people were engaged in.

More recently, there is an emerging body of literature that documents the relationship between socio-economic conditions and health outcomes in Japan, both by researchers in medical profession and in the social sciences. *Social Disparity and Health* (Kawakami, Kobayashi, and Hashimoto 2006), for example, is edited by a research team in the Medical School at the University of Tokyo. Tsutsumi (2006), one of the chapters in the book, reports the relationship between occupation on the one hand and job strain and hypertension on the other. Kondo (2005), an epidemiologist, shows that education and income affect depression symptoms, subjective health, and the need for long-term care among the elderly population in Japan. Ishida (2006) examines the national survey of the elderly who were 65 years old or over and finds that although the onset of chronic health conditions and the visit to doctors are not affected by

socio-economic factors, there are clear differentials in physical discomfort, activity restriction, depression, and subjective perception of health by social class and income. Katase (2008) using the 2005 SSM survey claims that those with low education are more likely to engage in health-risk behaviors (smoking and drinking) than the highly-educated especially among men and that education is positively related with subjective health. Kondo et al. (2008) claim that relative income deprivation is related to poor self-reported health independently of absolute level of income in Japan. Therefore, there is clearly an accumulation of the empirical studies on social inequality of health in Japan.

This study departs from the previous studies conducted in Japan in two respects. First, it uses panel survey to identify the effect of the socio-economic positions on health-related outcomes. By taking full-advantage of the panel-type research design, it focuses on the impact on health of the changes in socio-economic positions within the individual, rather than the difference between individuals with varying socio-economic positions. Second, the study incorporates a wide range of work-related conditions and workplace arrangements, in addition to the typical socio-economic outcomes of education, employment status, and income. These include indicators of autonomy and authority at workplace, flexible work arrangements, relationship with co-workers, and opportunities for training and upgrading skills. None of the studies cited above about health inequality in Japan used detailed measures of working conditions.

Research conducted in other nations has documented the effects of various work-related conditions and attributes on health outcomes. Borg and Kristensen (2000) show that the changes in the self-reported health were affected not only by social class but also by various work environment factors, including repetitive work, skill discretion, job demands, social support, and job insecurity. Brand et al. (2007) report that physical and psychological job characteristics affect self-assessed health, cardiovascular and musculoskeletal health problems, and depression, and that job characteristics mediate the association between socio-economic status and health outcomes. Niedhammer et al. (Niedhammer et al. 2008) take into account psychological demands, decision latitude, and social support, in addition to occupation, work contract and occupational exposures, in assessing the impact on self-reported health, absence by long sickness, and work injury. They report that all these work factors except for psychological demands affect health outcomes and that occupational differences in health were reduced after adjusting for work factors.

Following these examples, this study will assess the effect of various job characteristics, in addition to education, employment status, and income, on health

conditions. Job characteristics include psychological and physical demands, social support and relationship with co-workers, autonomy and authority at the workplace, training opportunities and skill upgrade, and flexibility and security. The key question in this study is whether the changes in job characteristics affect the changes in health conditions. The study will pay attention to the changes within the individual, taking into account unobserved differences between individuals. By using the panel-type research design, different statistical models which attempt to control for unobserved heterogeneity will be employed to identify the effect of job characteristics on health outcomes.

2. DATA AND VARIABLES

The data set used in this paper comes from the Japanese Life Course Panel Surveys (JLPS). The first wave JLPS was conducted in Japan from January to April, 2007. It consists of the youth panel (20 to 34 years old) and the middle-aged panel (35 to 40 years old). The 2007 JLPS sampled respondents from the population of men and women aged 20-34 (for the youth panel) and aged 35-40 (for the middle-aged panel) residing in Japan in November 2006, using the electoral and resident registry.[3] Because the response rates among the youngest people (especially men) are known to be lower than others, we stratified the sample by gender and age group, in addition to the geographical region and city size. We sampled respondents separately for males and females from 20-24, 25-29, 30-34, and 35-40 age groups.

The sampled individuals were first contacted by mail and asked to take part in the survey. The enclosed letter explained that there would be a follow up after the initial survey. This will reduce the response rate in the first wave, but it is hoped that those people who agreed to participate will continue the survey, thereby increasing the retention rate. Those who agreed to take part in the survey, received the questionnaires by mail, and the staff from a professional survey company visited the respondents to collect the questionnaires. For the youth survey, 3367 respondents returned the questionnaires and for the middle-aged survey 1433 respondents returned the questionnaires. The response rates were 34.5% for the youth survey, and 40.4% for the middle-aged survey.[4]

The second wave of JLPS was conducted from January to March, 2008. It followed up all the respondents who returned the questionnaires in 2007. The initial inquiry mail was sent in December 2007, and the questionnaires were sent in January 2008. The staff from a professional survey company collected the questionnaires by visiting respondents in January and February. For the youth survey, 2719 respondents

returned the 2008 JLPS questionnaires, and for the middle-aged survey 1246 respondents returned the questionnaires. The retention rate was 80.1% for the youth survey and 86.9% for the middle-aged survey. Because we are interested in the change of health and work conditions across two waves, our analysis is restricted to the respondents who completed the second wave. The youth survey and the middle-aged survey are combined and analyzed together since the two surveys had identical questionnaires.

The JLPS asked a number of questions related to the respondents' health conditions. Three health-related outcomes are used in this paper. The first variable is self-reported health. The respondents were asked to report their present health condition: "how do you feel about your present health?" The responses were: "1 very good," "2 good," "3 ordinary," "4 not good," and "5 bad." The higher the score, the worse the self-perceived health condition. The second variable measures activity restriction due to health. The respondents were asked: "were daily housework and activities related to their job restricted because of health reasons in the last month?" The following four-point scale is used to record the responses: "1 not at all," "2 seldom," "3 sometimes," and "4 always or almost always." The third variable is a measure of depression symptoms. The respondents were asked: "were you heavily depressed during the last month?" and the responses were coded as: "1 not at all," "2 seldom," "3 sometimes," and "4 always or almost always." All three variables are scored in the way that the highest score corresponds to the worst health conditions.

Socio-economic variables include the following: education, employment status, and income. Education is measured by the attendance in higher education. The original responses to the last school attended were six categories (years of schooling are indicated in parentheses): (1) junior high schools (9 years), (2) senior high schools (12 years), (3) post-secondary vocational schools (13 years), (4) junior colleges and technical colleges (14 years), and (4) four-year universities including graduate school (16 years). The respondents who attended junior colleges, technical colleges, universities, and graduate schools are given the score of one and zero otherwise for higher education variable. Education variable was originally included in the analysis as a years-of-schooling variable, but the difference between those who went to higher education and those who did not seem to be the major threshold. Instead of using the linear specification, this paper focuses on the difference between the two.

Employment status is based on the condition of employment at the time of the survey in 2007 and 2008. The following categories are used to distinguish employment status: employer, full-time employee (base category), part-time and

temporary employee, self-employed and family worker, and not working. Because those who did not work did not have responses to job characteristic variables, these respondents were excluded from the analysis. Individual income is measured by the approximate yen amount (in ten thousand). The respondents were asked to choose one of 13 categories representing their individual income. The midpoints of each category are used to estimate the individual income of the respondent in each category.

The JLPS contains rich questions about the working conditions, work environments, and work arrangements. The following questions are asked about the characteristics of the workplace.[5] If it applies to the workplace of the respondent, the score of one is given to the variable, zero otherwise. Variable names are shown in parentheses.

(1) over-time work (overt) – almost everyday people do over-time work
(2) labor shortage (labshort) – there is chronicle labor shortage
(3) deadline (deadl) – always chased at the deadline
(4) help each other (helpo) – there is an atmosphere of helping each other
(5) independent work (indepw) – most work is done independently
(6) coordinating work (coordw) – most work is done by coordinating with each other
(7) guidance to juniors (guidej) – there is an atmosphere of seniors guiding juniors
(8) transfer (transf) – there is a mechanism for moving positions based on people's preference
(9) advice to young people (advicey) – there is a designated advisor for giving advice to young workers
(10) advice for future work (advicef) – there are opportunities for getting advice about the future work

The following questions are asked about autonomy and authority at the workplace, training opportunities, flexibility, and security. When the respondent believes that it strongly applies or applies to his/her work, a score of one is given to the variable, zero otherwise.

(11) determine pace (pace) – I could determine the pace of my work
(12) decide work pattern (decide) – I could decide my work pattern
(13) decide subordinate's work (boss) – I could decide the subordinate's work
(14) opportunities for training (train) – I have opportunities for training
(15) opportunities for upgrading skills (upskill) – I have opportunities for upgrading my

job skills

(16) flexibility in work (flex) – I could arrange my work schedule to fit the needs for child-care, housework, and study

(17) insecurity in work (unsecure) – there is a possibility that I could be unemployed in a year

Finally, the respondent's gender and age and age square are included as control variables.

3. ANALYSIS

Distribution of Health-related Outcomes and Other Variables

Table 1 presents descriptive statistics for the variables used in this paper. The first set of variables presents the distributions of three health-related outcomes. First, with regard to the self-reported health, 15 percent of our respondents reported that their health was "very good," 34 percent "good," 39 percent "ordinary," 11 percent "not good," and 1 percent "bad" at wave 1. The distribution of self-rated health changed very little between wave 1 (2007) and wave 2 (2008). Second, almost 70 percent of our respondents had no activity restriction due to health conditions while 13 percent experienced some restriction at wave 1. The proportion of those who had restriction seems to have increased slightly from wave 1 to wave 2. Third, respondents with depression symptoms (sometimes and always) amount to 35 percent at wave 1, and the proportion increased slightly to 37 percent at wave 2. These one-way distributions of health outcomes show little changes between the two waves.

There are significant correlations among these the health-related variables. However, these correlations are not exceptionally high: between self-reported health and activity restriction (r=.287 at wave 1 and r=.291 at wave2), between self-reported health and depression (r=.284 at wave 1 and r=.264 at wave2), and between activity restriction and depression (r=.265 at wave 1 and r=.297 at wave2). These results suggest that these variables are related but tap different aspects of respondent's health condition.

The second set of variables pertains to socio-economic ones. The distribution of education shows that half of the respondents attended institutions of higher education. Since there is a rapid increase in the attendance rate to higher education (especially four-year universities) beginning in 1990s, these young respondents clearly benefited from the expansion of the higher education sector. Education variable is fixed and did not change between the two waves. As to the employment status, about 60 percent of the respondents are full-time employees and 30 percent part-time employees. Women

are much more likely to engage in part-time work than men, since the proportion of part-time work reaches 48 percent among women while it is only 16 percent among men. There are very few employers and self-employed/family workers among our respondents. As to the individual income, we see slight increase in the average level of income from 260 thousand yen to 274 thousand yen.

The third set of variables relate to job characteristics. There are seventeen detailed job characteristics that are considered in this paper. Among the characteristics of the workplace, we learn that some characteristics are more prevalent than others. For example, overtime work and labor shortage are reported by more than 30 percent of our respondents at wave 1, while features related to advice (whether there is a designated advisor for young workers and whether there are opportunities for getting advice for future work) are reported by less than ten percent of our respondents. Cooperation and coordination with co-workers seem to be a prevalent feature since over 40 percent of the respondents report that there is an atmosphere of helping each other and that their work is done by coordinating with each other. With regard to autonomy and authority, over 60 percent of the respondents replied that they could determine the pace of their work and almost half replied that they could decide their work pattern. Training and opportunities for upgrading job skills seem to be prevalent among our respondents, and about half of the respondents report that their work allows flexibility. The prospect of losing their job is reported by some 13 percent of respondents.

When we compare the distribution of job characteristics between the two waves, there is no substantial change. If anything, the proportion of favorable job characteristics (such as helping each other, coordinating work, determining pace, and flexibility) seemed to have increased slightly, while the proportion of unfavorable job characteristics (such as overtime and labor shortage) seemed to have decreased slightly.

Changes in Health-related Outcomes

Table 2 reports the cross-tabulation of health conditions at wave 1 and those at wave 2. It shows how much health outcomes changed between 2007 and 2008 within the individual. There are substantial changes in health conditions between the two waves. Table 2a shows the respondents' responses to self-reported health at two waves. The numbers on the main diagonal indicate the cases in which the same responses were observed at two time points. The row percentages of those in the main diagonals, as shown in the second row, are not very high. Among those who reported "very good" health at wave 1, only 52 percent reported the same response at wave 2, and about a third (35%) reported "good." Among those who reported "bad" health at wave 1, only

38 percent remained “bad” at wave 2 and half shifted to “not good” category. If we compute the proportion of individuals who did not change their responses between the two waves, it is only 53 percent of all individual cases. The remaining 47 percent changed their response. Among those who changed responses, about half (22 %) improved their self-rated health and the other half (25%) worsened their self-reported health. Furthermore, among those who changed responses, 85 percent changed response to adjacent category (such as between “very good” and “good”), and the remaining 15 percent experienced two-step changes. Individuals, therefore, seem to make small changes in reporting their health.

Table 2b presents the cross-tabulation of the responses to activity restriction at wave 1 and 2. Among those who had no activity restriction at wave 1, three-fourths (74%) remain in the same category after a year. In contrast, respondents who were in other categories at wave 1 tend to experience change of their health conditions; only about 30 percent remain in the same category. Among those who always or almost always had restrictions in daily activities due to health problems at wave 1, only 31 percent remained in the same category while about a half (49%) experienced two or three-step changes to either “seldom” or “not at all” categories. It is possible that some of these people had physical injuries at wave 1 and later recovered from the injuries. The proportion of individuals who did not change their health conditions with respect to activity restriction is 60 percent, so the remaining 40 percent changed their conditions. However, it should be noted that the respondents who did not have any restriction at all are less likely to change their conditions than those who were in other categories at wave 1. With respect to the direction of change, among those who changed responses 58 percent of those did so toward the direction of worsening their health, while 42 percent changed toward the direction of improving their health.

Table 2c shows the cross-tabulation of the responses to the depression question at wave 1 and 2. The proportion of individuals who did not experience change in depression question is 47 percent, so more than a half (53%) of all individuals experienced change in depression symptoms. Among those who experienced change, 54 percent changed toward the direction of worsening depression while 44 percent toward the direction of improving the depression.

In summary, despite the fact that the distributions of health outcomes are very similar between wave 1 and wave 2, it does not necessarily imply that individuals did not experience a change of health conditions. On the contrary, our results suggest that there are substantial changes in health conditions between the two waves. Depression symptom is most volatile, followed by self-reported health, and then activity restriction.

Even with the activity restriction, about 40 percent of individuals changed their responses between the two waves. In the next section, we will examine what factors account for these changes in health outcomes.

Determinants of Health-related Outcomes

Table 3 presents the results of predicting the self-reported health. Four different models are fitted to the data. The first model is the fixed effects model and can be written as:

$$y_{it} = \alpha_i + \boldsymbol{X}_{it}\boldsymbol{\beta} + \varepsilon_{it} \qquad (1)$$

where i stands for individual and t stands for time or panel wave. α_i is a set of intercept for the *i*th individual, and it is treated as a parameter to be estimated for each cross-section observation *i*. $\boldsymbol{X}_{it}$ is the *i* th observation on explanatory variables, and ε_{it} denotes the disturbance term.

The important feature of the fixed effects model is that we allow for arbitrary correlation between explanatory variables and unobserved unit (individual) effect (Wooldridge 2002), and the main advantage of using the panel data is "the ability to remove a time-invariant unobservable" (Lee 2002, p. 16). The parameters of the fixed effects model uses information on the effect of the changes in the explanatory variables on the changes in the dependent variable, so that the parameters of the fixed effects model are not affected by the unobserved heterogeneity bias.

The second model is the random effects model and can be written as:

$$y_{it} = a + \boldsymbol{X}_{it}\boldsymbol{\beta} + \theta_i + \varepsilon_{it} \qquad (2)$$

where θ_i denotes the unit (individual) effects. The key feature of the random effects model is that the unobserved θ_i are assumed to be uncorrelated with explanatory variables and the unit effects θ_i are treated as a random effect. The random effects models are prevalent in sociological research (Halaby 2004). The attraction of the random effects model is that it can include time-invariant explanatory variables so that variation between individuals may be assessed at the same time as the change within the individual. Two versions of the random effects models are considered in the paper. Model (2) includes only time-variant explanatory variables, and Model (3) includes both time-variant and time-invariant explanatory variables. Model (2) is shown for the purpose of comparison with Model (1) and (3).

Finally, the Hausman and Taylor (HT) estimation model is introduced. The model can be written as:

$$y_{it} = \boldsymbol{X}_{it}\boldsymbol{\beta} + \mathbf{Z}_i\boldsymbol{\gamma} + \theta_i + \varepsilon_{it} \qquad (3)$$

where $\mathbf{Z}_i$ are cross-sectional time-invariant variables. Hausman and Taylor (1981) split X and Z into two sets of variables: X = [X_1 ; X_2] and Z = [Z_1 ; Z_2]. The major advantage of this model is that we are able to break down X and Z variables into two components: those which are correlated with θ_i and those which are independent of θ_i. X_1 and Z_1 are assumed to be exogenous and are not correlated with θ_i and ε_{it}. In contrast, X_2 and Z_2 are endogenous because they are correlated with θ_i but not with ε_{it}. The fixed effects model would sweep θ_i and "remove the [heterogeneity] bias, but in the process it would also remove the $\mathbf{Z}_i$ and hence the Within [fixed effects] estimator will not give an estimate of $\boldsymbol{\gamma}$ (Baltagi 2005, p. 126). The HT estimation will include time-variant variables while relaxing the assumption of the random effects model on time-invariant variables. The HT estimation, "which involves mixing estimators that have the desirable properties of fixed effects for time-varying explanatory variables with random effects estimators for time-invariant explanatory variables, goes to the heart of the resistance many researchers have shown to fixed effects estimation"(Halaby 2005, p. 530). Because the individual unit effects are likely to be correlated with some time-variant explanatory variables, the HT estimation has a practical appeal. The HT estimation will allow the researchers to take advantage of the fixed effects model (i.e., removing the heterogeneity bias) while retaining the ability to identify the parameters of the time-invariant variables (i.e., estimating the unit individual effects).

Table 3 Model (1) presents the estimators of the fixed effects model for the self-reported health. The model does not distinguish between time-variant exogenous and time-variant endogenous since there is no time-invariant variable included in the equation.[6] Among the job characteristics, the following variables indicate significant effects: (1) helpo - when the respondent's workplace becomes more cooperative inducing the atmosphere of helping each other, there is an improvement in the self-reported health (negative sign); (2) advicef – when the respondent's workplace changes in the way that there are opportunities for getting advice about future work, self-reported health tend to improve; (3) decide and pace – when the respondent's workplace changed and he/she is now able to decide his/her work pattern and pace of work, there is an improvement in the self-reported health; and (4) deadl – when the respondent's workplace becomes always chased at the deadline, his/her self-reported

health tends to worsen.

It is important to notice that these effects of job characteristics are estimated after controlling for the heterogeneity bias. These effects pertain to the effect of the changes in the job characteristics within the individual, and unobserved differences between individuals (unit effects) are removed from the model.

Table 3 Models (2) and (3) are the random effects model. Model (2) includes time-variant explanatory variables, and Model (3) includes both time-variant and time-invariant (gender and education) variables in the equation. By comparing Model (2) and (3), the addition of the two time-invariant variables did not change the estimates of job characteristics, and these two variables did not contribute to eliminating the heterogeneity bias. At the bottom of the table, we show the results of the Hausman tests by comparing the estimates of the fixed effects model and the random effects model. Large values of the Hausman chi-square statistics will imply that the assumption of no correlation between the unit effects and the time-variant explanatory variables is rejected and hence the fixed effects model is preferred. Hausman tests are routinely used in econometrics analyses, while they are not popular in sociological research (Halaby 2005). The results of the Hausman tests lead us to reject the assumption of the null hypothesis, and the estimates from the random effects model are subject to heterogeneity bias.

By comparing the estimates of the fixed effects and the random effects models, there are two noticeable differences. Income and labor shortage (labshort) coefficients are significant in the random effects model, while they are not significant in the fixed effects model. This finding implies that the estimates of the random effects model tend to overestimate the "true" effect of the change because they confound the effect of the change in the time-variant explanatory variable with the effect of the difference between individuals. For example, the effect of income (-0.134) of the random effects model is about twice of the size of the effect of income (-0.065) of the fixed effects model because the effect of the random effects model include both the effect of the change in income between the two waves within the individual (i.e., increased income leads to improved self-reported health) and the effect of individual differences in income (i.e., people with higher income tend to have better self-reported health than those with lower income). Similarly, the effect of the labor shortage of the random effects model includes both the effect of the change of the workplace condition in which there is shortage of labor and the effect of difference between respondents who work in a workplace with short labor supply and those who do not.

Finally, Model (4) shows the estimates of the HT estimation model. Time-variant

and time-invariant variables are each divided into two components: exogenous variables which are independent of θ_i and endogenous variables which are correlated with θ_i. HT model provides the estimates of the time-invariant variables in addition to time-variant explanatory variables, by allowing some of time-invariant variables to be endogenous. The Hausman test statistics indicate that the assumption of null hypothesis is not rejected, thereby preferring the HT model to the fixed effects model. The parameters of job characteristics variables are very similar between those of the fixed effects model and those of the HT model, and the coefficients which are significant are the same in the two models. By relaxing the assumption of the random effects model, the coefficients of income and labor shortage are no longer significant. The advantage of HT model over the fixed effects model is that the former provides estimates for the time-invariant effects, that is, the unit individual effects. Both gender and education are not significant at 5 percentage level, but they are significant at 10 percentage level. Males tend to show lower self-reported health score than females, and people with higher education tend to show higher self-reported health score than those without higher education.

Table 4 presents the results of fitting various models predicting activity restriction. When we compare four models using the Hasuman statistics, we arrive at the conclusion that the fixed effects model is our preferred model. The assumption of the null hypothesis of no correlation for the random effects model and for the HT model is rejected at 5 percent significance level.

Using the fixed effects model as our representation, we find the following effects of job characteristics on activity restriction: (1) guidej – when the respondent's workplace is changed to have the atmosphere of seniors guiding juniors, the respondent is less likely to experience activity restriction; and (2) labshort – when the respondent's workplace changes to experience chronicle labor shortage, he/she is more likely to suffer from activity restriction.

These two variables are the only factors affecting activity restriction. In other words, activity restriction is not much affected by job characteristics and workplace conditions. Because the analysis of the effect of job characteristics requires that the respondent is working at the time of the survey, those with severe activity restriction are likely to be out of the labor market and excluded from our analysis.

Table 5 presents the results of predicting depression symptoms. The comparison of four models suggests (1) that the null hypothesis used in the random effects model is rejected and the fixed effects model is preferred over the random effects model, and (2) the Hausman test is not significant for the HT model and the HT model is preferred over

the fixed effects model. With regard to the effects of job characteristics, the following coefficients of the HT model are significant: (1) helpo – when the workplace changed to an atmosphere of helping each other, the depression symptoms are reduced; (2) advicey – when the respondent's workplace changes in the way that advisors to young workers are provided, depression tends to improve; (3) income – when the respondent's income increased, there is a tendency for the reduction in depression; (4) pace – when the respondent is able to decide his/her pace of work, there is an improvement in the depression symptoms; and (5) when the respondent becomes to feel that there is a possibility of unemployment in a year, there is a tendency for increased depression symptoms.

The comparison of the estimates of the fixed effects model and the random effects model suggests that the effects of overtime and deadline in the random effects model are primarily the result of the differences in these two job characteristics between individuals. Because the magnitude of these two effects is much smaller in the fixed effects model, the effects of the random effects model picked up the following effect: (1) the respondents who have a job in the workplace where people do over-time work almost everyday are more likely to suffer from depression than those who do not work in such a place; and (2) the respondents who have a job in the workplace where workers are always chased at the deadline are more likely to suffer from depression than those who do not work in such a place.

4. DISCUSSION

This paper examined the relationship between job characteristics and workplace conditions on the one hand and health-related outcomes on the other. We identified three different health-related outcomes and examined the effects of various job-related variables separately for each outcome. The first major conclusion from the analyses pertains to the finding that there are substantial changes in health-related outcomes between short periods of time. Although the distributions of health-related outcomes are very similar at two points in time, it does not necessarily imply that the individuals did not experience a change in health conditions. On the contrary, our results suggest that there are substantial changes in health conditions between the two waves. Depression symptom is most volatile, followed by self-reported health, and then activity restriction. Even with the activity restriction, about 40 percent of individuals changed their responses between the two waves.

The second major conclusion of this paper is that the effects of job characteristics depend on the different health-related outcomes. Self-reported health is affected by a

variety of job-related factors. Changes in the workplace conditions and environments regarding the atmosphere of helping each other, getting advice for future work, being chased at the deadline affect the self-reported health. The ability to control work pace and work pattern seems to improve self-reported health.

Depression symptoms are also affected by a number of job-related characteristics. The atmosphere of helping each other and the control over the pace of work are two important factors which affect both depression and self-reported health. The change in income exerts an effect of reducing depression symptoms, while the possibility of unemployment tends to increase depression.

Activity restriction is not much affected by job characteristics. The only factors which had significant effects are the changes in the workplace conditions regarding the atmosphere of seniors guiding juniors and chronicle labor shortage. The guidance tends to reduce the experience of activity restriction, while labor shortage tends to increase the likelihood of activity restriction. As argued above, the lack of extensive effects of job characteristics on activity restriction may be due to the fact that only respondents working at the time of the survey are included in the analysis and those with severe activity restriction who are likely to be out of the labor market are excluded from our analysis.

In summary, all these findings suggest that the workplace conditions and job characteristics have profound influence on the workers' health.

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Table 1 Descriptive Statistics

	2007	2008
Health-related variables		
Self-reported Health		
1 very good	14.8	14.0
2 good	34.4	35.0
3 ordinary	39.3	37.6
4 not good	10.7	12.1
5 bad	0.9	1.3
Activity restriction		
1 not at all	69.0	63.8
2 seldom	17.5	19.1
3 sometimes	10.2	12.8
4 always/almost always	3.3	4.3
Depression		
1 not at all	35.4	33.6
2 seldom	30.1	29.3
3 sometimes	26.0	27.2
4 always/almost always	8.5	9.9
Socio-economic variables		
Education		
middle school	1.5	1.5
high school/ vocational schools	47.7	47.7
junior college/technical college	13.7	13.7
university/ graduate school	37.2	37.2
higher education attendance	50.8	50.8
average years of schooling	15.2	15.2
Employment status		
employer	1.6	1.9
full-time employee	59.1	60.7
part-time employee	31.3	30.6
self-employed, family worker	6.5	6.7
Income		
average income	260.0	273.5
Job characteristic variables		
Overtime (overt)	40.2	39.9
Labor shoratge (labshort)	30.9	26.8
Deadline (deadl)	17.7	17.3
Help each other (helpo)	41.6	43.8
Independent work (indepw)	28.8	30.0
Coordinating work (coordw)	46.5	48.8
Guidance to juniors (guidej)	33.2	34.4
Transfer (transf)	10.3	11.7
Advice to young people (advicey)	3.5	4.0
Advice for future work (advicef)	7.9	9.0
Determine pace (pace)	61.3	63.6
Decide work pattern (decide)	47.7	49.3
Decide subordinate's work (boss)	20.8	21.7
Opportunities for training (train)	47.0	49.8
Opportunities for upgrading skills (upskill)	60.8	60.6
Flexibility in work (flex)	48.2	52.3
Insecurity in work (unsecure)	12.6	13.0
Gender		
male	47.9	47.9
female	52.1	52.1
Age		
20-24 in 2007	19.4	19.4
25-29 in 2007	20.8	20.8
30-34 in 2007	28.3	28.3
35-40 in 2007	31.5	31.5
average age	30.8	31.8

Table 2 Changes in Health Outcomes between Wave 1 (2007) and Wave 2 (2008)

a) Self-reported health

	Wave 2 (2008)					
Wave 1 (2007)	1 very good	2 good	3 ordinary	4 not good	5 bad	Total
1 very good	301	201	72	9	0	583
	51.6	34.5	12.3	1.5	0.0	100
2 good	175	719	392	61	5	1352
	12.9	53.2	29.0	4.5	0.4	100
3 ordinary	74	414	858	194	6	1546
	4.8	26.8	55.5	12.5	0.4	100
4 not good	3	37	158	195	26	419
	0.7	8.8	37.7	46.5	6.2	100
5 bad	0	4	0	17	13	34
	0.0	11.8	0.0	50.0	38.2	100
Total	553	1375	1480	476	50	3934
	14.1	35.0	37.6	12.1	1.3	100

b) Activity restriction

	Wave 2 (2008)				
Wave 1 (2007)	1 not at all	2 seldom	3 sometimes	4 always/ almost always	Total
1 not at all	1993	425	229	55	2702
	73.8	15.7	8.5	2.0	100
2 seldom	317	197	133	37	684
	46.3	28.8	19.4	5.4	100
3 sometimes	147	108	113	36	404
	36.4	26.7	28.0	8.9	100
4 always/almost always	43	20	27	40	130
	33.1	15.4	20.8	30.8	100
Total	2500	750	502	168	3920
	63.8	19.1	12.8	4.3	100

c) Depression symptom

	Wave 2 (2008)				
Wave 1 (2007)	1 not at all	2 seldom	3 sometimes	4 always/ almost always	Total
1 not at all	801	342	195	39	1377
	58.2	24.8	14.2	2.8	100
2 seldom	313	462	323	71	1169
	26.8	39.5	27.6	6.1	100
3 sometimes	169	289	423	135	1016
	16.6	28.4	41.6	13.3	100
4 always/almost always	26	51	117	139	333
	7.8	15.3	35.1	41.7	100
Total	1309	1144	1058	384	3895
	33.6	29.4	27.2	9.9	100

Note: The first row shows cell count, and the second row shows row percentage.

Tabel 3 OLS Fixed Effects, GLS Random Effects, and GLS Hausman/Taylor Estimates for Self-reported Health

	Model (1) FE		Model (2) RE		Model (3) RE		Model (4) HT	
Time variant exogenous								
employ	−0.405		0.008		0.000		−0.123	
part	−0.077		−0.064	*	−0.055		−0.055	
semp	0.306		0.058		0.026		−0.083	
helpo	−0.080	**	−0.085	**	−0.083	**	−0.086	**
indepw	−0.013		−0.027		−0.022		−0.011	
coopw	−0.038		−0.032		−0.034		−0.038	
guidej	−0.008		−0.031		−0.033		−0.012	
transf	0.054		−0.011		−0.001		0.014	
advicey	−0.026		0.010		0.009		0.010	
advicef	−0.119	*	−0.107	**	−0.106	**	−0.100	*
decide	−0.069	*	−0.071	**	−0.070	**	−0.074	**
Time variant endogenous								
age	−0.055		0.001		0.002		−0.080	
age2	0.002		0.000		0.000		0.002	
income	−0.065		−0.139	*	−0.134	*	−0.091	
overt	−0.030		−0.017		−0.010		−0.027	
labshort	0.043		0.089	**	0.089	**	0.044	
deadl	0.093	*	0.127	**	0.129	**	0.092	*
pace	−0.063	*	−0.083	**	−0.076	**	−0.061	*
boss	−0.027		0.023		0.007		−0.023	
train	0.016		0.004		0.006		0.014	
upskill	−0.038		−0.050	*	−0.048	*	−0.040	
flex	−0.050		−0.084	**	−0.076	**	−0.048	
unsecure	0.017		0.061	*	0.057		0.017	
Time invariant exogenous								
male					0.054		0.066	
Time invariant endogenous								
education					−0.189	**	−0.492	
constant	2.721		2.489	**	2.560	**	3.452	**
Wald chi-sq			222.69		277.98		134.60	
Hausman chi-square			41.35		37.29		12.24	
df			23		23		10	
p-value			0.011		0.030		0.269	

Note: The coefficients for income are multiplied by 1000.
* siignificant at 5%; ** significant at 1%

Tabel 4 OLS Fixed Effects, GLS Random Effects, and GLS Hausman/Taylor Estimates for Activity Restriction

	Model (1) FE		Model (2) RE		Model (3) RE		Model (4) HT	
Time variant exogenous								
employ	0.027		−0.001		0.005		−0.125	
part	−0.050		−0.008		−0.019		0.015	
semp	−0.020		0.039		0.050		−0.058	
helpo	−0.019		−0.035		−0.040		−0.031	
indepw	0.021		0.011		0.014		0.022	
coopw	−0.028		−0.033		−0.039		−0.046	
guidej	−0.117	**	−0.061	*	−0.064	**	−0.057	*
transf	0.033		−0.018		−0.022		−0.002	
advicey	0.030		0.038		0.035		0.034	
advicef	−0.085		−0.037		−0.030		−0.032	
decide	−0.021		−0.036		−0.033		−0.036	
Time variant endogenous								
age	0.087		0.036		0.033		−0.079	
age2	0.000		0.000		0.000		0.002	
income	0.108		−0.295	**	−0.193	**	0.066	
overt	−0.016		−0.049	*	−0.041	+	−0.012	
labshort	0.089	*	0.067	**	0.064	**	0.081	*
deadl	−0.034		0.025		0.028		−0.032	
pace	0.051		0.000		0.004		0.057	
boss	0.003		0.039		0.049	+	0.001	
train	0.037		0.028		0.029		0.049	
upskill	−0.062		−0.004		−0.001		−0.061	*
flex	0.011		0.029		0.025		0.015	
unsecure	−0.006		0.125	**	0.130	**	−0.005	
Time invariant exogenous								
male					−0.126	**	−0.163	**
Time invariant endogenous								
education					−0.029		−0.516	
constant	−1.320		0.948	**	1.069	**	2.444	*
Wald chi-sq			108.02		131.88		91.81	
Hausman chi-square			78.14		73.78		23.44	
df			23		23		10	
p-value			0.00		0.00		0.01	

Note: The coefficients for income are multiplied by 1000.
* siignificant at 5%; ** significant at 1%

Tabel 5 OLS Fixed Effects, GLS Random Effects, and GLS Hausman/Taylor Estimates for Depression

	Model (1) FE		Model (2) RE		Model (3) RE		Model (4) HT	
Time variant exogenous								
employ	0.206		0.066		0.077		−0.026	
part	−0.057		0.035		0.023		0.044	
semp	0.260		0.126	*	0.142	*	0.033	
helpo	−0.055		−0.056	*	−0.061	*	−0.069	*
indepw	−0.033		0.000		0.004		0.003	
coopw	−0.049		−0.006		−0.014		−0.020	
guidej	−0.056		−0.048	+	−0.052	+	−0.021	
transf	−0.073		−0.070	+	−0.073	+	−0.079	+
advicey	0.146	+	0.102		0.098		0.127	*
advicef	0.013		−0.035		−0.027		−0.019	
decide	−0.042		−0.045		−0.041		−0.053	+
Time variant endogenous								
age	0.154		−0.052	+	−0.056	*	0.035	
age2	−0.001		0.001		0.001		0.000	
income	−0.211		−0.257	**	−0.140	*	−0.249	*
overt	0.017		0.056	*	0.066	*	0.026	
labshort	−0.020		0.030		0.026		−0.024	
deadl	−0.012		0.092	**	0.097	**	−0.007	
pace	−0.112	**	−0.117	**	−0.115	**	−0.113	**
boss	0.049		0.049		0.060	+	0.043	
train	0.031		0.032		0.031		0.041	
upskill	0.022		−0.042		−0.039		0.017	
flex	0.007		−0.034		−0.042		0.006	
unsecure	0.156	**	0.234	**	0.238	**	0.161	**
Time invariant exogenous								
male					−0.154	**	−0.108	**
Time invariant endogenous								
education					−0.028		−0.118	
constant	−1.080		3.284	**	3.437	**	1.468	
Wald chi-sq			222.19		247.16		96.93	
Hausman chi-square			52.74		53.57		15.98	
df			23		23		10	
p-value			0.00		0.00		0.10	

Note: The coefficients for income are multiplied by 1000.
* siignificant at 5%; ** significant at 1%

[1] Healthy life expectancy is computed from life expectancy, but includes an adjustment for time spent in poor health. Healthy life expectancy measures the equivalent number of years in full health that a newborn child is expected to live based on the present level of mortality rates and the distribution of health states in the population (World Health Organization 2004).

[2] People who are receiving pubic assistance (low income families) are exempt from the payment of premium for the national health insurance.

[3] Because of the change in the rules regarding the access to official registries, both electoral and resident registries are used so that we could assure sampling from each district. The usual procedure is try to access the electoral registry and, if it is not possible, the resident registry was used instead.

[4] The response rate is computed by the number of cases which returned the questionnaires divided by the number of sample attacked. Among those who were originally sampled, we excluded those who were dead, or had no correct address, or moved out the address sampled.

[5] The 2007 JLPS asked respondents who worked at the time of the survey to report the job characteristics about the current work, and asked respondents who did not work at the time of the survey to report the job characteristics about the last job they held. The 2008 JLPS asked the job characteristics to only those who worked at the time of the survey. Therefore, the respondents who did not work at wave 2 are excluded from the analysis although the respondents who did not work at wave 1 but had previous job were included in the analysis.

[6] The distinction between the time-variant exogenous and the time-variant endogenous applies only to the HT estimation model.

1

東京大学社会科学研究所パネル調査プロジェクトについて

労働市場の構造変動、急激な少子高齢化、グローバル化の進展などにともない、日本社会における就業、結婚、家族、教育、意識、ライフスタイルのあり方は大きく変化を遂げようとしている。これからの日本社会がどのような方向に進むのかを考える上で、現在生じている変化がどのような原因によるものなのか、あるいはどこが変化してどこが変化していないのかを明確にすることはきわめて重要である。

本プロジェクトは、こうした問題をパネル調査の手法を用いることによって、実証的に解明することを研究課題とするものである。このため社会科学研究所では、若年パネル調査、壮年パネル調査、高卒パネル調査の３つのパネル調査を実施している。

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東京大学社会科学研究所パネル調査プロジェクト
ディスカッションペーパーシリーズについて

東京大学社会科学研究所パネル調査プロジェクトディスカッションペーパーシリーズは、東京大学社会科学研究所におけるパネル調査プロジェクト関連の研究成果を、速報性を重視し暫定的にまとめたものである。

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No.8	深堀聰子	若者の働くこと・結婚すること・子どもをもつことに関わる意識 高卒パネル（JLPS-H）と NELS による日米比較（2008 年 3 月発行）
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No.11	安藤理	公共政策支持の規定要因～公共事業と所得再分配に着目して～（2008 年 4 月発行）
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No.13　伊藤秀樹　高校生の自信と卒業後の揺らぎ（2008 年 4 月発行）

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