How Does Unemployment Affect the Health-related Behavior of Japanese Men?

A Panel Data Analysis

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Abstract

By using panel data, this study examines the effect of unemployment on various types of individual health-related behavior, namely physical exercise, dietary habits, smoking, drinking, and sleep duration among Japanese men aged 20 –40 years. The results indicate that the effect of unemployment on health-related behavior varies. It is found that exercise habits and sleep duration are affected by unemployment, while there are no observed effects on dietary habits, smoking, and frequency of drinking. Being unemployed has positive effects on frequency of exercise and sleep duration. When an individual suffers from unemployment in two successive periods, he increases the frequency of exercise, while current unemployment directly affects sleep duration. The positive effects of unemployment on exercise and sleep are explained by the increased time in the health investment function.

JEL classification codes: I12, I19, J22, J60

Keywords: health capital, unemployment, health-related behavior, exercise, smoking, drinking, sleep, panel data

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1. Introduction

In Japan, it had been a norm that young people who graduate from high school or college immediately obtain a job for life. Therefore, unemployment did not draw much public attention for a long time. However, the unemployment rate rose gradually during the depression that lasted approximately 10 years starting from the early 1990s, reaching an unprecedented 5% in 2001; this rose to 5.5% in 2002 and 2003. Although the unemployment rate showed some improvement, decreasing to 3.9% in 2007, it rose again to 5.4% in 2010 after the economic slowdown, triggered by the Lehman Shock in the autumn of 2008. From examining the unemployment rate in 2010 by age group, it is evident that it reaches approximately 4.0% in the age group of 40–54 years and rises to 10.3% in the age group of 20–24 years. It seems that unemployment is turning into a serious problem among the youth in Japan despite the rate being lower than that in some European countries (OECD, 2010). Further, one of the most prominent features of unemployment in Japan is the high frequency of long-term unemployment (lasting 12 months or more), often because the Japanese employment system has historically lacked flexibility. In such a society, the effect of unemployment on health could be much larger than in countries where the labor market is more flexible.

Thus far, the process by which drastic changes in the labor market affect the well-being of the working population in Japan has not been well examined. Does a change in employment status, particularly, losing a job, affect an individual's behavior or time allocation within a day?

The aim of this study is to examine the effects of unemployment on health-related behavior among Japanese men aged 20–40 by using data from the Japanese Life Course Panel Survey (JLPS) conducted by the Institute of Social Science, University of Tokyo. In doing so, this

study controls for unobservable individual heterogeneity by using the fixed-effects model analysis. Furthermore, this study employs a set of interaction terms of explanatory variables in order to examine how the effects of unemployment differ with the employment status in the previous term. Moreover, I also conduct an analysis using a subsample in order to mitigate the problem of reverse causality (i.e., that a health-related behavior determines employment status or motivation for job search).

This study focuses on the effect of unemployment on men. Female samples were excluded from the analysis because it is more difficult to distinguish the effects specific to the employment status of women: women's labor force participation in Japan is strongly related to their marital status, the spousal tax deduction they receive from their husbands' income, whether they have children, and whether they are co-residing with their parents after marriage.

In processing the analysis, a fixed-effects model is employed to control for an unobserved heterogeneity of individuals, since employment status seems to depend heavily on individuals' socioeconomic characteristics and health conditions. It is doubtful that the effect of unemployment is the same even when the status of employment in the previous period is different. Therefore, I further estimate another model that includes a variable to represent unemployment in the previous period, and an interaction term of previous unemployment and current unemployment.

The remainder of this paper is organized as follows: Section 2 discusses the related literature. Section 3 explains the data and empirical strategies. Section 4 presents the results, and Section 5 concludes the study.

2. Related literature

There is a considerable amount of literature that examines the social impact of

unemployment. It is known that unemployed individuals experience higher mortality (see Roelfs et al. 2011 for an extensive literature review). For example, Eliason and Storrie (2009) found that the overall mortality risk among men increased by 44 percent during the initial years after job loss using employer–employee matched data in Sweden for 1987 and 1988. Sullivan and Wachter (2009) utilized administrative data on the quarterly employment and earnings of Pennsylvanian workers in the 1970s and 1980s matched to Social Security Administration death records encompassing the period from 1980 to 2006 and estimated the effect of job displacement on mortality. They found that mortality rate in the year after displacement is 50–100 percent higher for high-seniority male workers.

However, the relationship between macro-level economic conditions and mortality is contradictory. Ruhm (2000) showed that mortality is pro-cyclical—suicides being an exception. Ruhm (2000) also conducted a microdata analysis and found that when the economy strengthens, smoking and obesity increases whereas physical activity is reduced and diet becomes less healthy. In recent years, research has been conducted on the relationship between economic conditions and health-related behavior of individuals. It is found that physical inactivity and body weight as well as tobacco and alcohol consumption decrease during economic downturns (Ruhm & Black 2002; Ruhm 2005). When the effects of macro-level economic conditions on the behavior of the general population are examined, it is unclear whether the improvement in the measures at the population level is a reflection of behavioral change among the unemployed or among those who are still employed but working fewer hours. Therefore, it is important to ascertain how individual job loss affects an individual's health behavior.

Empirical research on the effects of job loss on health behavior shows mixed results, although it is found that job loss has a detrimental effect on health behavior in most cases (see

Henkel 2011; Roelfs et al. 2011). Morris et al. (1992) found increases in body weight but no increases in either smoking or drinking after a job loss. Montgomery et al. (1998) examined the effect of job loss among male participants who had experienced unemployment in Britain, controlling for their health behavior at age 16. They found an increased risk of smoking and low body weight among these participants.

It should be noted that most studies on the effect of job loss on health behavior used cross-sectional data. Therefore, it is difficult to distinguish causation from mere correlation because of unobserved individual heterogeneity. It is important to examine the causal path that explains how job loss affects behavioral change from the economic perspective as well as using panel data. First, there is the stress hypothesis, according to which, job loss causes psychological distress and unhealthy behavior. Medical studies have found that stress increases both eating (Adam & Epel 2007) and smoking (Kassel et al. 2003). Second, job loss might also affect health behavior through an income effect. The loss in income might reduce the amount of tobacco smoked or amount of beer consumed. Third, the reason why job loss affects smoking and body weight is possibly related to increased available time that the individual may have to indulge in related activities (Schunck & Rogge 2010).

Falba et al. (2005) and Deb et al. (2011) reported reliable results in terms of causal effects as they use panel data and focus on exogenous job loss. Falba et al. (2005) show that job loss increases the probability of smoking relapse and increases the daily number of cigarettes smoked by regular smokers using Health and Retirement Survey (HRS). Deb et al. (2011) also employed the HRS and found an increase in drinking and the probability of being overweight, but only for individuals who already displayed poor health behavior prior to job loss.

Murcus (2012) reported estimated results in Germany, where there is more generous unemployment assistance than in the US. He estimated the effect of involuntary job loss on

smoking behavior and body weight using German Socio-Economic Panel Study (SOEP) data for the period 2000–2010. He found that job loss increases the probability of smoking initiation by three percentage points on average. However, there is little evidence on whether baseline smokers, that is, individuals who smoked before losing their jobs, intensify their smoking or are less likely to stop smoking due to job loss. Job loss was found to increase body weight slightly (by around 0.3 kg), but significantly. In particular, single individuals as well as individuals with lower health or socioeconomic status prior to job loss exhibited high rates of smoking initiation.

There is scarce literature on this topic in the Japanese context. Among the few studies, Granados (2008) reported the relationship between macroeconomic conditions and mortality. The study found that general mortality and age-specific death rates tend to increase during economic expansions and reduce during economic recessions, as in other industrial economies. Suicides and deaths attributable to diabetes and hypertensive disease, which constitute approximately four percent of total mortality, fluctuate counter-cyclically. At an individual level, Kan (2012) found that unemployment is related to deterioration of mental health, while there is no significant effect on self-reported physical health in the younger working population. There is no known reason for why unemployment does not relate to worse physical health in this age group. A possible explanation for this is that the direct effect of stress on health cancels out the effect of increased available time to spend on lifestyle activities. In order to investigate the mechanism that unemployment does not affect the physical health of younger men, it is crucial to examine how unemployment affects health-related behavior. This is the motivation for the current study.

In the next section, I outline the hypothesis that is tested in this study. As stated previously, the behavioral change among the unemployed is related to their income, time available,

psychological factors, and their education.

3. Data and empirical strategies

3.1. Data

The JLPS conducted by the Institute of Social Science, University of Tokyo, is used for this analysis. The JLPS comprises two surveys, both on Japanese residents: the youth survey and the middle-aged survey. The youth survey sampled respondents from the population of men and women in the age group of 20–34 years and the middle-aged survey sampled men and women in the age group of 35–40 years, using electoral and resident registries. The first wave of the JLPS was conducted from January to April 2007. For the youth and middle-aged surveys, 3,367 responses (response rate: 34.5%) and 1,433 responses (response rate: 40.4%) respectively were obtained. From January to March 2008, respondents were contacted again for a follow-up survey; 2,719 responses (response rate: 80%) were obtained for the youth survey and 1,246 responses (response rate: 87%) were obtained for the middle-aged survey.

The survey is designed to investigate how lifestyles and ways of thinking among the Japanese working population are changing according to the ever-evolving labor market structure and rapidly aging society. It comprises a wide range of questions regarding respondents' work, life, attitudes, employment status, and socioeconomic status. In addition, the JLPS includes questions on health-related behavior for every two years. For the present study, I employed three waves (2007, 2009, and 2011) of the JLPS. The youth and middle-aged surveys were utilized together, but students were excluded from the sample.

The outcome variables examined in this study are frequency of physical exercise, dietary habits, smoking, frequency of drinking, and sleep duration. Details of each variable as well as empirical specification are provided below.

3.2. Theoretical framework

The theoretical framework of this analysis is a simple application of the health capital model (Grossman 1972). Assume that the intertemporal utility function of a typical consumer is

$$U = U(\phi_0 H_0, \cdots, \phi_n H_n, Z_0, \cdots, Z_n), \quad (1)$$

where H_0 is the inherited health stock, H_t is the health stock in the *t*th time period, ϕ_t is the service flow per unit stock, and Z_t is total consumption of another commodity in the *t*th period. In this framework, net investment in the health stock equals gross investment minus depreciation.

$$H_{t+1} - H_t = I_t - \delta_t H_t, \quad (2)$$

where I_t is the gross investment and δ_t is the depreciation rate of health stock in the *t*th period. Consumers have gross investments in health as well as in other commodities in the utility function in accordance with household production functions. These functions are written in the following manner:

$$I_t = I_t(M_t, E_t, D_t, S_t, Al_t, Sl_t, TH_t : E_t),$$
$$Z_t = Z_t(X_t, T_t : E_t), \quad (3)$$

where M_t represents medical care, X_t is the goods input in the production of the commodity Z_t, TH_t and T_t are time inputs for investment in health and for producing other commodities, respectively, and E_t is the stock of human capital (Grossman, 1972). I include other elements in the health investment function as well: E_t represents exercise, D_t dietary habits, S_t smoking, Al_t alcohol consumption, and Sl_t sleep duration. These elements are partially affected by the time available under the time constraint:

$$TW_t + TL_t + TH_t + T_t = \Omega_t . \quad (4)$$

In this equation, TW_t is the working hours, TL_t is time lost in activities due to ill health, and Ω_t is the total time available. The budget constraint is expressed in the following manner:

$$\sum \frac{P_t M_t + V_t X_t}{(1+r)^t} = \sum \frac{W_t TW_t}{(1+r)^t} + A_0 , \quad (5)$$

where P_t and V_t are the prices of M_t and X_t, respectively, W_t is the wage rate, A_t is discounted property income, and r is the interest rate (Grossman 1972). Based on this framework, this study empirically investigates the effect of increase in available time due to unemployment on health investment on one hand and other effects of unemployment, such as stress on behavior, on the other hand. Then, it estimates the net effect of unemployment on health-related behavior.

The principle hypothesis proposed in this study is that unemployment causes worse health behavior. A panel data analysis enables the elimination of the influence of unobserved time-invariant heterogeneity; however, there is another tricky part in estimating the causal effect of unemployment. This is reverse causality, where unemployment and health-related behavior are simultaneously determined. This reverse causality might not be as serious as the relationship between health condition and employment status, but it is possible. For example, people might lose their jobs after they develop a drinking problem. In such a case, the results obtained from conventional regression models could be biased. It is ideal to use exogenous entry into being unemployed, for example, due to plant closure; however, there is no employee–employer matched data or information on the reason for the termination of previous job in the JLPS.

Therefore, in this study, I conducted a complementary analysis using a subsample that excluded individuals who are or/and were always or often been restricted from housework or their job due to health problems. It can be said that TL_t and TL_{t-1} are set to zero in equation

(3). By doing so, I excluded the sample that would show strong reverse causality (i.e., that their health affected their work).

3.3. Econometric model

3.3.1. Basic model: Model 1

This study estimates the effects of unemployment on various types of health-related behavior, with the employed as a reference group.

The linear specification of the model is expressed in the following manner:

$$H_{it} = \alpha + \beta U_{it} + \mathbf{X_{it}}\boldsymbol{\delta} + \nu_i + \varepsilon_{it} \quad \varepsilon_{it} \sim iid(0, \sigma^2), \tag{6}$$

where H_{it} represents the outcome measures of a respondent i of time t, U_{it} indicates "unemployed," and $\mathbf{X_{it}}$ is a vector of control variables. The explanatory variables included in $\mathbf{X_{it}}$ are the basic socioeconomic characteristics of a respondent. Each outcome variable and explanatory variable is explained in sections 3.3.3 and 3.3.4.

3.3.2. A model with interaction with previous unemployment: Model 2

A fixed-effects model, specifically a within-estimator, is employed to estimate the effect of unemployment controlling for the unobservable individual effect by using the "time-demeaning" process (Wooldridge 2002). A fixed-effects model, in which an explanatory variable is binary, does not differentiate either the direction of the change or different states of the unchanged variable. However, the effect of unemployment could be different if the status of employment in the previous period is different. Therefore, in Model 2, a variable representing unemployment in the previous period and an interaction term of previous unemployment and current unemployment are included. The model is expressed in the following manner:

$$H_{it} = \alpha + \beta_1 U_{it} + \beta_2 U_{it-1} + \beta_3 U_{it} U_{it-1} + \mathbf{X_{it}}\boldsymbol{\delta} + \nu_i + \varepsilon_{it} \quad \varepsilon_{it} \sim iid(0, \sigma^2), \text{ (7)}$$

where H_{it} represents the same outcome variables as those in model 1 and U_{it-1} represents previous unemployment and takes the value 1 if previously unemployed, and zero otherwise. The interaction term $U_{it}U_{it-1}$ takes the value of 1 only when a respondent is unemployed in two successive periods. Consequently, β_1 indicates the effect of current unemployment, β_2 indicates the effect of unemployment in the previous period; then, the effect of unemployment for two successive periods is $\beta_1 + \beta_2 + \beta_3$. A group of people who are employed in two successive periods are used as the reference category.

3.3.3. Outcome variables

a. Frequency of physical exercise

In the JLPS, respondents were asked, “How often are you committed to physical activities such as walking, jogging, aerobics, swimming, and playing tennis?” The choices are (1) Every day, (2) 5–6 days a week, (3) 3–4 days a week, (4) 1–2 days a week, (5) 1–3 days a month, and 6) Almost never. Every option is standardized to a number of days a week; the outcome variable is the median value of each category. The actual values of *exercise* are given below.

Options	Values
(1)	7 days
(2)	5.5 days
(3)	3.5 days
(4)	1.5 days
(5)	0.47 day
(6)	0 day

b. Dietary habits

This study uses two questions regarding dietary habits asked in the JLPS: “How often do you have regular three meals a day?” and “How often do you eat pot noodles or fast-food or other such food?” Two outcome variables *threemeal* and *fastfood* are constructed on the basis of the same rule as *exercise*.

c. Smoking intensity

The respondents were asked to indicate the number of cigarettes smoked a day, using five categories: (1) Never smoked, (2) Quit smoking, (3) 1–10 cigarettes a day, (4) 11–20 cigarettes a day, and (5) 21 cigarettes or more a day. Although there are a few options, the outcome variable is the median value of each category. The values of the outcome variable *smoke*[1] are presented below.

Options	Values
(1)	0
(2)	0
(3)	5.5
(4)	15.5
(5)	30

d. Frequency of drinking

The respondents were asked to indicate the frequency of drinking alcoholic beverages using eight options: (1) Do not drink, (2) Quit drinking, (3) On a special occasion, (4) Twice or thrice a month, (5) 1–2 days a week, (6) 3–4 days a week, (7) 5–6 days a week, and (8) Every

[1] Since the number of options is very limited, I attempted other specifications such as logistic regression or ordered logistic regression. The results do not contradict the linear specification. Therefore, I present the results obtained from the linear regression.

day. Every option is standardized to a number of days a week; the outcome variable *drink* is the median value of each category.

Options	Values
(1)	0 days
(2)	0 days
(3)	0.29 days
(4)	0.58 days
(5)	1.5 days
(6)	3.5 day
(7)	5.5 days
(8)	7 days

e. Sleep duration

Respondents were asked what time they wake up and go to bed on a weekday. The variable *sleep* was calculated using this information. *Sleep* is counted by minutes.

3.3.4. Independent variables

The key explanatory variable in this study is *unemployed*, which indicates that the respondent is in a state of unemployment. In labor economics, people who are not searching for a job are categorized not as “unemployed,” but as “not in the labor force.” Thus, strictly speaking, such people are not unemployed. However, in the present study, I included people who do not work—regardless of whether they are searching for a job—in the unemployed group, as the ratio of nonworking people in the sample is very small. In addition, there should not be any crucial problems during the retired phase due to deteriorating health because the

respondents' ages ranged from 20–40 years at the time of the study.

Other explanatory variables included in the models are age, age-squared, education, marital status, household income per person, and year dummy variables. It is known that losing a job causes a loss in long-term earnings as well as short-term earnings decline (Jacobson et al. 1993); thus, being unemployed certainly entails an income decline. It is difficult to distinguish the income effect from other effects caused by unemployment if a model is estimated without a variable that explicitly denotes income. Therefore, household income per person is included as an explanatory variable. When the results are interpreted, the coefficient of *household income per person* implies the effect of income loss as a coefficient of *unemployed*, which has other effects such as the effect of increased leisure time or the psychological effect.

Model 1 estimates the effects of unemployment status. Model 2, which includes an interaction term of current and previous employment status, separately estimates the effect of three different employment trajectories: previously employed but currently unemployed; previously unemployed but currently employed; unemployed in two successive periods, with the continuously employed as a reference category.

4. Results

4.1. Descriptive analysis

Table 1 summarizes the descriptive statistics of the whole sample by employment status. From examining the socioeconomic status of the sample, it is evident that over 50 percent of the respondents have college-level or higher education. Thus, it can be said that the sample of JLPS respondents are more educated than the average population[2]. Comparing the employed

[2] According to the statistics from the 2010 Population Census of Japan, college graduates account for 30.2 percent among men in the age group of 25–44 years (Ministry of Internal Affairs and Communications, 2012)

with the unemployed reveals that there is a difference in the level of education—37.1 percent of the unemployed have college-level or higher education, while 51.1 percent of the employed have the same. It is obvious that the household income per person among the unemployed is lower than that among the employed—2,480,000 yen and 3,885,000 yen respectively.

[Table 1 is around here.]

With regard to health-related behavior, significant differences between two groups are observed in frequency of exercise, smoking, drinking, and sleep duration. The unemployed are more committed to physical exercise; they do some exercise approximately two days a week, while the employed exercise for 0.86 day on average. In smoking and drinking, there is an opposite tendency between the two groups. Those who are unemployed smoke more cigarettes a day, but drink alcohol less frequently. Since alcohol consumption is measured by the frequency of drinking and not by the number of drinks consumed at a time, we cannot identify a binge drinker. Therefore, the outcome measure *drink* might reflect the opportunity for drinking. It is understandable that the unemployed sleep more than the employed; the difference is approximately 45 minutes.

4.2. Estimation results from the full sample

Table 2 shows the effects of unemployment on various types of health-related behavior. In the table, for each outcome variable, the left column presents the results from the pooled analysis, the middle column presents the results from the fixed-effects model, and the right column presents the results from Model 2, which includes the interaction term of current unemployment and previous unemployment.

The results from the fixed-effects model indicate the effect of unemployment assuming a reverse causality would not be so serious. Even after controlling for the individual effect, the

unemployed are found to exercise more than the employed. The difference is 1.4 days per week. When considering the effect of unemployment in the previous period, the coefficient of the interaction term of current unemployment and previous unemployment is significantly positive, while the coefficient of current unemployment is not more statistically significant. Those who are unemployed for two successive periods exercise more by 1.75 days compared to those who are continuously employed.

The results reveal that unemployment does not affect the regular consumption of three meals a day. The coefficient of unemployment in the estimation for the frequency of eating fast food is statistically negative; however, no effects are found in the panel analysis. It is interpreted that dietary habits depend more on individual differences than on employment status.

[Table 2 around here]

Although summary statistics by employment status show a difference in the number of cigarettes smoked a day, the results from econometric estimation do not show any statistically significant influence of employment status. Since the number of categories that indicate smoking intensity is very limited, only four categories and cases where a respondent smokes more than 21 cigarettes are top-coded. These might cause problems in an econometric estimation. Therefore, I attempted different specifications such as a logistic model and ordered logistic model; however, none of the results show a significant effect even by pooled estimation. With regard to drinking, the result from the pooled estimation shows a negative effect of unemployment; however, the effect is not significant in the panel analysis.

Further, unemployment has significant and consistent effects on sleep duration. In the pooled estimation, those who are unemployed sleep for approximately 39 minutes more than those who are employed. It is interesting that current unemployment increases sleep duration

by approximately 48 minutes, when the effect of previous unemployment is included in the equation.

With regard to other explanatory variables, education explains most types of health-related behavior. College education increases the frequency of exercise and regular consumption of meals, but decreases the frequency of eating fast food. Having a junior college or college degree decreases the number of cigarettes smoked a day as well as the frequency of drinking alcohol. It also decreases sleep duration, probably because people who are more educated may work longer hours. Income is also an important determinant of health-related behavior. It has positive effects on physical exercise, and this is also reflected in the result of the fixed-effects model. As far as results from a pooled estimation are concerned, income seems to relate to fast food, smoking, drinking, sleep duration, and physical exercise. The direction of the influence of income on smoking and drinking is opposite—the richer drink more often but smoke less often.

4.3. Estimation results from the subsample

Table 3 presents the descriptive statistics of the subsample. In comparison with Table 1, the subsample shows better health-related behavior, but the difference is small. The results of the econometric estimation are presented in Table 4. They are consistent with the results in Table 2. The unemployed exercise more and sleep longer than the employed. Further, although the mechanism is uncertain to me, the coefficient of *unemployed* in the equation of *fastfood* is negative and significant at the 10 percent level.

Considering that the results from the subsample are consistent with the results from the full sample, the reverse causality does not seem very serious in examining the effect of unemployment on health-related behavior.

[Table 3 and Table 4 around here]

5. Conclusion

In this study, I analyzed the effects of unemployment on different types of health-related behavior, namely physical exercise, dietary habits, smoking, drinking, and sleep duration. Because employment status is heavily dependent on individuals' socioeconomic characteristics and health conditions, I employed a fixed-effects model in order to control for the unobserved heterogeneity of individuals. Moreover, the effect of unemployment could be different if the status of employment in the previous period are different. Therefore, I estimate a model that includes a variable for unemployment in the previous period and an interaction term of previous unemployment and current unemployment.

The results reveal that exercise habits and sleep duration are affected by unemployment, while there are no observed effects on dietary habits, smoking, and frequency of drinking. Moreover, being unemployed has positive effects on frequency of exercise and sleep duration. Further, it is found that when an individual suffers from unemployment in two successive periods, there is an increase in the frequency of exercise, while current unemployment directly affects sleep duration.

One possible interpretation of these results is that an unemployed person has more time to invest in inculcating a healthy behavior, although the function of time differs according to the types of behavior. It might take a little while to change the exercise habit; thus, unemployment in two successive periods shows a positive and significant effect on exercise, while the effect of current unemployment disappears in Model 2. It may take lesser time to change sleep duration than it does with the exercise habit. In the estimated results, the effect of current unemployment on sleep duration is consistently positive and significant.

This study empirically investigated the net effect of unemployment on health-related

behavior. To conclude, it seems that the effect of an increase in available time dominates the possible stress effect in the change in health-related behavior due to unemployment—particularly, time-intensive behaviors such as exercise and sleep—among younger working population. However, change in available time was not found to affect dietary habits. Considering the fact that education has significant effect on them, these habits are probably formed during the process of the growth and development of individuals.

It is important to bear in mind that the respondents of the JLPS are more educated than the general population and attrition was probably a problem in estimation. The adverse effects of unemployment could be more serious among the general population. The effects of unemployment among older people are also another concern because they are less likely to find a new job, which may cause more stress. Therefore, an estimation conducted by using a larger amount of and more general data, such as administrative data, would be desirable for a more detailed research if such data include information on the health-related behavior of individuals.

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Table 1: Summary statistics of samples

	All		Employed		Unemployed	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Exercise (days/week)	0.886	1.639	0.856	1.592	2.097	2.719
3 meals a day (days/week)	5.137	2.641	5.138	2.642	5.127	2.610
Fast food (days/week)	1.313	1.420	1.321	1.427	0.976	1.088
Smoking (numbers of a day)	5.997	8.874	5.965	8.831	7.300	10.464
Drinking (days/week)	2.441	2.596	2.468	2.601	1.356	2.144
Sleep duration (minutes)	404.805	64.576	403.704	63.639	448.886	84.186
Unemployed	0.024	0.154				
Age	33.622	5.501	33.628	5.499	33.371	5.624
Age square	1160.679	363.020	1161.075	362.892	1144.829	370.412
Education: High school or less	0.287	0.453	0.287	0.452	0.300	0.462
Education: Junior college	0.205	0.404	0.202	0.402	0.329	0.473
Education: College or more	0.508	0.500	0.511	0.500	0.371	0.487
Married	0.425	0.494	0.424	0.494	0.486	0.503
Household income per person (yen)	3,851,371	2,223,821	3,885,623	2,219,518	2,480,329	1,959,231
Number of observations	2872		2802		70	

Table 2: Unemployment and Health Behaviors

	(1) Physical exercise			(2) Regularly having three meels a day			(3) Eating fastfood		
		FE			FE			FE	
VARIABLES	Pooled	Model 1	Model 2	Pooled	Model 1	Model 2	Pooled	Model 1	Model 2
Unemployed	1.341***	1.423***	0.887	0.0772	-0.136	0.712	-0.462***	-0.404	-0.269
	(0.196)	(0.321)	(0.584)	(0.318)	(0.410)	(0.723)	(0.171)	(0.269)	(0.479)
Age	-0.265***	-0.329***	-0.721**	-0.0983	0.222	0.754**	-0.0761	0.0787	0.152
	(0.0619)	(0.123)	(0.280)	(0.100)	(0.157)	(0.346)	(0.0538)	(0.103)	(0.230)
Age-squared	0.00396***	0.00493***	0.0104***	0.00234	-0.00281	-0.00938*	0.000814	-0.00138	-0.00200
	(0.000943)	(0.00180)	(0.00387)	(0.00153)	(0.00230)	(0.00479)	(0.000820)	(0.00151)	(0.00318)
Junior college	0.127			0.401***			-0.105		
	(0.0875)			(0.142)			(0.0761)		
College or more	0.311***			0.633***			-0.318***		
	(0.0732)			(0.118)			(0.0636)		
Married	0.0422	0.0692	0.496	0.00866	-0.00956	-0.441	0.105*	-0.0344	0.256
	(0.0641)	(0.0687)	(0.353)	(0.104)	(0.0876)	(0.437)	(0.0557)	(0.0575)	(0.290)
Household income/Person	5.38e-08***	5.00e-08*	1.18e-07**	3.37e-08	5.19e-08	4.59e-08	-4.17e-08***	-2.51e-08	5.43e-09
	(1.41e-08)	(2.83e-08)	(4.77e-08)	(2.29e-08)	(3.61e-08)	(5.90e-08)	(1.23e-08)	(2.37e-08)	(3.91e-08)
Year 2009	0.0489	0.0398	0	-0.103	-0.168**	0	-0.0391	-0.0911*	0
	(0.0748)	(0.0603)	(0)	(0.121)	(0.0769)	(0)	(0.0651)	(0.0505)	(0)
Year 2011	0.000897			0.0217			0.110		0
	(0.0779)			(0.126)			(0.0677)		(0)
Unemployed_1			0.274			0.0374			0.312
			(0.555)			(0.686)			(0.455)
Unemployed*Unemployed_1			1.754*			0.770			-0.0574
			(0.973)			(1.204)			(0.799)
Constant	4.731***	5.968***	12.45**	5.213***	0.787	-9.507	3.216***	0.412	-1.682
	(0.999)	(2.095)	(5.071)	(1.616)	(2.672)	(6.274)	(0.868)	(1.754)	(4.162)
Observations	2872	2872	1549	2872	2872	1549	2872	2872	1549
R-squared	0.035	0.024	0.052	0.026	0.007	0.025	0.028	0.007	0.005
Number of Groups		1574	1043		1574	1043		1574	1043

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2: Unemployment and Health Behaviors (continued)

	(4) Smoking			(5) Drinking			(6) Sleep duration		
		FE			FE			FE	
VARIABLES	Pooled	Model 1	Model 2	Pooled	Model 1	Model 2	Pooled	Model 1	Model 2
Unemployed	1.092	0.451	−0.913	−1.013***	−0.380	−0.413	39.73***	33.04***	48.14**
	(1.041)	(1.154)	(1.906)	(0.307)	(0.298)	(0.589)	(7.708)	(10.47)	(20.63)
Age	0.575*	0.365	0.744	0.228**	0.105	0.161	−0.572	2.794	9.638
	(0.328)	(0.443)	(0.914)	(0.0968)	(0.114)	(0.282)	(2.429)	(4.015)	(9.886)
Age-squared	−0.00715	−0.0130**	−0.0200	−0.00190	−0.000668	−0.00167	0.00680	−0.0593	−0.156
	(0.00500)	(0.00648)	(0.0126)	(0.00147)	(0.00167)	(0.00390)	(0.0370)	(0.0587)	(0.137)
Junior college	−2.738***			−0.399***			−11.52***		
	(0.463)			(0.137)			(3.432)		
College or more	−4.526***			−0.458***			−13.74***		
	(0.388)			(0.114)			(2.871)		
Married	0.00650	0.0683	−0.381	−0.0986	0.0156	0.167	−3.768	−2.255	−11.26
	(0.340)	(0.247)	(1.154)	(0.100)	(0.0637)	(0.356)	(2.515)	(2.237)	(12.48)
Household income/Person	−1.34e-07*	1.36e-07	−1.86e-07	4.31e-08*	−1.60e-08	−2.99e-08	−3.70e-06***	−5.76e-07	4.91e-07
	(7.48e-08)	(1.01e-07)	(1.56e-07)	(2.21e-08)	(2.62e-08)	(4.81e-08)	(5.54e-07)	(9.21e-07)	(1.68e-06)
Year 2009	−1.258***	0.0709	0	−0.140	−0.00374	0	−1.232	1.281	0
	(0.396)	(0.216)	(0)	(0.117)	(0.0559)	(0)	(2.936)	(1.962)	(0)
Year 2011	−2.922***		0	−0.280**		0	−1.007		0
	(0.412)		(0)	(0.122)		(0)	(3.055)		(0)
Unemployed_1			−1.931			−0.448			24.87
			(1.810)			(0.559)			(19.59)
Unemployed*Unemployed_1			3.201			−0.659			−3.063
			(3.178)			(0.981)			(34.38)
Constant	−0.448	8.271	5.472	−2.679*	−0.244	−0.922	441.0***	381.7***	261.9
	(5.291)	(7.518)	(16.55)	(1.562)	(1.943)	(5.110)	(39.18)	(68.20)	(179.1)
Observations	2872	2872	1549	2872	2872	1549	2872	2872	1549
R-squared	0.076	0.062	0.073	0.059	0.012	0.009	0.043	0.012	0.019
Number of Groups		1574	1043		1574	1043		1574	1043

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3: Summary statistics of sab-samples

	All		Employed		Unemployed	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Exercise (days/week)	0.889	1.635	0.863	1.595	2.262	2.813
3 meals a day (days/week)	5.137	2.641	5.135	2.643	5.235	2.516
Fast food (days/week)	1.318	1.425	1.321	1.429	1.159	1.190
Smoking (numbers of a day)	5.951	8.833	5.950	8.825	6.039	9.299
Drinking (days/week)	2.461	2.598	2.477	2.602	1.626	2.273
Sleep duration (minutes)	404.346	64.399	403.513	63.679	449.059	84.896
Unemployed	0.018	0.134				
Age	33.617	5.507	33.627	5.502	33.078	5.820
Age square	1160.403	363.326	1161.018	363.081	1127.392	378.480
Education: High school or less	0.286	0.452	0.286	0.452	0.314	0.469
Education: Junior college	0.201	0.401	0.199	0.400	0.294	0.460
Education: College or more	0.513	0.500	0.515	0.500	0.392	0.493
Married	0.424	0.494	0.423	0.494	0.471	0.504
Household income per person (yen)	3,873,007	2,223,201	3,894,390	2,224,062	2,725,057	1,860,836
Number of observations	2789		2738		51	

Table 4: Unemployment and Health Behaviors (with sub-sample)

	(1) Physical exercise			(2) Regularly having three meels a day			(3) Eating fastfood		
		FE			FE			FE	
VARIABLES	Pooled	Model 1	Model 2	Pooled	Model 1	Model 2	Pooled	Model 1	Model 2
Unemployed	1.474***	1.270***	0.852	0.197	0.249	0.731	−0.286	−0.498*	−0.285
	(0.229)	(0.357)	(0.624)	(0.370)	(0.449)	(0.763)	(0.200)	(0.300)	(0.504)
Age	−0.258***	−0.359***	−0.709**	−0.0839	0.299*	0.753**	−0.0665	0.0832	0.177
	(0.0626)	(0.126)	(0.291)	(0.101)	(0.158)	(0.355)	(0.0547)	(0.105)	(0.235)
Age-squared	0.00387***	0.00535***	0.0103**	0.00216	−0.00400*	−0.00936*	0.000657	−0.00146	−0.00226
	(0.000953)	(0.00184)	(0.00402)	(0.00155)	(0.00231)	(0.00491)	(0.000834)	(0.00154)	(0.00325)
Junior college	0.149*			0.405***			−0.110		
	(0.0892)			(0.145)			(0.0780)		
College or more	0.338***			0.624***			−0.321***		
	(0.0742)			(0.120)			(0.0649)		
Married	0.0364	0.0597	0.548	−0.0170	−0.0353	−0.490	0.112**	−0.0238	0.286
	(0.0650)	(0.0708)	(0.367)	(0.105)	(0.0889)	(0.449)	(0.0569)	(0.0594)	(0.297)
Household income/Person	4.77e-08***	3.23e-08	1.23e-07**	4.21e-08*	5.52e-08	6.74e-08	−4.31e-08***	−3.13e-08	−1.28e-08
	(1.43e-08)	(2.92e-08)	(5.03e-08)	(2.32e-08)	(3.67e-08)	(6.15e-08)	(1.25e-08)	(2.45e-08)	(4.07e-08)
Year 2009	0.0363	0.0269	0	−0.0941	−0.182**	0	−0.0413	−0.100*	0
	(0.0760)	(0.0617)	(0)	(0.123)	(0.0776)	(0)	(0.0665)	(0.0518)	(0)
Year 2011	0.00205		0	0.0124		0	0.0983		0
	(0.0787)		(0)	(0.128)		(0)	(0.0688)		(0)
Unemployed_1			0.402			−0.0348			0.490
			(0.669)			(0.818)			(0.541)
Unemployed*Unemployed_1			1.618			0.864			−0.265
			(1.053)			(1.287)			(0.851)
Constant	4.646***	6.557***	12.11**	4.916***	−0.427	−9.568	3.084***	0.379	−2.137
	(1.008)	(2.134)	(5.272)	(1.634)	(2.682)	(6.447)	(0.882)	(1.791)	(4.261)
Observations	2789	2789	1502	2789	2789	1502	2789	2789	1502
R-squared	0.034	0.019	0.052	0.027	0.009	0.027	0.028	0.008	0.007
Number of Groups		1543	1017		1543	1017		1543	1017

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Unemployment and Health Behaviors (with sub-sample) (continued)

	(4) Smoking			(5) Drinking			(6) Sleep duration		
		FE			FE			FE	
VARIABLES	Pooled	Model 1	Model 2	Pooled	Model 1	Model 2	Pooled	Model 1	Model 2
Unemployed	0.0335	−0.219	−2.125	−0.722**	−0.310	−0.379	40.90***	37.26***	50.87**
	(1.208)	(1.277)	(1.951)	(0.359)	(0.324)	(0.613)	(8.982)	(11.52)	(21.35)
Age	0.595*	0.400	1.298	0.244**	0.143	0.282	−1.487	2.452	10.68
	(0.330)	(0.449)	(0.908)	(0.0982)	(0.114)	(0.285)	(2.458)	(4.053)	(9.942)
Age-squared	−0.00734	−0.0134**	−0.0270**	−0.00214	−0.00122	−0.00312	0.0202	−0.0564	−0.170
	(0.00504)	(0.00658)	(0.0126)	(0.00150)	(0.00167)	(0.00394)	(0.0375)	(0.0593)	(0.137)
Junior college	−2.715***			−0.362***			−11.48***		
	(0.471)			(0.140)			(3.505)		
College or more	−4.486***			−0.457***			−13.60***		
	(0.392)			(0.116)			(2.915)		
Married	0.101	0.113	−0.481	−0.113	0.0307	0.269	−4.556*	−2.713	−11.20
	(0.343)	(0.253)	(1.149)	(0.102)	(0.0642)	(0.361)	(2.555)	(2.283)	(12.57)
Household income/Person	−1.42e-07*	1.50e-07	1.10e-10	4.46e-08**	−7.72e-09	−1.71e-10	−3.52e-06***	−5.51e-07	−3.34e-07
	(7.55e-08)	(1.04e-07)	(1.57e-07)	(2.24e-08)	(2.65e-08)	(4.94e-08)	(5.61e-07)	(9.41e-07)	(1.72e-06)
Year 2009	−1.428***	0.00813	0	−0.152	−0.0330	0	−1.494	1.022	0
	(0.402)	(0.221)	(0)	(0.119)	(0.0560)	(0)	(2.987)	(1.992)	(0)
Year 2011	−2.981***		0	−0.299**		0	−1.141		0
	(0.416)		(0)	(0.124)		(0)	(3.092)		(0)
Unemployed_1			−0.679			−0.759			41.17*
			(2.091)			(0.657)			(22.88)
Unemployed*Unemployed_1			2.080			−0.342			−20.25
			(3.291)			(1.033)			(36.02)
Constant	−0.842	7.438	−5.999	−2.931*	−0.897	−3.480	455.8***	389.7***	246.2
	(5.326)	(7.632)	(16.48)	(1.583)	(1.935)	(5.175)	(39.62)	(68.84)	(180.4)
Observations	2789	2789	1502	2789	2789	1502	2789	2789	1502
R-squared	0.077	0.063	0.070	0.057	0.012	0.013	0.039	0.013	0.022
Number of Groups		1543	1017		1543	1017		1543	1017

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1