and immediate effects of health status within relatively shorter periods - 3 years – on the probabilities of not working and being retired from labor market, and working hours per week. Also, we include current wage rate at each study period as an opportunity cost of "not working" or "being retired" for adjusting individual economic incentives.

3. Data

3-1. Data source and samples to be anlyzed

The data in this study is the waves I-III of "Survey on Health and Retirement" conducted in every March from 2008 through 2010 by NIPSSR. In order to examine various effects of middle- and old-aged people's health status on retirement behevior, the survey focuses on males and females who are 45 and older and younger than 80 years old at the beginning of the wave I. In 2008, 2,747 respondents are randomly extracted out of the 39,311 monitoring samples owned by the Central Research Services, Inc (CRS). The monitoring samples are collected by the monthly omnibus survey conducted by CRS. The CRS extracts samples randomly from the residents' administrative registration records every month and creates the master sample including those who agree to be monitored for all kinds of surveys. For adjusting the distributions of respondents' sex and age to the National Census, the CRS carefully extracts the samples in a way that the number of respondents becomes proportional to the number of population in each sex and 5-year age group based on the residents' administrative registration records in each municipal city. The remuneration paid for respondents is a 500 yen coupon ticket for purchasing books.

Out of 2,747, 1,074 were responded to the wave I (respondent rate: 39%). In wave II which was conducted in March of 2009, in addition to those who responded to

the first wave, 578 new samples were randomly chosen from CRS monitors. Then, 862 out of 1,074 wave I samples (respondent rate: 80%) and 257 out of 578 new samples (respondent rate: 44%) answered the wave II. Wave III (March, 2010) surveyed 1,119 who had responded to wave I and/or II. Out of 1,119, 954 responded to wave III (respondent rate: 85%). "Survey on Health and Retirement" asked almost the same questions related health and working status to respondents' spouses as of wave II. 937 and 798 spouses responded to the questionnaire in 2009 and 2010, respectively. For the purpose of this study, we extracted male samples from both data of respondents and their spouses. Eventually, the numbers of samples to be analyzed are 423, 665, and 676 males in wave I, II, and III.

3-2. Health measures and working status

In this section, we describe primary variables used for our empirical analyses. First, for health measures, "Survey on Health and Retirement" asked respondents and/or spouses to choose their diseases from a list of 29 diseases (including ``other diseases'')[7], if they were diagnozed by physicians once in the past. Also, the survey asked their age when they were diagnozed. Because the data are solely based on self-reported records

[7] The list of disease includes (1) heart disease (angina or heart failure, cardiac infarction, valvular disease, etc.); (2) high blood pressure; (3) hyperlipidemia; (4) cerebral stroke, cerebrovascular disorder; (5) cancer or malignant tumor (including leukemia and lymphoma, excluding benign skin cancer); (6) diabetes; (7) gout; (8) chronic lung disease (chronic bronchitis or emphysema, etc); (9) asthma; (10) digestive disease 1 (gastrointestinal disease such as ulcer); (11) digestive disease 2 (liver disease such as hepatitis B/C, cirrhosis, etc, excluding liver cancer); (12) digestive disease 3 (gallbladder disease); (13) digestive disease 4 (other types of digestive disease other than above and unspecified one); (14) kidney; (15) myoma of the uterus, ovarian disease; (16) disease of the thyroid gland (Graves' disease, prostate enlargement, etc); (17) urination problems (including incontinence, leak, difficulty to urinate, ureteral calculus); (18) joint disease (arthritis, rheumatism); (19) hernia, neuralgia; (20) lower back ache, stiff shoulders; (21) femoral neck fracture (thighbone joint); (22) osteoporosis; (23) eye disorder (cataract, glaucoma, etc); (24) ear disorder (hearing loss, etc); (25) pollen allergy, other allergies, etc; (26) Parkinson's disease; (27) skin disease; (28) depression, psychological disorder; and (29) other. However, we should notice that the list had been revised after the first wave and the number of diseases to be listed had increased from 21 to 29.

(not based on cilinical and/or physiological examination such as blood tests and cytodiagnosis), we cannot avoid measurement errors. Based on these questions, three types of health measures within the past 3 years before the date of survey are created; (1) the number of diagnosed diseases, (2) the clinical history of three major diseases (cancer or malignant tumore, cerebral stroke and cerebrovascular diseases, and heart diseases), and (3) the clinical history of lifestyle related diseases (hypertension, hyperlipidemia, diabetes, and gout). However, we disregard whether or not people have recovered from these diseases by the date of survey. Further, although the number of diseases is a common measure to assess people's health status in epidemiology, severity and its effects on physical functions could not be adjusted because either severe or mild diseases are weighted equally in the calculation of this variable. Thus, we will also focus on two additional health measures (2) and (3) other than just number of diseases.

Second, as regards working status, "Survey on Health and Retirement" asked respondents and/or their spouses to choose their working status from the following ten alternatives: (1) a regular employee; (2) a contract employee; (3) a temporary employee; (4) a part-time employee; (5) carrying on business on my own (including self-employees in the primary sector industry); (6) self-employed professions; (7) working at home (e.g. doing side job); (8) qualified professions; (9) other types of work; and (10) no job (including housewife and students). Moreover, the survey asked them whether or not they are seeking jobs at the date of survey and how many hours they work during the week in average. Based on these questions, we create three variables for working status as follows: "not working" at the date of survey (1 if (10) was chosen; 0, otherwise); "been retired" by the date of survey (1 if not working and also not seeking a job at the time of survey; 0, otherwise); and average hours of working per

week. Using these variables, we could identify health effects on people's temporary withdrawal from the labor market from permanent retirement.

4. Basic statistics

4-1. Individual characteristics

Table 1 shows basic statistics of major individual characteristics related to the analysis at each survey period from wave I through III. First, the ratio of "not working" has been increasing from 23.4% in 2008, 34.7% in 2009, and 38.8% in 2010. In particular, we observed a big jump of decline in the ratio by 11.3 percentage points from 2008 through 2009, which would probably reflect a negative effect of so-called "Lehman Shock" on the labor market for elderly workers, in addition to the ageing effects of the sample. Further, the ratio of being retired (those who are not working and also who are not seeing job) has slightly risen from 31.6% in 2009 to 33.9% in 2010[8] and average hours of working per week has declined during the three survey periods.

Second, as regards clinical history within the past 3 years before the date of survey, people's health status has been deteriorating with respect to number of diagnosed diseases, three major diseases, and lifestyle related diseases. This would mainly be explained by the aging of samples. However, we should notify that considerable changes in two health measures – number of diagnosed diseases and ratio of lifestyle related diseases - from 2008 to 2009 might be affected by major revisions in the list of disease of "Survey on Health and Retirement" (see footnote 7). The ratios of three major diseases could be reliable because all the waves included "cancer or malignant

[8] "Survey on Health and Retirement" did not ask whether or not respondents and/or spouses are seeking jobs in the first wave. Therefore, we could not obtain the ratio of "being retired" in the year of 2008.

tumore, cerebral stroke and cerebrovascular diseases, and heart diseases" in the list.

Third, we show individual characteristics other than working and health status. Regardless of respondents and/or spouses' working status, we impute aggregated market hourly wages by prefecture, industry, and size of firms, based on "Basic Survey on Wage Structure" conducted by MHLW at each survey year. Market hourly wage is an exogenous variable, calculated by (scheduled cash earnings/(scheduled hours worked + actual number of overtime worked)). This variable would indicate an opportunity cost of "not working" or "being retired" for adjusting individual economic incentives. For educational achievement, almost a half of samples are high-school graduates and about 40% attained higher educational level than high-school. Thus, our samples tend to achieve higher level of education than the nation-wide average in the same age cohort shown by "School Basic Survey" conducted by Ministry of Education, Culture, Sports, Science and Technology. Also, the mean of household wealth among samples is 3,500-4,000 ten thousand yen, which is higher than the average in Japan, shown by "Family Income and Expenditure Survey (Statistics Bureau)" and "Public Opinion Survey on Household Financial Assets and Liabilities (the Central Council for Financial Service Information)". Therefore, we have to be cautious that our results would be biased toward relatively rich population with high educational achievement in Japan.

-Table 1-

4-2. Onsets of diseases and working status

Table 2-1-Table 2-3 are cross tabulations between incidence of disease within the past 3 years before the date of survey (onsets of at least one disease, three major

diseases, and lifestyle related diseases) and variables related to working status at each date of the survey, by 10-age group. Table 2-1 shows that the probability of "not working" would have a significantly positive correlations with the onsets of diseases, in particular the onsets of three major diseases within the past 3 years, regardless of age. Second, Table 2-2 indicates that the correlations between the probability of "being retired from the labor market" and the onsets of diseases might be positive but not significant as much as Table 2-1. Hence, it would imply that not many males decide to leave the labor market within relatively short periods after they are diagnosed these diseases. Table 2-3 compares average working hours per week between those who had been diagnosed and who had not. We observe the negative correlations of working hours with the onsets of "at least one disease" and "lifestyle related diesases". Therefore, those who are diagnosed these diseases would face some difficulty in working for same hours as the ones bofore the incidence. On the other hand, this is not the case for those who are diagnosed three major diseases. However, in Table 2-3, we excluded those who are not working at the date of each survey (therefore, whose working hours are 0) from the calculation and thus, we cannot reject the possibility of sample selection bias such that we observe only less severe people.

-Table 2-1, Table 2-2, and Table 2-3-

4-2. Onsets of diseases and the probability of continuing to work

Table 3 shows cross tabulation between onsets of diseases and variables related to working status at wave III (in 2010), focusing only on those who have jobs at wave I (in 2008). Therefore, columns (A) and (B) specify the probabilities of shifting from

"working" to "not working" and from "working" to "being retired" during wave I through III, respectively. Also, column (C) implies mean hours of working among those who have remained in labor market from the survey period of wave I through III.

First, column (A) shows a significantly positive correlation between the onsets of "three major diseases" and the probability of shifting from "working" to "not working" during wave I-III. Thus, the incidence of severe diseases might be a major cause of disturbing for male workers to stay in the labor market. On the other hand, we did not observe a significant relations between the onsets of "at least one diease" and "lifestyle related diseases" and the probabilty of changing working status. As regards column (B), no significant correlations are observed between the incidence of diseases and male workers' decisions to be retired. It implies that withdrawal from the labor market would be a long-term decision-making, regardless of the onsets of diseases. Finally, column (C) shows a negative correlation between the onsets of "three major diseases" and average hours of working per weak among those who had remined in the labor market during wave I-III. That is not the case for the relations between the onsets of "at least one disease" and "lifestyle related diseases".

In sum, the incidence of severe diseases such as "three major diseases" within 3 years before the date of survey would significanlty be correlated to males' working status and average hours of working. That implies that serious health deterioration would matter the labor participation of mid- and old-age males. However, the results from these basic statistics are most likely to be biased, due to sample selection and endogeneity of the data. So, we will challenge these issues in the next sections to evalute health effects on people's working status in the standarized econometric framework.

5. Empirical strategy

5-1. Empirical specifications

This section describes our empirical model for evaluating health effects on working status and hours of working. In order to adjust the endogeneity problem of health measures, we will estimate the labor supply function by Probit estimation as follows[9]:

$$y_{it} = \begin{cases} 1 & (if \quad y_{it}^{*}=\alpha h_{it}+X_{1,it}\beta+\varepsilon_{it}>0) \\ 0 & (if \ y_{it}^{*} = \alpha h_{it} + X_{1,it}\beta + \varepsilon_{it} \leq 0) \end{cases} \qquad (1)$$

$$h_{it} = X_{1,it}\gamma + X_{2,it}\delta + v_{it}$$

Here, y_{it} is a dichotomous variable, which indicates "1" if an *i*th individual is not working (or retired) at time *t*; "0", otherwise. Also, h_{it} indicates *i*th individual's health status within the past 3 years before the date of survey *t* (the number of diagnosed diseases; the clinical history of three major diseases; and the clinical history of lifestyle related diseases)[10]. $X_{1,it}$ is a vector of *i*th individual's characteristics other than health status at time *t*, such as hourly market wage, age, marriage status, educational achievements, household wealth, and year dummies. $X_{2,it}$ are IVs for identifying h_{it} in the model. We assume bivariate normal distribution between ε_{it} and v_{it} with $Cov(\varepsilon_{it}, v_{it}| \ = X_{1,it}, X_{2,it}) = \rho$.

As regards average hours of working per week, we will formulate the standard

[9] For confirming the robustness, we also will conduct linear probability estimation by two-stage least square (2SLS) method.

[10] For estimating our model, we use both IV probit and bivariate probit.

censored Tobit model as follows:

$$y_{it} = \begin{cases} y_{it}^* & (if \quad y_{it}^* = \alpha h_{it} + X_{1,it}\beta + \varepsilon_{it} > 0) \\ 0 & (if \quad y_{it}^* = \alpha h_{it} + X_{1,it}\beta + \varepsilon_{it} \leq 0) \end{cases} \tag{2}$$

$$h_{it} = X_{1,it}\gamma + X_{2,it}\delta + v_{it}$$

Here, y_{it} is *i*th individual's average hours of working per week and definitions of other variables are the same as the equation (1). Further, in this model, we add two dummy variables indicating working status related to hours of working, such as (1) a regular employee or public servant; and (2) a contract, temporary, or part-time employee.

We estimate these models for entire male samples, age younger than 60, and age 60 and older, separately. We divide samples at age 60, which is a common compulsory retirement age in Japan, probably because individual health status might have different impacts on males in these two age groups. Besides the rapid health deterioration due to aging for males aged 60 and older, for example, they are more likely to be non-regular workers with low wage rate and therefore low opportunity costs of withdrawal from the labor market than those younger than compulsory retirement age[11].

5-2. Instrumental variables (IVs)

In order to address the endogeneity biases of health measures in equations (1) and (2), we apply BMI at age 30 and parent medical history as IVs ($X_{2,it}$). BMI at age 30 is calculated from a respondent's height in the present (assuming that his height has

[11] Iwamoto (2000) and Ohishi (2000) also divided the sample in the same way as this study.

not changed much after 20 years old) and weight in 30 years of age. Respondents whose BMI was higher than 22 in 30 years are expected to be more likely to have lifestyle related and/or other diseases in old age. According to the recent literature of epidemiological research, overweight and obesity in young adulthood and middle age, measured by BMI, are associated positively with subsequent higher morbidity, disability (Taylor and Østbye, 2001; Ferraro et al.,2002; Stenholm et al., 2007), and therefore medical expenditure (Daviglus et al., 2004; Daviglus, 2005), in old age.

Another IV is parent clinical history, which would be suspected to influence their children's diseases through genetic channel as well as lifestyle and preference such as dietary habit, drinking and smoking addictions. When the number of diagnosed diseases within the past 3 years before the date of survey is a dependent variable in the first stage of the regression, dummy variables whether each respondent's parents had diagnosed lifestyle related diseases, cancer or malignant tumore, cerebral stroke and cerebrovascular diseases, and heart diseases, are used as IVs. On the other hand, when using three major diseases and lifestyle related diseases, we employ dummies whether each respondent's parents had diagnosed three major diseases and lifestyle related diseases. We created these IVs for both parents and either father or mother, separately.

6. Empirical results

6-1. Results for entire male samples

Table 4-1 and Table 4-2 show the effects of the number of diagnosed diseases within the past 3 years before the date of survey on the probabililties of "not working" and "being retired from the labor market" at the time of survey. Columns of (C) and (D) in these tables show the results based on IV estimation method for adjusting the

endogeneity problem between health and working statuses. Table 4-1 and Table 4-2 show that having one additional disease would raise the probability of "not working" and "being retired from the labor market" by about 10-14 and 6-8 percentage points, respectively.

The sizes of effects seem to be larger than the results from one-stage OLS and Probit analyses shown in columns (A) and (B). This might be because IV estimates mitigate downward bias due to measurement errors in self-reported health status or the reversed effects such that people's health status become improved because of "not working". As regards IVs, those with higher BMI at age 30 would be diagnosed more number of diseases in old age and parent clinical history of lifestyle related diseases tend to have significant positive correlations with respondents' number of diseases. If both father and mother were diagnosed heart diseases, the number of diseases become significantly postive. However, there would be no impacts of parent clinical history of cancer or malignant tumore, and cerebral stroke and cerebrovascular diseases on respondents' number of diagnosed disease[12]. Both tests of weak- and over-identification imply that these IVs would satisfy necessary conditions such that instruments are significantly correlated with respondents' health status and a null hypothesis that IVs are not correlated with an error term of labor supply function (ε_{it}) cannot be rejected.

-Table 4-1, Table 4-2 -

Table 5-1 and Table 5-2 show the effects of onsets of three major diseases. Columns of (C) and (D) in Table 5-1 and Table 5-2 show that onsets of three major

[12] Children might take preventive actions to care of lifestyle and preference such as dietary habit, drinking and smoking addictions if their parents were diagnosed cancer or malignant tumore, and cerebral stroke and cerebrovascular diseases. Such preventive behavior by children would alleviate the correlation of onsets of these diseases between parents and children.

diseases would raise the probability of "not working" and "being retired" by about 52-83 and 57 percentage points, respectively. The size of these effects are tremendously larger, compared to the results in Table 4-1 and Table 4-2. This implies that those who are diagnosed three major diseases would face vast difficulty to stay in the labor market. In this model, IVs also satisfy tests of weak- and over-identification.

-Table 5-1, Table 5-2 -

Table 6-1 and Table 6-2 show the effects of onsets of lifestyle related diseases. Columns of (C) and (D) in Table 6-1 and Table 6-2 show that onsets of three major diseases would raise the probability of "not working" and "being retired" by about 34-39 and 21-27 percentage points, respectively. Since the size of these effects are larger than the number of diseases and smaller than onsets of three major diseases, these health measures would reflect the severity of diseases. In this model, IVs also satisfy tests of weak- and over-identification.

-Table 6-1, Table 6-2 -

Table 7 shows the effects of three types of health status on hours of working per week. Marginal effects in column (A) indicates that having one additional disease would shorten hours of working per week by about 5 hours. Also, columns (B) and (C) show that onsets of three major diseases and lifestyle related diseases could decrease hours of working per week by about 17 and 10 hours, respectively. Hence, the size of effects are the largest for three major diseases, following lifestyle related diseases and the number of diagnosed diseases, which is consistent to the effects on the probabilities

of "not working" and "being retired". Based on these regression results, we could conclude that onsets of three major diseases and lifestyle related diseases are significant health factors to disturb males to stay in the labor market. Once people are diagnosed these diseases, the probablity of leaving labor force would be raising and hours of working per week would significanlty deciline even for those who stay in the labor market.

-Table 7 –

6-2. Results for split samples (under 60 versus 60 and older)

Table 8-1, Table 8-2, and Table 8-3 show the effects of three types of health status on the probability of "not working" and hours of working at the date of survey, separately for two age groups-under 60 and 60 and older[13]. Table 8-1 shows that the number of diagnosed diseases have no significant effects on the probablity of "not working" and working hours per week for males under 60, while having one additional disease would significantly raise the probability of "not working" by about 15-18 percentage points and decrease hours of working per week by about 6 hours for males at age 60 and older. Therefore, the impacts of one additional diagnosed disease on working status would differ among age groups. The difference might reflect discrepancy of types and severity of diseases between these age groups, due to the ageing.

-Table 8-1–

[13] We use samples in 2009 and 2010 for estimating health effects on the probability of "being retired from the labor market, because there are too few samples which had been retired between 2008 and 2009 to run regression analyses. Hence, we cannot obtain robust results for health effects on respondents' retirement decisions due to few numbers of samples.

Table 8-2 shows that no differences of onsets of three major diseases on the probablity of "not working" are observed between two age groups. Onsets of three major diseases would significantly raise the probablity of "not working" by about 64 and 51 percentage points for males under 60 and at age 60 and older, respectively. Therefore, regardless of age, having severe diseases such as three major diseases might be disturbing to work at least for the time being. On the other hand, the size of negative effects on working hours per week seems to be larger in age group under 60 than older age group (about 33 versus 13 hours). This is possibly because older males after the compulsory retirement age are likely to work for much less hours than those younger than 60 and therefore, much smaller size of effects would be obtained.

-Table 8-2–

Table 8-3 shows that onsets of lifestyle related diseases would significantly increase the probablity of "not working" by 49-54 percentage points and they might decrease working hours per week by about 12 hours for males at age 60 and older. No significant effects could be observed for males under 60. Although the effects are not statistically significant, it would be interesting to point out a positive effect of onsets of lifestyle diseases on hours of working for males under 60. The results might imply the possiblity of a reversed effect such that long hours of working might unbalance people's lifestyle of diet, sleeping, and exercising, which could raise the probablity of having lifestyle related diseases such as hypertension, hyperlipidemia, diabetes, and gout. In any case, since our IVs satisfied necessary conditions, we cannot end up any definite

conclusions.

7. Conclusions

Using unique panel data on health and retirement, this study evaluated the effects of health status within the past 3 years before the date of survey on the probabilities of not working and being retired from labor market, and average hours of working per week. In this study, we focused only on male samples. Our empirical results show that the deterioration of health status would have a significant negative effect on the probability of not working and retired from the labor market, and also it would tend to decrease average working hours per week. In particular, for those who have the history of the three major diseases, both rates of not working and being retired tend to increase by approximately 52-83 and 57 percentage points, respectively, and working hours per week would be shortening by about 17 hours. Further, working status for males who are 60 years and older would be influenced by the number of past diagnosed diseases and the clinical history of lifestyle diseases more significantly than those under 60, while the clinical history of three major diseases has a significant effect on both age groups.

Based on our results, onsets of three major diseases would be one of major negative factors on working capability not only for males after the retirement age but also males in the prime of life. Since onsets of these diseases are likely to disturb male workers staying in the labor market and/or to decrease their working hours at least temporality, his family might be facing financial difficulty due to losing earnings from the major breadwinner. Therefore, further research should be done to estimate economic

loss when male workers become older and have serious diseases, and to evaluate how private insurance and/or social security system could afford to supplement their economic loss.

References

Iwamoto Y (2000) "Health and income (Kenko to shotoku)". National Institute of Population and Social Security Research (ed.) *Transformation of Family and Households and Function of Security of Living (Kazoku Setai no Henyo to Seikatsu Hosho Kino)*; pp.95-117. Tokyo University Press (in Japanese)

Ohishi A (2000) "Health effects on elderly person's decisions on working (Korei sha no shugyo kettei niokeru kenko yoin no eikyo)". *The Monthly journal of the Japan Institute of Labour* 42(8); pp.51-62. (in Japanese)

Noguchi H (2008) "Impacts of Household Economic Resources on Female Psychological Health Status- Some Evidence from "Japanese Panel Survey of Consumers-(Setai no keizai shigen ga shussan ikuji niokeru josei no shinriteki kenko ni ataeru ekyo – shohi seikatsu nikansuru panel chosa wo mochiita jissho bunseki)". *The Economic Review (Keizai Kenkyu)*. 59(3): pp.209-227. (in Japanese)

Hamaaki J and Noguchi H (2010) "Health status and labor participation of elderly person in Japan (Chukoreisha no kenkojotai to rodosanka)"*The Monthly journal of the Japan Institute of Labour* 6-1; pp.5-24. (in Japanese)

Adams P, Hurd MD, McFadden D, Merrill A, and Ribeiro T (2003) "Health, Wealth, and Wise? Tests for Direct Causal Paths between Health and Socioeconomic Status". *Journal of Econometrics* 112:pp.3-56.

Anderson, KH. and Burkhauser RV (1985) "The Retirement-health nexus:A new measure of an Old Puzzle" *Journal of Human Resources*, 20, pp.315-330.

Bazzoli GJ (1985) "The Early Retirement Decision: New Empirical Evidence on the Influence of Health" *Journal of Human Resources*, 20, pp.214-234.

Baker M, Stabile M, and Deri C (2004) "What Do Self-reported, Objective, Measures of Health Measure?" *Journal of Human Resources*, 39, pp. 1067-1093.

Bound J (1991) "Self-Reported versus Objective Measures of Health in Retirement Model" *Journal of Human Resources*, 26, pp.107-137.

Bound J Schoenbaum M, Stinebrickner TR, and Waidmann T (1999) "The Dynamic Effects of 17 Health on the Labour Force Transitions of Older Workers" *Labour Economics*, 6, pp.179-202.

Chirikos TN and Nestel G (1984) "Economic Determinants and Consequences of Self-Reported Work Disability" *Journal of Health Economics*, 3, pp.117-136.

Currie J and Madrian BC (1999) "Health, Health Insurance and the Labor Market" in Ashenfelter OC and Card D eds. *Handbook of Labor Economics*, Vol.3C, North Holland.

Daviglus ML, Liu K, Yan LL, Amber P, Manheim L, Manning W, Garside DB, Wang R, Dyer AR, Greenland P, and Stamler J (2004) "Relation of Body Mass Index in Young Adulthood and Middle Age to Medicare Expenditures in Older Age" *Journal of American Medical Association*, 292, pp.2743-2749.

Daviglus ML (2005) "Health Care Costs in Old Age are Related to Overweight and Obesity Earlier in Life." *Health Affairs* (web exclusives).

Dwyer DS and Mitchell OS (1999) "Health Problems as Determinants of Retirement: Are Self-Rated Measure Endogenous?" *Journal of Health Economics*, 18, pp.173-193.

Ferraro KF, Su YP, Gretebeck RJ, Black DR, and Badylak SF (2002) "Body Mass Index and Disability in Adulthood: A 20-Year Panel Study" *American Journal of Public Health*, 92, pp.834-840.

Hamaaki J and Noguchi H (2009) "Does Health Status Matter to People's Retirement Decision in Japan?: An Evaluation of "Justification Hypothesis" and Measurement Errors in Subjective Health", mimeo, presented at iHEA 7th World Congress on

Health Economics.

Haveman RH, Wolfe BL, Kreider B, and Stone M (1994) "Market Work, Wages and Men's Health" *Journal of Health Economics*, 13, pp.163-182.

Mathiowetz N and Lair T (1994) "Getting better? Change or Error in the Measurement of Functional Limitations" *Journal of Economic and Social Measurement*, 20, pp. 237–62.

Stenholm S, Sainio P, Rantanen T, Koskinen S, Jula A, Heliövaara M, and Aromaa A (2007)"High-Body Mass Index and Physical Impairments as Predictors of Walking Limitation 22 Years Later in Adult Finns". *Journal of Gerontology*, 62A, pp.859-865.

Taylor DH and Østbye T (2001) "The Effect of Middle- and Old-Age Body Mass Index on Short-Term Mortality in Older People" *Journal of American Geriatrics Society*, 49, pp.1319-1326.

Waidmann T, Bound J, and Schoenbaum M (1995) "The Illusion of Failure: Trends in the Self-Reported Health of the U.S. Elderly". *NBER Working Paper* No. 5017.

Table 1. Basic statistics

	Wave I March 2008 (N=423)	Wave II March 2009 (N=665)	Wave III March 2010 (N=676)
Not working	23.4%	34.7%	38.8%
Being retired from the labor market	-	31.6%	33.9%
Average hours of working per week	43.7 (15.2)	40.9 (16.5)	40.7 (15.1)
Clinical history within the past 3 years before the date of survey			
Number of diagnosed diseases	0.24	1.25	1.77
Three major diseases	2.1%	9.3%	14.2%
Lifestyle related diseases	9.2%	25.4%	33.0%
Market hourly wage (by prefecture, thousand yen)	1.941 (0.58)	1.918 (0.501)	1.849 (0.558)
Age	60.0 (8.6)	62.1 (9.2)	63.2 (9.2)
Married	94.1%	94.0%	92.8%
Educational achievement			
Junior high school graduate	10.9%	13.5%	13.5%
High school graduate	47.3%	45.6%	44.4%
Junior college or technical college graduate	5.4%	5.0%	6.8%
University (undergraduate or graduate) graduate	35.2%	35.2%	34.0%
Household wealth (ten thousand yen, gross value)	3935 (5006)	3822 (6379)	3506 (5287)

Note1: The values in the parentheses show standard deviations, shown only for continuous variable.
Note2: "Survey on Health and Retirement" did not ask whether or not respondents and/or spouses are seeking jobs in the first wave. Therefore, we could not obtain the ratio of "being retired" in the year of 2008. Also, we had to exclude some samples with missing variables from the calculation and therefore the entire numbers of samples for these ratios are 651 and 643 in wave2 and 3, respectively.
Note3: Regardless of respondents and/or spouses' working status, we impute aggregated market hourly wages by prefecture, industry, and size of firms, based on "Basic Survey on Wage Structure" conducted by MHLW at each survey year. Market hourly wage is an exogenous variable, calculated by (scheduled cash earnings/(scheduled hours worked+actual number of overtime worked)).

Table 2-1. Cross tabulation between onsets of disease and the probability of "not working"

Health measures within past 3 years before the date of survey		The probability of "not working"							
	Age	40-49 (N=174)		50-59 (N=551)		60-69 (N=622)		70- (N=417)	
At least one disease	Onset	3.5%	**	5.5%		40.3%		79.3%	*
	Not	0.0%		5.4%		36.9%		73.2%	
Three major diseases	Onset	40.0%	***	16.7%	***	52.6%	***	91.7%	***
	Not	0.6%		4.9%		36.6%		73.9%	
Lifestyle related diseases	Onset	6.7%	***	5.8%		42.0%		80.5%	
	Not	0.0%		5.4%		37.3%		75.0%	

Note: ***,**, * indicate the statistical significance at 1%, 5%, and 10% significance level.

Table 2-2. Cross tabulation between onsets of disease and the probability of "being retired from the labor market"

Health measures within past 3 years before the date of survey		The probability of "being retired from the labor market"							
	Age	40-49 (N=117)		50-59 (N=396)		60-69 (N=456)		70- (N=325)	
At least one disease	Onset	1.3%		2.3%		35.8%		78.2%	
	Not	0.0%		2.8%		37.7%		72.3%	
Three major diseases	Onset	0.0%		4.2%		46.4%	**	90.4%	***
	Not	0.9%		2.4%		34.9%		72.9%	
Lifestyle related diseases	Onset	2.6%	*	3.2%		37.7%		78.9%	
	Not	0.0%		2.3%		36.1%		74.3%	

Note: ***,**, * indicate the statistical significance at 1%, 5%, and 10% significance level.

Table 2-3. Cross tabulation between onsets of disease and average hours of working per week

Health measures within past 3 years before the date of survey		average hours of working per week							
	Age	40-49 (N=171)		50-59 (N=521)		60-69 (N=382)		70- (N=98)	
At least one disease	Onset	45.1	***	44.6		34.9	**	24.9	**
	Not	51.5		46.1		38.4		31.9	
Three major diseases	Onset	49.0		39.8	**	35.5		29.6	
	Not	48.4		45.7		36.8		28.5	
Lifestyle related diseases	Onset	44.0	***	43.0	**	33.3	***	29.3	
	Not	49.9		46.0		37.9		28.3	

Note: ***,**, * indicate the statistical significance at 1%, 5%, and 10% significance level.