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分担研究報告

引退が中高年の健康・健康行動に及ぼす影響に関する研究

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研究要旨
加齢に応じて、健康面でさまざまな問題が発生することはよく知られている。本研究では、引退の内生性を処理したうえで、引退によって健康・健康行動がどのように変化するかを分析する。ただし、分析に際しては、健康・健康行動の変化を，非連続的なもの（例：引退を機に運動を始める）と連続的なもの（例：引退を機に運動の回数を増やす）とに区別する。分析の結果、引退はとりわけ男性の場合、健康や健康状態の非連続的な変化を即座にもたらすとともに、それらの変化のペースにも影響を及ぼすことが明らかとなった。例えば、余暇時間に運動する確率は引退を契機にしてジャンプするが、加齢による低下ペースも引退後に緩和する。

A．研究目的

加齢に応じて、健康面でさまざまな問題が発生することはよく知られている。しかし、加齢による健康や健康行動の変化は，個人が直面する社会経済環境の変化にも影響されるだろうし、個人に備わっている属性、あるいはこれまでの人生の過ごし方に規定される面もあるはずである。本章では、そうした点を念頭に置いて、「中高年者縦断調査」のパネル・データを用いて中高年の健康・健康行動の変化を分析することを目的とする。

B．研究方法

「中高年者縦断調査」のパネル・データから得られる情報を活用して、①個人レベルの固定効果をコントロールするとともに、②引退の内生性に起因するバイアスを軽減し、③引退による健康・健康行動の影響を水準と変化のペースという２つの側面から把握する、という３点に留意する。具体的には、３つの健康アウトカム（主観的健康感、有症、心理的ディストレス）と３つの健康行動（喫煙、飲酒，余暇時間における運動）とに注目して、引退の影響を固定効果・操作変数法(FE-IV)に基づいて分析する。さらに，引退の健康・健康行動への影響は男女間で異なることが予想されるので、分析は男女サンプルに分けて行う。

（倫理面への配慮）

政府の公的統計の二次利用に基づく分析であり、倫理面への追加的な配慮は不要

C．研究結果

引退が多くの健康変数に異なる形で影響を及ぼすことが明らかになった。男性の場合、引退が良好な形で即座に影響を及ぼすものとして、余暇時間での運動や主観的健康感、心理的ディストレスが挙げられる。また、引退後の変化のペースが望ましい方向に変化するものとしては、喫煙や余暇時間での運動、主観的健康感、有症が挙げら

れる。しかし、過度な飲酒は加齢や引退の影響を受けないことが分かった。

６つの健康変数のなかで、引退時における非連続的な変化の度合いが最も顕著なのは余暇時間における運動だった。これは、引退によって時間的余裕ができることを考えれば十分予想できることだと言えよう。

さらに、引退の健康効果は男女によって大きく異なることも確認された。男女間で共通に観測されたのは、余暇時間に運動をする確率が引退を契機にして大きく上昇するという点だけである。また，男性の場合と異なり、健康変数の変化率は引退前後でほとんど変わらなかった。

D．考察

引退は健康に対して基本的にプラスに作用する、というのがこの研究で得られた基本的知見である。人々は、引退をきっかけとしてライフスタイルを健康的な方向に変える傾向がある。中高年層の健康増進策を考える場合は､そこが狙い目になるだろう。時間的な自由度が高まる中高年層をターゲットとした健康促進策を地方自治体等が中心となって展開すれば、人々の意識と相俟って大きな効果を生む可能性がある。

なお、引退の影響は、女性では男性ほど明確になっていない。引退前における就業形態の男女間格差がその原因になっている可能性がある。女性の場合は，正規労働者の比率が男性より低いだけでなく、労働時間も短めである。その分だけ、ライフ・イベントとしての引退の重みが限定的であり、健康や健康行動への影響もその分小さ目になると考えられる。もちろん、こうした状況は女性労働をめぐる社会情勢の変化によって大きく変化する可能性がある。

E．結論

引退は、とりわけ男性の場合，健康や健康状態の水準に非連続的な変化を即座にもたらすとともに、それらの変化のペースにも無視できない影響を及ぼすことが明らかになった。

F．健康危険情報

G．研究発表

1． 論文発表

Takashi Oshio and Mari Kan, “The dynamic impact of retirement on health: evidence from a nationwide ten-year panel survey in Japan,” *Preventive Medicine*, 100, 287-293, 2017 年 7 月.

H．知的財産権の出願・登録状況

1. 特許取得

なし

2．実用新案登録

なし

3.その他

なし

（資料）

Takashi Oshio and Mari Kan, "The dynamic impact of retirement on health: evidence from a nationwide ten-year panel survey in Japan," *Preventive Medicine*, 2017,100, 287-293.

ABSTRACT

Retirement is a major life-course transition that is closely related to changes in health. This study examined the dynamic impact of retirement on health and health behaviors, distinguishing an immediate change in the level of health at retirement and a change in the rate of change after retirement. We used panel data from 9,283 individuals (4,441 men and 4,842 women) who had retired during a nationwide ten-year panel survey in Japan conducted in 2005–2014. We focused on three health behaviors (current smoking, heavy alcohol drinking, and leisure-time physical activity) and two health indicators (self-rated health and psychological distress). We estimated regression models that controlled for both time-invariant individual attributes and the endogeneity of retirement, using panel data collected during the five years before and after retirement. Results generally confirmed that the transition was accompanied by favorable changes in health and health behaviors with some gender differences. Among men, retirement immediately promoted leisure-time physical activity and reduced poor self-rated health and psychological distress. Retirement also accelerated smoking cessation and leisure-time physical activity and decelerated reporting poor health. Among women, retirement immediately promoted leisure-time physical activity and reduced psychological distress, while it did not affect the rate of change in any health variable after retirement. The current study underscores the need for more in-depth knowledge of the dynamic impact of retirement on health. This will assist in developing policy measures to help the middle-aged population make healthy transitions from work to retirement.

INTRODUCTION

Retirement is a major transition in later life that is closely related to changes in health. The impact of retirement on health is potentially a key determinant of quality of life among middle-aged and elderly individuals (van der Heide et al., 2013; Zantinge et al., 2014). Additionally, the association between retirement and health is a central issue for public policy in developed countries, because retirement is closely related to public pension schemes (Gruber and Wise, 1999) and health and long-term care for the elderly are expected to continue to increase public spending (de la Maisonneuve and Oliveira Martins, 2013).

It is reasonable to predict that retirement would have a favorable impact on health, considering the stressful influence of work. Indeed, many studies have attempted to confirm this, focusing on various types of health behaviors such as smoking (Celidoni and Rebba, 2016; Ding et al., 2016; Lang et al., 2007), alcohol consumption (Brennan et al., 2010; Celidoni and Rebba, 2016; Ding et al., 2016; Zins et al., 2011), and physical activity (Chung et al., 2009; Ding et al., 2016; Feng et al., 2016; Slingerland et al., 2007; Stenholm et al., 2016). Studies have also considered overall health variables measured by self-rated health and mental health indicators (Behncke, 2012; Coe and Zamarro, 2011; Hesel, 2016; Neuman, 2008; Westerlund et al., 2009; Westerlund et al., 2010; Zhu, 2016). As surveyed by van der Heide et al. (2013) and Zantinge et al. (2014), many studies have confirmed that retirement has a

beneficial effect on health, while several other studies have obtained opposing or inconsistent results. Indeed, there are many reasons to assume the negative effects of retirement on health, through life-course disruptions, loss of key social role, income loss, and others.

There are at least three factors that may result in mixed and inconsistent observations about the positive effects of retirement, besides differences inherent to datasets collected from different countries and study groups. First, results may be biased as studies have not fully considered individual differences such as personality traits and inherent characteristics. Prospective cohort studies have usually compared health variables between participants who had retired during baseline and follow-up and those who continued to work throughout the study (e.g., Feng et al., 2016; Lang et al., 2007; Slingerland et al., 2007). These studies did control for sociodemographic and socioeconomic attributes observed through surveys, but they could not control for unobserved individual attributes, making it difficult to identify the causal effect of retirement on health. Fixed-effects (FE) regression models have often been used to control for time-invariant individual attributes, both observed and unobserved (Celidoni and Rebba, 2016; Chung et al. 2009; Zhu, 2016).

Second, retirement must be endogenous in general; it may be a choice made by an individual, at least to some extent. To alleviate the endogeneity biases, an increasing number of studies have been utilizing the instrumental variable (IV) method (Behncke, 2012; Coe and Zamarro, 2011; Hessel, 2016; Zhu, 2016). In the first stage, this method estimates retirement through an IV expected to affect retirement but not health directly. In the second stage, the model explains health by the retirement predicted in the first stage. Many studies have used eligibility for public pension benefits as an IV (Coe and Zamarro, 2011; Hessel, 2016; Neuman, 2008; Zhu, 2016), because it is institutionally fixed and expected to affect an individual's decision to retire but not his/her health directly. In recent years, FE-IV models, which are a combination of an FE model and an IV method, have often been used to address biases due to both individual time-invariant attributes and the endogeneity of retirement (Bonsang et al., 2012; Godard, 2016; Zhu, 2016).

Third, retirement is likely to affect health in two different ways: (i) an immediate change in the level at retirement and (ii) a change in the rate of change after retirement. For example, it might be that even if health keeps deteriorating after retirement, retirement reduces its rate of deterioration. A simple comparison between pre- and post-retirement levels of the health outcome may fail to capture this type of beneficial impact of retirement on health, even if the endogeneity of retirement is successfully controlled for. Indeed, studies have found that the health effect of retirement tends to change over time (Stenholm et al., 2016; Zhu, 2016), suggesting the need for examining the dynamic effect of retirement on health.

In the current study, we examined how retirement affects the dynamics of health and health behaviors, explicitly considering the above-mentioned issues—that is, (i) controlling for individual heterogeneity, (ii) alleviating endogeneity biases of retirement, and (iii) distinguishing two types of health effects of retirement. We estimated FE-IV models to examine both types of health effects of retirement separately for three health behaviors (current smoking, heavy alcohol drinking, and leisure-time physical activity) and two health indicators (self-rated health and psychological distress). We also considered gender differences in health effects of retirement, assuming that socio-institutional

backgrounds of retirement and their implications for health may differ between men and women.

The present study is also expected to shed new light on the understanding of the impact of retirement on health; it used a nationwide dataset in Japan, contrary to previous studies, most of which have used data from Europe, the U.S., and other Western countries. Japan is characterized not only by a high level of labor force participation and long life-expectancy among the elderly but also by a gradual and less straightforward transition from work to retirement (Shimizutani and Oshio, 2010). In addition, a lower share of full-time employees among middle-aged women is expected to lead to more limited impact of retirement on women's health in Japan.

METHODS

Study sample

We used data obtained from a nationwide, ten-wave panel survey, "The Longitudinal Survey of Middle-Aged and Older Adults," which was conducted by the Japanese Ministry of Health, Labour and Welfare (MHLW) each year between 2005 and 2014. Japan's Statistics Law required the survey to be reviewed from statistical, legal, ethical, and other viewpoints. We obtained the survey data from the MHLW with its official permission, so the current study did not require ethical approval.

Samples in the first wave were limited to those aged 50–59 years and were collected nationwide in November of 2005 through a two-stage random sampling procedure. A total of 34,240 individuals responded (response rate: 83.8%). The second to tenth waves of the survey were conducted in early November of each year from 2006 to 2014, and 22,748 individuals remained in the tenth wave (average attrition rate of 4.0% in each wave). No new respondents were added after the first wave.

To capture the impact of retirement as precisely as possible, we focused exclusively on the observations of the respondents who had been working continuously since the first wave and retired during the second and tenth waves (assuming that they had been working until the first wave). We excluded the data of participants when and after they resumed working after the first retirement. We also considered the observations at most five years before and after retirement; for example, we concentrated on the observations between waves 1 and 9 for the respondents who retired in wave 4 and on the observations between waves 3 and 10 for the respondents who retired in wave 8. This is because too long a period from retirement may make it difficult to distinguish the effects of retirement from other factors. Excluding further respondents who were missing key variables, we used the data of 9,283 individuals (4,441 men and 4,842 women). The total number of observations was 54,113 (25,833 for men and 28,280 for women).

Measures

Health behaviors

We considered three health behaviors: current smoking, heavy alcohol drinking, and leisure-time physical activity, each of which was expressed as a binary variable. We considered a participant who answered "yes" to the question "do you smoke currently?" to be a current smoker. We defined heavy problem drinking as an intake of more than three *go* (540 ml) of Japanese sake or an equivalent amount of alcohol every day, which corresponds to about 60 g of pure alcohol. This threshold was based on a

study that showed that maintaining alcohol consumption below 46 g/day appeared to minimize the risks of mortality in a Japanese population (Inoue et al., 2012). We considered respondents to have engaged in leisure-time physical activity if they reported that they were doing moderate-intensity or vigorous aerobic activity at least two days per week. This threshold was roughly consistent with the guideline proposed by the MHLW (2013).

Health

We considered two health indicators—poor self-rated health and psychological distress, each of which was expressed as a binary variable. Regarding self-rated health, the respondents were asked to indicate their current health condition on a 6-point scale: 1 (*very good*), 2 (*good*), 3 (s*omewhat good*), 4 (*somewhat poor*), 5 (*poor*), and 6 (*very poor*). A binary variable for poor self-rated health was constructed by assigning the value 1 to those who indicated 4, 5, or 6 on the scale, and zero to those who indicated 1, 2, or 3 on the scale.

We measured psychological distress using the Kessler Psychological Distress Scale (K6; Kessler et al., 2002; Kessler et al., 2010). The respondents were asked to answer a six-item questionnaire that included items such as, "During the past 30 days, about how often did you feel a) nervous, b) hopeless, c) restless or fidgety, d) so depressed that nothing could cheer you up, e) that everything was an effort, and f) worthless?" The questions were rated on a 5-point scale (0 = *none of the time* to 4 = *all of the time*). Then, the sum of the reported scores (range: 0–24) was calculated and defined as the K6 score. Higher K6 scores reflect higher levels of psychological distress. K6 scores ≥ 5 indicate mood/anxiety disorder in a Japanese sample, as validated by preceding studies (Furukawa et al., 2008; Sakurai et al., 2011). A binary variable for psychological distress was constructed by assigning the value 1 to those with K6 scores ≥ 5 and the value zero to those with K6 scores below 5.

Covariates

As covariates, we constructed three binary variables to indicate whether the respondent was living alone, had a spouse, and was providing informal care to any family member. It should be noted that these covariates are potentially endogenous and affected by both retirement and health; however, we confirmed that estimation results remained virtually intact even if omitting them in regressions. In addition, we used the indicator variables for each wave to control for wave-specific factors.

Analytic strategy

Following some descriptive analyses, we estimated regression models to explain each health variable separately. The benchmark model is given by the following:

$$Health_{it} = \alpha Retired_{it} + \theta(Age_{it} - Retirement\ age_i) + \theta\beta Retired_{it} \times (Age_{it} - Retirement\ age_i) + \gamma \boldsymbol{X}_{it} + \varepsilon_i + \xi_{it}, \quad (1)$$

where *Health* indicates a binary variable of health, and *Age* and *Retirement age* indicate current age and retirement age, respectively. The subscripts *i* and *t* correspond to individual and wave, respectively. *Retired* is a binary variable, which is equal to one if age is equal to or higher than retirement age and zero otherwise. The value of ($Age_{it} - Retirement\ age_i$) is in the range between –5 and 5 and is negative before retirement, equal to zero at retirement, and positive after retirement. $\boldsymbol{X}$ is a set of time-variant

covariates, ε_i is a time-invariant individual factor, and ξ_{it} is an error.

As illustrated in Figure 1, an immediate change in the level of health at retirement is indicated by α. The rate of change in health changes from θ before retirement to $(1+\beta)\theta$ after retirement. β indicates the proportion of a change in the rate of change in health after retirement with its positive and negative values corresponding to acceleration and deceleration, respectively. The value of β is implicitly computed by dividing the estimated value of $\beta\theta$ by that of θ.

In the actual regression analyses, we estimated

$$Health_{it} = (\alpha_1 + \alpha_2 Female_i)\times Retired_{it} + (\theta_1 + \theta_2 Female_i)\times(Age_{it} - Retirement\ age_i) + (\theta_1\beta_1 + \theta_2\beta_2 Female_i)\times Retired_{it}\times(Age_{it} - Retirement\ age_i) + \gamma \boldsymbol{X}_{it} + \varepsilon_i + \xi_{it}, \quad (2)$$

for the entire sample to incorporate potential gender differences, instead of estimating eq. (1) separately for men and women. Eq. (2) includes three interaction terms with a binary variable, $Female_i$, which indicate female participants. An immediate impact on the level of health at retirement (denoted by α in eq. (1)) is given by α_1 for men and $\alpha_1 + \alpha_2$ for women, with the gender difference to be tested by the significance of estimated value of α_2. The proportion of change in the rate of change in health after retirement (denoted by β in eq. (1)) is calculated by dividing the estimated value of $\theta_1\beta_1$ by that of θ_1 for men and by dividing the estimated value of $(\theta_1\beta_1 + \theta_2\beta_2)$ by that of $(\theta_1 + \theta_2)$ for women. The gender difference can be tested by the significance of the difference between these two estimated proportions.

We first estimated eq. (2) as an FE model, in which all variables are mean-centered and, hence, a time-invariant individual factor (ε) is automatically removed from regression. To make the estimation results easily understood, we treated the regression model as a linear probability model (*Wooldridge, 2013*) rather than a logistic/probit model. Further, considering the potential endogeneity of retirement, we estimated two additional first-stage, linear FE models: (i) to explain *Retired* by *Eligible*, that is, a binary variable allocated as 1 if age is equal to or higher than the eligibility age for public pension benefits, and (ii) to explain (*Age − Retirement age*) by (*Age − Eligibility age*), which is the difference between the current age and the eligibility age for public pension benefits, along with the same covariates used in eq. (2). In the second stage, we estimated the FE model (2) by replacing *Retired* and (*Age – Retirement age*) with their predicted values obtained from the first-stage estimations.

For the eligibility ages of public pension benefits, we used those for the wage-proportional benefits of the Employees' Pension Insurance (EPI) program, which covers private-sector employees. This was relevant for public-sector employees as well, because they have a similar pension program to the EPI. EPI benefits consist of flat-rate and wage-proportional components. The eligibility age for the flat-rate benefit was raised gradually from age 60 in 2001 for men and 2006 for women. The eligibility age for the wage-proportional benefit was raised gradually from age 60 in 2013 for men but remained fixed at 60 until 2018 for women. We focused on the eligibility age for the wage-proportional benefit as the EPI insured participants were generally not eligible for any benefit before that age. It should be noted that the variation of the eligibility age was limited; the proportions of eligibility age 60 (for those born before April 2, 1953), 61 (for those born between April 2, 1953 and April 1, 1955), and 62 (between April 2, 1955 and April 1, 1957) were 88.0%, 10.1%, and 1.9%, respectively, among male participants, and the eligibility age was 60 for all female participants. However, both IVs (*Eligible* and *Age − Eligibility age*), had sufficiently large variation in the observations to make the first-stage estimations effective.

RESULTS

Figure 2 depicts the observed distribution of retirement age for men and women, confirming the spikes of retirement age at 60 for both genders; 21.5% and 16.6% of men and women, respectively, retired at age 60. This result is in line with the fact that most participants in this survey became eligible for public pension benefits at age 60.

Table 1 compares occupational status and hours worked per week between men and women one year before retirement, along with educational attainment. Compared to women, a larger proportion of men had been regular employees and executives and had been working for a longer time. Nearly half of female participants had been working as part-time or temporary workers. Table 2 shows how the level of each health variable changes from two years before to two years after retirement. Among both men and women, the prevalence of current smoking and heavy drinking decreases after retirement while that of leisure time activity increases. Self-rated health worsens after retirement while there is no significant change in psychological distress.

However, comparisons between only two time points cannot grasp the dynamics of health around retirement. Figures 3 and 4 compare evolutions of health and health behaviors around retirement among men and women, respectively. Remarkable jumps at retirement are observed for leisure-time physical activity among both men and women. By contrast, smoking secession accelerates after retirement especially among men. A trend in psychological distress turns from upward to downward at retirement, albeit not substantially, among both men and women.

Estimation results of FE models are summarized in Table 3. The key focuses are on (i) the estimated coefficient on *Retired* (α), i.e., the immediate impact of retirement, and (ii) the estimated proportion of the impact on the rate of change after retirement (β). The estimated values of α suggest that retirement immediately discouraged both men and women from smoking and prompted them to engage in leisure-time physical activity. Meanwhile, the estimated values of β suggest that retirement reduced a rising pace of reporting poor self-rated health and psychological distress among both men and women while it accelerated smoking cessation only among men. The gender difference was not significant in α or β for any health variable.

To examine how these estimation results are affected by controlling for the endogeneity of retirement, Table 4 summarizes the FE-IV results (with first-stage regression results available upon request). Retirement immediately encouraged both men and women to engage in leisure-time physical activity and reduce their probability of psychological distress. Meanwhile, retirement immediately reduced the probability of poor self-rated health only among men. Significant changes in the rate of change in health variables after retirement were observed only among men; retirement accelerated smoking secession and leisure-time physical activity and decelerated self-reporting poor health. A significant gender difference was observed in two cases; the immediate impact on leisure-time physical activity was higher and the post-retirement rate of reporting poor health declined more remarkably among men.

DISCUSSION

We investigated the dynamics of health around retirement and generally confirmed that the transition is accompanied by favorable changes in health and health behaviors. However, results were not fully consistent across health variables. The most remarkable and consistent impact was observed on leisure-time physical activity, in line with several preceding studies. Current smoking was another health behavior affected by retirement especially among men. By contrast, alcohol consumption was not related to retirement, adding to generally mixed results in preceding studies. Retirement had a generally positive impact on self-rated health and psychological distress, confirming general results in preceding studies.

Results also uncovered gender differences in the health effect of retirement. The effect of retirement on health was more limited for women than for men, although the differences were not statistically significant in most cases. We can speculate that our findings were related to the gender differences in occupational status before retirement. As shown in Table 1, female participants worked less than male participants before retirement, with a higher proportion of part-time and temporary workers and shorter hours worked, which may have resulted in a more limited impact of retirement on health for women.

Finally, our findings highlighted the importance of two methodological issues. First, controlling for endogeneity of retirement tended to affect substantially the estimation results, as already suggested by previous studies which utilized FE-IV methods. Second, an immediate change in the level of health at retirement and a change in its rate of change after retirement should be distinguished. These two types of impact differed across health variables as well as between genders, making simple comparisons between before and after retirement sometimes misleading.

Study limitations and strength

We recognize that the current study has several limitations. As suggested by Chung et al. (2009), job status before retirement is expected to confound the effect of retirement on health even among those of the same gender, an issue disregarded in the present study. More broadly, the relevance of retirement for health is likely affected by socio-institutional background. Notably, a gradual transition to retirement and a limited proportion of full-time employees among middle-aged women require us to be cautious in generalizing the results in this study to other countries.

Meanwhile, our analysis had two important features. First, it controlled for the endogeneity of retirement as well as time-invariant individual attributes. Second, it distinguished an immediate change in the level of health at retirement and a change in its rate of change after retirement. These two methodologies allowed us to provide new insights into the understanding of the dynamics of health around retirement.

Conclusions

The current study underscores the need for more in-depth knowledge of the dynamic impact of retirement on health. This will assist in developing policy measures to help the middle-aged population make healthy transitions from work to retirement.

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Figure 1. Dynamics of health around retirement: an illustrative example

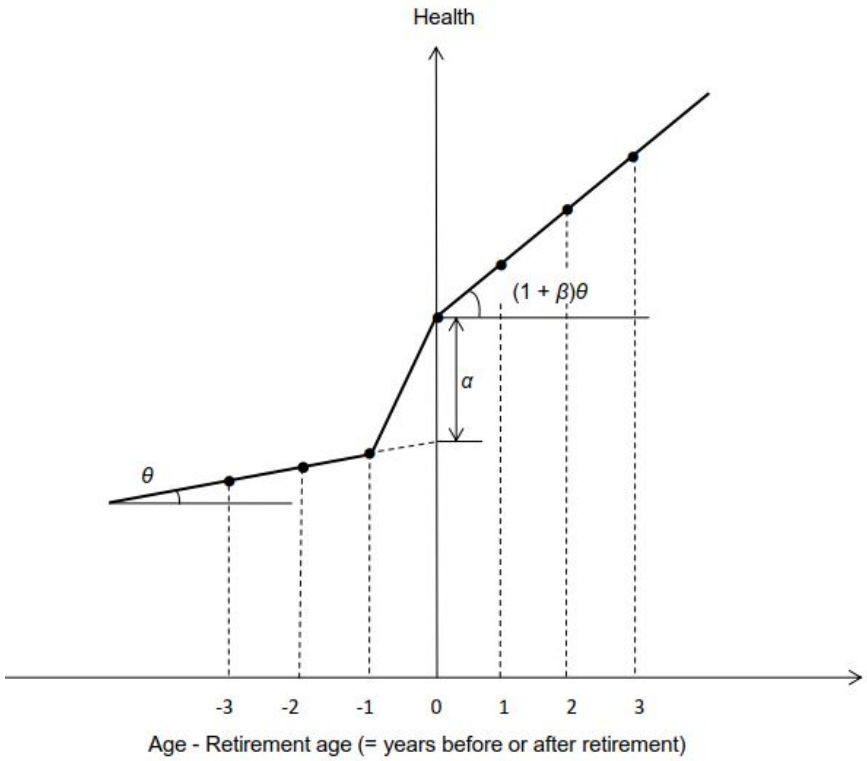

Figure 2. Distribution of retirement age

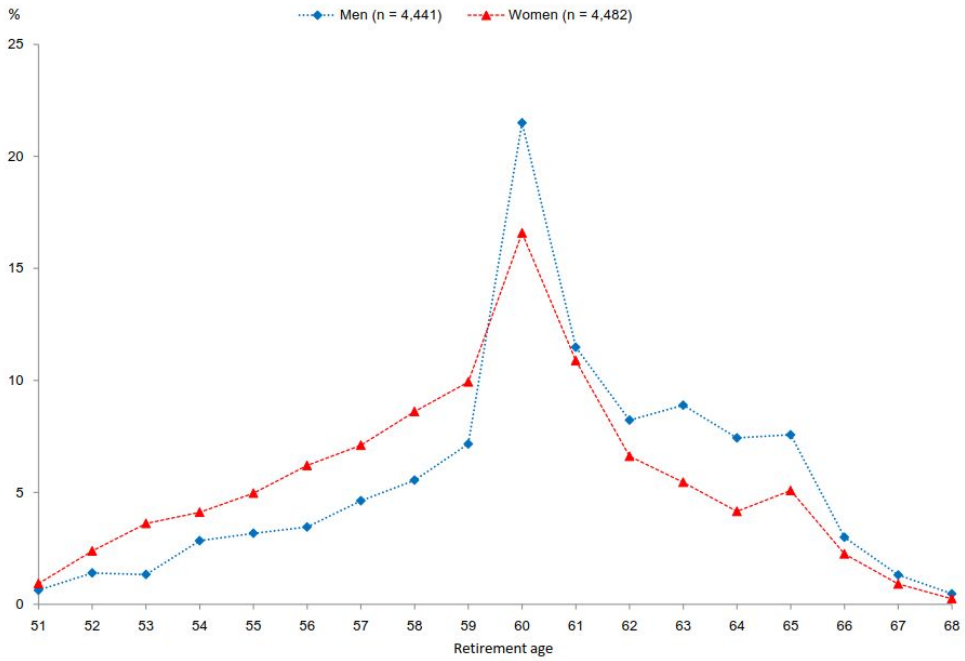

Figure 3. Evolution of health and health behavior among men around retirement (*n* = 25,833 of 4,441 individuals)

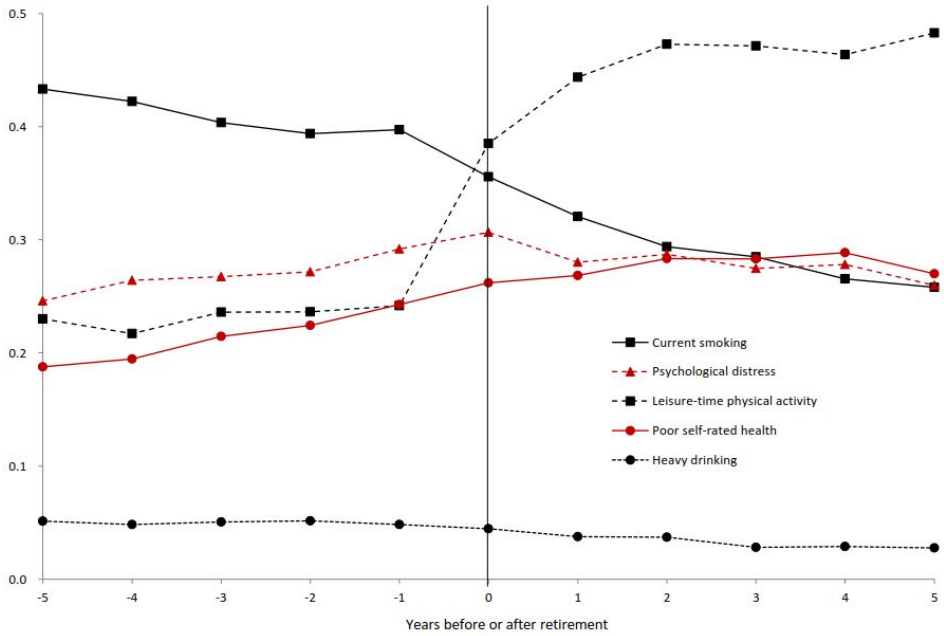

Figure 4. Evolution of health and health behavior among women around retirement (*n* = 28, 280 of 4,842 individuals)

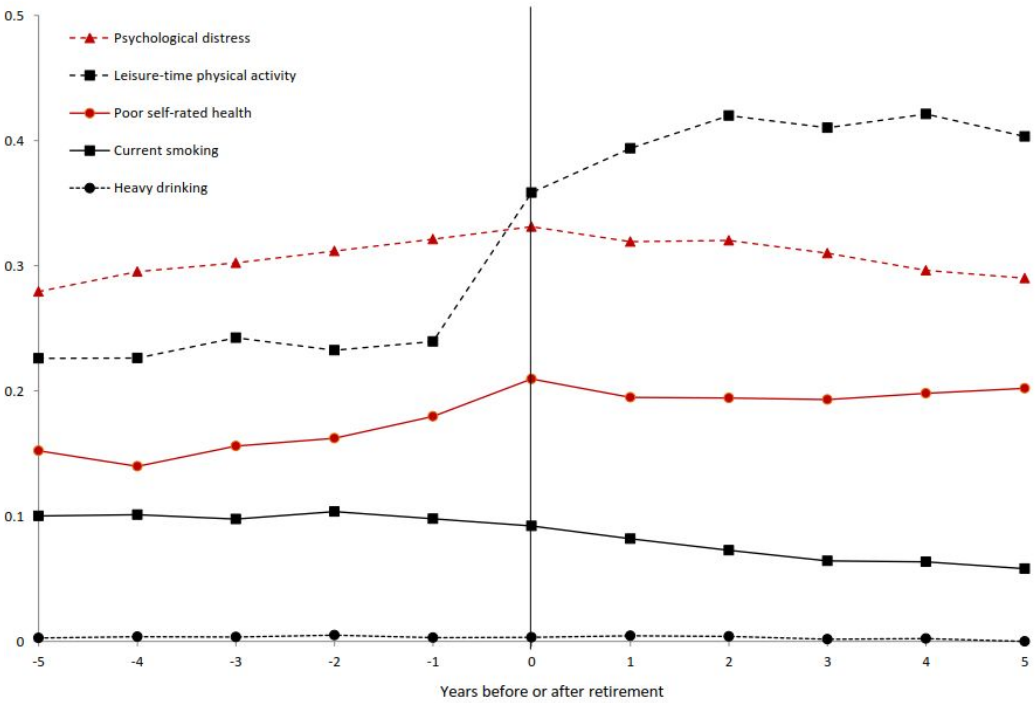

Table 1
Job status one year before retirement.

	Men	Women
Occupational status		(%)
Regular employee	50.2	24.3
Executive	5.8	1.7
Part-time or temporary worker	9.0	46.5
Dispatched employee	0.9	0.8
Contract worker	20.9	7.2
Self-employed	9.1	4.1
Family worker	0.6	8.4
Side job at home	0.1	3.5
Other	3.4	3.4
Total	100.0	100.0
Hours worked per week		
M	39.4	29.6
SD	(13.2)	(14.3)
Cf. Education level		(%)
Junior high school	17.7	17.2
High school	48.8	53.7
Junior college	6.8	22.1
College or above	25.9	6.6
Other	0.8	0.4
Total	100.0	100.0
N	4441	4842

Table 2
Changes in health and health behavior (prevalence) from two years before retirement to two years after retirement.

	Men ($n = 5094$)				Women ($n = 5599$)			
	Before	After	Change		Before	After	Change	
Current smoking	0.394	0.294	−0.100	***	0.104	0.073	−0.031	***
Heavy drinking	0.052	0.037	−0.015	*	0.005	0.004	−0.001	
Leisure-time physical activity	0.236	0.473	0.236	***	0.232	0.420	0.187	***
Poor self-rated health	0.224	0.283	0.059	***	0.162	0.194	0.032	**
Psychological distress	0.272	0.287	0.015		0.312	0.320	0.009	

* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

Table 3
Estimated associations between retirement and health obtained from FE models (54,113 observations of 9283 individuals)[a].

		Retired[b]			(Age − Retirement age)[c]			Retired × (Age − Retirement age)			β		
		Coef. (α)		(SE)	Coef. (θ)		(SE)	Coef. ($\beta\theta$)		(SE)			(SE)
Current smoking	Men	−0.014	***	(0.003)	−0.021	***	(0.001)	−0.004	**	(0.002)	0.200	*	(0.081)
	Women	−0.013	***	(0.003)	−0.002		(0.001)	−0.002		(0.001)	0.983		(1.079)
	Difference	−0.001		(0.001)	−0.019	***	(0.001)	−0.002		(0.002)	−0.784		(1.075)
Heavy alcohol drinking	Men	−0.001		(0.002)	−0.003	***	(0.001)	0.000		(0.001)	0.161		(0.414)
	Women	−0.001		(0.002)	0.000		(0.001)	−0.001		(0.001)	4.681		(29.80)
	Difference	0.000		(0.001)	−0.003	**	(0.001)	0.000		(0.001)	−4.520		(29.76)
Leisure-time physical activity	Men	0.138	***	(0.007)	0.014	***	(0.002)	0.005		(0.003)	0.365		(0.278)
	Women	0.136	***	(0.006)	0.003		(0.003)	0.004		(0.003)	1.479		(2.167)
	Difference	0.002		(0.002)	0.011	***	(0.003)	0.001		(0.004)	−1.114		(2.155)
Poor self-rated health	Men	0.006		(0.006)	0.012	***	(0.002)	−0.012	***	(0.003)	−0.990	***	(0.187)
	Women	0.008		(0.005)	0.008	***	(0.002)	−0.009	***	(0.003)	−1.122	***	(0.304)
	Difference	−0.002		(0.002)	0.004		(0.003)	−0.003		(0.004)	0.132		(0.354)
Psychological distress	Men	0.003		(0.007)	0.008	***	(0.002)	−0.009	**	(0.003)	−1.219	***	(0.338)
	Women	0.002		(0.006)	0.012	***	(0.002)	−0.010	***	(0.003)	−0.837	***	(0.217)
	Difference	0.001		(0.002)	−0.004		(0.003)	0.001		(0.004)	−0.382		(0.403)

[a] Controlled for living alone, having a spouse, providing informal care to any family member, and waves.
[b] = 1 if age ≥ retirement age; = 0 otherwise.
[c] Range: from −5 to 5.
* $p < 0.05$.
** $p < 0.01$.

Table 4
Estimated associations between retirement and health obtained from FE-IV models (54,113 observations of 9283 individuals)[a].

		Retired[b]			(Age − Retirement age)[c]			Retired × (Age − Retirement age)			β		
		Coef. (α)		(SE)	Coef. (θ)		(SE)	Coef. ($\beta\theta$)		(SE)			(SE)
Current smoking	Men	−0.009		(0.030)	−0.023	***	(0.005)	−0.003	***	(0.001)	0.132	*	(0.055)
	Women	−0.047		(0.028)	0.005		(0.005)	−0.001		(0.001)	−0.257		(0.299)
	Difference	0.039		(0.033)	−0.027	***	(0.005)	−0.002		(0.001)	0.389		(0.298)
Heavy alcohol drinking	Men	−0.026		(0.019)	0.002		(0.003)	−0.001		(0.001)	−0.578		(1.032)
	Women	−0.019		(0.018)	0.003		(0.003)	−0.001		(0.000)	−0.231		(0.27)
	Difference	−0.007		(0.021)	−0.001		(0.004)	0.000		(0.001)	−0.347		(0.95)
Leisure-time physical activity	Men	0.475	***	(0.061)	−0.044	***	(0.011)	0.006	***	(0.002)	−0.138	**	(0.047)
	Women	0.283	***	(0.058)	−0.025	*	(0.010)	0.002		(0.001)	−0.070		(0.065)
	Difference	0.192	**	(0.068)	−0.019		(0.011)	0.004	*	(0.002)	−0.068		(0.065)
Poor self-rated health	Men	−0.136	**	(0.051)	0.034	***	(0.009)	−0.005	***	(0.002)	−0.153	**	(0.053)
	Women	−0.054		(0.049)	0.017	*	(0.008)	0.000		(0.001)	0.022		(0.071)
	Difference	−0.082		(0.057)	0.016		(0.009)	−0.006	***	(0.002)	−0.174	*	(0.079)
Psychological distress	Men	−0.204	***	(0.057)	0.039	***	(0.010)	0.002		(0.002)	0.040		(0.047)
	Women	−0.124	*	(0.055)	0.028	**	(0.009)	0.002		(0.001)	0.077		(0.056)
	Difference	−0.080		(0.063)	0.012		(0.011)	−0.001		(0.002)	−0.038		(0.064)

[a] Controlled for living alone, having a spouse, providing informal care to any family member, and waves.
[b] = 1 if age ≥ retirement age; = 0 otherwise.
[c] Range: from −5 to 5.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.