The Effect of Patient Cost Sharing on Utilization, Health, and Risk Protection

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A Online Appendix

A.1 Derivation of Out-of-pocket Health Expenditures

This section describes how I convert the cost sharing formula in Table 1 into actual monthly out-of-pocket health expenditures in Table 2. Ideally, I would like to have access to information on actual out-of-pocket expenditures at the individual level (like Medical Expenditure Panel Survey in the US). In the absence of such data, I attempt to derive the same.

Fortunately, I know the exact formula for cost sharing (Table 1) and have access to individual-level insurance claim data, which is the monthly summary of medical expenditures claimed for insurance reimbursement to medical institutions (called the Survey of Medical Care Activities in Public Health Insurance). Since a portion of this monthly total medical expenditure is paid as patient cost sharing, using the formula in Table 1, I can compute the average out-of-pocket medical expenditures at each age for each survey year of the Patient Survey.[1]

The insurance claim data are monthly, since reimbursements to the medical institutions are conventionally paid monthly in Japan. Thus, the stop-loss is set monthly, rather than annually, unlike the US. The age of patients is measured in years in this data.

The steps used to compute the average monthly out-of-pocket expenditures are as follows. Note that the cost sharing formula differs by outpatient visits and inpatient admissions; since inpatient admissions are more expensive and put more financial burden on patients, the coinsurance rate of inpatient admissions tends to be set lower than that of outpatient visits.

[1] The remaining medical expenditures are paid by insurance societies, the source of this money being a fund of pooled premiums of insured members and assistance from the government.

A.1.1 Patients below age 70

First, I compute the average monthly out-of-pocket health expenditures for 69-year-old patients. For those below age 70, the coinsurance rate is determined by the type of health insurance: National Health Insurance (NHI), employees in employment-based health insurance, and dependents of employees in employment-based health insurance. Among those subscribing to NHI, the coinsurance rate differs among those who are still employed, retired former employees, and dependents of retied employees. I use information from the Comprehensive Survey of Living Conditions (CSLC) to compute the rate of those employed among the NHI recipients. Also, assuming that males who are not employed are retired former employees and that females who are not employed are dependents of retired employees, I compute the weighted average of the coinsurance rate for NHI. This assumption does not make any major difference to this computation since the fraction of retired former employees is quite small. In fact, the coinsurance rate for only outpatient visits during 1984–2002 differs by 10 percent between retired former employees and dependents of retired employees, and the computed weighted coinsurance rate for NHI is around 28 percent, which is very close to the coinsurance rate for the employed and dependents of retired employees subscribing to NHI (30 percent). For inpatient admissions, this assumption plays no role, since the coinsurance rate for inpatient admissions is the same (20 percent) for retired former employees and their dependents.

Then, actual out-of-pocket medical expenditures, AM_{ipt}, for individual i whose health insurance plan is p (p= 1-3, where 1: NHI, 2: employees in employment-based health insurance, and 3: dependents of employees in employment-based health insurance), and who use service j (j =1-2, where 1: inpatient admissions, 2: outpatient visits) in survey year t, is given as follows:

$$AM_{ipt} = min(EM_{ijpt}, SL_{jpt})$$

where EM_{ijpt} is the expected payment without stop-loss (or the maximum amount of out-of-pocket expenditure), and SL_{jpt} is the stop-loss for each plan p and each service use j in survey year t.

Suppose there is an individual whose total medical expenditure for inpatient use in June 2008 is 1 million Yen, and the coinsurance rate is 30 percent. This indicates an EM_{ijpt} of 300 thousand Yen. On the other hand, SL_{jpt} is 87,430 Yen ($80,100 + (1,000,000 - 267,000) \times 0.01$, according to the formula in Table 2). Since SL is smaller than EM, AM is 87,430 Yen. I compute AM for each individual-level claim data and take the simple average to compute the average expenditure AM_{jpt} by each plan type p, for each service j in survey year t.

Finally, I take a weighted average of each insurance type W_{pt} obtained from the CSLC. Therefore, the average monthly out-of-pocket medical expenditure AM for age 69 is

$$AM_{jt}(age69) = \sum_{p=1}^{3}(W_{pt} \times AM_{jpt})$$

for use of service j in each survey year t of the Patient Survey. I take W_{pt} for each year t from the CSLC in year $t-1$, since the CSLC is conducted a year before the Patient Survey. The exception is the Patient Survey for 1984, for which I use the fraction from 1987 of the CSLC as a weight, since it is the closest year for which information is available. The majority of 69 year-olds (roughly 70-80 percent) subscribe to NHI, and the rest to employment-based health insurance.

A.1.2 Patients above age 70

Next, I compute the average out-of-pocket health expenditures for 70-year-old patients, all of whom receive Elderly Health Insurance. Since the utilization is endogenous (i.e., the observed out-of-pocket medical expenditure already reflects the change in cost sharing), I compute a counterfactual out-of-pocket expenditure for 70-year-old patients assuming that they have the same amount of utilization as the average 69-year-old. I compute the average monthly frequency of outpatient visits and the average length of stay for inpatient admissions for age 69. Then, I apply the formula for age 70 to compute the monthly average out-of-pocket medical expenditures in the same manner as I have done for age 69.

Finally, the overall out-of-pocket medical expenditure in Table 2 is the weighted average of the out-of-pocket medical expenditure across all survey years for outpatient visits and inpatient admissions, using the populations at age 69 in each survey year as the weights. Table K in the Online Appendix shows the estimated out-of-pocket medical expenditure for each survey year.

It is worth mentioning that these figures are a rough estimate of actual out-of-pocket medical expenditures, since the actual cost sharing is slightly more complicated. For example, different coinsurance rates are applied to specific populations, and there is another way to reduce out-of-pocket medical expenditures. For example, in October 2002, the coinsurance rate for those over age 70 with high income—7 percent of the population, according to Ikegami et al. (2011)—was raised from 10 percent to 20 percent. Also, for all ages, the stop-loss is set lower for people with very low income. Nonetheless, since most of the patients are covered under the basic cost sharing formula, the cost sharing I estimate should be within an acceptable range.

A.2 Cost-Benefit Analysis

In this section, I conduct a simple cost–benefit analysis. Since it requires making a number of assumptions, the results are more speculative. Nonetheless, the exercise provides a rough estimate on the social costs and benefits of the marginal change in cost sharing at age 70.

To understand the costs and benefits in this framework, I first describe the items of social costs and benefits associated with the change in the price of health care services at age 70. The program incurs two types of costs. The first entails extra spending for mechanical reasons, i.e., the government has to bear additional payments due to higher reimbursements for consumers above 70 (I denote this as item #1). The second refers to efficiency costs from the moral hazard on increased health spending (I denote this as item #2). The sum of items #1 and #2 is the amount of increased spending by the government. Since marginal costs are associated with raising public revenue, these numbers have to be multiplied by the marginal cost of funds (MCF) to estimate the total social cost. On the benefit side, there are two benefits. The first concerns the mechanical gain by lower cost sharing accrued to consumers, which is exactly the mirror image of the increase in government reimbursement (i.e., item #1). The other benefit is risk protection against unexpected out-of-pocket medical spending, which I explain at length later on in this Appendix (I denote this as item #3). Note that since I did not find any short-term health effects, the social benefit does not include a health benefit. Thus, the net benefit can be written as follows.

$$
\begin{aligned}
Net\ Benefit &= (Total\ Benefit) - (Total\ Cost) \qquad (1) \\
&= (\#3 + \#1) - MCF \times (\#1 + \#2) \\
&= \#3 - (MCF - 1) \times \#1 - MCF \times \#2
\end{aligned}
$$

Note that the mechanical cost is multiplied by (MCF-1), which is the excess burden of the public fund or dead weight loss, while the moral hazard is multiplied by MCF, since there is no benefit accrued by consumers to offset the cost. Next, I estimate each component (items #1, #2, and #3).

A.2.1 Social Cost

The first cost is the mechanical cost. Since the out-of-pocket medical expenditures reported in the CSLC do not distinguish between outpatient visits and inpatient admissions, I need to make an assumption to estimate the out-of-pocket spending distribution that mechanically adjusts for what the Elderly Health Insurance would have covered if it were applied to those just below age 70. Since the coinsurance rate for both inpatient admissions and outpatient visits was 30 percent for those below 70, and 10 percent for those above 70 in 2007, I assume that two-thirds of the out-of-pocket medical expenditures just below age 70 is the mechanical cost.[2] Since the average out-of-pocket medical expenditure just below age 70 is 152 thousand Yen (see the first row of Table I in the Appendix), the average mechanical cost is 102 thousand Yen (1,020 US dollars).

Second, there are efficiency costs from the moral hazard on increased health spending. As seen from the results on utilization, most of the increased spending may have been socially inefficient. However, it is difficult to pinpoint exactly what may be considered as socially efficient use of medical services. By treating the entire increase in utilization as a social cost, I provide an upper bound on the efficiency costs of lowered cost sharing. The difference between the counterfactual and actual out-of-pocket medical expenditure just above age 70 should be the moral hazard. The first row in Column (1) in Table I in the Appendix indicates that the counterfactual mean value of the out-of-pocket medical expenditure is 51 thousand Yen (= 152/3). The actual out-of-pocket medical expenditure just above the cut-off is 100 thousand Yen (152 - 52), and therefore, the moral hazard is 49 thousand Yen.

A.2.2 Social Benefit: Welfare Gains from Risk Protection

To estimate the reduction in risk exposure, I combine the expected utility framework with the quantile RD estimates and calculate the change in the risk premium associated with out-of-pocket expenditure as a measure of the welfare gain from lower cost sharing at age 70.[3]

Specifically, I assume that each individual has utility $U(C)$, which is the function of net non-health consumption C. I then assume the individual must satisfy a budget constraint for each

[2]This assumption is reasonable since only 2 percent of those aged 65–69 pay beyond the stop-loss in the sample. Note that Table 2 shows that 14.6 percent of those aged 65–69 reach the stop-loss conditional on being admitted.

[3]This approach is akin to that used in Feldstein and Gruber (1995), Finkelstein and McKnight (2008), and Englehardt and Gruber (2011). My welfare estimates may be bound to be lower than those in the US, since it is much less likely to have catastrophic health expenses in Japan due to the government's stringent control over national fee schedules (Ikegami and Campbell, 1995).

period $C = Y - M$, where Y denotes per-period income, and M is the individual's out-of-pocket medical expenditure. M is a random variable with the probability density function $f(M)$ with support $[0, \bar{M}]$.

I calculate the change in the risk premium associated with lower cost sharing by computing the risk premium for both just below (denoted as zero) and above age 70 (denoted as one). For those just below age 70, the risk premium (or certainty equivalence) π_0 can be defined by a fixed amount such that

$$U(Y - \pi_0) = \int_0^{\bar{M}} U(Y - M_0) f(M_0) dM_0. \tag{2}$$

The expression measures the amount a risk-averse individual would be willing to pay to insure against random variation in out-of-pocket spending.

For those just above age 70, lower cost sharing at age 70 reduces not only the variance but also the mean of the out-of-pocket spending distribution. However, since the difference between the mean values of M_0 and M_1 is simply a transfer between the insured and insurers (or the government), I calculate the certainty equivalence for the out-of-pocket risk distribution just above age 70 with an adjustment to make the mean of the risk distribution just above age 70 equal to that of just below age 70 (i.e., I evaluate the mean-preserving spread in risk).

Thus, I define the risk premium π_1 for those just above age 70 as

$$U(Y - \pi_1) = \int_0^{\bar{M}} U(Y - M_1 + \mu_1 - \mu_0) f(M_1) dM_1,$$

where μ_0 and μ_1 are the mean of M_0 and M_1 respectively.

A decrease in risk exposure just above 70 to just below 70 is reflected as a decline in the risk premium; the absolute value of this decline Δ provides a measure of the insurance value, and hence, the welfare gain of lower cost sharing. Thus,

$$\Delta = |\pi_1 - \pi_0|. \tag{3}$$

In practice, I measure Δ in the three steps. First, I estimate the following equation for each quantile q

$$M_i^q = \alpha_0^q + \alpha_1^q Post70_i + f^q(a) + X_i^{'} \gamma^q + \varepsilon_i, \tag{4}$$

where M_i^q is the out-of-pocket medical expenditure at quantile q, and $f^q(a)$ is a quantile-specific smooth function of age, where age a is normalized to zero at age 70. $X_i^{'}$ are demographic controls in the form of dummy variables for marital status, gender, region and birth month. Note that Figure 5 in the main text plots α_1^q, along with their 95 percent confidence interval.

Second, I use these quantile estimates to calculate for each individual i in the sample the quantiles of the out-of-pocket spending distribution $\hat{M}_i^q$, conditional on the individual's characteristics $X_i^{'}$ just below and above age 70. Specifically, for each $i = 1, ..., N$ in the sample, $\hat{M}_{i0}^q$ for those below age 70 can be written as

$$\hat{M}_{i0}^q = \hat{\alpha}_0^q + X_i^{'}\hat{\gamma}^q, \tag{5}$$

for $q = 1, ..., 99$, where $\hat{\alpha}_0^q$ and $\hat{\gamma}^q$ come from equation (4) at each quantile q as above.

For those above age 70, I compute the counterfactual out-of-pocket spending distribution the individual faces once the quantile treatment estimates of lower cost sharing estimated in equation (4) are applied. Therefore, $\hat{M}_{i1}^q$ for those above age 70 can be written as

$$\hat{M}_{i1}^q = \hat{M}_{i0}^q + \hat{\alpha}_1^q, \tag{6}$$

where $\hat{\alpha}_1^q$ is the RD estimate from equation (4) for each quantile q.

Because there are 99 quantile estimates for each individual i, to ensure that the sum of the probabilities is one, I set conditional out-of-pocket spending at the very bottom of the distribution to zero, or $q = 0$, i.e., $\hat{M}_{i1}^0 = \hat{M}_{i0}^0 = 0$. I now have 100 points of equal probability of occurrence in the out-of-pocket spending distribution for each individual. Following Finkelstein and McKnight (2008) and Englehardt and Gruber (2011), I truncate predicted out-of-pocket spending from below at zero and from above at 80 percent of individual income as a benchmark.

Finally, I calculate the risk premium π_{0i} for those below age 70 for each individual i by solving

$$U(Y - \pi_{0i}) = \frac{1}{100}\left[\sum_{q=1}^{99} U(Y_i - \hat{M}_{0i}) + U_0\right], \tag{7}$$

where $U_0 = U(Y_i)$, and the right-hand side is the average utility, given its income Y_i for each individual. In a similar vein, I calculate the risk premium π_{1i} for individuals just above age 70 by solving

$$U(Y - \pi_{1i}) = \frac{1}{100}\left[\sum_{q=1}^{99} U(Y_i - \hat{M}_{1i} + \hat{\mu}_1 - \hat{\mu}_0) + U_1\right],$$

where $U_1 = U(Y_i + \hat{\mu}_1 - \hat{\mu}_0)$, and I make an adjustment by subtracting from the individual's income the average difference in out-of-pocket expenditures between the 100 estimates for the original distribution just below age 70 ($\hat{\mu}_0$) and the 100 estimates for the counterfactual distribution ($\hat{\mu}_1$).

Following the literature, I specify the constant relative risk aversion (CRRA) utility function $U(C) = -\frac{1}{\phi-1}C^{1-\phi}$, which implies the Arrow–Pratt measure of relative risk aversion of $\phi = -\frac{CU''}{U'}$. For a typical risk aversion of 3 in the CRRA utility function (see e.g., McClellan and Skinner, 2006), I estimate that this decline in risk premium, or welfare gain, is 37 thousand Yen (370 US Dollars) per person. This is less than the average cost of the moral hazard.

However, it is important to note that the previous estimate on the decline in risk exposure is understated, since the out-of-pocket expenditures include the behavioral response of increased utilization of health care services. Here, I once again assume that cost sharing would have been one-third if Elderly Health Insurance was mechanically applied to those just below age 70. For a typical risk aversion (= 3) in the CRRA utility function, using this mechanically adjusted out-of-pocket spending, I estimate that this decline in risk premium is doubled from 37 to 98 thousand Yen per person.

Table J in the Online Appendix shows the sensitivity of the welfare gain to two particular assumptions: risk aversion and maximum level of out-of-pocket medical expenditures as a share of income. In fact, the estimates are quite sensitive to these two assumptions. First, Panel A shows that compared to an estimated welfare gain of 98 thousand Yen per person with a relative risk aversion of 3, the welfare gain falls to about 8 thousand Yen with a relative risk aversion of 1 and rises to 306 thousand Yen with a relative risk aversion of 5 (assuming the cap on out-of-pocket spending is 80 percent of income). Next, if I replace my baseline 80 percent cap on out-of-pocket medical expenditures as a share of income with a cap of 60 percent, the estimated welfare gain falls from 98 thousand Yen to 33 thousand Yen, and if I impose a cap of 90 percent, the welfare estimate rises to 203 thousand Yen (assuming a relative risk aversion of 3). Finally, Panel B shows the risk premium at other percentiles. The median is 85 thousand Yen, and the 95th percentile is 214 thousand Yen, suggesting the welfare gains are skewed.

A.2.3 Discussion

My central estimate of risk reduction is 98 thousand Yen per person (980 US Dollars). One way to gauge the size of the estimate is to simply plug estimated benefits and costs into equation (1) and calculate the MCF such that the two are equal. Since I have the estimated values for all components (items #1, #2, and #3), it is straightforward that the MCF is 1.32, or in other words, the MCF should be less than 1.32 to have positive net benefits. This value is very close to some of the estimates of the MCF in the 1990s (e.g., 1.3; see Poterba, 1996).[4]

Put differently, assuming the MCF is 1.3, the sum of the program financing costs and moral hazard suggests that the total annual social cost was 94.3 thousand Yen ($102 \times 0.3 + 49 \times 1.3$) per elderly beneficiary. Here, the deadweight loss and moral hazard associated with program financing was responsible for one-third and two-thirds of the total cost. My estimate of risk reduction (98 thousand Yen per person) suggests that the welfare gain of risk protection from lower patient cost sharing is comparable to the total social cost, indicating that the welfare gain of risk protection may fully cover the total social cost in this setting.

Although somewhat speculative, a simple cost–benefit analysis shows that the welfare gain of risk protection from lower cost sharing is on the same order of magnitude as the total social cost. However, there are a number of caveats to my welfare calculation. On the one hand, the stylized welfare calculations may overstate the welfare gains, since the use of a one-period model ignores the possibility that individuals can use savings or other mechanisms to smooth expenditure risk over several periods, thus potentially leading me to overstate the welfare gains from lower cost sharing. This may indeed be the case, since the elderly seem to have some savings.[5] On the other hand, the welfare gains may be understated because the calculations were based on an annual, rather than lifetime, measure of medical expenditure risk. In fact, there is some evidence that out-of-pocket medical expenditures are positively serially correlated (Feenberg and Skinner, 1994; French and Jones, 2004). These studies suggest that the lifetime distribution of out-of-pocket spending may be even more right-skewed than the annual distribution; therefore, the reduction in risk exposure in the lifetime scale may be even greater.[6] Furthermore, my welfare calculation does not incorporate the welfare gains from health improvements. While I do not find any *short-term* reduction in

[4]There is no consensus estimate for the MCF, since it depends on behavioral responses to taxation and may differ by country at any given point in time. Nonetheless, to have a rough estimate, I focus on income tax, since it is a major source of taxes. The simplest formula is $\frac{1}{(1-\rho*(\frac{t}{1-t}))}$ where ρ is the elasticity of taxable income and t is the income tax rate (Kopczuk, 2005). Assuming that both the elasticity of taxable income and the tax rate are 0.4, the MCF would be 1.36, which is close to the value I use (1.3).

[5]The average net savings at age 69 is 5,418 thousand Yen, which is roughly two and half times the average annual income (1,860 thousand Yen). Since saving and debt are only reported at the household level, I divide the net saving (i.e., saving - debt) by the number of household members.

[6]Further, the stylized model treats medical expenditures as affecting the budget constraint only and does not allow for any utility change from increased medical expenditures.

mortality or improvement in any self-reported health measures, it is possible that preventive care induced by lower cost sharing at age 70 may prevent future severe health events and thus improve health in the long run. It is infeasible to estimate long-run effects in this framework, because individuals eventually age into treatment.

A.3 Data Appendix

In this study, I use a variety of datasets collected mainly by the Ministry of Health, Labour and Welfare. A brief description of each dataset is provided in this data appendix. The English to Japanese translations of the dataset titles can be found at the website of the Ministry of Health, Labour and Welfare (http://www.mhlw.go.jp/toukei/itiran/eiyaku.html).

	Name of Dataset	Period	Interval
1	Patient Survey	1984-2008	Every three year (9 rounds in total)
2	Comprehensive Survey of Living Conditions	1986-2007	Every three year (8 rounds in total)
3	Survey of Medical Care Activities in Public Health Insurance	1984-2008	Every year
4	Vital Statistics: Mortality data	1984-2008	Every year

1. Patient Survey

Source: http://www.mhlw.go.jp/english/database/db-hss/dl/sps_2008_06.pdf

Started in 1948, the Patient Survey is a national sample survey of hospitals and clinics that gathers information on the utilization of medical institutions in Japan. The comprehensive version of the Patient Survey has been conducted every three years since 1984. It covers roughly 2,000–7,000 hospitals and 3,000–6,000 clinics per survey year. It collects information on the International Classification of Diseases (ICD) codes, patients' principal sources of payment, and limited sociodemographic characteristics such as gender and patients' place of residence. Individual-level patient microdata files are available from 1984 onwards.

There are two datasets in the Patient Survey, namely outpatient data and discharge data, which I use to examine outpatient visits and inpatient admissions respectively.

1.1 Outpatient Data

The outpatient data in the Patient Survey is collected on one day in mid-October (normally a weekday in the second week) and includes information on all patients who visit hospitals or clinics as outpatients (i.e., visits to hospitals or clinics not culminating in hospitalization). The datasets contain 75,000–100,000 individuals/outpatient visitors. This data include the exact dates of birth and the survey, the latter being equivalent to the exact dates of visits. This enables me to compute age in days at the time of the outpatient visit. The sample size of the outpatient data is about 500,000–1,500,000 per survey year.

1.2 Discharge Data

The discharge data in the Patient Survey report details of all the inpatients discharged from the surveyed hospitals and clinics in the month of September of the survey year. The datasets contain about 180,000–970,000 inpatient records per survey year. The sample size has become larger in more recent years. The data include the exact dates of birth, admission, discharge, and surgery. The data also contain information about whether the patient needed surgery and the types of main surgeries conducted (collected from 1999 onwards). Unlike the CSLC, the discharge data include patients who die in the surveyed hospitals and clinics.

2. Comprehensive Survey of Living Conditions

Source: http://www.mhlw.go.jp/english/database/db-hss/cslc.html

The CSLC is a nationwide repeated cross-section survey of households that has been gathering information on the health of the Japanese people since 1986. The CSLC collects information on sociodemographic characteristics and health-related topics. The long version of CSLC (used in this study) is conducted every three years. Individuals are sampled randomly from 3000–5000 districts from the National Census, which is conducted every five years. The microdata files are available from fiscal year 1986 onwards. The survey reports the month of birth. Knowing the month the survey was conducted in, I use this information to compute the age in months. The long version of the CSLC consists of three questionnaires: household, health, and income and savings. A long-term care questionnaire was added in 2004. I mainly use the data pertaining to the health questionnaire that collects information on self-reported physical and mental health and limitations in individuals' daily activities.

I also use the information concerning insurance in the household questionnaire to compute the average health insurance coverage of each health insurance type. I map the same to the Survey of Medical Care Activities in Public Health Insurance to derive out-of-pocket medical expenditures. The household forms also include basic individual sociodemographic information, such as gender, marital status, employment, and household size. The income and savings questionnaire records the amounts of income, savings, and debt as well as the source of income. Information on out-of-pocket medical expenditures at the individual level was collected in 2007 alone. I use individual income and out-of-pocket medical expenditures to compute the welfare gains from risk reduction.

The survey typically covers 240,000–290,000 households and 740,000–800,000 household members in each round. The income and savings questionnaire is conducted for approximately only 15 percent of the whole sample.

3. Survey of Medical Care Activities in Public Health Insurance

Source: http://www.mhlw.go.jp/english/database/db-hss/dl/shw-03.pdf

The Survey of Medical Care Activities in Public Health Insurance is a survey of health insurance claims data, which gathers yearly information on detailed statements of medical fees. I use this information to derive the average monthly out-of-pocket medical expenditures for those who use medical institutions as described in Appendix Section A1.

Due to the monthly reimbursements to medical institutions, the claim data are a summary of the medical expenditures per month per individual using these institutions in June of the survey year. The data are collected from the prefectural branches of the Social Insurance Medical Fee Payment Fund for employment-based health insurance recipients and the Federation of National Health Insurance for NHI recipients. Health insurance claim data from society-managed employment-based health insurance recipients has been collected since 1999. The individual's age is recorded in years.

4. Vital Statistics: Mortality Data

Source: http://www.mhlw.go.jp/english/database/db-hw/outline/index.html

The 1984–2008 National Mortality Details Files is an annual census of deaths in Japan. The data contain the universe of deaths and information on the deceased's dates of birth and death, which enables me to compute age in days at the time of death. The data also include gender, nationality, place of death, and cause of death, the latter being classified according to the ICD. In Japan, the ICD9 classification was used till 1994, after which it adopted ICD10.

References

[1] **Engelhardt, Gary V., and Gruber, Jonathan.** 2011. "Medicare Part D and the Financial Protection of the Elderly." *American Economic Journal: Economic Policy* 3(4): 77–102.

[2] **Feenberg, Daniel, and Jonathan Skinner.** 1994. "The Risk and Duration of Catastrophic Health Expenditures." *Review of Economics and Statistics* 76(4): 663–647.

[3] **Feldstein, Martin, and Jonathan Gruber.** 1995. "A Major Risk Approach to Health Insurance Reform." *Tax Policy and the Economy* 9: 103–130.

[4] **Finkelstein, Amy, and Robin McKnight.** 2008. "What Did Medicare Do? The Initial Impact of Medicare on Mortality and Out of Pocket Medical Spending." *Journal of Public Economics* 92(7): 1644–1668.

[5] **French, Eric, and John Bailey Jones.** 2004. "On the Distribution and Dynamics of Health Care Costs." *Journal of Applied Econometrics* 19(6): 705–721.

[6] **Ikegami, Naoki, and John C. Campbell.** 1995. "Medical Care in Japan," *New England Journal of Medicine*, 333: 1295–1299.

[7] **Ikegami, Naoki, Byung-Kwang Yoo, Hideki Hashimot, Masatoshi Matsumoto, Hiroya Ogata, Akira Babazono, Ryo Watanabe, Kenji Shibuya, Bong-Min Yang, Michael R Reich, and Yasuki Kobayashi.** 2011. "Japanese Universal Health Coverage: Evolution, Achievements, and Challenges." *The Lancet* 378(9796): 1094–1105.

[8] **Kopczuk, Wojciech.** 2005. "Tax Bases, Tax Rates and the Elasticity of Reported Income." *Journal of Public Economics* 89(11–12): 2093–2119.

[9] **Poterba, James.** 1996. "Government Intervention in the Markets for Education and Health Care: How and Why?" in *Individual and Social Responsibility* Victor Fuchs (ed). University of Chicago Press.

Appendix Figures and Tables

FIGURES

Figure A: Seasonality in Day of Birth in the Patient Survey Data

This figure shows that there is substantial seasonality and heaping in the reported birthdays of patients observed in the Patient Survey. First, heaping on the first day of the month is observed, which is likely due to reporting. Second, there are many more births in the first quarter than in the other three quarters throughout the sample period.

Figure B: Seasonality in the Mortality Data

Figures B1 and B2 show seasonality in the mortality data. Figure B1 shows seasonality in the reported birthdays of those deceased, and this pattern is very close to that observed in the Patient Survey in Figure A. Figure B2 plots the reported death dates, and there is substantial seasonality in the death dates also. First, heaping on the first day of the month is observed, which is likely due to reporting. Second, there are many more deaths in the winter than in the summer, and the highest number of deaths is observed in January.

Figure C: Age Profile of Employment by Gender

This figure displays the actual and fitted age profiles of employment for the 1986–2007 pooled Comprehensive Survey of Living Conditions (CSLC) sample (age measured in months). These profiles all trend relatively smoothly through age 70 for both genders.

Figure D: Age Profiles for First-time and Repeat Outpatient Visits

Figures D1 and D2 display the age profiles for first-time and repeat outpatient visits, respectively. Figure D1 shows that the number of first-time visits decreases steadily prior to age 70, reflecting the trend of deteriorating health as people get older, and then, it jumps sharply at age 70. Figure D2 shows that the age profiles of repeat visitors are very similar to those of overall outpatient visits, since 94 percent of total outpatient visits are repeat visits.

Figure E: Robustness of Results on Inpatient Admissions

Figures E1 and E2 show the robustness of the estimates on inpatient admissions. Figure E1 shows the results on the donut-hole RD, by excluding a few months of observations around the threshold. The figure shows that the estimates get smaller and the standard errors larger as the "hole" is expanded. However, as long as the removal of the data is within a three-month period from both sides of age 70, the estimates are statistically significant at the 95 percent level. Figure E2 shows that the results on inpatient admissions are not driven by how I limit the sample by admission dates. The results are pretty robust to the length of the windows from the discharge date. Note that more than 90 percent of inpatient admissions occurred within three months from the date of discharge.

Figure F: Age Profile for Inpatient Admissions for Selected Surgery

This figure displays the age profile of inpatient admissions for two procedures: open-stomach surgery (Figure F1) and intraocular lens implantation (Figure F2). I find a drop-off just prior to age 70, coupled with a temporary surge shortly after age 70 for both procedures. This pattern suggests that some people who are close to 70 delay surgery until they become eligible for Elderly Health Insurance, in order to reduce out-of-pocket expenditures.

Figure G: Age Profile of Inpatient Admissions for Selected Diagnoses

These graphs display the age profile of inpatient admissions for the following selected diagnoses: heart disease, cerebrovascular disease, respiratory diseases, and Ambulatory Care Sensitive Conditions (ACSCs) (see Table D in the Appendix for the list of ACSCs). Figures G1 and G2 show that there are sharp increases in the number of inpatient admissions for heart disease and cerebrovascular disease, and they are statistically significant (as shown in Table 4). While there are slight increases for respiratory diseases and ACSCs in Figures G3 and G4 respectively, they are not statistically significant at the conventional levels.

Figure H: Age Profile for Cause-specific Mortality
This figure plots age profiles for mortality from cause-specific deaths for three broad leading causes of death among the elderly (cancer, heart disease, cerebrovascular disease), and also respiratory diseases. These figures show that there are no discernible patterns for any of the selected causes of deaths.

Figure I: Age Profiles for Fraction in Good or Very Good Health
Respondents to the Comprehensive Survey of Living Conditions (CSLC) report health on a five-point scale (very poor, poor, fair, good, or very good). This figure shows the age profiles of the fraction of people who report themselves to be in good or very good health (cumulatively 31 percent of the population), based on pooled 1986–2008 CSLC samples. The graph shows that health gradually declines with age, but I do not find any observable change in self-reported health at age 70. Table I in the Appendix confirms this age pattern.

Figure J: Out-of-pocket Medical Expenditures
Figure J1 compares the distribution of out-of-pocket medical expenditures in 2007 for 65–69 year-olds (not covered by Elderly Health Insurance) and 70–74 year-olds (covered by Elderly Health Insurance). The graph reveals that 70–74 year-olds at the top of the distribution spend substantially less than 65–69 year-olds, despite the large offsetting increase in utilization among those above 70. Figure J2 compares an adjacent age group (age 60–64) to the near-elderly (age 65–69), neither of whom benefit from lower cost sharing. The figure shows that out-of-pocket medical expenditure among 65–69 year-olds is higher than that among 60–64 year-olds, indicating that medical expenditure tends to increase with age. This finding is reassuring; it suggests that Figure J1 is not measuring any systematic change in spending by age groups.

Figure K: RD Estimates and Fraction of Outpatient or Inpatient Care
Figure K1 and K2 show the RD estimates by diagnosis group (see Table G for the list) as they relate to the fraction of visits in each group using outpatient or inpatient care at age 69, respectively. The diagnosis group with highest fraction of outpatient care in Figure K1 is hypertensive disease (diagnosis group 26), where the fraction is 94.2 percent. The RD estimate for this diagnosis group is 8.2 percent, and it is not statistically different from overall estimate of 10.3 percent (see Panel A in Table 3). Similarly, the diagnosis group with the highest fraction of inpatient care in Figure K2 is benign neoplasm (diagnosis group 15), where the fraction is 78.5 percent. The RD estimate for this diagnosis group is 11.7 percent, and it is not statistically different from overall estimate of 8.2 percent (See Panel A in Table 4).

TABLES

Table A: Summary Statistics (Ages 65–75)

This table summarizes descriptive statistics for the Patient Survey (outpatient data and discharge data), CSLC, and mortality data.

Table B: RD Estimates on Employment and Family Structure at Age 70

This table shows the RD estimates at age 70 on a variety of demographic outcomes in the CSLC. None of these outcomes show any discontinuities at age 70.

Table C: Top 5 Diagnoses and RD Estimates

This table lists the top 5 diagnoses for outpatient visits and inpatient admissions and their corresponding RD estimates.

Table D: List of Ambulatory Care Sensitive Conditions (ACSCs)

This table lists the ACSCs developed by the Agency for Healthcare Research and Quality (AHRQ), for which proper and early treatment can reduce subsequent avoidable admissions.

Table E: Robustness of RD Estimates on Outpatient Visits for Selected Outcomes

This table reports alternative specifications for RD models of outpatient visits for selected outcomes. There are three alternative estimates of the RD at age 70: (1) the basic RD estimates from the main tables in the paper, (2) an RD estimate from a model fit to data for people who are 67–73 years old, (3) an RD estimate from a cubic polynomial in age, fully interacted with a dummy for age 70 or older. Both age in months as well as age in days are used as the running variables. Outcomes are selected so that there are no zero cells for any age in days for these outcomes.

Table F: Robustness of RD Estimates on Inpatient Admissions for Selected Outcomes

This table reports alternative specifications for RD models of inpatient admissions for selected outcomes. There are three alternative estimates of the RD at age 70: (1) the basic RD estimates from the main tables in the paper, (2) an RD estimate from a model fit to data for people who are 67–73 years old, (3) an RD estimate from a cubic polynomial in age, fully interacted with a dummy for age 70 or older.

Table G: List of Diagnosis Groups

This table lists the diagnosis groups used for Figure 5.

Table H: RD Estimate on Morbidity at Age 70

This table reports RD estimates on morbidity using 1986–2007 CSLC data. Column (2) presents estimates from linear probability models for the probability that people report their health as good or better. Column (4) reports estimates from a simple linear regression for the mean assessment of health (assigning 1 to poor health and 5 to very good health). In the remaining columns, I also look at the mental health, but I do not find any changes in mental health outcomes either. Overall, I do not find any evidence that lower cost sharing leads to a discrete jump in morbidity measures.

Table I: RD Estimates on Out-of-pocket Medical Expenditures at Age 70

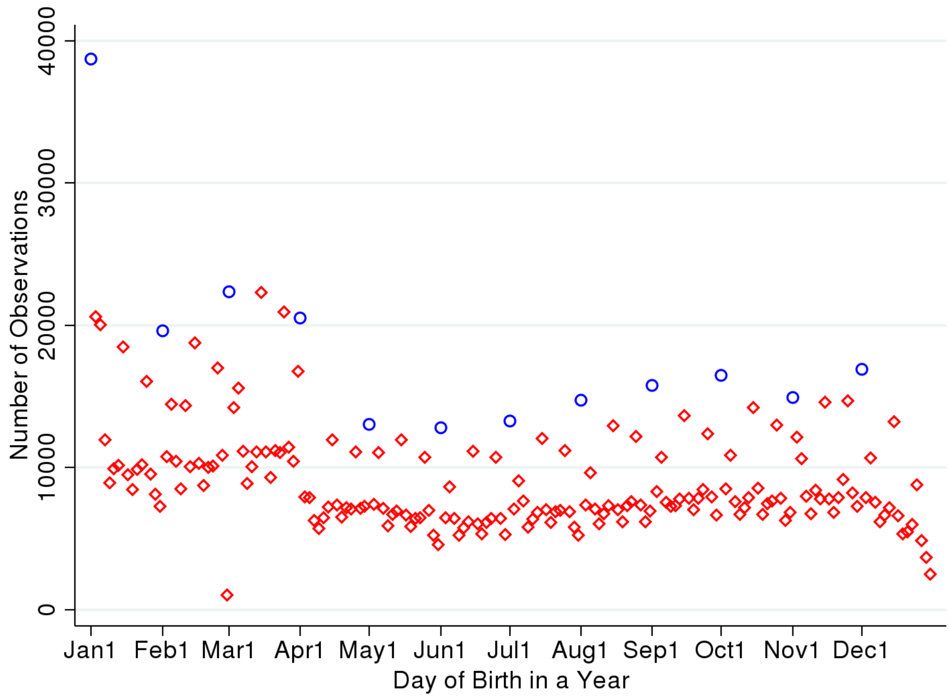
This table reports the RD estimates on out-of-pocket medical expenditures in 2007 at each tenth centile above the 40th percentile and at the 95th and 99th percentile in Column (2), with a mean value just below age 70 in Column (1). This table corresponds to Figure 7B.

Table J: Sensitivity of Welfare Gain from Risk Protection

This table shows the sensitivity of welfare gain to two particular assumptions: risk aversion and maximum level of out-of-pocket medical expenditures as a share of income.

Table K: Estimated Out-of-pocket Medical Expenditure per Month across Survey Years
This table reports the estimated out-of-pocket medical expenditure per month across survey years using Survey of Medical Care Activities in Public Health Insurance (see Section A3 in the Online Appendix). The number used to compute the elasticity in the main text is the weighted average of the out-of-pocket medical expenditure across all survey years for outpatient visits and inpatient admissions, using the populations at age 69 in each survey year as weights. See Section A1 in the Online Appendix for details.

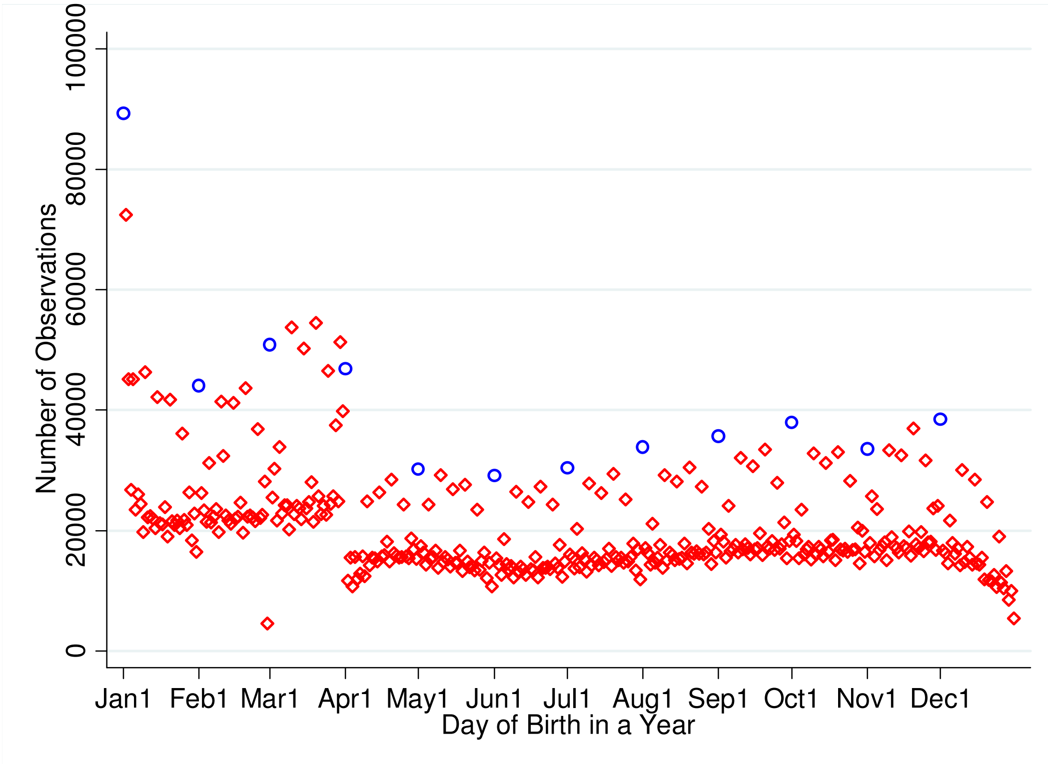
Figure A: Seasonality in Day of Birth in the Patient Survey Data



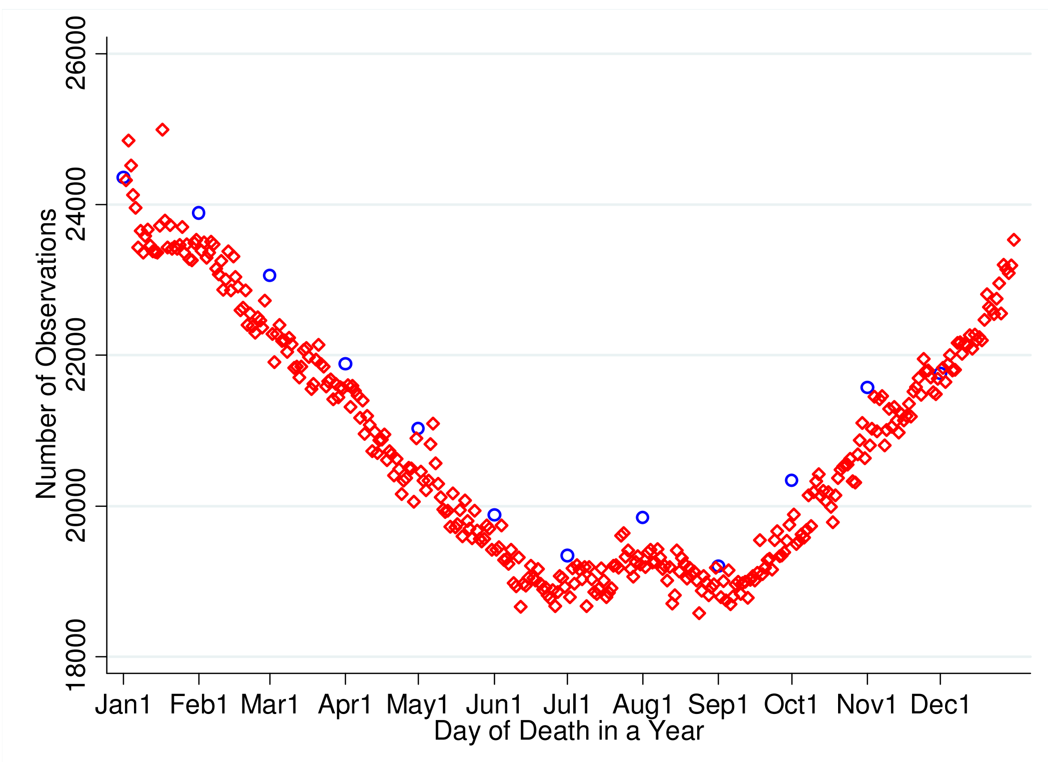
Note: I pool outpatient data for 1984–2008 from the Patient Survey. The circles indicate the first day of the month.

Figure B: Seasonality in the Mortality Data

B1. Seasonality in Day of Birth

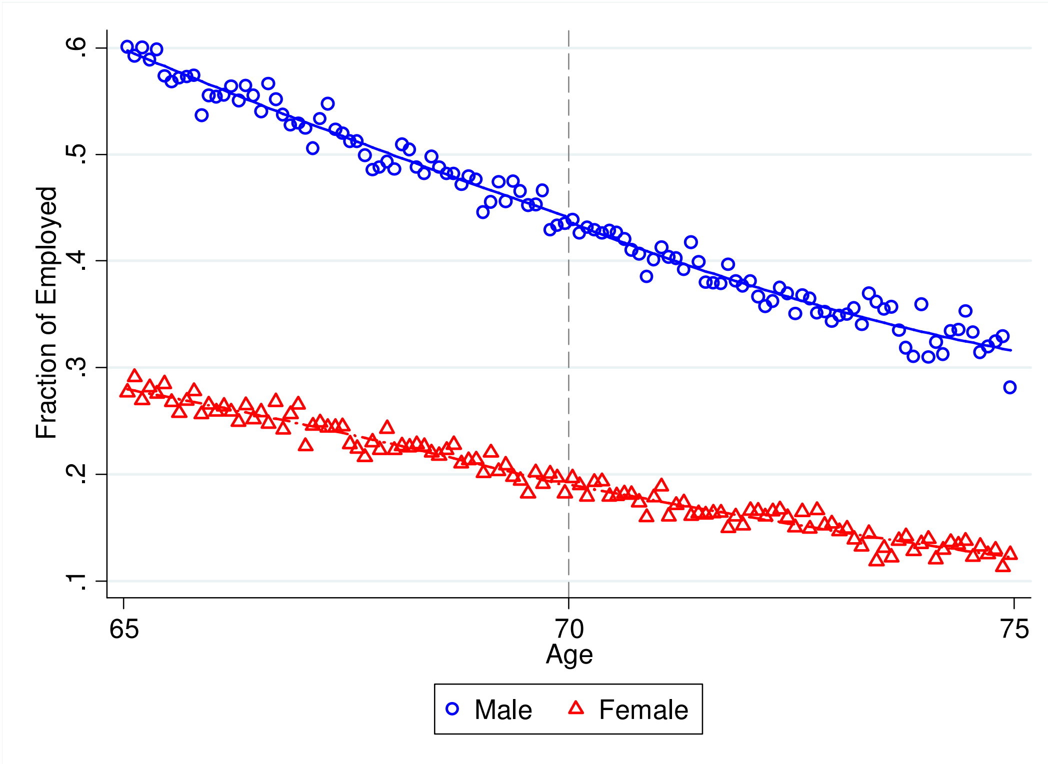


B2. Seasonality in Day of Death



Note: I pool mortality data from among those born during 1919–1933 for 1984–2008. The circles indicate the first day of the month.

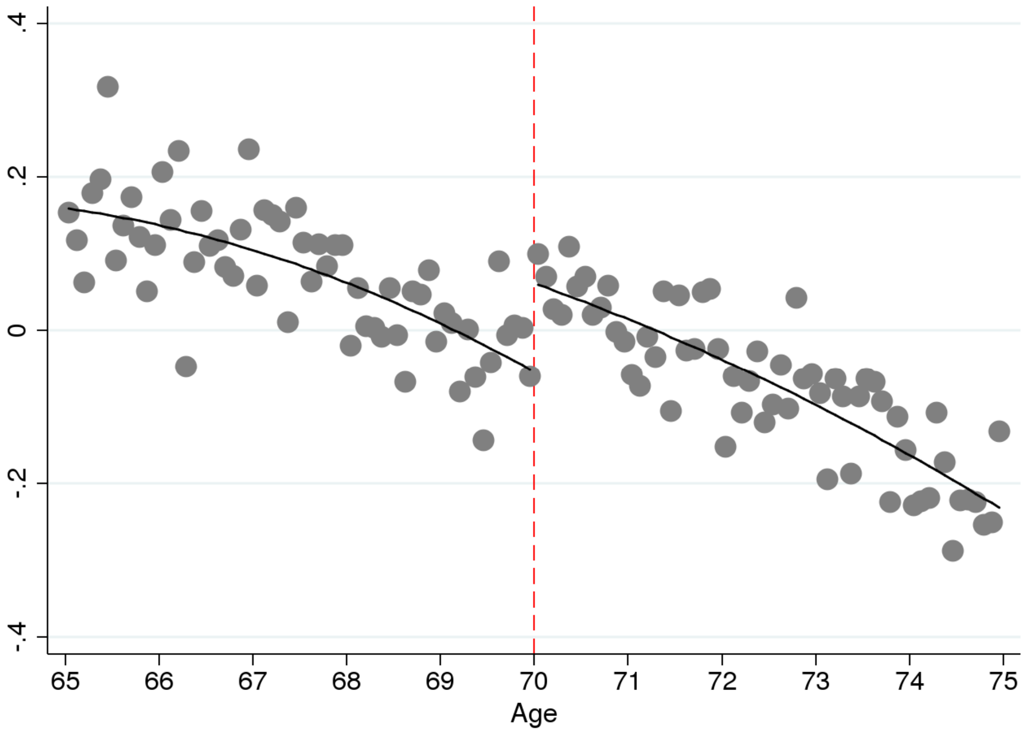
Figure C: Age Profile of Employment by Gender (1987–2007 CSLC)



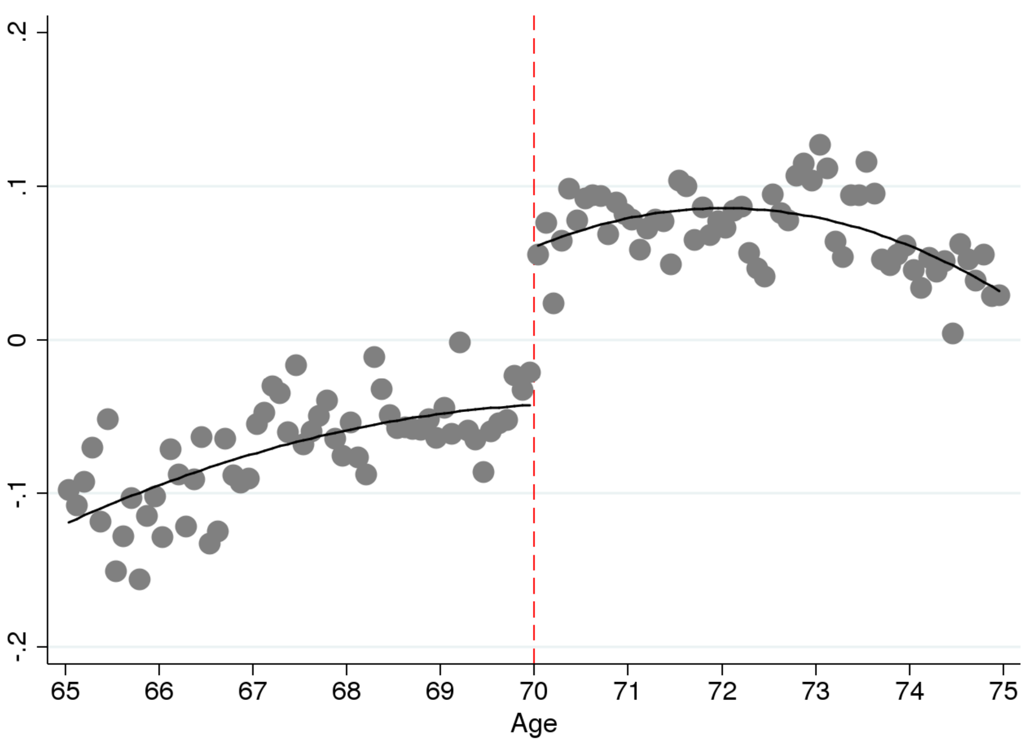
Note: I pool outpatient data for 1986–2007 from the CSLC. The markers represent actual averages (age in months), and the lines represent fitted regressions from models that assume a quadratic age profile, fully interacted with a dummy for age 70 or older, separately for male and female patients.

Figure D: Age Profiles for First-time and Repeat Outpatient Visits (Log Scale)

D1. First-time Visits



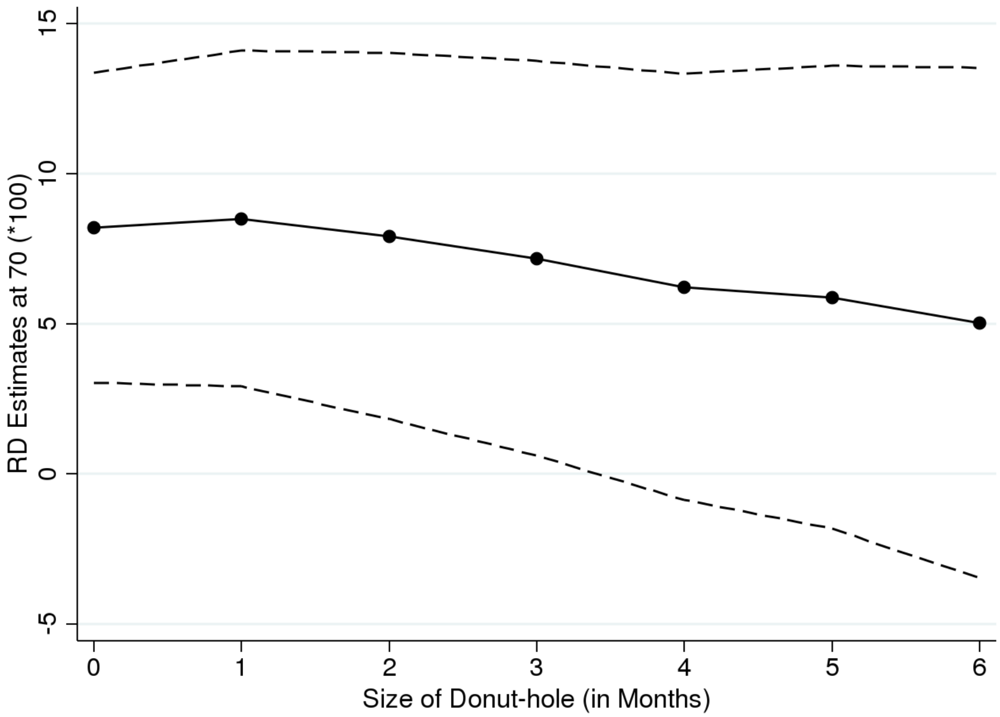
D2. Repeat Visits



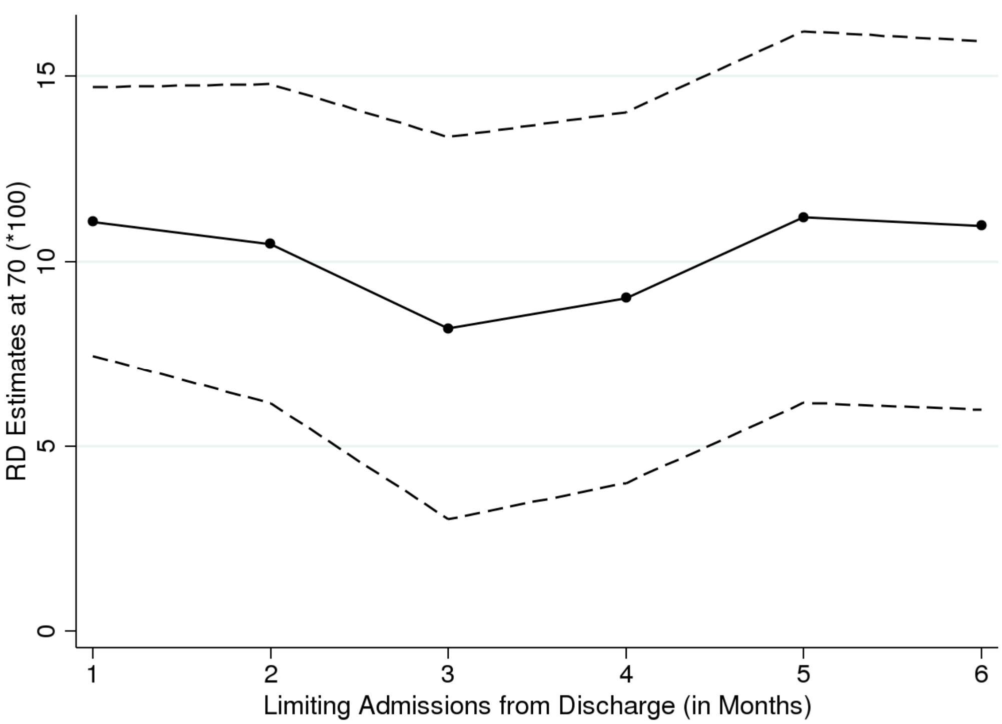
Note: I pool outpatient data for 1984–2008 from the Patient Survey. The markers represent averages of the residuals of log outcomes regressed by birth month fixed effects and survey year fixed effects, to partial out the seasonality in birth and the underlying common shocks in the survey year, respectively. The lines represent fitted regressions from models that assume a quadratic age profile, fully interacted with a dummy for age 70 or older.

Figure E: Robustness of Results on Inpatient Admissions

E1. Estimates from the "Donut-hole" RD



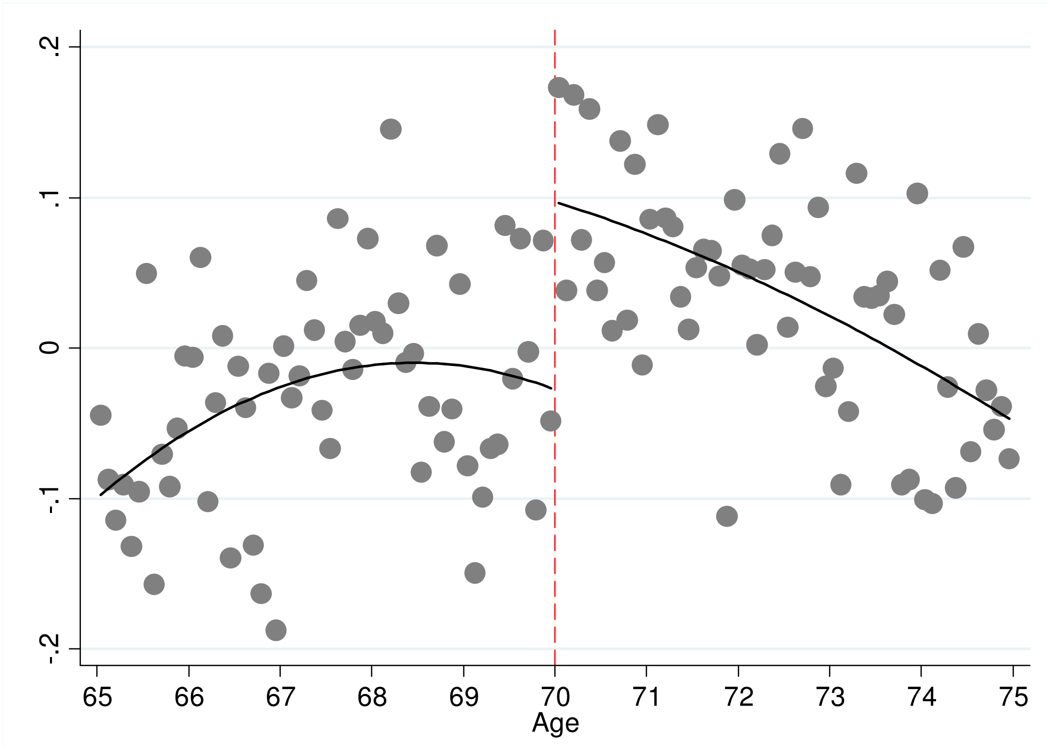
E2. Limiting the Sample by Different Windows from Discharge



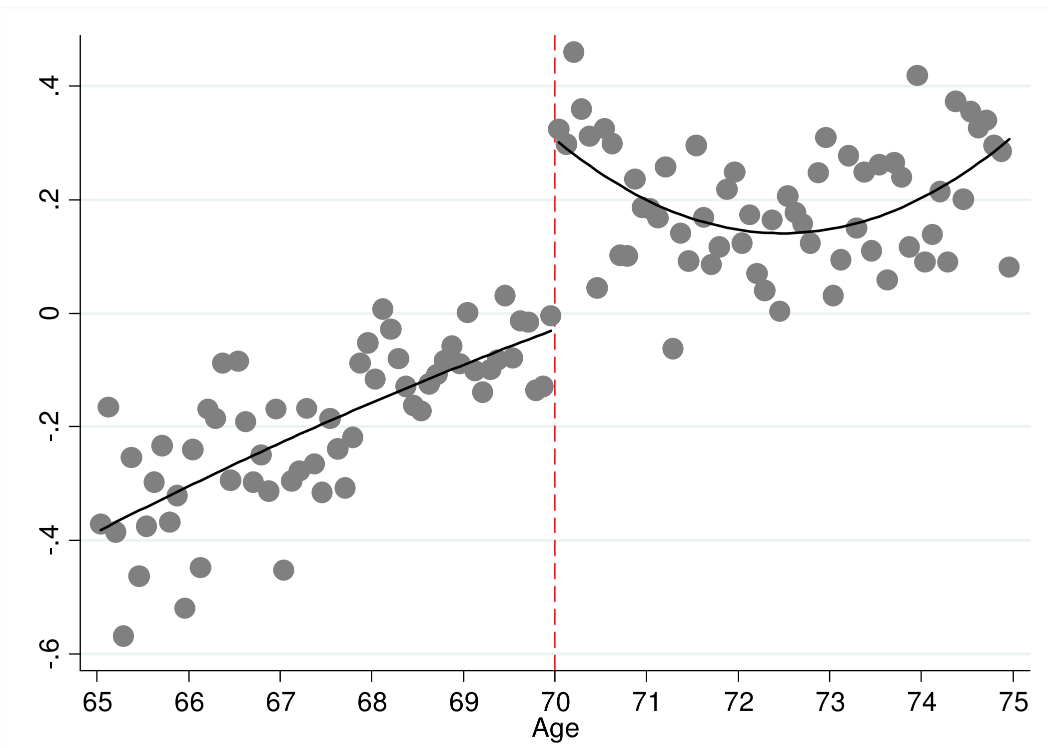
Note: I pool discharge data for 1984–2008 from the Patient Survey. The model here is a quadratic age profile, fully interacted with a dummy for age 70 or older. The dashed line indicates the 95 percent confidence interval.

Figure F: Age Profile for Inpatient Admissions for Selected Surgery (Log Scale)

F1. Open-stomach Surgery

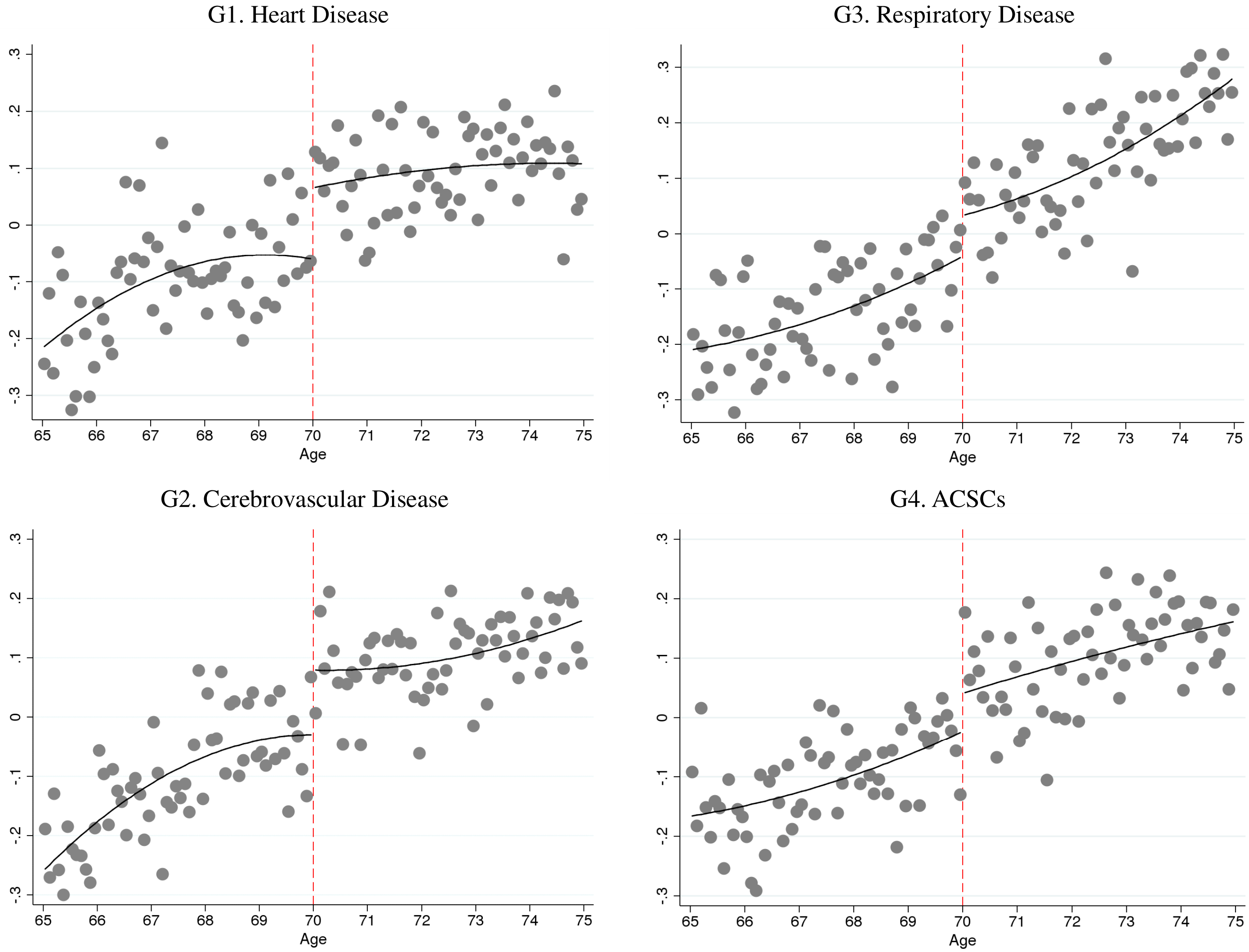


F2. Intraocular Lens Implantation



Note: I pool discharge data for 1999, 2002, 2005, and 2008 from the Patient Survey, since surgery-specific information was collected for only these four survey years. I use admissions within three months from discharge, and thus, the sample size is 1,440. The markers represent the averages of residuals of log outcomes regressed by birth month fixed effects, admission month fixed effects, and the survey year fixed effects, in order to partial out the seasonality in birth and the underlying common shocks in the survey year, respectively. The lines represent fitted regressions from models that assume a quadratic age profile, fully interacted with a dummy for age 70 or older.

Figure G: Age Profile of Inpatient Admissions for Selected Diagnoses (Log Scale)

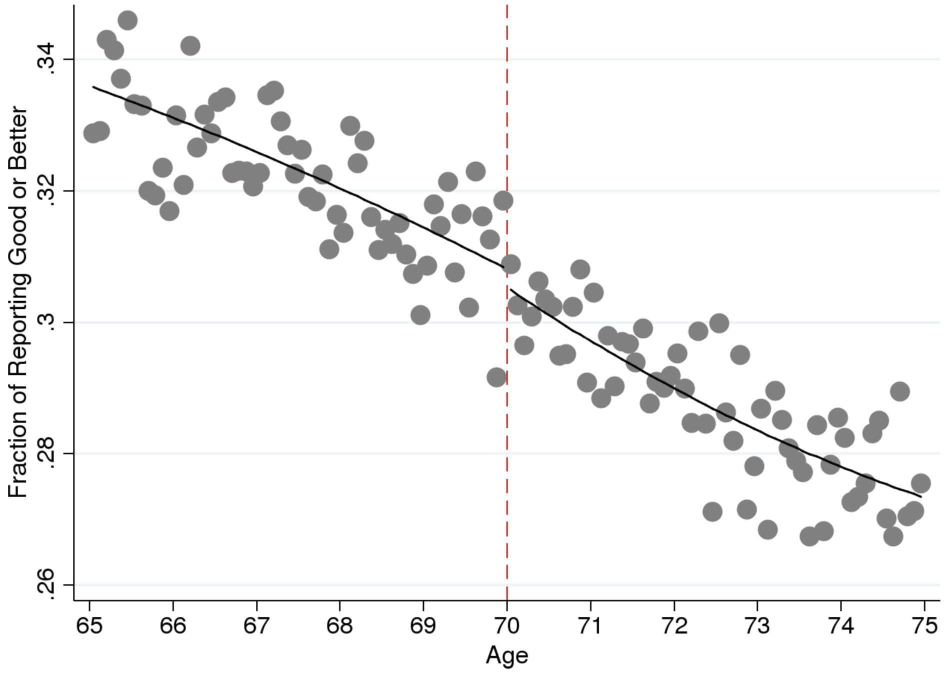


Note: I pool discharge data for 1984–2008 from the Patient Survey. The corresponding RD estimates at age 70 are statistically significant at 5 percent for Figures H1 and H2 only. The markers represent the averages of residuals from regressions of log outcomes on birth month fixed effects, admission month fixed effects, and survey year fixed effects (aggregated by age in months). The lines represent fitted regressions from models that assume a quadratic age profile, fully interacted with a dummy for age 70 or older.

Figure H: Age Profile for Cause-specific Mortality (Log Scale)

Note: I pool mortality data for 1984–2008 for patients born during 1919–1933. The markers represent the averages of residuals from regressions of log outcomes on birth month fixed effects and death month fixed effects (aggregated by age in month). The lines represent fitted regressions from models that assume a quadratic age profile, fully interacted with a dummy for age 70 or older.

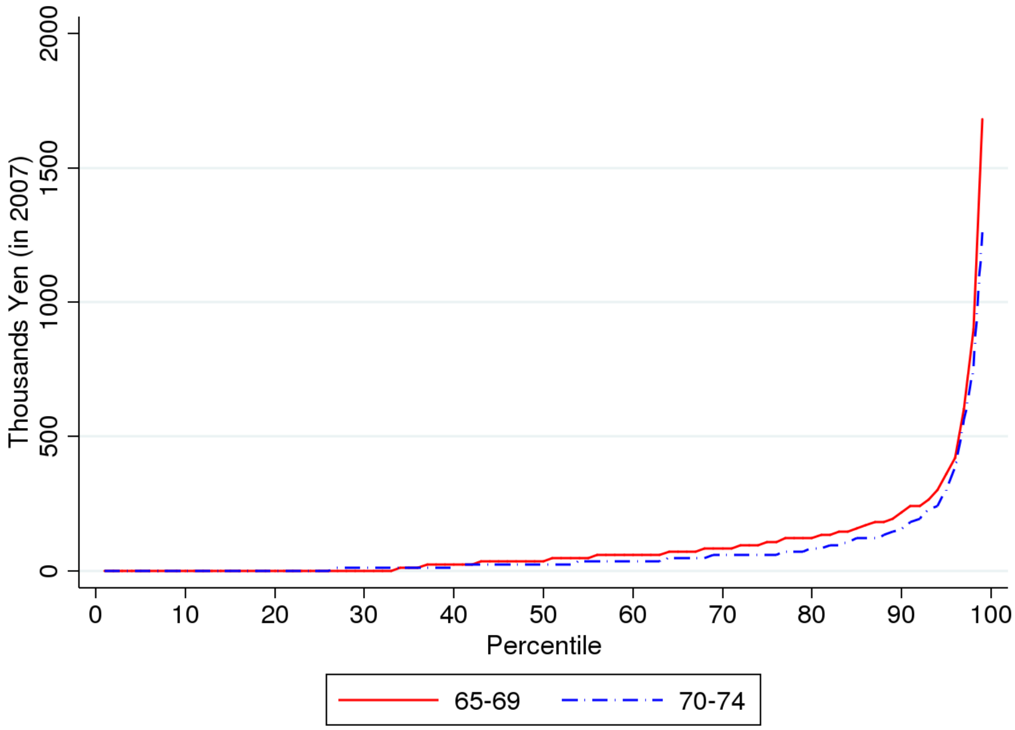
Figure I: Age Profiles for Fraction in Good or Very Good Health



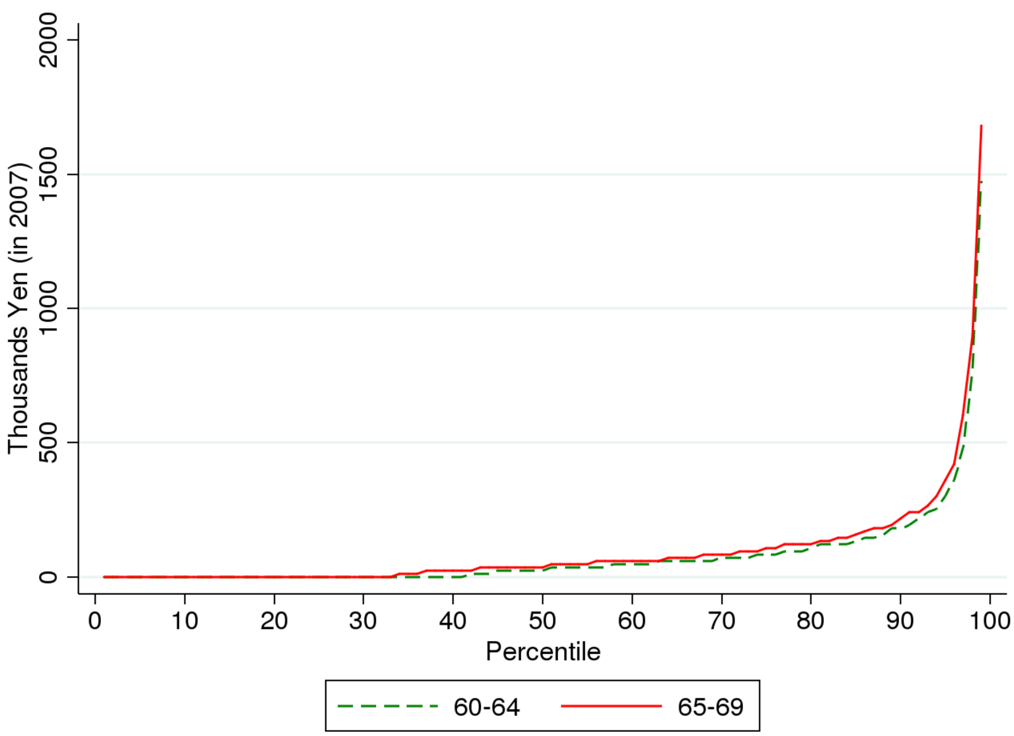
Note: I pool data for 1986–2007 from the CSLC. The markers represent actual averages (age in months), and the lines represent fitted regressions from models that assume a quadratic age profile, fully interacted with a dummy for age 70 or older.

Figure J: Out-of-pocket Medical Expenditures

J1. Ages 65–69 (Near-elderly) and Ages 70–74 (Elderly)



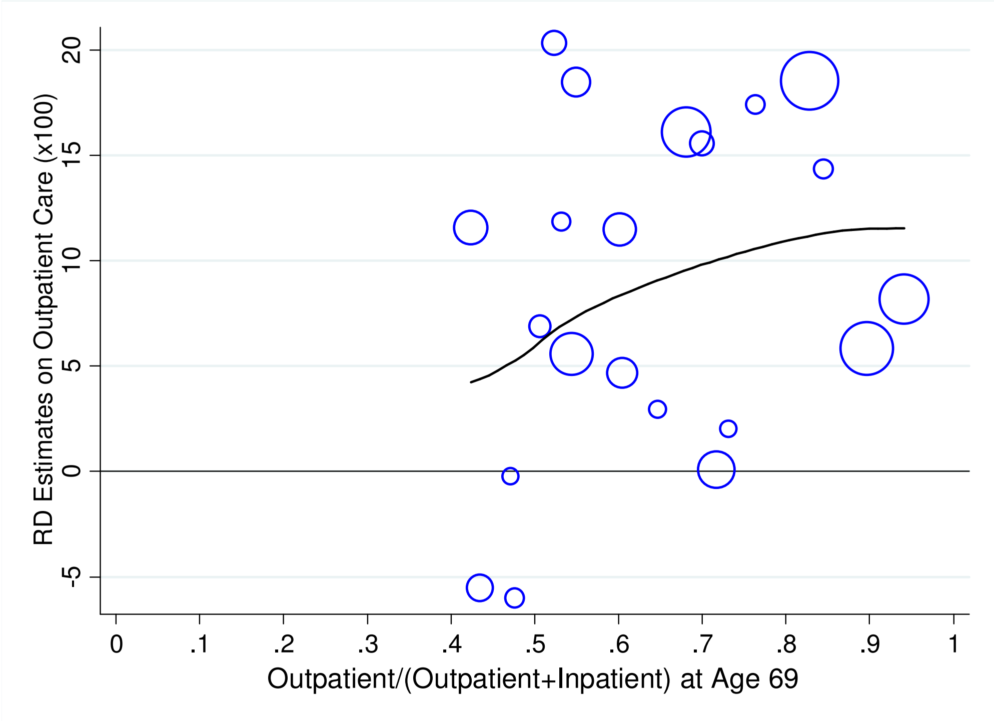
J2. Ages 60–64 and 65–69 (Near-elderly)



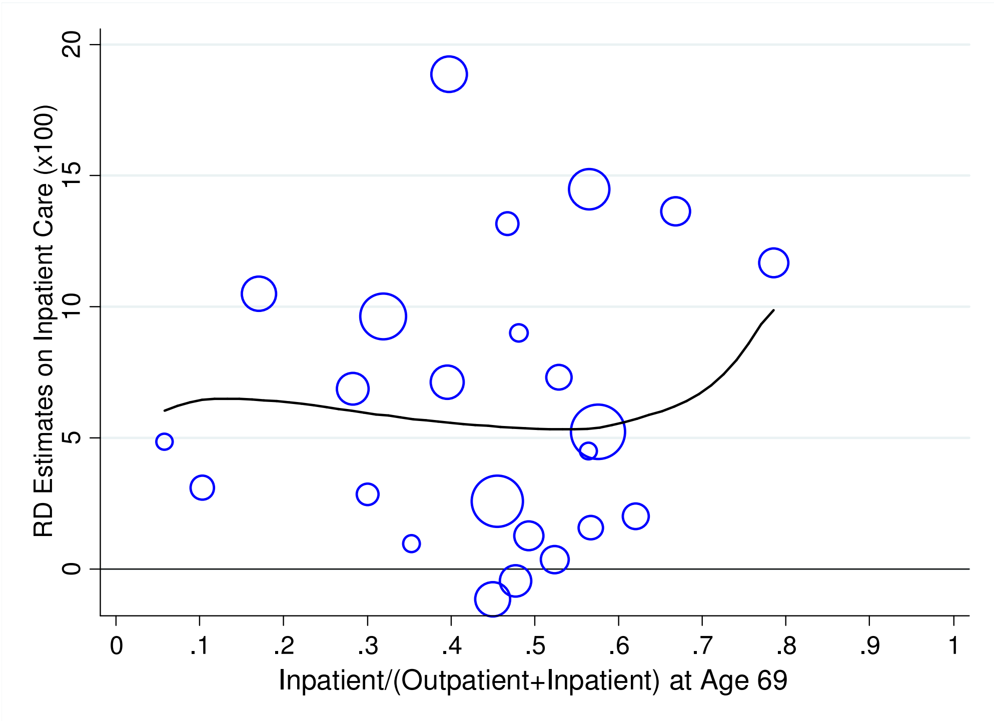
Note: The data are sourced from the 2007 CSLC. I multiply the monthly out-of-pocket expenditures by 12 to convert the values to an annual basis. One thousand Yen roughly equaled 10 US dollars in 2007.

Figure K: RD Estimates and Fraction of Outpatient or Inpatient Care

K1. RD Estimates on Outpatient Care



K2. RD Estimates on Inpatient Care



Note: I pool outpatient data and discharge data for 1984–2008 from the Patient Survey. The y-axis represents the RD estimates at age 70, and the x-axis is fraction of visits in each diagnosis group using outpatient or inpatient care at age 69, respectively. See Table G for the list of diagnosis groups. I omit diagnosis groups with less than 1 percent of the total observations of outpatient and inpatient care respectively, because their sample sizes are too small to provide credible estimates. The size of each dot reflects the number of observations for the control group (those aged 69) for outpatient and inpatient care, respectively. The solid line is a kernel-weighted local linear smoothing, using the reciprocal of the variance of each RD estimate as weight for the observation.

Table A: Summary Statistics (65–75 years)

Variables		Mean (SD)
A.	Outpatient Data	
	Repeat visits	0.94
	Hospital	0.44
	Clinic	0.56
	Male	0.42
	With referral	0.05
	Days from last outpatient visit (days)	13.6
		(20.2)
B.	Discharge Data	
	With surgery	0.35
	Male	0.54
	Hospital	0.99
	Clinic	0.01
	Open-head surgery	0.007
	Open-heart surgery	0.011
	Open-stomach surgery	0.038
	Musculoskeletal surgery	0.045
	Endoscopic surgery: Stomach	0.007
	Intraocular lens implantation	0.021
	Length of stay (days)	18.1
		(17.7)
	Location before admission: outpatients in the same hospital	0.67
C.	CSLC Data	
	Self-reported health: Good or better	0.31
	Are stressed	0.41
	Male	0.45
	Currently married	0.74
	Employed	0.31
	Hours of work per week	6.82
	Income (thousand Yen)	1,860
		(1,920)
	Receiving pension	0.95
	With long-term health insurance	0.03
D.	Mortality Data	
	Male	0.64

Note: One thousand Yen roughly equaled 10 US dollars.

Table B: RD Estimates on Employment and Family Structure at Age 70

	All	By Gender		Data	
		Male	Female	Years Available	Sample Size for "All"
A. Employment-related					
(1) Employed	0.3	0.5	0.1	1986–2007	573,104
	(0.4)	(0.5)	(0.5)		
(2) Retired	-0.1	0.8	-0.7	1986–2007	573,104
	(0.5)	(0.7)	(0.6)		
(3) Hours of work	0.0	0.1	0.0	2004–2007	39,978
	(0.0)	(0.1)	(0.2)		
(4) Family income (thousand Yen)	-54.9	-212.0	88.1	1986–2007	77,967
	(113.0)	(174.9)	(144.9)		
(5) Income (thousand Yen)	-32.3	-29.9	-34.1	2004–2007	18,757
	(89.8)	(179.9)	(54.3)		
B. Family Structure					
(6) Married spouse present	0.5	0.5	0.4	1986–2007	573,104
	(0.5)	(0.5)	(0.7)		
(7) Head of household	0.0	-0.1	0.1	1986–2007	573,104
	(0.4)	(0.4)	(0.6)		
C. Other					
(8) Receiving pension	0.3	0.2	0.4	1986–2007	573,104
	(0.3)	(0.4)	(0.4)		
(9) Long-term care insurance	-0.1	-0.5	0.2	2001–2007	232,928
	(0.3)	(0.4)	(0.3)		

Note: Estimated regression discontinuities at age 70 are shown from models that include a quadratic of age, fully interacted with dummy for age 70 or older among people between ages 65–75. The exception is a pension dummy, since there is a discrete jump at age 65 favoring the probability of receiving pension. Thus, I limit the sample to ages 66–74. Other controls include indicators for gender, region, marital status, birth month, and sample year. I use pooled 1986–2007 samples from the CSLC. Sample sizes differ by variables, since some variables are only collected for a shorter period. Note that income is collected for roughly 15 percent of all samples. Standard errors (in parentheses) are clustered at the age-in-months level, as this is the most refined available version of the age variable. All regressions are weighted to take into account the stratified sampling frame in the data. ***, **, and * denote significance at the 1 percent, 5 percent, and 10 percent levels respectively. As all coefficients on *Post*70 and their standard errors have been multiplied by 100, they can be interpreted as percentage changes.

Table C: Top 5 Diagnoses and RD Estimates

C1. Outpatient Visits

Rank	Diagnosis	ICD9 (3-digit)	Share (Percent)	RD Estimates	SE
1	Essential Hypertension	401	16.1	8.0***	2.4
2	Spondylosis and Allied Disorders	721	4.7	23.7***	3.6
3	Diabetes Mellitus	250	4.7	1.7	4.4
4	Osteoarthrosis and Allied Disorders	715	4.3	25.3***	4.2
5	Cataract	366	3.4	12.0**	4.9

C2. Inpatient Admissions

Rank	Diagnosis	ICD9 (3-digit)	Share (Percent)	RD Estimates	SE
1	Cataract	366	4.4	22.6***	6.5
2	Angina Pectoris	413	4.1	11.4	7.3
3	Occlusion of Cerebral Arteries	434	3.8	13.7***	4.6
4	Diabetes Mellitus	250	3.2	7.4	5.8
5	Malignant Neoplasm of the Stomach	151	3.1	4.8	6.1

Note: For both Figures C1 and C2, I pool outpatient data for 1984–2008 from the Patient Survey. ***, **, and * denote significance at the 1 percent, 5 percent, and 10 percent levels respectively.

Table D: List of Ambulatory Care Sensitive Conditions

No.	Diagnosis
1	Diabetes, Short-term Complications
3	Diabetes, Long-term Complications
5	Chronic Obstructive Pulmonary Disease
7	Hypertension
8	Congestive Heart Failure
10	Dehydration
11	Bacterial Pneumonia
12	Urinary Infections
13	Angina without Procedure
14	Uncontrolled Diabetes
15	Adult Asthma
16	Lower Extremity Amputations among Patients with Diabetes

Note: I excluded entry #2 (Perforated Appendicitis) from the analysis, since this index indicates the number of admissions for perforated appendices as a share of admissions for appendicitis only. In addition, entry #14 requires the fifth digit of ICD9, which I do not have, since this diagnosis includes 25002 and 25003 only (25000, 25001, and 25009 should not be included). To account for this, I only include Diabetes (2500), which also report secondary diagnosis.

Table E: Robustness of RD Estimates on Outpatient Visits for Selected Outcomes

Running Variable: Age in	Month			Day		
	Basic	Age 67–73	Cubic	Basic	Age 67–73	Cubic
	(1)	(2)	(3)	(4)	(5)	(6)
A. All	10.3***	11.3***	12.1***	11.4***	12.3***	12.7***
	(1.8)	(2.3)	(2.6)	(1.6)	(2.1)	(2.2)
B. By Period						
Years 1984–1999	12.0***	12.3***	12.5***	14.0***	14.1***	14.2***
	(1.8)	(2.2)	(2.5)	(1.7)	(2.2)	(2.3)
C. By Visit Type						
Repeat visits	10.3***	11.2***	12.1***	11.4***	12.1***	12.5***
	(1.9)	(2.3)	(2.6)	(1.6)	(2.1)	(2.2)
D. Days from Last Outpatient Visits among Repeat Visits						
1 day	16.4***	20.9***	21.6***	15.7***	17.1***	16.5***
	(4.4)	(6.1)	(6.5)	(2.1)	(2.7)	(2.9)
4–7 days	8.5***	6.6	8.7*	9.6***	11.7***	10.5***
	(3.0)	(4.1)	(4.6)	(2.3)	(3.1)	(3.2)
E. By Institution						
Clinic	13.8***	15.1***	16.0***	13.4***	14.2***	14.7***
	(1.8)	(2.3)	(2.6)	(1.1)	(1.5)	(1.5)
F. By Referral						
Without referral	10.5***	11.6***	12.5***	11.5***	12.3***	12.8***
	(1.9)	(2.3)	(2.6)	(1.6)	(2.1)	(2.2)
G. By Gender						
Male	11.3***	11.7***	12.5***	12.7***	14.2***	13.6***
	(2.2)	(2.7)	(3.1)	(2.0)	(2.7)	(2.8)
Female	9.7***	11.1***	11.9***	10.1***	11.3***	12.3***
	(1.9)	(2.3)	(2.6)	(1.7)	(2.2)	(2.4)

Note: Each cell is the estimate from separate estimated regression discontinuities at age 70. I use pooled 1984–2008 samples of outpatient data. Column (1) is the model that includes quadratic of age, fully interacted with dummy for age 70 or older among people between ages 65–75, where the data are collapsed into age in months. Controls are dummies for each survey year and each month of birth. The "Basic" model in Column (4) includes a quadratic age profile, fully interacted with dummy for age 70 or older among people between ages 65–75, where the data are collapsed into age in days. Controls are dummies for each survey year and each day of the year. Robust standard errors are in parentheses. ***, **, and * denote significance at the 1 percent, 5 percent, and 10 percent levels respectively. As all coefficients on *Post*70 and their standard errors have been multiplied by 100, they can be interpreted as percentage changes.

Table F: Robustness of RD Estimates on Inpatient Admissions for Selected Outcomes

		Basic	Age 67-73	Cubic
		(1)	(2)	(3)
A.	All	8.2***	10.0***	11.2***
		(2.6)	(3.4)	(3.6)
B.	By Period			
	Years 1984–1999	9.6***	10.9***	12.2***
		(2.2)	(2.8)	(3.0)
	Years 2002–2008	5.3**	8.0**	9.4***
		(2.6)	(3.3)	(3.6)
C.	By Admission Day			
	First half of the month	9.8***	12.1***	13.8***
		(2.8)	(3.6)	(3.7)
	Second half of the month	8.7***	10.4**	11.8***
		(3.2)	(4.2)	(4.4)
D.	Surgery			
	Without surgery	6.4**	6.9**	8.0**
		(2.6)	(3.4)	(3.6)
	With surgery	12.0***	17.3***	20.0***
		(3.5)	(4.5)	(4.7)
E.	Type of Surgery			
	Open-stomach surgery	12.6**	15.1**	15.5**
		(5.3)	(6.6)	(6.9)
	Intraocular lens implantation	22.9***	29.7***	38.5***
		(5.2)	(6.7)	(8.3)
F.	Gender			
	Male	8.1***	10.2***	11.1***
		(2.8)	(3.6)	(3.8)
	Female	9.0***	10.4***	12.2***
		(2.8)	(3.6)	(3.9)
G.	By Diagnosis			
	Cataract	22.6***	31.6***	46.4***
		(6.5)	(8.5)	(9.7)
	Occlusion of cerebral arteries	13.7***	16.3***	18.2***
		(4.6)	(5.9)	(6.3)
	Ischaemic heart disease	14.5**	17.3*	16.5*
		(7.1)	(9.3)	(9.7)
	Cerebral infarction	12.8***	14.4**	14.5**
		(4.6)	(6.0)	(6.3)
H.	Location Before Admission			
	Outpatients in the same hospital	9.7***	11.3***	13.0***
		(2.9)	(3.7)	(3.9)

Note: The "Basic" model includes a quadratic age profile, fully interacted with dummy for age 70 or older among people between ages 65–75. Controls are dummies for each survey year, each month of birth, and each month of admission. I use pooled 1984–2008 samples of discharge data. Robust standard errors are in parentheses. ***, **, and * denote significance at the 1 percent, 5 percent, and 10 percent levels respectively. As all coefficients on *Post*70 and their standard errors have been multiplied by 100, they can be interpreted as percentage changes.

Table G: List of Diagnosis Groups

No.	ICD 9	Diagnosis Group
1	001-009	Intestinal Infectious Diseases
2	010-018	Tuberculosis
3	020-041	Other Bacterial Diseases
4	045-079	Viral Diseases
5	080-088	Rickettsiosis and Other Arthropod-borne Diseases
6	090-099	Venereal Diseases
7	100-139	Other Infectious and Parasitic Diseases and Late Effects of Infectious and Parasitic Diseases
8	140-149	Malignant Neoplasm of Lip, Oral Cavity, and Pharynx
9	150-159	Malignant Neoplasm of Digestive Organs and Peritoneum
10	160-165	Malignant Neoplasm of Respiratory and Intrathoracic Organs
11	170-175	Malignant Neoplasm of Bone, Connective Tissue, Skin, and Breast
12	179-189	Malignant Neoplasm of Genitourinary Organs
13	190-199	Malignant Neoplasm of Other and Unspecified Sites
14	200-208	Malignant Neoplasm of Lymphatic and Hematopoietic Tissue
15	210-229	Benign Neoplasm
16	230-234	Carcinoma in Situ
17	235-239	Other and Unspecified Neoplasm
18	240-259 270-279	Endocrine and Metabolic Diseases, Immunity Disorders
19	260-269	Nutritional Deficiencies
20	280-289	Diseases of Blood and Blood-forming Organs
21	290-319	Mental Disorders
22	320-359	Diseases of the Nervous System
23	360-379	Disorders of the Eye and Adnexa
24	380-389	Diseases of the Ear and Mastoid Process
25	390-398	Rheumatic Fever and Heart Disease
26	401-405	Hypertensive Disease
27	410-414	Ischemic Heart Disease
28	415-429	Diseases of Pulmonary Circulation and Other Forms of Heart Disease
29	430-438	Cerebrovascular Disease
30	440-459	Other Diseases of the Circulatory System
31	460-465, 470-478	Diseases of the Upper Respiratory Tract
32	466, 480-519	Other Diseases of the Respiratory System
33	520-529	Diseases of Oral Cavity, Salivary Glands, and Jaws
34	530-579	Diseases of Other Parts of the Digestive System
35	580-599	Diseases of Urinary System
36	600-608	Diseases of Male Genital Organs
37	610-629	Diseases of Female Genital Organs
38	630-639	Abortion
39	640-646	Direct Obstetric Causes
40	647-648	Indirect Obstetric Causes
41	650	Normal Delivery
42	680-709	Diseases of Skin and Subcutaneous Tissue
43	710-739	Diseases of the Musculoskeletal System and Connective Tissue
44	740-759	Congenital Anomalies
45	760-779	Certain Conditions Originating in the Perinatal Period
46	780-799	Signs, Symptoms, and Ill-defined Conditions
47	800-829	Fractures
48	830-848	Dislocations, Sprains, and Strains
49	850-869, 950-957	Intracranial and Internal Injuries, Including Nerves
50	870-904	Open Wounds and Injury to Blood Vessels
51	930-939	Effects of Foreign Body Entering through Orifice

52	940-949	Burns
53	960-989	Poisonings and Toxic Effects
54	996-999	Complications of Medical and Surgical Care
55	910-929, 958-959, 990-995	Other Injuries, Early Complications of Trauma
56	905-909	Late Effects of Injuries, of Poisonings, of Toxic Effects, and of Other External Causes

Note: This list of diagnosis groups is sourced from the Basic Tabulation List of ICD 9. Note there are no observations for birth-related group 38–41 and 45. See http://www.wolfbane.com/icd/icd9a.htm.

Table H: RD Estimates on Morbidity at Age 70

	Self-reported Health				Stress-related			
	Good or Better Health (Percent)		Linear Regression (1 = poor, 5 = excellent)		Stress Dummy (Percent)		Stressed Due to Own Health and Care (Percent)	
	Age 68–69	RD at 70	Age 68–69	RD at 70	Age 68–69	RD at 70	Age 68–69	RD at 70
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. All	31.4	-0.3	2.8	1.1	41.1	0.4	25.3	0.2
		(0.6)		(1.3)		0.4		(0.7)
B. By HH Income								
Above median	32.1	-0.1	2.7	2.3	39.2	-0.7	22.9	1.0
		(1.9)		(4.3)		(2.4)		(2.0)
Below median	30.1	1.4	2.8	-5.1	44.8	-3.2	29.2	-0.5
		(2.0)		(4.7)		(2.5)		(2.3)
Years Available	1986–2007				1995–2001			

Note: Entries in the odd-numbered columns are the mean of the outcome variables shown in the column headings for 68–69 years-olds. Entries in the even-numbered columns are estimated regression discontinuities at age 70, from models that include quadratic control for age, fully interacted with a dummy for age 70 or older among people between ages 65–70. Other controls include indicators for gender, region, marital status, birth month, and survey year. Except Column (4), estimates are based on a linear probability model fit to pooled samples of CSLC conducted every three years since 1986. Standard errors (in parentheses) are clustered at the age-in-months level, as this is the most refined available version of the age variable. All regressions are weighted to take into account the stratified sampling frame in the data. ***, **, and * denote significance at the 1 percent, 5 percent, and 10 percent levels respectively. Available years for each outcome are described in the last row. Income is collected for roughly 15 percent of all samples, and thus, the sample size of Panel B is smaller than that of the full sample. All coefficients in the even-numbered columns on *Post*70 and its standard error have been multiplied by 100, in order to interpret them as percentage changes. HH stands for household.

Table I: RD Estimates on Out-of-pocket Medical Expenditures at Age 70

	Out-of-pocket Expenditure Just Below Age 70	RD Estimates at Age 70
	(1)	(2)
Mean	152	-52
40th Percentile	30	-13***
Median	52	-24***
60th Percentile	65	-24***
70th Percentile	96	-38***
80th Percentile	139	-50***
90th Percentile	247	-74***
95th Percentile	419	-107***
99th Percentile	1,793	-499*

Note: All monetary values are in thousand Yen in 2007 (roughly equal to 10 US dollars). ***, **, and * denote significance at the 1 percent, 5 percent, and 10 percent levels respectively.

Table J: Sensitivity of Welfare Gain from Risk Protection

		Distribution Adjusted	
		Using Quantile Estimates	Determined "Mechanically"
		(1)	(2)
A. At Mean			
1. Risk Aversion			
(80 percent income cap)	1	2	8
	3	37	98
	5	123	306
2. Cap on Percent of Income			
(Risk Aversion = 3)	60	10	33
	90	85	203
B. Distribution			
(80 Percent Cap, Risk Aversion = 3)			
	25th percentile	11	45
	Median	19	85
	75th percentile	46	146
	90th percentile	105	192
	95th percentile	130	214
	99th percentile	161	249

Note: All estimates are in thousand Yen in 2007. One thousand Yen roughly equaled 10 US dollars in 2007. See Section A2 in the Online Appendix for details.

Table K: Estimated Out-of-pocket Medical Expenditures per Month across Survey Years

K1. Outpatient Visits

	Cost Sharing			Percent Reached Stop-loss	
	Below 70	Above 70	Percent Reduction	Below 70	Above 70
Year	(1)	(2)	((1)-(2))/(1)	(4)	(5)
All	3.99	1.08	73	0.1	0.6
1987	3.96	0.80	80	0.1	-
1990	4.26	0.80	81	0.1	-
1993	4.48	1.00	78	0.1	-
1996	4.23	1.02	76	0.1	-
1999	3.91	1.00	74	0.2	-
2002	3.61	1.30	64	0.1	0.5
2005	3.97	1.28	68	0.2	0.7
2008	3.69	1.20	68	0.1	0.5

K2. Inpatient Admissions

	Cost Sharing			Percent Reached Stop-loss	
	Below 70	Above 70	Percent Reduction	Below 70	Above 70
Year	(1)	(2)	((1)-(2))/(1)	(4)	(5)
All	41.65	13.10	69	14.6	0.0
1987	44.52	7.86	82	26.6	0.0
1990	42.21	7.42	82	21.6	0.0
1993	40.78	11.91	71	11.5	0.0
1996	39.70	10.65	73	11.5	0.0
1999	38.65	15.09	61	9.2	0.0
2002	35.86	15.54	57	8.7	0.0
2005	46.39	15.73	66	18.3	0.0
2008	45.64	15.63	66	13.5	0.0

Note: All monetary values are in thousand Yen in 2007 (roughly equal to 10 US dollars). See Section A1 in the Online Appendix for details.