Reducing Inequality While Improving Health: The Long-Run Impacts from the Onset of Universal Health Insurance in Japan

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Abstract

Health insurance provides an important safety net to individuals in the distress of illness and financial hardships. Providing universal insurance is pursued by many governments to ensure the access to healthcare and to reduce the health and economic inequalities facing less advantaged populations. Exploiting the historic onset of universal insurance in Japan in 1956-1961, this paper examines the long-run impacts of universal insurance on population health and economic outcomes as well as the inequalities across gender. I find that exposure to universal insurance early in life led to lower mortality and chronic disease burdens in prime age. For women, universal insurance increased college enrollment and the probability of marrying a college-educated spouse. Within households, the homemaker's role shifted from women to men whereas employment and earnings increased for women relative to men. The results indicate that, in addition to improving population health in the long run, universal insurance could reduce the gender inequality in socio-economic status by increasing the education and earnings of women.

Keywords: universal health insurance, long-run impacts, insurance expansions, health, human capital, employment, earnings, Japan

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1 Introduction

In the second half of the twentieth century, universal health insurance was implemented in many countries through expansions of existing public insurance programs. The UK, Japan, and the Nordic countries were the first to implement universal insurance in the 1950s and the 1960s, and expansions later gained momentum in Latin America, Africa, and Asia-Pacific countries in the 1990s and the 2000s [1-3]. By 2009, universal insurance has been implemented in 58 countries around the world [4]. While a large body of evidence documents the immediate impacts of insurance on individuals [5-6], the impacts of universal insurance reforms in the long run are not directly observable until decades after the original reform.

This paper examines the long-run impacts of Japan's universal reform in 1961. Announced in 1956, the reform required that all prefectures expand public insurance to implement universal insurance by April 1961. Before the reform, uninsured individuals included workers without industry union insurance and the elderly, and uninsurance rates differed greatly across prefectures. With the reform, the national insurance rate increased from 71% in 1955 to 100% in 1961, and prefectures with lower pre-reform insurance rates achieved greater coverage gains over this period.

I exploit the rapid expansion induced by the reform to study the impacts of universal insurance on health and economic outcomes over the long run. To do so, I focus on the 1956-1965 birth cohorts who were differentially exposed to the universal reform in age 0-5. Specifically, exposure to universal insurance was greater for cohorts born closer to the implementation year of 1961 and increased more across cohorts in prefectures with low insurance rates prior to the reform. Across different exposure levels, I compare the health and economic outcomes in prime age (41-50) of these cohorts based on survey and administrative records on education, employment, health conditions, and mortality. Consistent with the literature on early-life investments, one would expect greater benefits on outcomes for more exposed cohorts.

To address the concern that prefectures with faster expansions during the reform also had better economic conditions that predict long-term outcomes, I construct a simulated exposure measure assuming that expansions in each prefecture occur at a constant annual rate between 1956 and 1961. The simulated measure is driven by two exogenous variations induced by the reform: the timing to accomplish universal insurance by 1961, and the differences in pre-existing insurance rates across prefectures. To the extent that alternative economic and demographic factors were not subject to the same growth pattern dictated by the insurance reform, instrumenting insurance exposure with the simulated measure can reduce the bias of confounding factors correlated with the expansion rate across prefectures.

The instrumental variable estimates show that early-life exposure to universal insurance has significant impacts on the health conditions in prime age. Based on Japan's Comprehensive Survey of Living Conditions, a ten percentage point increase in childhood exposure reduced diabetes prevalence rates by 0.89 percentage points in age 41-50, and reduced hypertension prevalence rates by 0.85 percentage points; both effects were fully concentrated in women. In the death certificate data, the exposure further reduced mortality by 1.1 per 100,000 individuals for men, driven by the reduction in cancer-related deaths, whereas mortality from other conditions did not differ with exposure.

Exposure to universal insurance further increased education attainment, employment, and earnings in the Employment Status Survey. High school graduation rates increased for both genders in cohorts more exposed to universal insurance, and college attendance increased specifically for women by 1.2 percentage points for every ten percentage point exposure in childhood. The exposure further increased employment and earnings for women relative to men, and impacted marital sorting for women by increasing the education attainment of their spouses. Within households, the homemaker's role shifted to men as full-time employment increased for women, and the overall income of husband and wife did not increase with exposure.

These results indicate persistent impacts of universal health insurance on individuals over the life cycle. While health and education attainment increased for both genders, exposure to universal insurance led to greater employment and improved marital sorting especially for women. As a result, the gender inequality in economic conditions decreased in more exposed cohorts. The impact on the gender gaps in socio-economic status suggests the role of universal insurance in building an inclusive and equitable society through improved outcomes of less advantaged populations.

2 Materials and Methods

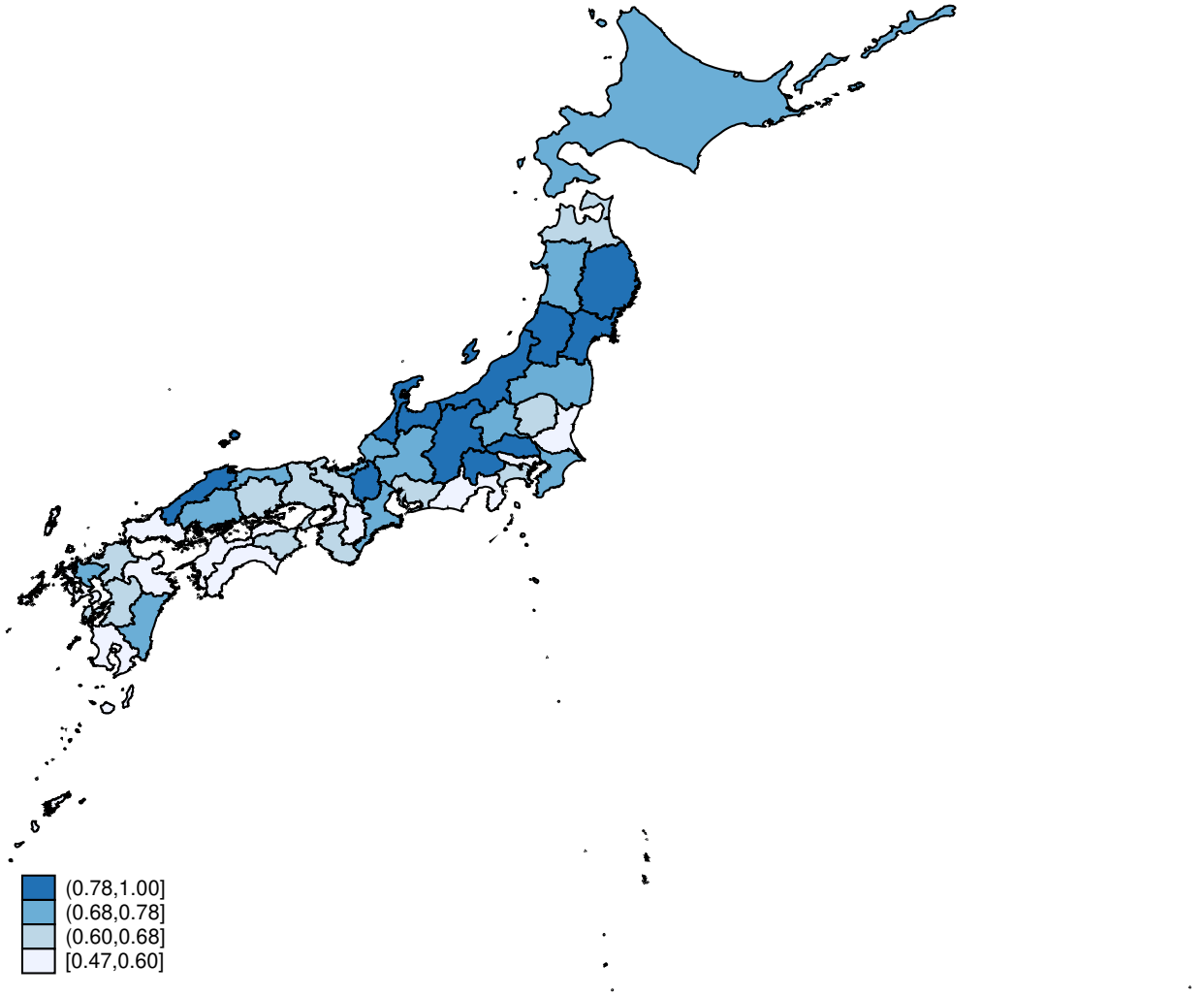
2.1 Japan's Universal Insurance Reform

Japan's health insurance system is composed of private insurance, sponsored by employers to cover workers and family members, and the public, community-based insurance provided by the local government to residents. Before the universal insurance reform, eligibility for community-based insurance was determined by municipalities administering the insurance, and many municipalities lacked coverage to the elderly, the unemployed, and workers without employment-based insurance. As the plight and inequality facing the uninsured became a social issue in the early 1950s, reforming the insurance system to achieve universal insurance gained popularity in the policy realm [7].

In January 1956, Prime Minister Ichiro Hatoyama announced the plan to cover the entire Japanese population with universal insurance. Towards this goal, community-based insurance was expanded to cover all residents without employment-based insurance. In 1957, the Ministry of Health and Welfare launched a four-year plan that mandated expansions of community-based insurance and stipulated the timeline to achieve universal insurance by April 1961. The reformed program must cover the same set of services as employment-based insurance, and the central government would subsidize municipalities for 20% of the benefit payments.

Before universal insurance became a policy objective, insurance rate differed greatly across prefectures in 1955 (Figure 1). The median insurance rate was 68% and the average was 71%. The lowest insurance rates in Kagoshima and Kochi were below 50%, and prefectures including Osaka, Shizuoka, Yamaguchi, and Tokyo had insurance rates less than 60%. In these prefectures, greater expansions were implemented over the reform period to achieve universal insurance by 1961. Prefectures such as Niigata, Shiga, Iwate, and Yamagata already had near universal insurance in 1955, and expansions were small in these prefectures.

Figure 1: Pre-reform insurance rates in prefectures in 1955



Notes: Figure plots the 1955 insurance rates across prefectures in Japan. The colors correspond to the inter-quartile ranges of insurance rates.

There is further variation in the speed of expansion across years during the reform period. Supplementary Figure S1 plots the insurance rate in each prefecture in 1955-1961. In prefectures such as Miyagi, Akita, and Tokushima, expansions picked up speed immediately after the reform and universal insurance was already achieved by 1959. Kanagawa, Kyoto, and Osaka, on the other hand, had slower expansions initially but accelerated in later years to achieve universal insurance by 1961. In contrast, the expansion speed in Ehime, Kochi, and Fukuoka was roughly constant over the reform period. Overall, prefectures differed greatly in both the size of expansion between 1955 and 1961 and the growth of insurance rates over this period.

2.2 Data

To study the long-run impacts of universal insurance, I follow cohorts born in 1956-1965 and examine their health and economic outcomes in prime age (41-50) using several survey and administrative records. For health outcomes, I use the health questionnaire of the Comprehensive Survey of Living Conditions, a repeated cross section of Japanese households, to measure the prevalence rates of diabetes, hypertension, cardiovascular diseases, stroke, and cancer in prime age. Table 1 summarizes the prevalence rates by gender in Panel A.[1] The most common conditions are hypertension and diabetes for both genders, whereas women have higher rates of cancer diagnosis in prime age.

I also derive the mortality rates of disease conditions based on the universe of death certificate records in Japan.[2] Specifically, I calculate the mortality rate as the number of disease-related deaths per 10,000 individuals in a given birth cohort each year. In Table 1, the mortality rate for the prime-age population is fairly low for both genders.

[1]The statistics are independently aggregated and analyzed by using the questionnaire information from the original survey data, which is under the jurisdiction of the Ministry of Internal Affairs and Communications. Aggregate statistics available to the public do not provide detailed information by age, year, and prefecture, and hence do not support the empirical analysis in this paper.

[2]These records are available in the Population Demographic Survey, administered by the Ministry of Health Labour and Welfare Division.

Table 1: Summary Statistics

	Women			Men		
	N	mean	s.e.	*N*	mean	s.e.
	Panel A: Health Outcomes					
Hypertension (%)	36,285	11.16	0.50	31,478	19.49	0.39
Diabetes (%)	36,285	3.42	0.22	31,478	9.42	0.33
Cardiovascular (%)	36,285	0.48	0.06	31,478	2.11	0.09
Stroke (%)	36,285	0.57	0.06	31,478	1.31	0.11
Cancer (%)	36,285	2.89	0.14	31,478	0.66	0.04
Mortality (per 10k individuals by age-year)						
Hypertension	4,588	2.28	0.02	4,600	4.35	0.09
Diabetes	4,588	0.03	0.001	4,600	0.08	0.004
Cardiovascular	4,588	0.17	0.008	4,600	0.63	0.02
Stroke	4,588	0.19	0.005	4,600	0.40	0.001
Cancer	4,588	1.17	0.01	4,600	1.05	0.02
	Panel B: Education and Economic Outcomes					
High School (%)	168,904	95.61	0.31	160,598	93.04	0.41
College Degree (%)	168,904	13.61	1.42	160,598	38.30	2.27
Married (%)	170,103	80.06	0.93	161,294	75.21	0.69
Spouse Has College Degree (%)	170,103	28.16	1.68	161,294	9.39	0.91
Employed (%)	170,391	44.56	1.45	161,766	93.80	0.19
Homemaker (%)	170,391	24.08	0.87	161,766	0.65	0.02
Log Earning	170,550	3.67	0.05	161,899	5.77	0.03

Notes: Table summarizes the health and economic outcomes in prime age (age 41-50) for the 1956-1965 birth cohorts. Panel A summarizes the prevalence rate of disease conditions using data from the Comprehensive Survey of Living Conditions and the mortality per 10 thousand individuals by age-year and gender from the vital statistics. Panel B summarizes education and employment for individuals and their spouses using data from the Employment Status Survey.

Hypertension and cancer are the leading causes of death, with hypertension accounting for 2-4 deaths per 10,000 individuals in a given birth cohort each year.

I examine education attainment and employment of individuals and married couples using the Employment Status Survey.[3] In Panel B, high school graduation rates are high for both genders, but college attendance is substantially higher for men than for women. Moreover, women are less likely to marry a spouse with college education, and the probability of having a college-educated spouse is much higher for men. For economic activities, women are less likely to be employed, have lower earnings, and predominantly assume the homemaker's role in households. These differences show that women have more limited access to higher education, participate less in the labor market, and mainly contribute to home production in prime age.

2.3 Empirical Strategy

2.3.1 Insurance Exposure

To understand how health and economic conditions differ across early-life exposure to universal insurance, I measure the insurance exposure of individuals using the average insurance rate in age 0-5. I focus on individuals born in 1956-1965, where exposure was greater for cohorts born closer to the 1961 onset of universal insurance and differed across prefectures depending on the pre-reform insurance rate and the growth over the reform period. Specifically, I construct insurance exposure as follows

$$exposure_{iatp} = \frac{1}{6} \sum_{\tau=b(i)}^{b(i)+5} insr_{\tau p}, \tag{1}$$

[3]This statistic was independently aggregated and analyzed by using the questionnaire information of the Employment Status Survey data, which is under the jurisdiction of the Ministry of Internal Affairs and Communications. Aggregate statistics available to the public do not provide detailed information by age, year, and prefecture, and hence do not support the empirical analysis in this paper.

where the exposure of individual i in year t, age a, and prefecture p is the average insurance rate between birth year $b(i)$ and age 5. For each childhood year τ in between, $insr_{\tau p}$ is the insurance rate in prefecture p. Supplementary Figure S2 plots the insurance exposure in each cohort. In the 1956-1958 cohorts, insurance exposure differed widely across prefectures and the average exposure was less than 90%. Exposure increased to over 95% in most prefectures in the 1959-1961 cohorts, and cohorts born after 1961 had full exposure to universal insurance.

To grasp the relationship between outcomes in prime age and insurance exposure early in life, I estimate the following equation using ordinary least squares (OLS),

$$y_{iatp} = \beta_0 + \beta_1 \cdot exposure_{iatp} + \theta_a + \mu_t + \delta_p + \beta \cdot X_{itp} + \epsilon_{iatp}, \tag{2}$$

where I regress outcome y_{iatp} on $exposure_{iatp}$ while controlling for the direct impact of survey year μ_t , individual age θ_a , and prefecture δ_p. The fixed effects absorb differences across birth cohorts and prefectures. Accounting for the differences, β_1 captures the differential impact of exposure across cohorts and prefectures as a result of the insurance reform. In addition, I interact prefecture-level GDP, community-based insurance rates, and demographic compositions in 1955 with a linear time trend in X_{itp}. These controls account for long-run time trends in the outcome variable due to differences in the economic and population growth across prefectures. I also include individual characteristics such as gender in X_{itp}.

Although expansions greatly varied insurance exposure across cohorts and prefectures, OLS estimates of β_1 may be biased due to unobserved determinants of exposure. For instance, prefectures with greater public support for the reform may experience faster expansions over time. More generally, demographic factors, incomes, and the government's capacity to administer universal insurance can impact the speed of expansion and hence exposure across cohorts. To the extent that omitted factors affecting exposure could bias

the OLS estimates, I instrument exposure with a simulated measure exploiting variations induced by policy.

2.3.2 Simulated Exposure

I construct the simulated measure to capture two variations specific to the universal reform. First, the reform imposed the timeline to implement universal insurance in all prefectures by 1961. The requirement implies that prefectures with previously low insurance rates must carry out greater expansions in 1956-1961. The timing to implement universal insurance by 1961 and the difference in pre-reform insurance rates introduce exogenous variations in the growth of insurance rates across prefectures over the reform period. Assuming equal expansions each year, simulated insurance rate in year τ is given by

$$insr^{simu}_{\tau p} = insr_{1955p} + \frac{\tau - 1955}{6}(1 - insr_{1955p}), \tag{3}$$

where expansion reduces the gap to universal insurance, $1 - insr_{1955p}$, evenly during the reform period. Based on the simulated insurance rate, simulated exposure is

$$exposure^{simu}_{iatp} = \frac{1}{6}\sum_{\tau=b(i)}^{b(i)+5} insr^{simu}_{\tau p}, \tag{4}$$

which is the average insurance rate in age 0-5 assuming even expansions over time. Different from the exposure measure in equation (1), the simulated measure determines the speed of expansion in 1956-1961 from the pre-reform insurance rates only, and the actual pace of expansion over time does not further impact the insurance exposure across cohorts. Thus, the simulated measure is not driven by time-varying factors that may be correlated with the expansion speed in prefectures.

I use the simulated measure as an instrument of exposure. For the instrument to be valid, simulated exposure should be correlated with the observed exposure of individuals.

In addition, simulated exposure should not be correlated with omitted factors affecting long-run outcomes in prime age. To the extent that omitted factors do not follow the same growth patterns across cohorts and prefectures as dictated by the insurance reform, instrumenting exposure with the simulated measure can alleviate the omitted variable bias in the OLS estimates.

In the instrumental variable framework, I estimate the following first-stage equation

$$exposure_{iatp} = \alpha_0 + \alpha_1 \cdot exposure^{simu}_{iatp} + \vartheta_a + \pi_t + \sigma_p + \alpha \cdot X_{itp} + \epsilon_{iatp}, \tag{5}$$

where I include the same set of controls as in equation (2). I then estimate the second-stage equation

$$y_{iatp} = \gamma_0 + \gamma_1 \cdot \widehat{exposure}_{iatp} + \rho_a + \omega_t + \psi_p + \gamma \cdot X_{itp} + \epsilon_{iatp}, \tag{6}$$

where $\widehat{exposure}_{iatp}$ is the predicted exposure from the first stage, and γ_1 estimates the causal impact of exposure on outcomes. I focus on OLS estimates from equation (2) and two-stage-least-squares (TSLS) estimates from equation (6) in the results below. I also examine heterogeneous impacts by gender. To further address concerns of omitted variables, I replace the time trends in X_{itp} with prefecture-year fixed effects to fully absorb the long-run trends in outcomes across prefectures. Moreover, using the Mobility Survey of the Japanese population, I show that exposure had little impact on whether individuals continued to live in the prefecture of birth in prime age. This result suggests that measurement error due to migration from the birthplace is unlikely to bias estimates of long-run impacts of exposure.

3 Results

3.1 Disease Conditions and Mortality

Table 2 shows the impact of insurance exposure on the disease conditions in prime age. In Panel A, OLS estimates show that gaining a ten percentage point exposure in age 0-5 reduced diabetes prevalence rates by 0.66 percentage point in prime age, but exposure did not significantly impact the prevalence of hypertension, cardiovascular diseases, or cancer. In Panel B, the simulated instrument strongly predicts insurance exposure (F-statistic over 1,000) and the TSLS estimates indicate similar impacts on disease conditions.[4] Across gender, the estimates show that the reduction in chronic conditions was mainly concentrated in women, reducing diabetes by 0.89 percentage points (26.3% below the mean) and reducing hypertension by 0.85 percentage points (8.1% below the mean).

Table 3 examines the impact on overall mortality and disease-specific mortality in every 10 thousand individuals by age-year and gender. In column 1-2, gaining a ten percentage point exposure in age 0-5 reduces the overall number of deaths by 0.06 individual per 10 thousand individuals in prime age, or by 1.8% below the mean, and the effect is primarily driven by the mortality reduction in men. Across disease conditions, mortality from chronic conditions such as diabetes or hypertension did not differ with exposure. In contrast, cancer-related deaths decreased significantly by 0.06 individual primarily for men, and this effect explains nearly 95% (=0.56/0.59) of the overall reduction in mortality in prime age.

I conduct additional analyses to assess the robustness of results. To better address time-varying factors that may impact long-run outcomes across prefectures, I control for prefecture-year fixed effects and show the TSLS estimates in Supplementary Table S2 and S3. The results indicate significant reductions in chronic conditions for women and reductions in cancer-related deaths for men, with similar effect magnitude as the main

[4] I show the first-stage prediction of exposure from the simulated instrument in Supplementary Table S1.

Table 2: Impacts of insurance exposure on disease conditions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Hypertension		Diabetes		Cardiovascular		Cancer	
				Panel A: OLS				
exposure	-0.022		-0.066**		0.004		0.005	
	(0.033)		(0.025)		(0.009)		(0.017)	
exposure · men		0.017		-0.047		-0.001		0.001
		(0.042)		(0.033)		(0.015)		(0.013)
exposure · women		-0.059		-0.083***		0.008		0.010
		(0.039)		(0.022)		(0.010)		(0.025)
				Panel B: TSLS				
exposure	-0.047		-0.066**		0.002		0.002	
	(0.036)		(0.028)		(0.009)		(0.016)	
exposure · men		-0.008		-0.040		-0.002		-0.002
		(0.048)		(0.035)		(0.014)		(0.012)
exposure · women		-0.085**		-0.089***		0.007		0.007
		(0.040)		(0.027)		(0.011)		(0.023)
F-statistic	1,466.0	731.5	1,466.0	731.5	1,466.0	731.5	1,466.0	731.5
y mean	0.15		0.062		0.012		0.018	
N	67,763		67,763		67,763		67,763	

Notes: Table estimates the impact of early-life insurance exposure on disease conditions in prime age. Panel A shows the OLS estimates. Panel B shows two-stage-least-squares (TSLS) estimates where the instrument is simulated exposure assuming equal expansions each year in 1956-1961. Separate effects by gender are shown in even-numbered columns. Standard errors clustered at the level of prefectures in the parentheses.

Table 3: Impacts of insurance exposure on mortality (per 10 thousand individuals)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Deaths		Hypertension		Diabetes		Cardiovascular		Cancer	
					Panel A: OLS					
exposure	-0.58***		-0.008		-0.002		0.040		-0.54***	
	(0.16)		(0.007)		(0.019)		(0.076)		(0.11)	
exposure · men		-1.08***		-0.011		0.002		0.080		-0.94***
		(0.19)		(0.010)		(0.026)		(0.089)		(0.12)
exposure · women		-0.054		-0.006		-0.005		0.002		-0.13
		(0.16)		(0.006)		(0.020)		(0.073)		(0.11)
					Panel B: TSLS					
exposure	-0.59***		-0.006		0.003		0.050		-0.56***	
	(0.17)		(0.008)		(0.022)		(0.076)		(0.11)	
exposure · men		-1.13***		-0.010		0.004		0.10		-0.99***
		(0.21)		(0.010)		(0.029)		(0.090)		(0.12)
exposure · women		-0.037		-0.003		0.002		-0.003		-0.12
		(0.16)		(0.007)		(0.022)		(0.074)		(0.11)
F-statistic	1,572.3	786.1	1,572.3	786.1	1,572.3	786.1	1,572.3	786.1	1,572.3	786.1
y mean	3.32		0.007		0.058		0.40		0.46	
N	9,188		9,188		9,188		9,188		9,188	

Notes: Table estimates the impact of early-life insurance exposure on mortality in prime age. I measure mortality as the number of deaths per 10 thousand individuals by age-year and gender. Panel A shows the OLS estimates. Panel B shows two-stage-least-squares (TSLS) estimates where the instrument is simulated exposure assuming equal expansions each year in 1956-1961. Separate effects by gender are shown in even-numbered columns. Standard errors clustered at the level of prefectures in the parentheses.

results in equation 6. In Supplementary Table S4, I examine whether migration could bias the estimates due to differential responses to exposure in the Mobility Survey. Around 30% of the Japanese population had moved from the prefecture of birth by prime age, but insurance exposure was not a significant predictor of migration.

3.2 Education and Employment

I next examine education attainment across insurance exposure in Table 4. For both genders, a ten percentage point exposure increased high school graduation rates by 1.3 percentage points, and increased college attainment for women by 1.1 percentage points. Because women had significantly lower college education rates compared to men (13.6% compared to 38.3% in Table 1), exposure resulted in a 4.5% drop in the education gap across gender. The education gain further impacted the assortative matching on the marital market. In column 5-8, exposure increased the marriage rate for men and increased the

spouse' education attainment for both genders. Specifically, the probability of marring a college-educated spouse increased for women by 1.2 percentage points and increased for men by 0.7 percentage points. These patterns indicate greater match quality in terms of education attainment especially for women's marital outcomes.

Table 4: Impacts of insurance exposure on education and marital sorting

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	High School		College Degree		Married to College-Educated Spouse		Married	
					Panel A: OLS			
exposure	0.088***		0.028		0.072***		0.049	
	(0.025)		(0.021)		(0.017)		(0.030)	
exposure · men		0.089***		-0.029		0.051***		0.082***
		(0.026)		(0.018)		(0.019)		(0.029)
exposure · women		0.087***		0.086***		0.095***		0.016
		(0.027)		(0.032)		(0.021)		(0.035)
					Panel B: TSLS			
exposure	0.13***		0.047**		0.092***		0.063**	
	(0.032)		(0.021)		(0.015)		(0.029)	
exposure · men		0.13***		-0.012		0.066***		0.095***
		(0.032)		(0.025)		(0.018)		(0.030)
exposure · women		0.12***		0.11***		0.12***		0.030
		(0.033)		(0.026)		(0.020)		(0.033)
F-statistic	1,265.0	632.6	1,265.0	632.6	1,266.1	633.1	1,266.1	633.1
y mean	0.94		0.26		0.19		0.68	
N	329,502		329,502		331,397		331,397	

Notes: Table estimates the impact of early-life insurance exposure on education and marital sorting by prime age. Panel A shows the OLS estimates. Panel B shows two-stage-least-squares (TSLS) estimates where the instrument is simulated exposure assuming equal expansions each year in 1956-1961. Separate effects by gender are shown in even-numbered columns. Standard errors clustered at the level of prefectures in the parentheses.

The education gain also impacted employment and earnings across gender in Table 5. For women, gaining a ten percentage point exposure increased full-time employment by 1.6 percentage points and reduced the homemaker's status by 0.8 percentage points. Roughly offsetting the impacts on women, exposure increased homemaking and reduced full-time employment for men, and the overall increase on employment was small and insignificant. Thus, exposure increased women's labor market activities and shifted the homemaker's role from women to men. As a result, earnings increased for women by 8.4% but decreased for men, whereas the overall income within household did not vary with

exposure.

Table 5: Impacts of insurance exposure on employment and earnings

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Employed		Homemaker		Log Personal Earnings		Log Household Earnings	
				Panel A: OLS				
exposure	0.026		0.005		-0.051		0.043	
	(0.022)		(0.026)		(0.14)		(0.088)	
exposure · men		-0.11***		0.093***		-0.90***		-0.051
		(0.024)		(0.016)		(0.12)		(0.096)
exposure · women		0.17***		-0.086**		0.82***		0.14
		(0.024)		(0.038)		(0.19)		(0.11)
				Panel B: TSLS				
exposure	0.019		0.008		-0.040		0.069	
	(0.024)		(0.026)		(0.16)		(0.085)	
exposure · men		-0.12***		0.095***		-0.90***		-0.022
		(0.025)		(0.016)		(0.13)		(0.093)
exposure · women		0.16***		-0.083**		0.84***		0.16
		(0.028)		(0.038)		(0.22)		(0.11)
F-statistic	1,265.8	633.0	1,265.8	633.0	1,265.1	632.6	1,265.1	632.6
y mean	0.69		0.12		4.72		5.82	
N	332,157		332,157		332,449		332,449	

Notes: Table estimates the impact of early-life insurance exposure on employment and earnings in prime age. Panel A shows the OLS estimates. Panel B shows two-stage-least-squares (TSLS) estimates where the instrument is simulated exposure assuming equal expansions each year in 1956-1961. Separate effects by gender are shown in even-numbered columns. Standard errors clustered at the level of prefectures in the parentheses.

These results show that exposure to universal insurance can reduce the gender inequality in socio-economic status through increased education and earnings for women. In addition to reducing the education gap by 4.5%, increasing the insurance exposure by 10 percentage points further reduced the employment gap by 5.7% and reduced the earnings gap by 11.4%. Moreover, consistent with the education gains, the increased employment of women relative to men did not reduce the overall earnings within households. These long-run benefits on the socio-economic status of women remain significant under alternative controls in the specification (Supplementary Table S5 and S6).

4 Discussion

This paper conducts a long-run follow-up on the health and economic impacts of the onset of universal health insurance in Japan. Over the period in 1956-1961, prefectures in Japan expanded their public insurance programs to achieve mandatory universal insurance by 1961. The expansions resulted in large variations in the exposure to universal insurance across birth cohorts and prefectures with different pre-reform insurance rates. Exploiting the variations, I show that insurance exposure in early childhood has substantial health benefits in prime age, reducing cancer-related deaths for men and the burden of diabetes and hypertension for women. Moreover, exposure increased high school graduation rates for both genders and increased college education specifically for women. The education gain increased women's probability of marrying a college-educated spouse, increased her employment and earnings in the labor market, and shifted the homemaker's role from women to men within households. Thus, in addition to the health benefits over the life cycle, universal insurance can further bolster the socio-economic status of women by reducing the inequality in education and employment opportunities by gender.

The long-run benefit on health differs in important ways from the short-term impacts of universal insurance. In particular, the reduction in cancer-related mortality in prime age contrasts with findings from [8] that universal insurance had no immediate impact on age-specific mortality by 1970. Moreover, less acute outcomes such as chronic conditions could already improve in prime age but only affect mortality later in life. The tendency for the health benefits to be latent but accumulate over the life cycle suggests that short-term evaluations of universal insurance may be missing out important benefits on health that materialize only decades after the initial reform.

In addition to the health benefits, universal insurance in the long run could contribute to reducing the gap in the education attainment and economic success across genders. In particular, the increase in women's college education led to greater probability of marrying a college-educated spouse, and within households, earnings increased for women due to

increased full-time employment. These results are consistent with broader patterns of increased assortative matching when education attainment increases across cohorts [9,10], and in the case of Japan, exposure to insurance expansions early in life can be a contributing factor to the secular trending in both education and marital sorting. Moreover, I find that insurance exposure had no significant impacts on the overall earnings of households but shifted the homemaker's role from women to men while increasing women's economic participation. As a result, the gender inequality in earnings and employment decreased as a result of universal insurance.

The long horizon of the health and economic benefits has implications for countries where universal insurance was introduced more recently, such as in Thailand, Mexico, and Vietnam. In these countries, although insurance greatly reduced infant mortality and improved education outcomes for older children [11-16], the subsequent impacts of these positive changes in adulthood are likely to be substantial but not yet observable in the present. Moreover, minority groups with historically low access to health services can benefit more from improved human capital and better conditions on the marital and labor market. These broader impacts provide evidence that universal insurance may indeed contribute to a more inclusive and equitable society, an objective in the global collaboration to expand universal insurance in the developing world [17].

The findings in this study should be interpreted subject to several limitations. First, there are likely longer-term impacts of universal insurance on mortality in the elderly and on the health and wellbeing of future generations. The benefit would be consistent with evidence on early-life determinants of old-age mortality [18-22] and the inter-generational transmission of health [23-25], but the current study does not examine these outcomes due to data limitation. Studies exploiting reforms in other countries would likely face the same constraints because very long-term outcomes are not yet observable even among countries achieving universal insurance in the 1950s. Thus, continued follow-up of the reform cohorts is necessary to fully understand the persistence of health impacts and the

potential transmission of gender norms from parents to children.

Moreover, while the study documents long-run impacts on health and economic conditions, it does not examine investment behavior that may have responded to insurance exposure and thus contributed to the long-run benefits. For instance, the attention towards less advantaged individuals during the reform period may have increased parents' preferences for gender equality and increased their investments in girls relative to boys. Similar attitude in the broader society could increase the public investment in girls and their access to social services. These changes in preferences and investment behavior could be powerful contributors to the long-term gains in the socio-economic standing of women.

In conclusion, this study documents the substantial long-term benefits of universal insurance on health and economic outcomes in the context of Japan, one of the first countries to achieve universal insurance through accelerated expansions in the 1950s. Exploiting differences in the exposure to universal insurance across cohorts and prefectures, I find that the burden of chronic conditions and mortality in prime age decreased with childhood exposure to universal insurance. Moreover, the gender inequality in college education, employment, and earnings decreased with exposure, whereas the homemaker's role shifted within households from women to men. The broader benefits on women's socio-economic status suggest that universal insurance reforms can contribute to a more equitable society by improving health and reducing the gender gaps in economic outcomes.

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Data Availability

The datasets used in this study were made available to the author through data sharing agreements facilitated by the Government Statistics Anonymized Data Usage Promotion Program in Japan. The data sharing agreements restrict the use of data to the proposed research only and prohibit lending or transfers of data to third parties or entities. Interested readers can access the datasets following instructions on the program website (https://www.soumu.go.jp/english/dgpp_ss/seido/2jiriyou.htm), or apply for access at the relevant bureaus directly.

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Competing Interests

The author declares no competing interests.

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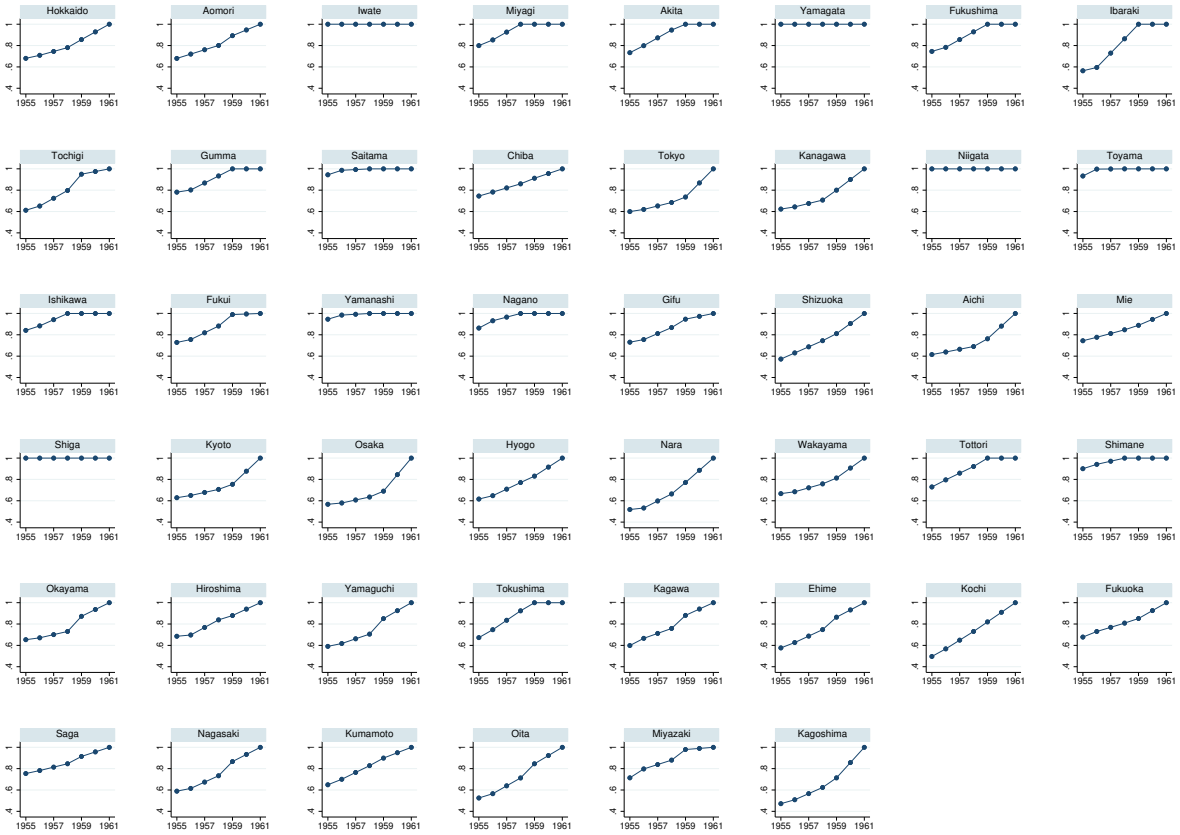
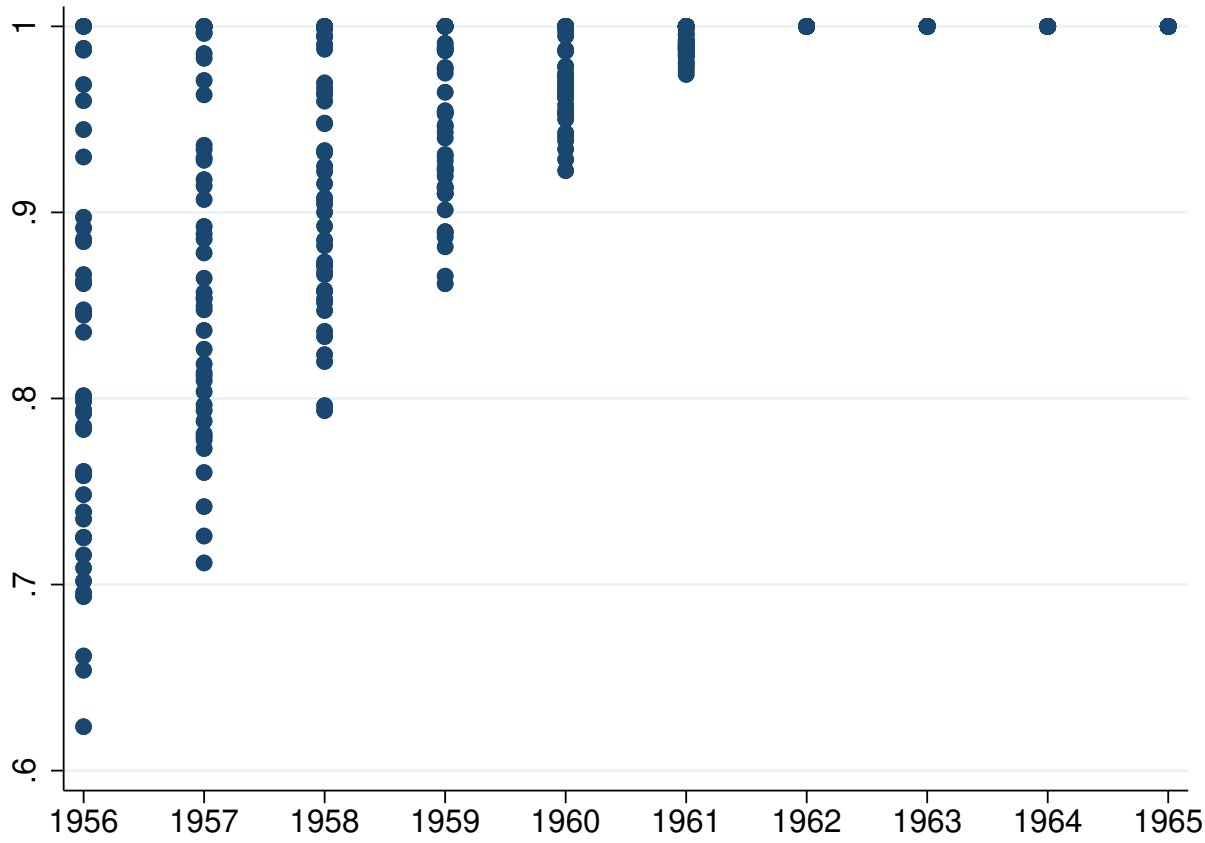
Supplementary Figures

Figure S1: Insurance expansion across prefectures in 1955-1961



Notes: Figure plots the trend of insurance rates in 1955-1961 in each of the 47 prefectures in Japan. Prefectures differed in the pre-reform insurance rate in 1955 and the incremental expansion each year during the reform period in 1956-1961. The variations in the expansions over time are illustrated in the Figure.

Figure S2: Insurance exposure across birth cohorts



Notes: Figure plots the insurance exposure in age 0-5 for cohorts born in 1956-1965, with different dots indicating the insurance exposure across prefectures in each birth cohort. Overall, the average exposure increases and the variance decreases in cohorts born closer to 1961, the implementation year of universal insurance.

A Supplementary Tables

Table S1: First-stage predictions of insurance exposure from the simulated instrument

	(1)	(2)	(3)	(4)	(5)	(6)
exposure	1.19***	1.19***	1.18***	1.18***	1.19***	1.19***
	(0.031)	(0.030)	(0.030)	(0.028)	(0.034)	(0.032)
Dataset	Comprehensive Survey of Living Conditions		Death Certificates		Employment Status Survey	
X_{itp}	Y		Y		Y	
prefecture-year FE		Y		Y		Y
F-statistic	1,466.0	1,573.3	1,572.3	1,770.4	1,265.8	1,379.7
y mean	0.15		0.062		0.012	
N	67,763		67,763		67,763	

Notes: Table estimates the first-stage prediction of insurance exposure from the simulated instrument. Different from the endogenous exposure, the simulated exposure assumes even expansions each year over the reform period in 1956-1961, so that exposure is fully determined from the timing to implement universal insurance by 1961 and the pre-reform differences in insurance rates across prefectures. Separate first-stage estimates and F-statistics are shown for different datasets used in this study. Standard errors clustered at the level of prefectures in the parentheses.

Table S2: Impacts of insurance exposure on chronic conditions, alternative specification

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Hypertension		Diabetes		Cardiovascular		Cancer	
				Panel A: OLS				
exposure	-0.029		-0.059**		0.005		0	
	(0.034)		(0.026)		(0.009)		(0.017)	
exposure · men		0.007		-0.038		0.001		0.003
		(0.042)		(0.034)		(0.015)		(0.013)
exposure · women		-0.063		-0.077***		0.010		0.004
		(0.040)		(0.024)		(0.010)		(0.025)
				Panel B: TSLS				
exposure	-0.049		-0.062**		0.002		0	
	(0.037)		(0.029		(0.009)		(0.016)	
exposure · men		-0.012		-0.035		-0.002		-0.003
		(0.049)		(0.035)		(0.014)		(0.012)
exposure · women		-0.083**		-0.087***		0.007		0.005
		(0.040)		(0.028)		(0.011)		(0.023)
F-statistic	1,573.3	783.4	1,573.3	783.4	1,573.3	783.4	1,573.3	783.4
y mean	0.15		0.062		0.012		0.018	
N	67,763		67,763		67,763		67,763	

Notes: Table estimates the impact of early-life insurance exposure on disease conditions in prime age. Different from the main specification, I include prefecture-year fixed effects to further address time-varying factors that may affect long-run outcomes across prefectures. Panel A shows the OLS estimates. Panel B shows two-stage-least-squares (TSLS) estimates where the instrument is simulated exposure assuming equal expansions each year in 1956-1961. Separate effects by gender are shown in even-numbered columns. Standard errors clustered at the level of prefectures in the parentheses.

Table S3: Impacts of insurance exposure on mortality (per 10 thousand individuals), alternative specification

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Deaths		Hypertension		Diabetes		Cardiovascular		Cancer	
					Panel A: OLS					
exposure	-0.54***		-0.012		0		0.015		-0.52***	
	(0.18)		(0.007)		(0.021)		(0.085)		(0.11)	
exposure · men		-1.04***		-0.014		0.005		0.055		-0.92***
		(0.21)		(0.010)		(0.028)		(0.095)		(0.13)
exposure · women		-0.023		-0.009		-0.004		-0.024		-0.11
		(0.18)		(0.007)		(0.022)		(0.085)		(0.12)
					Panel B: TSLS					
exposure	-0.62***		-0.007		-0.001		0.030		-0.56***	
	(0.17)		(0.008)		(0.023)		(0.078)		(0.11)	
exposure · men		-1.16***		-0.010		0		0.084		-0.99***
		(0.22)		(0.010)		(0.030)		(0.090)		(0.13)
exposure · women		-0.071		-0.004		-0.002		-0.024		-0.13
		(0.16)		(0.007)		(0.022)		(0.077)		(0.11)
F-statistic	1,770.4	885.2	1,770.4	885.2	1,770.4	885.2	1,770.4	885.2	1,770.4	885.2
y mean	3.32		0.007		0.058		0.40		0.46	
N	9,188		9,188		9,188		9,188		9,188	

Notes: Table estimates the impact of early-life insurance exposure on mortality in prime age. I measure mortality as the number of deaths per 10 thousand individuals by age-year and gender. Different from the main specification, I include prefecture-year fixed effects to further address time-varying factors that may affect long-run outcomes across prefectures. Panel A shows the OLS estimates. Panel B shows two-stage-least-squares (TSLS) estimates where the instrument is simulated exposure assuming equal expansions each year in 1956-1961. Separate effects by gender are shown in even-numbered columns. Standard errors clustered at the level of prefectures in the parentheses.

Table S4: Impacts of insurance exposure on migration from the birthplace by prime age

	(1)	(2)	(3)	(4)
exposure	0.003	-0.039		
	(0.12)	(0.13)		
exposure · men			0.12	0.098
			(0.12)	(0.12)
exposure · women			-0.081	-0.13
			(0.16)	(0.16)
	OLS	TSLS	OLS	TSLS
F-statistic		1,980.4		986.5
y mean	0.30	0.30	0.30	0.30
N	7,295	7,295	7,295	7,295

Notes: Table estimates the impact of early-life insurance exposure on mortality in prime age. I measure mortality as the number of deaths per 10 thousand individuals by age-year and gender. Different from the main specification, I include prefecture-year fixed effects to further address time-varying factors that may affect long-run outcomes across prefectures. Panel A shows the OLS estimates. Panel B shows two-stage-least-squares (TSLS) estimates where the instrument is simulated exposure assuming equal expansions each year in 1956-1961. Separate effects by gender are shown in even-numbered columns. Standard errors clustered at the level of prefectures in the parentheses.

Table S5: Impacts of insurance exposure on education and marital sorting, alternative specification

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	High School		College Degree		Married to College-Educated Spouse		Married	
					Panel A: OLS			
exposure	0.087***		0.036*		0.075***		0.057*	
	(0.027)		(0.020)		(0.018)		(0.030)	
exposure · men		0.088***		-0.022		0.054**		0.089***
		(0.028)		(0.020)		(0.020)		(0.030)
exposure · women		0.085***		0.093***		0.097***		0.023
		(0.029)		(0.029)		(0.021)		(0.035)
					Panel B: TSLS			
exposure	0.12***		0.047**		0.086***		0.066**	
	(0.032)		(0.022)		(0.016)		(0.029)	
exposure · men		0.13***		-0.013		0.061***		0.098***
		(0.032)		(0.025)		(0.019)		(0.030)
exposure · women		0.12***		0.11***		0.11***		0.033
		(0.033)		(0.027		(0.020)		(0.033)
F-statistic	1,380.2	690.1	1,380.2	690.1	1,381.0	690.6	1,381.0	690.6
y mean	0.94		0.26		0.19		0.68	
N	329,502		329,502		331,397		331,397	

Notes: Table estimates the impact of early-life insurance exposure on education and marital sorting by prime age. Different from the main specification, I include prefecture-year fixed effects to further address time-varying factors that may affect long-run outcomes across prefectures. Panel A shows the OLS estimates. Panel B shows two-stage-least-squares (TSLS) estimates where the instrument is simulated exposure assuming equal expansions each year in 1956-1961. Separate effects by gender are shown in even-numbered columns. Standard errors clustered at the level of prefectures in the parentheses.

Table S6: Impacts of insurance exposure on employment and earnings, alternative specification

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Employed		Homemaker		Log Personal Earnings		Log Household Earnings	
				Panel A: OLS				
exposure	0.026		0.007		-0.058		0.040	
	(0.023)		(0.026)		(0.15)		(0.093)	
exposure · men		-0.11***		0.096***		-0.91***		-0.052
		(0.025)		(0.016)		(0.13)		(0.10)
exposure · women		0.17***		-0.084**		0.81***		0.13
		(0.025)		(0.039)		(0.19)		(0.12)
				Panel B: TSLS				
exposure	0.019		0.005		-0.035		0.049	
	(0.025)		(0.026)		(0.17)		(0.084)	
exposure · men		-0.12***		0.093***		-0.90***		-0.040
		(0.025)		(0.017)		(0.13)		(0.091)
exposure · women		0.16***		-0.085**		0.85***		0.14
		(0.029)		(0.039)		(0.22)		(0.11)
F-statistic	1,379.7	689.9	1,379.7	689.9	1,379.3	689.7	1,379.3	689.7
y mean	0.69		0.12		4.72		5.82	
N	332,157		332,157		332,449		332,449	

Notes: Table estimates the impact of early-life insurance exposure on employment and earnings in prime age. Different from the main specification, I include prefecture-year fixed effects to further address time-varying factors that may affect long-run outcomes across prefectures. Panel A shows the OLS estimates. Panel B shows two-stage-least-squares (TSLS) estimates where the instrument is simulated exposure assuming equal expansions each year in 1956-1961. Separate effects by gender are shown in even-numbered columns. Standard errors clustered at the level of prefectures in the parentheses.

健康増進と格差是正：
日本の国民皆保険制度の長期的な健康と経済的利益

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—要約—

健康保険は、病気や経済的困難に苦しんでいる人々にとって重要なセーフティーネットとなる。国民皆保険は、医療へのアクセスを確保し、恵まれない人々が直面している健康的/経済的な不平等さを軽減するために、多くの国により議論し続けられている。本研究では、1956 年から 1961 年に日本で誕生した国民皆保険制度の歴史を用いながら、国民皆保険が国民の長期的な健康と（家計の）経済的地位に及ぼす影響と、ジェンダー間の不平等さに及ぼす長期的な影響を検証した。著者は、若年期での国民皆保険加入が、働き盛りのプライムエイジでの死亡率と慢性疾患の負担を減少させることを発見した。また、女性の場合、国民皆保険は大学入学率を向上させ、同時に、高等教育を受けた配偶者と結婚する確率を上昇させた。世帯内では、主婦（主夫）の役割が女性から男性にシフトした一方で、就職率と収入の増加は男性に比べ女性の方が高かった。 これらの結果は、国民皆保険が、長期的に国民の健康を改善することに加え、女性の教育機会と収入を増やし、社会経済的地位におけるジェンダー間の不平等さを軽減する可能性を示している。

キーワード：国民皆保険、長期的影響、保険の拡張、健康、人的資本、雇用、所得、日本

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