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人生の初期段階おける医療サービスの利用と健康状況に対する政策介入効果

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研究要旨

本研究の目的は，1990 年代に急速に普及した地方自治体による乳幼児医療費助成制度が，人生の初期段階における就学前の子どもの医療サービスの利用とその健康状況にどのような影響を及ぼしたのかについて，2018 年 4 月 24 日(承認番号：厚生労働省発政統 0424 第 3 号)によって提供を受けた複数のデータ(『患者調査』(1993-1999);『社会医療診療行為別調査』(1992-2001);『国民生活基礎調査』(1992-2001); 『人口動態調査(死亡票)』(1990-2000))を用い検証を行う．当該助成制度については，自治体による，導入時期(年／月)，制度の対象年齢，対象年齢の改正時期(年／月)にばらつきを「自然実験」として活用し，差の差(difference-in-difference:DID)分析を行った．分析対象とした地域は，東京都 23 区，政令指定都市，及び，人口が 50 万人以上の 33 の自治体である．当該地域における就学前児童(0-6 歳)は，全自動の約 19%を占めている．

分析の結果，当該助成制度の導入により，通院間隔，再診患者数，1 カ月当たりの医療支出で測定した外来の利用が大幅に増加する傾向にあることが確認されたが，他方，入院では統計学的に有意な違いは観察されず，1 歳未満の乳児について術後の入院期間にのみ有意な延伸傾向がみられた．また，当該助成制度の導入は，親によって回答された子どもの主観的健康状態(発熱，咳，鼻汁などの有訴確率)を統計学的に有意に改善する傾向にある一方で，退院時に医師によって判断される客観的な健康状態(寛解，軽快，不変，増悪，死亡)には影響がないことがわかった．但し，当該助成制度は，1 歳未満乳児の死亡率を千人当たり 0.79 人減少する可能性が示唆された．

本研究が得た結果から，乳幼児医療費助成制度の導入は，人生の初期時点における医療サービスへのアクセスと就学前乳幼児の健康状態の改善に一定程度寄与することが確認された．

A. 研究目的

Child health has been the focus of policymakers all over the world because it is widely recognized that investments in child health result in a good quality of adult life, including a healthy life (Boudreaux et al. 2016; Thompson 2017; Miller and Wherry 2018), high educational attainment (Cohodes et al. 2016), and even success in the labor market (Smith, 2009; Brown et al. 2015). For that reason, many developed countries provide health insurance with generous coverage, often free of charge, for children. For example, the Children's Health Insurance Program (CHIP) in the United States regulates cost-sharing of healthcare for children to 5% of a household's annual income. Even countries with universal healthcare systems, such as Germany, Sweden, Taiwan, South Korea, and Japan, provide subsidies for child healthcare; these countries have been facing significantly declining child populations due to a decline in the total fertility ratio (United Nations 2017).

Taxpayers may tolerate an increase in healthcare costs to some extent if generous child healthcare policies actually improve children's health outcomes by improving healthcare accessibility. Otherwise, as Baicker and Goldman (2011) pointed out, such policies may destruct current efforts by the governments of almost all developed countries to contain overall healthcare costs to ensure the sustainability of their social security systems. The latter could result from the so-called "moral hazard"—that is, the unnecessary use of healthcare services from either the supply or demand side as a result of increases in the generosity of health insurance and/or subsidies.

One of the most prominent studies on this issue—the RAND Health Insurance Experiment (RAND HIE)—shows that generous copayments would eventually lead to little benefit in health outcomes, as measured by various indicators (Manning et al. 1987). A more recent study by the Oregon Health Insurance Experiment (Oregon HIE) finds a similar result, namely, that there are positive effects on self-rated health (SRH) and mental health but no effects on physical health (Baiker et al. 2013) and one-year mortality (Finkelstein et al. 2012). Further, the results of observational studies using quasi-experimental designs suggest that there is no reliable evidence on the health improvement effects of generous insurance (for a review, see Kiil and Houlberg 2014; Einav and Finkelstein 2018).

However, these studies focus on adults and/or the elderly population rather than on children, and their results may not simply apply to children. Murray and Lopes (1997) estimated worldwide cause of death patterns for multiple age-sex groups and found that the types of diseases leading to death vary across age groups. According to their study, individuals aged 0–15 years are most likely to die from communicable diseases and maternal, perinatal, and nutritional disorders, regardless of region, whereas non-communicable diseases are the dominant causes of death for individuals over 15 years of age, and, in particular, for elderly individuals. Further, Van den Bruel et al. (2010) emphasize the challenge for primary healthcare workers of determining how to identify the approximately 1% of children with serious illness. One likely reason for this challenge is that children, as "principals," often cannot describe and convey their own health statuses accurately to parents and/or physicians, as "agents." Thus, asymmetric information between principals and agents may be more serious for children's healthcare than for adults' healthcare.

In this study, we exploit the unique variation in eligibility for the subsidy for children's healthcare use among Japanese municipalities to investigate the effect of free children's healthcare on the healthcare use and health outcomes of preschool children from zero to six years of age. In Japan, the subsidy functions in addition to the universal health insurance; it is provided by each municipality to support healthcare spending for children and decreases cost-sharing from 30% to 0%. Because each municipality introduced and expanded the subsidy for different eligible ages at different times, subsidy eligibility varies substantially at the municipality-age-time level, which allows us to estimate behavioral responses to free healthcare using the difference-in-differences (DID) framework. To this end, we collected data on the subsidy statuses of 33 cities with relatively large populations by reviewing the minutes available on each municipal council's homepage. We then merged this information with four nationally representative individual-level datasets on healthcare use and health status.

Our study contributes to the growing body of evidence on the consequences of generous insurance for children. First, we investigated the effect of a change in insurance generosity (i.e., a decrease in the copayment from 30% to 0%), rather than the provision of health insurance. This distinction is important, because most studies related to this topic focus on Medicaid/CHIP in the United States (for a review, see Howell and Kenney 2012); however, these may not simply apply to many developed countries with universal health insurance.

Second, we examined the effect of introducing generous insurance for various age groups. Nillson and Paul (2018), who focused on countries with universal health insurance other than the United States, investigated the effect of free healthcare for children on their healthcare use by exploiting the abolition of copayments for outpatient care in Sweden. However, these studies examined the effect of a copayment change at a particular age that results from a sharp age discontinuity for eligibility. In contrast, our estimation strategy—which originates from various age variations due to different ages of eligibility for the subsidy in different municipalities—enables us to estimate the age-specific effect for children aged zero to six years. An understanding of the different effects for various age groups would be more informative for policymakers when designing such policies.

Finally, a more innovative feature of this study relative to previous studies is that we use multiple nationally representative data sources, and, thus, we evaluate richer and more comprehensive healthcare use, including both outpatient and inpatient care and various health outcomes of children, such as subjective symptoms reported by parents, discharge outcomes evaluated by physicians, and mortality rates. Similar to our study, Iizuka and

Shigeoka's (2018) study focused on Japan's subsidy and found that it would significantly raise the children's healthcare use. However, they mainly focused on the effect on healthcare use by utilizing claim data.　Hence, the evidence obtained from this study could contribute to the debate on the costs and benefits of the child healthcare policy (e.g., the subsidy), which should involve a very controversial debate on the value and cost of saving a child's life through healthcare policies.

B. 研究方法

B-1. Institutional background

B-1-1. The healthcare system in Japan

Before introducing the subsidy, we briefly describe the institutional background of the Japanese healthcare system. In Japan, universal health insurance was introduced in 1961 by the National Health Insurance Act, the stated goal of which was that all citizens should receive healthcare services equally (Ikegami et al. 2011). Japan's public insurance essentially covers all medical treatments for illness and injury, including outpatient and inpatient care, drug prescriptions, and dental care. However, medical visits that are not for reasons considered illnesses or injuries, such as delivery, health checkups, immunization, and cosmetic surgery, are not covered. Injuries from traffic accident and work-related accidents are also not covered because another type of insurance covers these issues. Further, those who receive public assistance owing to low incomes and physical or mental disabilities are not covered because the public assistance system provides medical assistance, thus obviating the need for such individuals to pay for healthcare (MHLW 2010).

The following features of the Japanese healthcare system provide some advantages in identifying behavioral responses to the change in patient cost-sharing. First, enrollment in health insurance is mandatory. All citizens are forced to enroll in either type of insurance, which is based on employment or residence. This rule prevents both adverse selection and cream skimming problems, namely, that unhealthy people tend to be enrolled into insurance with wider coverage than healthy people are and that private insurance companies might try to choose and sell to healthy people with lower risks rather than to unhealthy people with higher risks (Newhouse 1984; Abbring et al. 2003; Finkelstein and Poterba 2004). Second, healthcare providers cannot price discriminate. The national government determines a fixed fee for each medical service (including for treatment, drugs, and devices), and providers are strictly prohibited from receiving additional fees. Thus, under the fee-for-service system, we do not face the cost-shift problem by providers, namely, that providers impose higher prices on private than on public insurers to compensate for losses from patients of public insurance (Clemens and Gottlieb 2017). Third, patients have free access to medical services. They can freely choose any type of physician, from general practitioners to specialists, as well as providers, from clinics to university hospitals, without a gatekeeper or a referral. Furthermore, there is no restriction on the number of visits.

The patient cost-sharing for children aged six years or under, who are the focus of this study, was 30% in the 1990s. This amount is same for outpatient and inpatient care, regardless of insurance type. The remaining fraction, 70% of the total medical cost, is paid by the insurer. Unlike the usual health insurance plan in the United States, there is no deductible option in Japan.

B-1-2. The healthcare system in Japan

In addition to the public insurance, a municipal subsidy is enforced to support the healthcare spending of households with children. In general, the municipal government pays the full amount of a patient's copayment to providers instead of to the child patients. Accordingly, children can receive healthcare services for free. The main purpose of the subsidy is to improve access to healthcare for children and reduce the financial burdens of households with children (MHLW 2016). Further, it is intended to attract young families with children for tax revenues and boost low fertility rates (Bessho 2012). The subsidy is only offered for healthcare services covered by the public healthcare insurance. Thus, healthcare services that are not already covered by public insurance, such as health checkups and immunization, are not covered by the subsidy either. Further, those who receive public assistance due to low income, single-parenthood, and physical or mental disabilities are not subsidized.

The following features of the subsidy provide large variations in its eligibility, which enable us to use the DID framework to identify its effects on healthcare use and health outcomes. First, the time of introduction of the subsidy differs across municipalities. Although most major municipalities introduced the subsidy in the early 1990s, the month and year of introduction differs across municipalities. Second, the eligible age for the subsidy also differs across municipalities because each municipal government can freely set the maximum age of eligible children, and it was drastically expanded in the 1990s. This property yields extensive variations in subsidy status, which is tied to children's ages. Thus, whether children can receive the subsidy (i.e., whether cost-sharing is 0% or 30%) is uniquely determined by residential municipality, age, and time. These unique variations across three dimensions—municipality, age, time—are the main sources of our DID framework.

B-2. Data

B-2-1. Subsidy status by municipality

The Ministry of Health, Labour and Welfare (MHLW) has published comprehensive information on the subsidy status for all municipalities as of 2011, but no information is available prior to that date. In particular, this information is not published for the 1990s, when most cities introduced the subsidy. To compensate for this shortage, we collected the following information through a review of the minutes available on the homepages of each municipal council: 1) the time (year and month) of introduction of the subsidy; 2) the maximum age of eligible children; and 3) the amendment of the eligible age and its timing (year and month). We collected this information for 33 entire municipalities with populations of more than 0.5 million from 23 specified districts (" Tokubetsu-ku") in the Tokyo Metropolis and 10 government-designated cities ("Seirei Shitei Toshi") across Japan. Ultimately, this study included 19% of preschool-age children (between zero and six years) in the 1990s.

Table 1 shows the introduction timing and changes in eligibility age for each municipality. For example, Chiyoda introduced the subsidy for children age four or under in April 1993. Then, it was expanded to children age six or under in September 1995. As shown in the table, the subsidy was dramatically expanded in the 1990s.

B-2-2. Comprehensive healthcare use and outcomes using multiple data sources

We used four nationally representative data sources from the MHLW to evaluate the effects of the subsidy on comprehensive healthcare use and children's health outcomes. From the entire survey sample, we extracted children ages zero to six years with families that live in the 33 large municipalities. Then, we merged individual-level data from each survey with subsidy status data, as shown in Table 1, using children's age, residential municipality, and survey year-month as identifiers. Appendix B summarizes the features of each data source.

B-2-2-1. Patient survey

The patient survey (PS), an repeated administrative cross-sectional survey, collects data on individual-level healthcare use from randomly selected medical institutions all over Japan. Because the PS is conducted every three years, we utilize three rounds of the survey in the 1990s (i.e., 1993, 1996, and 1999), when the subsidy was drastically expanded.

The PS comprises two types of surveys on healthcare use: outpatient visits and inpatient discharges. The outpatient survey collects data on all patients who visit randomly selected medical institutions in a certain day in October of the survey year. The survey provides information on days from the previous visit, which is equivalent to information on visit intervals and which is controlled by children's parents. The inpatient survey collects data on all patients who were discharged from randomly selected medical institutions during September of the survey year. This survey contains information on hospital stay length, which is most likely to depend on a physician's decision. Further, the inpatient survey includes patients' outcomes as evaluated by a physician. A physician assesses patients' outcomes at discharge according to five levels (i.e., cured, lightened, unchanged, worse, and dead) compared to the time of admission. The PS also includes individual demographic characteristics, including age, gender, birth month, residential municipality, and medical institution identifiers, which allows us to include medical institution fixed effects.

We use only observations for patients who need medical treatment, excluding visits for preventive care, such as health checkups and vaccinations, because these visits are not covered by public health insurance or the subsidy. We also exclude both outpatients and inpatients who suffered external accidents, such as traffic accidents, for the same reason. Further, to exclude unusually long hospital stays, we limit the inpatient data to individuals hospitalized for at most three months. This exclusion is reasonable because only 1.1% of admissions in our data last for more than three months.

B-2-2-2. Statistics of Medical Care Activities in Public Health Insurance

The Statistics of Medical Care Activities (SMCA) provide annual claim data collected during May from randomly selected medical institutions throughout Japan. We use the data from 1992 to 2001. The SMCA provides data on monthly spending; demographic characteristics, including age and gender; and the municipality where the care-providing medical institution is located. Because the SMCA provides claim data on medical care covered by public health insurance, patients who received uninsured care, such as health checkups and immunizations, are not contained in the original data.

Unfortunately, unlike in the PS, patients' residential municipalities are not available in the SMCA. Thus, we simply assume that a patient resides in the municipality in which the medical institution is located. This assumption is reasonable because an examination of the validity of this assumption using the PS data indicated that 88% of children visited a medical institution in their residential municipalities. The inpatient data, however, indicate that 74% of children are hospitalized at a medical institution in their residential municipalities.

B-2-2-3. Comprehensive Survey of Living Conditions

The Comprehensive Survey of Living Conditions (CSLC), a prevalent nationally representative survey of randomly selected households, is conducted to investigate the health and socio-economic status of the Japanese population. One of the biggest advantages of using the CSLC is that we can observe the overall treatment effects of the subsidy on the entire population because this survey reflects all children, regardless of their use of medical treatments, whereas above two data sources (i.e., the PS and the SMCA) include only those who use medical treatments. Because the CSLC is conducted every three years, we use the rounds of the survey conducted in 1992, 1995, 1998, and 2001. The CSLC surveys healthcare use and various health-related statuses of all members of the randomly selected households, including (1) whether an individual currently uses outpatient care, (2) whether he/she is currently hospitalized, (3) whether he/she had any subjective symptom of any illness in the past few days, and (4) the type of symptoms. Parents are required to answer the questions on behalf of children aged six years or under. The CSLC also contains individual demographic characteristics, including age, gender, and birth month, and household characteristics, such as the number of household members, home ownership, and residential municipality.

We exclude households who receive public assistance owing to low incomes because such households are fully supported by medical assistance. They therefore receive all types of healthcare with no out-of-pocket payments and, thus, are not subject to the subsidy, as stated in Section 2. Further, we restrict the sample to children who live with their both parents because some municipalities provide public assistance to children from single-parent household, and such children are not subsidized for the same reason as described above.

One problem with the CSLC is that we cannot identify which households reside in each of the 23 specified districts in the Tokyo Metropolis. Thus, for these households, we assign the individual data from the CSLC to the subsidy status with 1994 as the year of subsidy introduction for children aged three years or under. The eligibility age then increases to all children under four years of age in 1998 (further expanded to under seven years of age in 2001) in the Tokyo Metropolis as a whole. We do so because, in 1994, all 23 specified districts offered the subsidy for children under the age of three years, and all of them expanded the maximum eligibility age to four and seven years at the youngest in 1998 and 2001, respectively (see Table 1).

B-2-2-4. Vital Statistics

The Vital Statistics (VS) include various information about all individuals who died in Japan. The data include the exact date of death, age, and residential municipality at the time of death. We calculate yearly mortality rate by age and municipality as follows. First, we extract children aged six or under who died in 1990, 1995, and 2000, excluding deaths due to external accidents, such as traffic accidents. Next, we aggregate the number of deaths by age and municipality. Then, we calculate the total population by age and municipality in 1990, 1995, and 2000 from the Census, which is a mostly nationwide survey conducted every five years by the Ministry of Internal Affairs and Communications. Finally, merging these two datasets by age, municipality, and survey year, we calculate yearly mortality rates for children.

B-2-3. Descriptive statistics

Table 2 summarizes the descriptive statistics of the outcome variables from each survey. Panel A describes the PS and indicates that the mean days from the previous outpatient visit, which represents the frequency of outpatient care use, is 21.60 days, and that 47% of children are subsidized. The mean length of a hospital stay is 8.96 days, and 11% of child patients were discharged as cured. Note that this discharged outcome is evaluated by a physician and, thus, represents the objective health status of a patient. Panel B summarizes monthly spending as collected by the SMCA. Children spend JPY 8.27 and 84.60 thousand (about USD 82.7) per month on outpatient and inpatient care, respectively. Note that these numbers reflect the total amounts paid to medical institutions by patients and insurers. Panel C reports the basic statistics from the CSLC. On average, 20% and 0.4% of children currently use outpatient care and inpatient care, respectively, and 24% of children have some subjective symptoms. Panel D, reflecting the VS, shows that the average mortality rate is 0.81 per 1,000 children. The mortality rate among this age group is extremely low, but it is somewhat higher in infants aged zero, at approximately 4.24 per 1,000 infants.

Figure 1 plots the time series of the fraction of subsidized children in our sample from the SMCA. In this figure, it is clear that the subsidy has expanded rapidly over time. For example, only 12% of children aged six years or under were subsidized in 1992, the beginning of the sample period, but that number expanded to 69%

of children by 2001. Furthermore, the figure shows that the coverage is remarkable in young children. All infants aged zero and one years in the sample are subsidized as of 1997.

Figure 2 provides time series data for the raw means of major outcome variables in our sample by subsidy status. This figure already shows interesting patterns. In Panel A of Figure 2, the days from the previous visit is less for subsidized children than for non-subsidized children, implying that subsidized children use outpatient care more frequently. Further, they spend more on healthcare than non-subsidized children do. In Panel B of Figure 2, subsidized children have longer hospital stays than non-subsidized children have. This difference is larger for hospitalizations with surgery. Panel C of Figure 2 plots differences in health outcomes by subsidy status. Subsidized children have a higher probability of a cured outcome at discharge than non-subsidized children have. In addition, a lower proportion of subsidized children have subjective symptoms. Although these figures illustrate simple means and do not control for individual characteristics, the main results from the regression analysis below are similar. In addition, these plots can be interpreted as the causal effect of the subsidy for free healthcare under the assumption that, in the absence of the subsidy, the improvement of healthcare use and outcomes would not have been systematically different in subsidized and non-subsidized children.

Figure 3 shows the results based on an event study of changes in major outcomes to provide a better view of the dynamic effects. In this figure, we plot the raw means and 95% confidence intervals of major outcome variables before and after the change in the subsidy status. Panel A indicates a change in days from previous visits. We can see that visit intervals are shorter after the introduction of the subsidy, particularly within 12 months, although they gradually return to their pre-subsidy levels. Panel B shows changes in hospital stay length, implying that stay length remains at almost the same level for 12 months after the introduction of subsidy, although it becomes slightly longer 18 months after the introduction. However, we observe no noticeable change, unlike in the case of outpatient use, suggesting that the effect of the subsidy might be limited for inpatient use. Panel C shows the results for the subjective symptom of a cough, which is the most prevalent symptom for children, and implies that the probability of a cough decreases after the implementation of the subsidy, especially within six months. This probability somewhat increases after 12 months, decreases again after 18 months, and persists after that.

B-2-4. Identification strategy

We estimated the following four types of equations using individual-level data for Equations (1) and (2), hospital/clinic-level aggregated data for Equation (3), and municipal-level aggregated data for Equation (4) to investigate the effect of free healthcare for children on their healthcare use and outcomes. We utilized the unique variations in subsidy eligibility across residential municipality, age, and time of introduction:

$$Y_{i,a,h,m,t} = \alpha_0 + \alpha_1 1[Subsidized]_{a,m,t} +$$

$$X_{i,t}\alpha_2 + \delta_h + \mu_m + \tau_t + \pi_{m,t} + \varepsilon_{i,a,h,m,t} \quad (1)$$

$$Y_{i,a,m,t} = \alpha_0 + \alpha_1 1[Subsidized]_{a,m,t} + X_{i,t}\alpha_2 + \mu_m + \tau_t + \pi_{m,t} + \varepsilon_{i,a,m,t} \quad (2)$$

$$Y_{a,h,m,t} = \alpha_0 + \alpha_1 1[Subsidized]_{a,m,t} + \gamma_a + \mu_h + \tau_t + \pi_{m,t} + \varepsilon_{a,h,m,t} \quad (3)$$

$$Y_{a,m,t} = \alpha_0 + \alpha_1 1[Subsidized]_{a,m,t} + \pi_m + \tau_t + \pi_{m,t} + \varepsilon_{a,m,t} \quad (4)$$

where $Y_{i,a,h,m,t}$ is a dependent variable that represents healthcare use and outcomes (i.e., days from previous visits, days of hospital stay, the probability of being cured at discharge from the PS, and monthly spending from the SMCA) for child i of age a at hospital h living in municipality m in survey year t in Equation (1). Second, because we cannot identify which hospital is used by an individual child from the CSLC, $Y_{i,a,m,t}$ in Equation (2) is the probability of using outpatient/inpatient care and of having subjective symptoms, such as a fever, a cough, wheezing, nasal discharge, itchy eyes, tinnitus, toothache, or rash, from the CSLC for child i of age a living in municipality m in survey year t. Third, in Equation (3), $Y_{a,h,m,t}$ represents the logarithm value of the number of first and repeat visits for outpatients/inpatients (from the PS) of age a at hospital h located in municipality m in survey year t. Finally, in Equation (4), $Y_{a,m,t}$ represents the mortality rate (from the VS) for individuals of age a, in municipality m in survey year t.

Regardless of the type of data, the key variable, $1[Subsidized]_{a,m,t}$, is a dummy indicating whether healthcare is subsidized. This variable depends on the maximum subsidy eligibility age a in municipality m in survey year t. $X_{i,t}$ is a vector of individual-level control variables, such as gender, birth month, age, and type of insurance. We included different control variables by data source, a full list of which is provided in Appendix A. We also included hospital fixed effects, δ_h; municipal fixed effects, μ_m; and survey year fixed-effects, τ_t. However, we note that Equations (2) and (4) do not contain hospital fixed effects, as we cannot identify specific hospitals. Further, we included a municipality-specific trend, $\pi_{m,t}$, which is the interaction of the municipality and survey year fixed effects, to control for time-varying unobserved factors correlated with healthcare use and outcomes by municipality level. The standard errors were two-way clustered on municipality and age.

Similar to Equations (1), (2), and (4), to estimate the age-specific effect of the subsidy, we estimated following three equations:

$$Y_{i,a,h,m,t} = \beta_0 + \sum_{a=0}^{6} \beta_a \{1[Subsidized]_{a,m,t} \times 1[Age \ \ a]\} + X_{i,t}\beta_2 + \delta_h + \mu_m + \tau_t + \pi_{m,t} + \varepsilon_{i,a,h,m,t} \quad (5)$$

$$Y_{i,a,m,t} = \beta_0 + \sum_{a=0}^{6} \beta_a \{1[Subsidized]_{m,a,t} \times 1[Age \ \ a]\} + X_{i,t}\beta_2 + \mu_m + \tau_t + \pi_{m,t} + \varepsilon_{i,a,m,t} \quad (6)$$

$$Y_{a,m,t} = \beta_0 + \sum_{a=0}^{6} \beta_a \{1[Subsidized]_{m,a,t} \times 1[Age \ \ a]\} + \mu_m + \tau_t + \pi_{m,t} + \varepsilon_{a,m,t} \quad (7)$$

where $1[Age \ \ a]$ is a dummy that takes the value of one if a child is of age a. The other variables are the same as in Equation (1). We estimated the above equations using ordinary least squares.

C. 研究結果

C-1. Effect on outpatient use

We first present results for the effect of the subsidy on the use of outpatient services. Table 4 reports the estimates for days from previous visit (column (1)), the number of patients (columns (2)-(4)), monthly spending (column (5)), and the probability of using outpatient care (column (6)). We report the estimated coefficient of α_1, derived from Equations (1)-(3), which represents the difference between subsidized children, who do not need to pay any of the cost, and non-subsidized children, who pay 30% of the total cost.

The point estimate in column (1) of Table 3 shows that the subsidy shortened visit intervals by 3.0 days, suggesting that subsidized children use outpatient care more frequently than those without subsidies. As the mean value for non-subsidized children is 22.46 days, the subsidy shortens outpatient intervals by 13%. Column (2) reports the result of the aggregated number of patients by medical institution and child's age. We do not find statistically significant differences. Columns (3) and (4) represent the results of regressions for the aggregated number of patients by first and repeat visits, respectively. Interestingly, although the estimate for first visits is not statistically significant, the estimate for repeat visits is significant. The number of patients with repeat visits increased by 5.7% due to the subsidy. These results suggest that the subsidy might encourage children with diseases to use healthcare services more frequently, whereas the moral hazard of healthy children using unnecessary outpatient care is less likely to occur. Column (5) reveals that the monthly spending for subsidized children increased by JPY 517 (approximately USD 5.17) compared to those without the subsidy. This estimate corresponds to a 6.8% increase from the mean value for non-subsidized children, which is JPY 7,525 (USD 75.25). Finally, we examine the effect on the probability of using outpatient care. Although the above three measures (i.e., days since previous visits, the number of patients, and monthly spending) from the PS and SMCA are observed only for those who use medical treatment, the probability of using outpatient care can be examined, as the CSLC surveys the entire child population regardless of the use of outpatient care. Column (6) shows that we find no significant difference between subsidized and non-subsidized children. This result might be consistent with the result for the number of patients, which is statistically significant only for repeat visits. Because the CSLC does not identify first or repeat visits, and, thus, the outpatient dummy equals one for a repeat patient, it does not change even if only repeat visits increase.

Panel A of Figure 4 demonstrates the age-specific effect, which includes the interaction of subsidy status with age (baseline: age six), as presented in Equations (5), (6), and (7). We find that the size of the effects tends to be larger for young children, particularly among infants aged zero and one years. Specifically, visit intervals for subsidized infants aged zero and one years were shortened by 7.8 and 6.9 days compared to non-subsidized children aged six years, which is significant at the 10% level. Considering that the mean visit interval of non-subsidized children is 22.5 days, this effect is considerably large. As for monthly spending, subsidized infants aged zero and one years spend more than JPY 2,387 (USD 23.87) and JPY 2,161 (USD 21.61), respectively, on medical care compared to non-subsidized children aged six years. This result corresponds to an approximate increase of 30% from the mean value for non-subsidized children, which is JPY 7,525 (USD 75.25). Further, the probability of using outpatient services is higher for younger children. Specifically, that for infants under the age of one is 6.3 percentage points higher than that for children aged six.

In sum, we find significant effects on various measures conditional on healthcare use. These results suggest that the subsidy encourages children who have already used outpatient care for any diseases to visit physicians more frequently. However, we find no significant effects for overall child population. Further, we observe no significant difference in the number of patients' first visits. These results imply that even if child patients receive zero cost-sharing for healthcare, the moral hazard that healthy children use unnecessary healthcare services rarely occurs.

C-2. Effect on inpatient use

In this subsection, we turn our focus to the use of inpatient care. Unlike outpatient services, to which patients have free access and no restrictions on the number of visits, a physician's decision is required for inpatient services. Thus, we can observe supply-side behavioral responses to changes in patients' cost-sharing.

First, column (1) of Table 4 reports the effect of the subsidy on the length of a hospital stay, which represents the intensity of care. We find no significant effect, suggesting that physicians do not hospitalize children for longer even if patients' cost-sharing is zero. Column (2) shows the result for the aggregate number of patients by hospital and children's age. We find no significant effect, implying that even if patients' cost-sharing is zero, physicians do not provide unnecessary inpatient care. Column (3) represents the estimate for monthly spending. As for the above two measures, we find no significant effect.

We examine the effect on the probability of using inpatient care based on the CSLC, which surveys the entire child population regardless of the use of inpatient care. Further, inpatient status is one of reliable measures for objective health status because a physician's decision based on the results of an examination is required. Previous studies find that access to primary care reduces preventable inpatient care in general populations (Chandra et al. 2010; Kolstad and Kowalski 2012). As shown in Column (4) of Table 5, we find no significant difference in hospitalization status between subsidized and non-subsidized children. In summary, these results suggest no significant effect on inpatient use in general.

Panel B of Figure 4 plots the age-specific effect on inpatient use. As shown in the figure, we find that the younger the children are, the longer the hospital stay length is for patients who are hospitalized with surgery. Subsidized infants aged zero years stay 3.8 days longer in hospitals than non-subsidized children aged six years do. However, we observe no significant differences by age for children who were hospitalized without surgery. These results suggest that the implementation of the subsidy leads to more careful treatments for younger children hospitalized with serious diseases. For the inpatient dummy, we find that the probability of being hospitalized for children aged one to four years is one percentage point lower than that for children aged six years. This result suggests that access to primary care reduces preventable inpatient care in this age group.

C-3. Effect on subjective health

Turning now to the effect on health, we investigate whether free healthcare improves children's health statuses. Again, our main focus is on comparing outcomes for subsidized and non-subsidized children before and after the introduction of subsidies. We first present results for subjective health, that is, the probability of having symptoms as measured by parents. Subjective health status is one of the standard measures of health status that are likely to provide useful predictions of future physical health status (Idler and Benyamini 1997). Previous studies find that good subjective health leads to fewer future hospitalizations (Nielsen 2015).

Table 5 reports the estimates on the probability of having various symptoms. We find that subsidized children are less likely to have fevers, coughs, and nasal discharge compared with non-subsidized children, suggesting that the subsidy improved children's subjective health, as measured by parents. In particular, the probability of having a cough, the most prevalent symptom in this age, decreased by 3.8 percentage points. Considering that the mean value of that for non-subsidized children is 12%, this effect is considerably large. However, we find no significant effects on the probability of wheezing, which might be associated with asthma; itchy eyes; tinnitus; toothache; and rash. Although we only observed significant effects for minor symptoms, it we can infer that the benefits from decreases in children's subjective symptoms might translate into further benefits, such as an increase in the labor supply of parents. For example, if parents view their children as having better subjective health, they might have lower rates of absenteeism in the workplace.

Furthermore, Panel A of Figure 5 plots the age-specific results for cough, the most prevalent symptom at this age, and wheezing, which might be associated with asthma. We find that subsidized children aged one and two years have lower probabilities of these symptoms compared to non-subsidized children aged six years. In particular, subsidized children aged one year have a 4.1 and 2.8 percentage points lower presentations of cough and wheezing, respectively. Considering that this age group has a lower probability of hospitalization (Panel B of Figure 4), it is likely that the subsidy causes parents to bring their children to physicians at earlier disease stages, preventing more serious and costly treatments.

C-4. Effect on objective health

We also examined the effect on objective health status. Column (1) of Table 6 reveals the effect on discharge outcomes as assessed by a physician. Physicians assess patients' outcomes at discharge in five stages (i.e., cured, lightened, unchanged, worse, and dead) relative to the time of admission. The dependent variable is a dummy variable that takes a value of one if a child patient was discharged as cured. We observe no significant effect on discharge outcomes, suggesting that the subsidy does not lead to an improved health status of hospitalized children. Further, Column (2) reports the effect on the mortality rate, which is another objective measure of health status. Similarly, we find no significant change in the mortality rate due to the subsidy.

Further, as shown in Panel B of Figure 5, which describes age-specific effects, we only observe a significant improvement in health status for infants aged zero years. Subsidized infants aged zero years have a 5.3% higher probability of a cured outcome at discharge compared to non-subsidized children aged six years. In addition, their mortality rate is lower by 0.79 per 1,000 children. In summary, although we find no significant effect on overall objective health, the subsidy leads to improved health status only for infants aged zero years.

C-5. Robustness checks

C-5-1. Common trends

In our DID estimates, we assumed that, in the absence of the subsidy, healthcare use and health outcomes would not have been systematically different for subsidized and non-subsidized children. To check the validity of this assumption, we conducted the following supplementary analyses.

We first investigated whether the outcome variables exhibited different trends before the subsidy was introduced. If children living in municipalities that introduced the subsidy early were already on an upward trajectory in healthcare use and health outcomes, we might overestimate the effect of the subsidy. To this end, using observations from the late 1980s, when the subsidy was not yet introduced in most municipalities, we estimated the placebo effect by assuming the introduction of the subsidy occurred five to seven years earlier than the actual year. As shown in Table 7, in general, these estimates are not statistically significant, suggesting that the pre-subsidy trends in healthcare use and health outcomes were similar for children living in municipalities with early and late introductions of the subsidy.

We then examined the trends following the implementation of the subsidy by utilizing amendments of the eligible age in each municipality. We restricted the samples to subsidized children and allocated the placebo effects to children who were subsidized before the eligible age amendments. Thus, we reviewed the post-subsidy introduction trends of outcome variables by comparing children who were originally subsidized to those who were newly subsidized by the amendment. Table 8 indicates that the effects of the subsidy on healthcare use were not significantly different, suggesting that the post-subsidy introduction trends were similar for the originally and newly subsidized groups by. These results imply that the effects remained constant after the implementation of the subsidy.

C-5-2. Effect on non-covered treatments

As stated in Section 2, the subsidy is only subject to medical treatments covered by public insurance, and we investigated these treatments in the main analysis. Here, we estimate the effect on treatments that were not covered by the subsidy, such as health checkups, immunization, and injuries from traffic accidents. Further, we include individuals who received public assistance owing to low incomes. If we find significant effects of the subsidy on these non-covered treatments, our main results are likely biased estimates including some other effects. Table 9 reports the results on the non-covered use of healthcare services. As shown in the table, we find no significant effects, suggesting that we have no concerns regarding biases caused by other effects besides the subsidy.

C-5-3. Migration

Another concern is whether households with children move to municipalities that offers generous subsidies. If migrant households with eligible children increase in such municipalities and if these households have unobservable biased attributes (for example, if they are more interested in their children's health and are working to improve it), the estimated effects of the subsidy may be biased. To alleviate this concern, we examined the effect of the subsidy implementation on the number of migrant households. To this end, we calculated the aggregate number of migrant households by children's age and municipality from 1990 and 2000 census data. We then estimated Equation (1), taking outcome variable as the number of migrant households. Table 10 reports the result, indicating that migrant households with children who are eligible for the municipality's subsidy increased by approximately 8% (108.59 out of 1,362.70 households); however, this result is not significant.

D. 考察

D-1. Price elasticity

Based on our estimates, we calculated the price elasticity of the demand for healthcare among children. As stated in Section 2, the Japanese healthcare system provides a non-discriminatory environment for calculating price elasticity, with no price discrimination by providers, because the national government determines the fixed fee for each medical activity. Hence, patients only need to pay a fixed amount regardless of their insurance type. This property enables us to assume that changes in healthcare use originate only from quantity controls rather than from price controls.

Based on our result for outpatient care use, as measured by visit intervals, the number of patients, and monthly spending, we calculated the semi-arc elasticity following Brot-Godberg et al. (2017). We find that the semi-arc elasticity for children aged six years or under in Japan ranges from approximately -0.21 to -0.46. These numbers are slightly less than those found by previous studies, which range between -0.49 and -0.63 for children aged seven to fourteen years in Japan (Iizuka and Shigeoka 2018) and between -0.36 and -0.42 for children aged seven years in Sweden (Nillson and Paul 2018). Further, it is considerably less than the range of -2.11 to -2.26 that was calculated from the RAND HIE for adults (Brot-Godberg et al. 2017). In summary, our study suggests that the price elasticity of the demand for healthcare is less for children than for adults.

D-2. Cost-benefit analysis

Another important interpretation of our finding considers the costs and benefits of the subsidy. We first calculated the cost of the subsidy per saved child. According to our estimates, the subsidy increases monthly outpatient spending for infants aged zero years by JPY 2,387 (about USD 23.87) and reduces their mortality rate by 0.8 per 1,000 children. This result implies that the annual cost per saved life is approximately JPY 36 million (USD 0.36 million), which is somewhat less than the previously estimated value of USD 1.61 million that resulted from Medicaid expansions in the United States (Currie and Gruber 1996).

The statistical value of a life calculated by previous studies generally exceeds our estimated cost of saving a child's life through the subsidy. For example, Itaoka et al. (2007) estimated the willingness to pay for reductions in the mortality risk through environmental policies, suggesting that the value of a Japanese adult's life ranges from JPY 103 to 344 million (approximately USD 1.03 to 3.44 million). However, this calculation does not include improvements in subjective health. Integrating these aspects, our study suggests that the introduction of the subsidy yields an acceptable cost-benefit ratio to policy makers.

E. 結論

It is recognized that investments in child health can affect various adult outcomes, and, thus, many developed countries provide health insurance with generous coverage for children. However, past studies on the effect of such generous health insurance predominantly focus on adults or the elderly, and surprisingly little is known about children. In this study, we examined the comprehensive effect of free healthcare for preschool-age children on healthcare use and health outcomes. We utilized the unique variations in eligible age and the timing of the subsidy introduction across municipalities in Japan.

We found that the free healthcare subsidy for children significantly increased outpatient use, as measured by visit intervals, the number of repeat patients, and monthly spending. The size of the effects tends to be larger for young children, particularly among infants aged zero and one years. However, we found little evidence of an increase in inpatient use under the subsidy. We found a significant increase in the length of a hospital stay only for infants aged zero who were hospitalized with any surgery. We also found that the subsidy significantly decreased the probability of having subjective symptoms—especially fever, cough, and nasal discharge. Further, the mortality rate for infants aged zero decreased by 0.79 per 1,000 individuals. In summary, our study suggests that free healthcare improves children's healthcare use as well as health outcomes, whereas its effect on health outcomes is limited for adults or the elderly, as shown by previous studies.

This study is subject to several limitations, which are left for future research. First, we focus only on the effect on children's outcomes. Considering that the subsidy aimed not only to improve children's health but also to support young parents with children, it may affect various parental outcomes, such as financial stress and health status. In particular, it seems likely that benefits from improvements in children's subjective health might translate into an increase in labor supply of parents (Baker et al. 2008; Bick 2016). For example, if parents view their children as having better subjective health, they might have lower rates of absenteeism in the workplace.

Second, although we mainly concentrated on the demand side responses to free healthcare, examining the effect on the supply side is important as well. Because the subsidy increases the number of outpatients, it may provide incentives for physicians to migrate to municipalities adopting generous subsidies. Considering that the number of pediatric hospitals in Japan has been decreasing recently due to a decline in the total fertility rate, such migration may contribute to significant improvements in access to healthcare services for children.

Finally, in this study, we restricted the analysis to urban areas due to data availability. It is difficult to collect subsidy status information in rural areas because most municipalities in these areas do not publish their municipal council minutes on their homepages. Considering that parental attributes, such as incomes, education levels, and types of job, are different in urban and rural areas, these differences likely lead to even larger differences in responses across regions.

F. 健康危険情報
特に無し.

G. 研究発表
1. 論文発表
Cheolmin Kang, Akira Kawamura, Haruko Noguchi. "Does Free Healthcare Affect Children's Healthcare Use and Outcomes? Evidence from the Subsidy for Children's Healthcare in Japan", *Journal of European Economics Association* へ投稿中.

2. 学会発表
Cheolmin Kang, Akira Kawamura, Haruko Noguchi. "Does Free Healthcare Affect Children's Healthcare Use and Outcomes? Evidence from the Subsidy for Children's Healthcare in Japan", The 2019 Asia Meeting of the Econometric Society. 2019.6. Xiamen University, located in the resort-like island city of Xiamen (also called Amoy), China. Accepted

Cheolmin Kang, Akira Kawamura, Haruko Noguchi. "Does Free Healthcare Affect Children's Healthcare Use and Outcomes? Evidence from the Subsidy for Children's Healthcare in Japan", International Health Economic Association (iHEA). 2019.7. Basel, The Switzerland. Accepted.

H. 知的財産権の出願・登録状況(予定を含む)
1. 特許取得
特に無し.

2. 実用新案登録
特に無し.

3. その他
特に無し.

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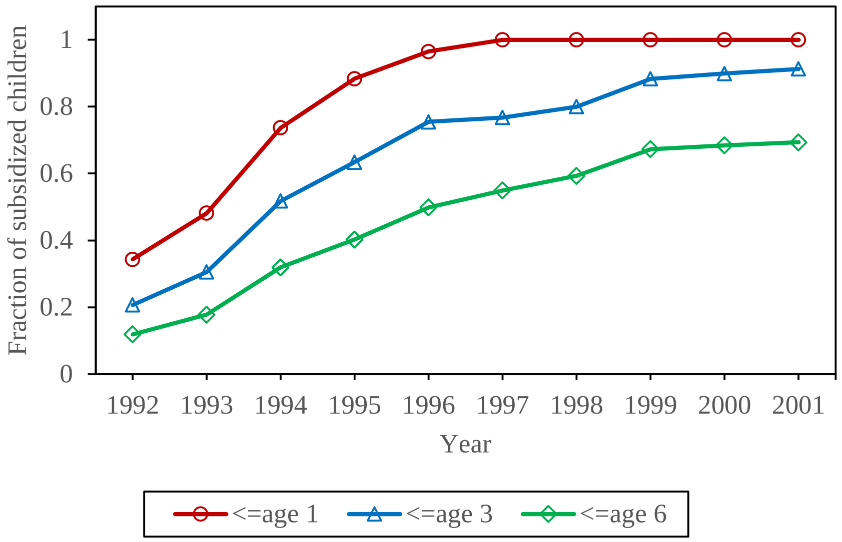
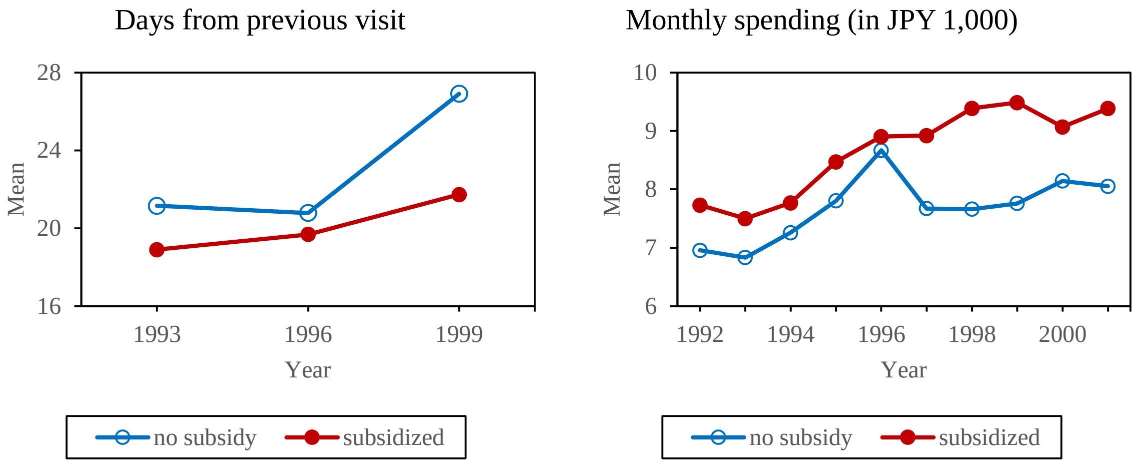
Figure 1. Time series of the fraction of subsidized children



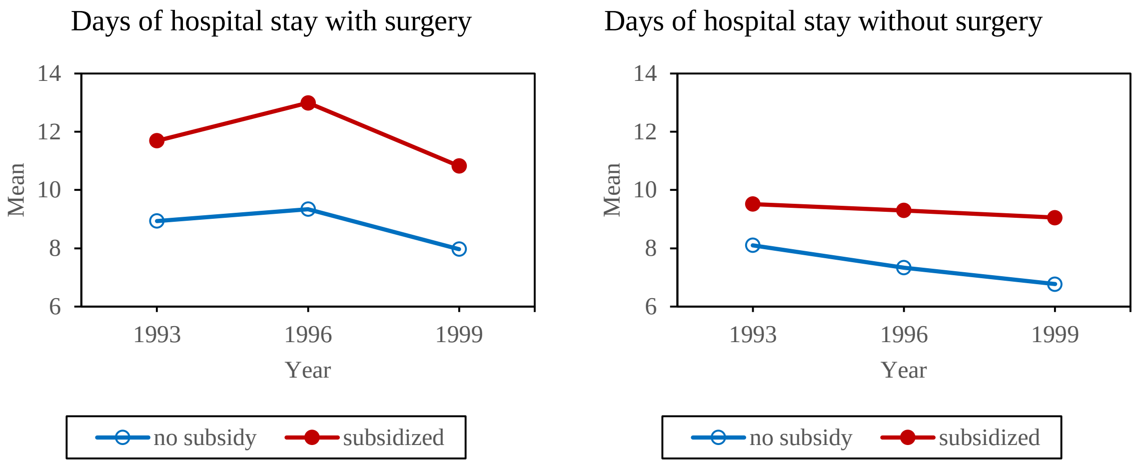
Notes: The full sample from the *SMCA* is used. The unit of observation is an individual child.

Figure 2. Time series of major outcome variables by subsidy status

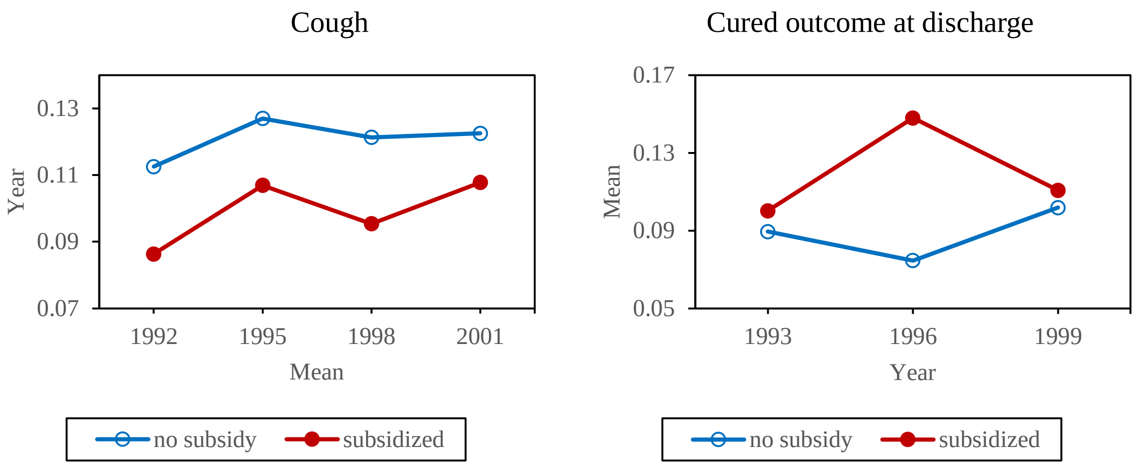
A. Outpatient use



B. Inpatient use

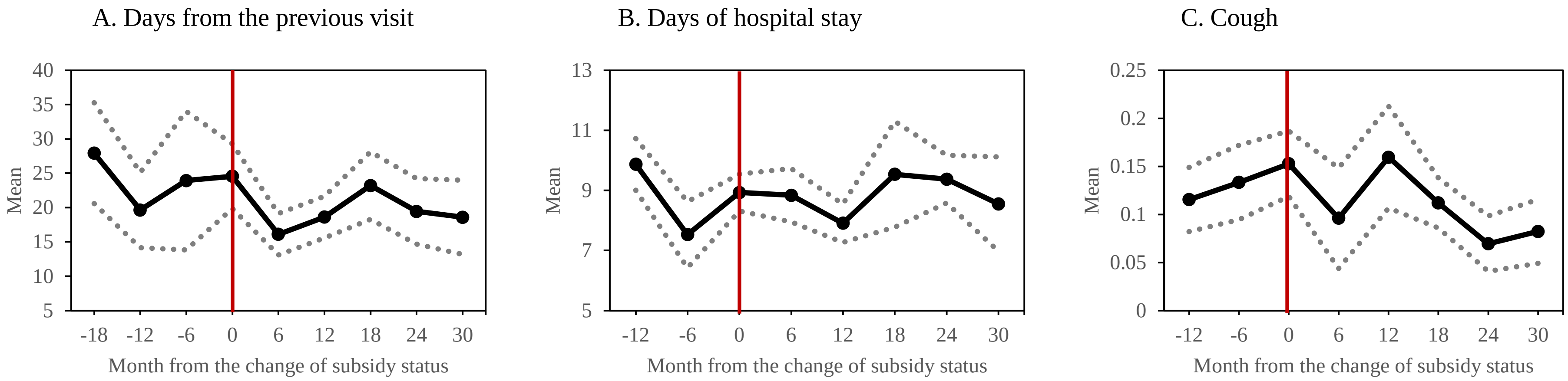


C. Health



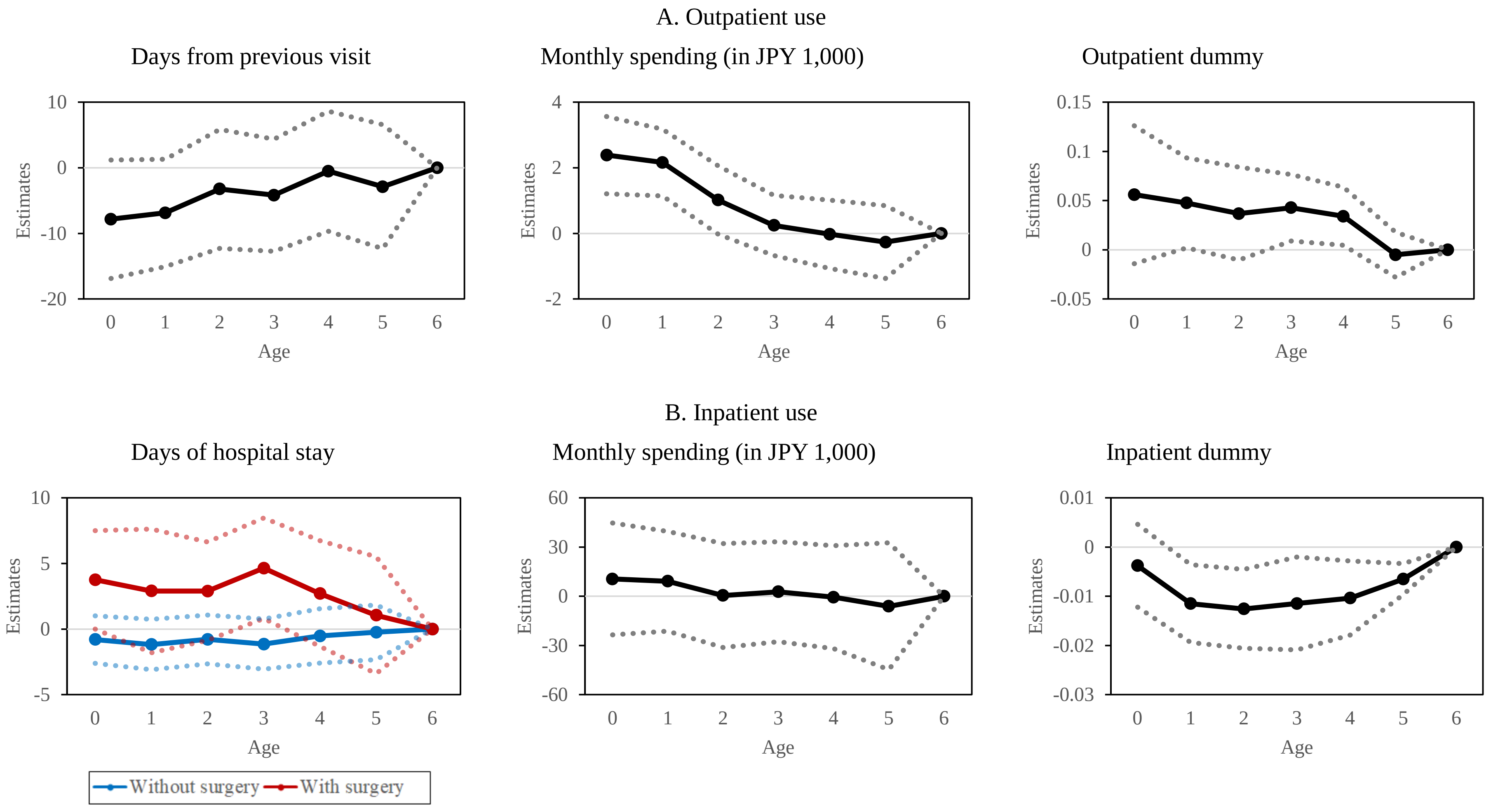
Notes: The main sample is used. The unit of observation is an individual child.

Figure 3. Event study



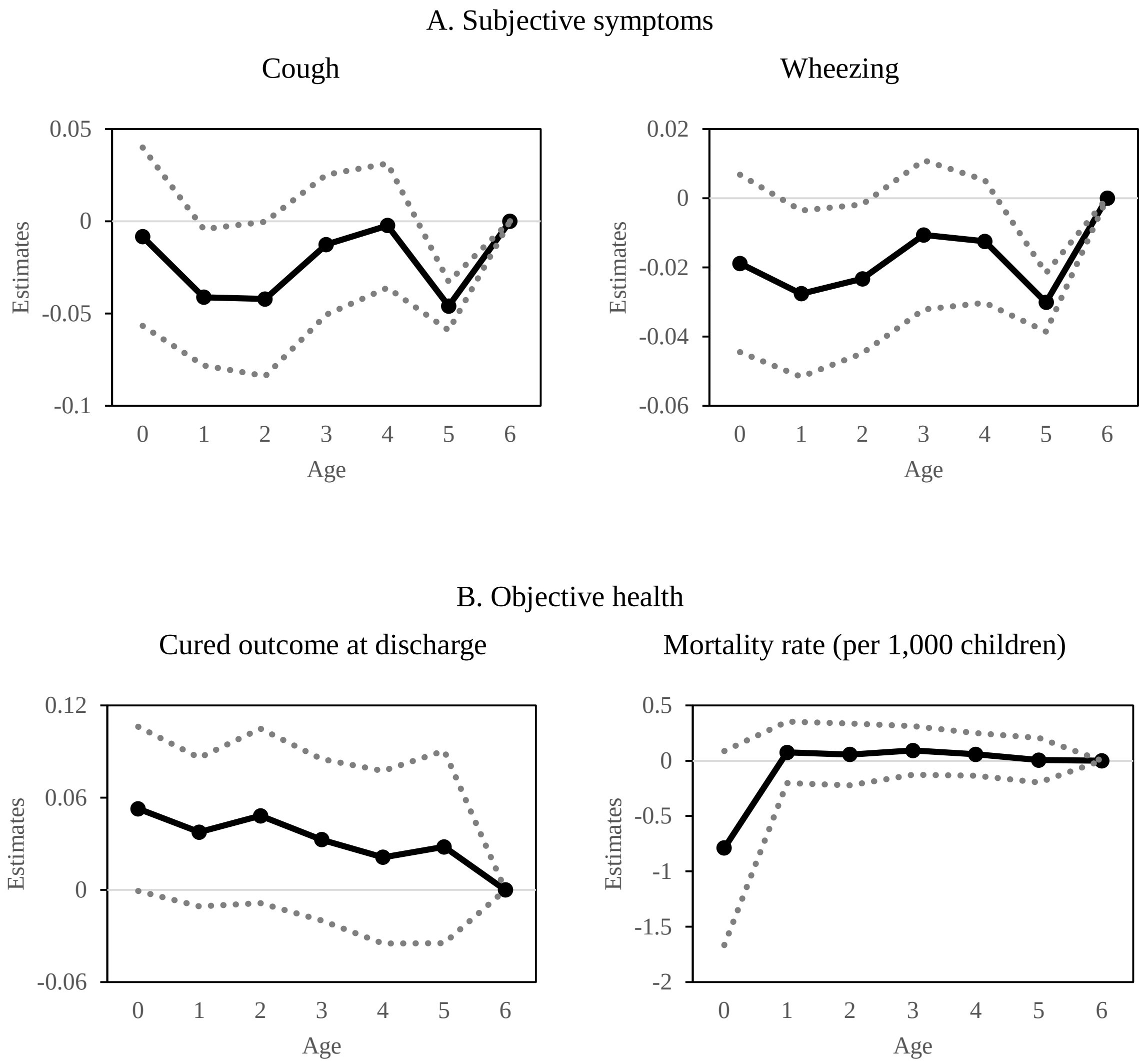
Notes: The main sample is used. The solid lines indicate the means of each outcome variable. The dotted lines indicate the 95% confidence intervals.

Figure 4. Effect on healthcare use by age



Notes: The sold lines represent the estimates of β_a for each age (baseline: age six) derived from Equation (2). The dotted lines are 95% confidence intervals.

Figure 5. Effect on health outcomes by age



Notes: The sold lines represent estimates of β_a for each age (baseline: age six) derived from Equation (2). The dotted lines are 95% confidence intervals.

Table 1. Evolution of the subsidy by municipality

	'70s	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01
23 specified districts in Tokyo												
Chiyoda				4		6						
Chuo				2		6						
Minato				2			6					
Shinjuku		2			6							
Bunkyo			1						6			
Taito				3			6					
Sumida					2		6					
Koto				2			6					
Shinagawa				1	2				5	6		
Meguro				2					4	6		
Ota			1		2		6					
Setagaya			1		2		6					
Shibuya					2				4	6		
Nakano	1			3					4	6		
Suginami				2					6			
Toshima				2			6					
Kita				2					6			
Arakawa			2			6						
Itabashi					2		6					
Nerima				2				6				
Adachi				2					6			
Katsushika					3			6				
Edogawa					3		6					
10 government-designated cities												
Sapporo	0					1					2	
Sendai	2											
Yokohama						0	2			3		
Kawasaki	0					2				3		
Nagoya	0				2						3	
Kyoto				1						2		
Osaka				0			2	3			4	5
Kobe	0				2							5
Hiroshima	0				1				2			3
Fukuoka	2											

Notes: This table shows the timing of the subsidy introduction and changes in eligibility age for each municipality. The numbers in the table represent the maximum eligible age. For example, Chiyoda introduced the subsidy for children aged four years or under in 1993. Then, it was expanded to children under six years of age in 1995. Although the month and year of the introduction of the subsidy differs across municipalities, we report only the year of introduction to save space. See Appendix A for details, including the month and year of introduction by municipality.

Table 2. Descriptive statistics	Mean	S.D.
Panel A: from the *PS*		
Outpatient (N=14,034)		
Days from previous visit	21.604	37.669
Subsidized	0.468	0.499
Inpatient (N=18,600)		
Days of hospital stay	8.961	10.750
Subsidized	0.634	0.482
Panel B: from the *SMCA*		
Outpatient (N=26,564)		
Monthly spending (in JPY 1,000)	8.272	7.526
Subsidized	0.496	0.500
Inpatient (N=2,938)		
Monthly spending (in JPY 1,000)	84.603	65.428
Subsidized	0.711	0.453
Panel C: from the *CSLC* (N=18,093)		
Outpatient dummy	0.203	0.402
Inpatient dummy	0.004	0.065
Subjective symptoms		
Fever	0.050	0.218
Cough	0.114	0.318
Wheezing	0.032	0.177
Nasal discharge	0.120	0.325
Itchy eyes	0.001	0.024
Tinnitus	0.001	0.025
Toothache	0.008	0.089
Rash	0.040	0.195
Subsidized	0.347	0.476
Panel D: from the *VS* (N=698)		
Mortality rate (per 1,000 individuals)	0.810	1.556
Subsidized	0.448	0.498

Notes: This table reports descriptive statistics for the main sample. Here, to save space, we report only the means and standard deviations of outcome variables and the key variables. See Appendix C for more details, including a full list of control variables.

Table 3. Effect on outpatient use	Days from the previous visit	ln (number of patients)			Monthly spending	Outpatient dummy
		All	First visit	Repeat visits		
	(1)	(2)	(3)	(4)	(5)	(6)
Subsidized	-2.997**	0.036	0.046	0.057*	0.517***	0.002
	(1.363)	(0.027)	(0.034)	(0.030)	(0.197)	(0.009)
Hospital fixed effects	X	X	X	X	X	
Municipality fixed effects	X	X	X	X	X	X
Year fixed effects	X	X	X	X	X	X
Municipality-specific trend	X	X	X	X	X	X
R2	0.110	0.411	0.119	0.332	0.109	0.012
Sample size	9,664	6,198	2,891	4,854	26,564	17,792
Data source	*PS*	*PS*	*PS*	*PS*	*SMCA*	*CSLC*

Notes: The table reports coefficients and standard errors (in parentheses) derived from Equation (1). The standard errors are two-way clustered at the municipality and age levels. *** indicates p< 0.01, ** indicates p< 0.05, and * indicates p< 0.1.

Table 4. Effect on inpatient use	Days of hospital stay	ln (N of patients)	Monthly spending	Inpatient dummy
	(1)	(2)	(3)	(4)
Subsidized	-0.017	0.058	-3.506	0.002
	(0.341)	(0.050)	(4.178)	(0.002)
Hospital fixed effects	X	X	X	
Municipality fixed effects	X	X	X	X
Year fixed effects	X	X	X	X
Municipality-specific trend	X	X	X	X
R2	0.117	0.375	0.491	0.006
Sample size	18,600	6,823	2,938	17,868
Data source	*PS*	*PS*	*SMCA*	*CSLC*

Notes: The table reports coefficients and standard errors (in parentheses) derived from Equation (1). The standard errors are two-way clustered at the municipality and age levels. *** indicates p< 0.01, ** indicates p< 0.05, and * indicates p< 0.1.

Table 5. Effect on subjective health	Fever	Cough	Wheezing	Nasal discharge	Itchy eyes	Tinnitus	Toothache	Rash
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Subsidized	-0.015**	-0.038***	-0.003	-0.028***	-0.001	0.000	0.000	-0.001
	(0.006)	(0.008)	(0.004)	(0.008)	(0.001)	(0.001)	(0.002)	(0.005)
Hospital fixed effects								
Municipality fixed effects	X	X	X	X	X	X	X	X
Year fixed effects	X	X	X	X	X	X	X	X
Municipality-specific trend	X	X	X	X	X	X	X	X
R2	0.009	0.014	0.006	0.016	0.005	0.004	0.011	0.005
Sample size	17,868	17,868	17,868	17,868	17,868	17,868	17,868	17,868
Mean of no subsidy	0.048	0.121	0.031	0.119	0.001	0.001	0.012	0.038
Data source	*CSLC*	*CSLC*	*CSLC*	*CSLC*	*CSLC*	*CSLC*	*CSLC*	*CSLC*

Notes: The table reports coefficients and standard errors (in parentheses) derived from Equation (1). The standard errors are two-way clustered at the municipality and age levels. *** indicates p< 0.01, ** indicates p< 0.05, and * indicates p< 0.1..

Table 6. Effect on objective health

	Cured outcome at discharge	Mortality rate
	(1)	(2)
Subsidized	0.002	-0.072
	(0.009)	(0.148)
Hospital fixed effects	X	
Municipality fixed effects	X	X
Year fixed effects	X	X
Municipality-specific trend	X	X
R2	0.320	0.398
Sample size	18,600	698
Data source	*PS*	*VS*

Notes: The table reports coefficients and standard errors (in parentheses) derived from Equation (1). The standard errors are two-way clustered at the municipality and age levels. *** indicates p< 0.01, ** indicates p< 0.05, and * indicates p< 0.1.

Table 7. Pre-subsidy trends	Outpatient use		Inpatient use		Health outcomes		
	Monthly spending	Outpatient dummy	Monthly spending	Inpatient dummy	Fever	Cough	Mortality rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Five years early							
Placebo	0.026	-0.012	0.285	0.000	-0.012	-0.019**	0.004
	(0.185)	(0.013)	(6.583)	(0.002)	(0.008)	(0.009)	(0.260)
Panel B: Six years early							
Placebo	-0.131	-0.002	3.604	0.000	0.002	-0.015	0.133
	(0.197)	(0.012)	(7.171)	(0.002)	(0.007)	(0.010)	(0.208)
Panel C: Six years early							
Placebo	-0.114	-0.003	3.491	0.001	0.008	-0.010	0.222
	(0.183)	(0.011)	(6.610)	(0.002)	(0.007)	(0.009)	(0.218)
Hospital fixed effects	X		X				
Municipality fixed effects	X	X	X	X	X	X	X
Year fixed effects	X	X	X	X	X	X	X
Municipality-specific trend	X	X	X	X	X	X	X
Sample size	17,140	10,759	806	10,821	10,821	10,821	459
Data source	*SMCA*	*CSLC*	*SMCA*	*CSLC*	*CSLC*	*CSLC*	*VS*

Notes: The table reports coefficients and standard errors (in parentheses) derived from Equation (1). Standard errors are two-way clustered at the municipality and age levels. *** indicates p< 0.01, ** indicates p< 0.05, and * indicates p< 0.1.

Table 8. Post-subsidy trends	Outpatient use				Inpatient use	
	Days from the previous visit	ln(N of patients)			Days of hospital stay	ln(N of patients)
		All	First visit	Repeat visits		
	(1)	(2)	(3)	(4)	(5)	(6)
Placebo	0.866	-0.024	-0.053	-0.008	-0.575	-0.038
	(1.909)	(0.043)	(0.062)	(0.044)	(0.710)	(0.052)
Hospital fixed effects	X	X	X	X	X	X
Municipality fixed effects	X	X	X	X	X	X
Year fixed effects	X	X	X	X	X	X
Municipality-specific trend	X	X	X	X	X	X
R2	0.081	0.415	0.180	0.350	0.1319	0.3236
Sample size	3,917	2,483	1,151	1,916	10,649	3,775
Data source	*PS*	*PS*	*PS*	*PS*	*PS*	*PS*

Notes: The table reports coefficients and standard errors (in parentheses) derived from Equation (1). The standard errors are two-way clustered at the municipality and age levels. *** indicates $p < 0.01$, ** indicates $p < 0.05$, and * indicates $p < 0.1$.

Table 9. Effect on non-covered treatments

	Outpatient use		Inpatient use	
	Days from previous visit	ln(N of patients)	Days of hospital stay	ln(N of patients)
	(1)	(2)	(3)	(4)
Subsidized	1.500	0.077	3.818	-0.573
	(11.875)	(0.116)	(2.328)	(0.558)
Hospital fixed effects	X	X	X	X
Municipality fixed effects	X	X	X	X
Year fixed effects	X	X	X	X
Municipality-specific trend	X	X	X	X
R2	0.151	0.207	0.428	0.032
Sample size	583	799	4,998	1,487
Data source	*PS*	*PS*	*PS*	*PS*

Notes: The table reports coefficients and standard errors (in parentheses) derived from Equation (1). Standard errors are two-way clustered at the municipality and age levels. *** indicates p< 0.01, ** indicates p< 0.05, and * indicates p< 0.1.

Table 10. Migrant households

	(1)
Subsidized	108.59
	(86.61)
Municipality fixed effects	X
Year fixed effects	X
Municipality-specific trend	X
R2	0.962
Sample size	462
Mean of no subsidy	1,362.70
Data source	Census

Notes: The table reports coefficients and standard errors (in parentheses) derived from Equation (1). The standard errors are two-way clustered at the municipality and age levels. *** indicates p< 0.01, ** indicates p< 0.05, and * indicates p< 0.1.

Appendix A. Month and year of the subsidy introduction by municipality and age

	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6
23 specified districts in Tokyo							
Chiyoda	Apr-93	Apr-93	Apr-93	Apr-93	Apr-93	Sep-95	Sep-95
Chuo	Apr-93	Apr-93	Apr-93	Oct-95	Oct-95	Oct-95	Oct-95
Minato	Jan-93	Jan-93	Jan-93	Apr-96	Apr-96	Apr-96	Apr-96
Shinjuku	Oct-91	Oct-91	Oct-91	Jan-94	Jan-94	Jan-94	Jan-94
Bunkyo	Oct-92	Oct-92	Oct-92	Oct-98	Oct-98	Oct-98	Oct-98
Taito	Apr-93	Apr-93	Apr-93	Apr-96	Apr-96	Apr-96	Apr-96
Sumida	Jan-94	Jan-94	Jan-94	Oct-96	Oct-96	Oct-96	Oct-96
Koto	Apr-93	Apr-93	Apr-93	Apr-96	Apr-96	Apr-96	Apr-96
Shinagawa	Apr-93	Apr-93	Jan-94	Apr-98	Apr-98	Apr-98	Nov-99
Meguro	Apr-93	Apr-93	Apr-93	Oct-98	Oct-98	Jun-99	Jun-99
Ota	Oct-92	Oct-92	Jan-94	Jan-96	Jan-96	Jan-96	Jan-96
Setagaya	Aug-92	Aug-92	Jan-94	Dec-96	Dec-96	Dec-96	Dec-96
Shibuya	Jan-94	Jan-94	Jan-94	Oct-98	Oct-98	Nov-99	Nov-99
Nakano	Apr-72	Oct-72	Oct-93	Oct-93	Oct-98	Oct-99	Oct-99
Suginami	Apr-93	Apr-93	Apr-93	Oct-98	Oct-98	Oct-98	Oct-98
Toshima	Apr-93	Apr-93	Apr-93	Apr-96	Apr-96	Apr-96	Apr-96
Kita	Jun-93	Jun-93	Jun-93	Oct-98	Oct-98	Oct-98	Oct-98
Arakawa	Oct-92	Oct-92	Oct-92	Oct-95	Oct-95	Oct-95	Oct-95
Itabashi	Jan-94	Jan-94	Jan-94	Oct-96	Oct-96	Oct-96	Oct-96
Nerima	Apr-93	Apr-93	Apr-93	Apr-97	Apr-97	Apr-97	Apr-97
Adachi	Oct-93	Oct-93	Oct-93	Oct-98	Oct-98	Oct-98	Oct-98
Katsushika	Jan-94	Jan-94	Jan-94	Jan-94	Dec-97	Dec-97	Dec-97
Edogawa	Jan-94	Jan-94	Jan-94	Jan-94	Sep-96	Sep-96	Sep-96
Whole districts	Jan-94	Jan-94	Jan-94	Oct-98	Oct-98	Nov-99	Nov-99
10 government-designated cities							
Sapporo	Apr-73	Jan-95	Jan-00				
Sendai	Apr-75	Apr-75	Apr-75				
Yokohama	Jan-95	Jan-96	Jan-96	Jan-99			
Kawasaki	Apr-88	Oct-95	Oct-95	Jan-99			
Nagoya	Apr-73	Apr-94	Apr-94	Dec-00			
Kyoto	Oct-93	Oct-93	Jan-99				
Osaka	Oct-93	Nov-96	Nov-96	Dec-97	Nov-00	Nov-01	
Kobe	Apr-73	Jul-94	Jul-94	Jul-01	Jul-01	Jul-01	
Hiroshima	Apr-73	Oct-94	Aug-98	Aug-01			
Fukuoka	Apr-73	Apr-73	Apr-73				

Notes: This table shows the month and year of the subsidy introduction for each municipality. For example, Chiyoda introduced the subsidy for children aged zero years in April 1993.

Appendix B. Summary of data sources on healthcare use and outcomes

	PS	*SMCA*	*CSLC*	*VS*
Survey period	Every three years	Every year	Every three years	Every year
Survey time	Outpatient: a certain day in October Inpatient: a month in September	A month in May	A certain day in June	Every day
Sampling unit	Randomly selected medical institutions	Randomly selected medical institutions	Population-based random-sampling survey	Population survey
Outcome variables used in this study	Outpatient: days from the previous visit, N of patients Inpatient: days of hospital stay, N of patients, discharge outcomes evaluated by a physician	Monthly spending	Outpatient dummy, inpatient dummy, subjective symptoms measured by parents	Mortality rate by age and municipality
Survey years used in this study	1993, 1996, 1999	1992–2001	1992, 1995, 1998, 2001	1990, 1995, 2000

Appendix C. Descriptive statistics

	Mean	S.D.
Panel A: from the *PS*		
Outpatient (N=14,034)		
Days from previous visit	21.604	37.669
Subsidized	0.468	0.499
First visit	0.311	0.463
Age (in year)	2.621	1.919
Female	0.445	0.497
Insurance type: residential-based	0.246	0.431
Inpatient (N=18,600)		
Days of hospital stay	8.961	10.750
Subsidized	0.634	0.482
Age (in year)	1.681	1.955
Female	0.423	0.494
Insurance type: residential-based	0.258	0.437
Panel B: from the *SMCA*		
Outpatient (N=26,564)		
Monthly spending (in JPY 1,000)	8.272	7.526
Subsidized	0.496	0.500
Age (in year)	2.706	1.922
Female	0.462	0.499
Insurance type: residential-based	0.341	0.474
Inpatient (N=2,938)		
Monthly spending (in JPY 1,000)	84.603	65.428
Subsidized	0.711	0.453
Age (in year)	1.597	1.879
Female	0.446	0.497
Insurance type: residential-based	0.242	0.429
Panel C: from the *CSLC* (N=18,093)		
Outpatient dummy	0.203	0.402
Inpatient dummy	0.004	0.065
Subjective symptoms		
Fever	0.050	0.218
Cough	0.114	0.318
Wheezing	0.032	0.177

Nasal discharge	0.120	0.325
Itchy eyes	0.001	0.024
Tinnitus	0.001	0.025
Toothache	0.008	0.089
Rash	0.040	0.195
Subsidized	0.347	0.476
Age (in year)	2.893	1.951
Female	0.490	0.500
Insurance type: residential-based	0.243	0.429
First-born	0.727	0.445
N of household members	4.093	0.963
N of children	1.595	0.629
Three-generation household	0.055	0.229
Age of father	35.007	5.460
Age of mother	32.347	4.601
Own house	0.401	0.490
Stand-alone house	0.294	0.455
Panel D: from the *VS* (N=698)		
Mortality rate (per 1,000 populations)	0.810	1.556
Subsidized	0.448	0.498
Age (in year)	2.993	1.998

Notes: This table reports descriptive statistics for the main sample. For the *PS* and the *CSLC*, we include birth month dummy variables throughout the study, but we do not report them here to save space.

Appendix D. Calculation of price elasticity

	Visit interval	Monthly spending	N of repeat patients
Effect of subsidy ($\hat{\alpha}_1$)	-2.997	0.517	0.057
Mean of subsidized children (q_1)	20.603	9.031	0.483
Mean of non-subsidized children (q_2)	22.457	7.525	0.444
Semi-arc elasticity	-0.464	-0.208	-0.407

Notes: We report the semi-arc elasticity, which is defined as $\varepsilon = \frac{2(q_2-q_1)}{(q_2+q_1)(p_2-p_1)} = \frac{2(\hat{\alpha}_1)}{(q_2+q_1)(0-0.3)} = -\frac{\hat{\alpha}_1}{(q_2+q_1)}/0.15$, where q_1, and q_2 represent the quantities of healthcare use for subsidized and non-subsidized children, respectively. Similarly, p_1, and p_2 represent the respective prices of healthcare. $\hat{\alpha}_1$ is the point estimate for healthcare use derived from the estimation of Equation (1).