Patient Cost Sharing and Healthcare Utilization in Early Childhood: Evidence from a Regression Discontinuity Design

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Abstract

Healthcare for children is highly subsidized in many public health insurance programs. However, the existing literature provides little evidence on how children's healthcare utilization and health react to these medical subsidy policies. This paper exploits a cost-sharing subsidy that has exempted copayment and coinsurance of healthcare service for children under the age of 3 in Taiwan since 2002. We use unique administrative claims data that contain all Taiwanese children born in 2003 and 2004, and conduct a regression discontinuity design by comparing the healthcare utilization right before and right after the children's third birthdays. Our results show that patients increase their number of outpatient visits and switch from low-quality providers to high-quality providers in response to the lower level of cost sharing before the third birthday. The implied price elasticity of total medical expenses for outpatient care is around -0.12. In contrast, the utilization of inpatient care for children *does not* respond to the large reduction in cost sharing before the third birthday. Finally, we find little evidence on the impact of the cost-sharing subsidy on children's short-run or long-run health.

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1 Introduction

Health conditions and medical treatment in early childhood are widely believed to have a substantial impact on later-life outcomes (Bharadwaj et al., 2013; Almond et al., 2011; Currie, 2009; Almond, 2006; Case et al., 2005; Currie and Madrian, 1999).[1] On the other hand, young children are vulnerable to diseases and bring about sizeable medical costs for their parents.[2] In line with this, many public health insurance programs exempt children from most cost-sharing requirements so as to reduce the barrier to necessary care in early childhood.[3] However, there is little evidence on how patient cost sharing affects children's healthcare utilization and health, which should be the key pieces of information when evaluating the effectiveness of the low cost-sharing policy for children's healthcare.

In this paper, we study this issue by exploiting a cost-sharing subsidy that has exempted all copayments and coinsurance for children under the age of 3 in Taiwan since March 2002. We focus on two major healthcare services: outpatient care and inpatient care. Patient cost sharing for outpatient care occurs in the form of a copayment. The amount of the copayment is based on the type of healthcare service (i.e. non-emergency/emergency care) and the type of healthcare provider (i.e. high-quality providers such as teaching hospitals or low-quality providers such as clinics). On average, the subsidy reduces the out-of-pocket price for non-emergency care (emergency care) by 46% (52%), which is equivalent to roughly 58 NTD (298 NTD), for all children who have not yet reached their third birthday.[4] In addition, the copayment exemptions narrows the difference in the out-of-pocket price between high-quality and low-quality providers. Regarding inpatient care, the cost sharing is based on the coinsurance. The subsidy reduces the coinsurance rate from 10% to 0%, which is equivalent to a decrease of roughly 1,300 NTD in the out-of-pocket price, for those under the age of 3. [5]

Since the eligibility for the cost-sharing subsidy is based solely on a child's age (i.e.

[1]Several recent studies (e.g. Bharadwaj et al., 2013; Almond et al., 2011) present convincing evidence showing that early-life medical treatments can reduce mortality and even result in greater long-run academic achievements in school. That is, health intervention in early childhood could be an investment with high returns.

[2]For example, in Taiwan, the number of outpatient visits for children under 3 years of age is around 20 per year. Compared with adults (12 visits per year), this age group has an especially high demand for healthcare services.

[3]For example, in the U.S., the government regulates the level of patient cost-sharing in the Children's Health Insurance Program (CHIP) to ensure that children from middle and low-income families can afford essential medical treatment. Similarly, national health insurance in Japan and Korea offers children under 6 years of age a lower level of patient cost sharing than those above age 6, to promote health investments in early childhood.

[4]1 USD = 32.5 NTD in 2006 so this was equal to 1.8 USD (7.4 USD).

[5]This was around 40 USD in 2006.

whether they have passed their third birthday), this feature helps us to plausibly isolate the effect of cost sharing from other confounding factors that might affect children's healthcare utilization. We use administrative claims data that consist of all medical records for 417,566 children born in 2003 or 2004, following them from their second to their fourth birthday. The age-based eligibility rule of the cost-sharing subsidy allows us to conduct a regression discontinuity (RD) design to examine the causal effect of patient cost sharing on children's healthcare utilization by comparing the use of healthcare for children just before and just after their third birthdays. Furthermore, we investigate whether lower cost sharing has any sort of positive impact on children's health.

We obtain four key findings. First, the cost-sharing subsidy significantly increases children's utilization of outpatient care. The price response is similar across non-emergency and emergency care. The implied price elasticity of total medical expense for non-emergency care (emergency care) is around -0.12 (-0.08). Second, a lower out-of-pocket price not only results in more outpatient visits (extensive margin) but also raises the cost of each visit (intensive margin). This is because the cost-sharing for outpatient care is in the form of tiered copayment. The copayment exemptions shrink price differences between providers, thus inducing patients to switch from low-quality to high-quality providers. Interestingly, most of the additional visits to high-quality providers are for minor illnesses, such as the flu, which can be treated by low-quality providers. Further investigating possible heterogeneous effects in detail, we also find preventive care and mental health services to have larger price responses than outpatient care for acute respiratory diseases. Third, in sharp contrast to the situation with outpatient care, a large decrease in the inpatient price before the age of 3 produces no change in the utilization of inpatient care. The estimated price elasticity of total medical expense for inpatient care is close to zero (about -0.004). This finding implies that children's inpatient care could be quite essential. Parents are unwilling to adjust a child's inpatient care in response to a price change. Fourth, there is little evidence to suggest that lower cost sharing has any short-term or long-term impact on children's health. The above findings imply that the level of patient cost sharing for young children should differ depending on the healthcare service. For example, providing free inpatient care for young children does not stimulate excessive inpatient use (i.e. moral hazard) but it might substantially reduce the financial risk for households. On the other hand, having a certain level of copayments for children's outpatient care is essential to avoid its overuse, especially at high-quality providers.

This paper contributes to the research on patient cost sharing in three ways. First, our paper provides credible and transparent estimates of the price elasticities of healthcare utilization in early childhood, a topic largely unexplored in the existing literature. The administrative data we use allows us to follow the same children over time and to precisely measure their age in days. Thus, our research design actually enables us to compare healthcare utilization by the same children just before and after their third birthdays, which convincingly controls other factors affecting children's healthcare utilization.[6] Compared with survey data, administrative data have no recall error. Thus, we can get an accurate measure of the key variable in our research design — patient's age at the time of a health visit. Prior studies using survey data find that there is substantial heaping in the reported birth dates of patients, which might reflect measurement error in patients' ages.[7] In addition, insurance enrollment in Taiwan is compulsory. This feature frees our estimates of any bias caused by a change in the composition of enrollees induced by the change in cost sharing. A few recent U.S. studies (Chandra et al., 2010a; Chandra et al., 2010b; Chandra et al., 2014) have used a quasi-experimental design exploiting a change in the copayments of one health insurance plan and using unchanged insurance plans as a control group. However, the change in cost sharing could also affect people's decisions to enroll in insurance plans. Such self-selection behavior could bias the elasticity estimates. For example, a larger proportion of people with lower price sensitivity might continue their enrollment after a cost-sharing increase, which might bias the price elasticity estimates toward zero. The Taiwanese National Health Insurance (NHI) is a single-payer scheme that every citizen is required to join.[8] Thus, our elasticity estimates are free of any bias from a change in the composition of the enrollees after the cost-sharing change.

Second, we investigate the effect of cost sharing, specifically tiered copayment, on a patient's choice of providers (i.e. price shopping behavior), which is an important behavioral response but is seldom discussed in the literature.[9] The institutional setting in Taiwan has several advantages for such analysis. On one hand, patients in Taiwan have complete freedom to choose their healthcare providers, as they can gain access to hospitals and specialists directly, without referral from a primary-care physician. On the other hand, the fee schedule

[6] In Taiwan, turning 3 does not coincide with any confounding factors, such as the age of starting school or a recommended immunization schedule. We will discuss this issue in Section 5.1.

[7] For example, Shigeoka (2014) finds that respondents in the Japanese Patient Survey tend to report the first day of the month as their birthday when they forget their exact date of birth.

[8] The only exceptions are citizens who have lost their citizenship, have died, or have been missing for more than six months.

[9] One recent paper (Brot-Goldberg et al., 2015) has also investigated the effect of cost-sharing on patient's price shopping behavior. They exploit a large shift in employee health insurance plan from zero cost-sharing to high deductible plan. Their results show that high deductible/coinsurance has little impact on patient's choice of providers, which is contrast to ours. The difference between our findings and theirs could be due to different effect of tiered copayment or the institutional setting as mentioned below.

is set by government, thus, we can plausibly ignore supply-side price response. In addition, the price information is quite transparent and not complicated. Most patients should have a comprehensive understanding of their out-of-pocket cost before choosing providers.

Third, this paper examines the long-run health impact of a lower degree of cost sharing. There is little evidence on this important issue due to the lack of data[10]. The unique policy change and longitudinal claim data make us able to fill this gap. We use the inpatient rate at age 8 to 10 to represent children's long-run health status, and examine whether the inpatient rates of cohorts who grew up with a longer period of copayment (coinsurance) exemptions between the ages of 0 and 3 have lower inpatient admission rates over ages 8 to 10 than those who experienced shorter periods of exemptions.

The rest of the paper is organized as follows. Section 2 summarizes related studies. Section 3 gives a brief overview of the institutional background. In Section 4, we discuss our data and sample selection. In Section 5 and 6, we describe our empirical strategy and analyze the main results. Section 7 provides concluding remarks.

2 Previous Literature

Estimating the causal effect of cost sharing on healthcare utilization and health is a challenging task. The main reason is that the variation in cost sharing is usually not exogenous and might depend on the outcome of interest. For example, people with a high level of healthcare utilization could pay a larger share of medical costs due to the rules of the insurance plan, whereby people in poor health might be forced to choose an insurance plan with a high level of patient cost sharing.

Credible estimates of the causal impact of cost sharing for children still rely on evidence from the RAND Health Insurance Experiment (RAND HIE), which randomly assigned participating households to different levels of patient cost sharing (ranging from free care to 95% cost sharing).[11] The RAND HIE provided estimates of the price elasticity of health-

[10] Medicaid......

[11] The health insurance contracts in RAND HIE adopted non-linear pricing, which makes estimating price elasticity challenging. Specifically, the insurance plans required initial cost sharing (free care, 25%, 50%, or 95%) but had an annual stop-loss (maximum dollar expense), in that the total out-of-pocket medical costs per year could not exceed 4,000 USD. Thus, the patients cost sharing would fall to zero once their annual out-of-pocket medical costs reached 4,000 USD. Such non-linear pricing imposes different prices on patients for the same healthcare at different times of the year. To summarize the estimated price elasticity, RAND researchers defined four kinds of price that patients respond to when making their healthcare decision: (1) the current "spot" price, (2) the expected end-of-year price, (3) the realized end-of-year price, and (4) the weighted average of the price paid over a year (Aron-Dine et al., 2013). In this study, the price elasticity of children's healthcare is calculated by defining price according to definition (1).

care utilization for children under 14 years of age (Leibowitz et al., 1985; Manning et al., 1981).[12] It found that higher patient payments significantly reduced children's utilization of outpatient care, but found mixed evidence of a cost-sharing effect on children's utilization of inpatient care. The estimated price elasticity of total medical expenses expenditure was around −0.12, slightly lower (in absolute value) than their full-sample estimate, −0.2.

However, the sample size for children in the RAND HIE was quite limited. Some estimates and subgroup analyses were not precise enough to confirm the presence or absence of a cost-sharing response (Leibowitz et al., 1985).[13] Additionally, the RAND HIE evidence is now over 30 years old. Both medical technology and the disease types have changed considerably during the past four decades. The varying healthcare environment could have affected the way in which the utilization of healthcare changes in response to differences in price. Finally, the estimated effect of cost sharing on children in the RAND HIE could be confounded by spill-overs from other family members, since the assigned cost sharing applied to all family members. In contrast, our research design can provide estimates of children's own-price elasticity, since the cost-sharing subsidy only affects family members under the age of 3.[14]

Subsequent to the RAND HIE, more recent studies have exploited quasi-experimental design to assess the causal impact of cost sharing on healthcare utilization. However, most of them focus on the price elasticities of the adult population (Cherkin et al., 1989; Selby et al., 1996; Rice and Matsuoka, 2004; Chandra et al., 2010a; Chandra et al., 2010b; Chandra et al., 2014; Shigeoka, 2014). Shigeoka (2014) exploited the sharp reduction in patient cost sharing at age 70 in Japan and applied a RD design to estimate the price elasticity of outpatient and inpatient visits by the elderly. He found the use of both health services to respond strongly to the price change, with obvious drops at age 70. The estimated price elasticities were around −0.17 (outpatient care) and −0.15 (inpatient care). He also examined the impact of the change in cost sharing on short-run health for the elderly and found little evidence of a health effect. Chandra et al. (2014) used a cost-sharing reform in Massachusetts as an exogenous variation in price and obtained a price elasticity of total medical expenses of around −0.16 for low-income adults.[15] However, these estimates might not be valid for

[12]For children under the age of 4, the RAND HIE found that inpatient care was price sensitive. Children assigned to a free plan had a significantly higher rate of inpatient admission than children assigned to 95% cost sharing. For children aged between 5 and 13, no consistent pattern of a cost-sharing effect on inpatient use was found (Leibowitz et al., 1985).

[13]As Leibowitz et al. (1985) comment, "Because hospitalizations for children are infrequent, our estimates of hospital use have wide confidence intervals and we can be less certain than for outpatient care about the presence or absence of a cost sharing response."

[14]The spill-over effect could still exist if a family has more than two children under the age of 3. However, such families account for less than 10% of the sample.

[15]This estimate is a weighted average across different healthcare services, such as office visits and prescrip-

the healthcare utilization of young children for two reasons. First, the types of healthcare services used by adults and children are quite different. Children's outpatient visits are rarely for chronic diseases and mostly for acute diseases, which need timely treatment and should not be sensitive to a price change. In addition, the majority of children's inpatient admissions are for respiratory diseases, which can be treated with bed rest or medication. Previous studies have found this type of inpatient care not to be price sensitive.[16] Second, healthcare interventions in early childhood could substantially benefit an individual's later life, as has been addressed by recent studies (Bharadwaj et al., 2013; Almond et al., 2011). Given such high returns, parents might not be willing to adjust their children's medical care in response to price changes. Based on the above two reasons, we expect healthcare utilization for young children to be less price sensitive than that for an older demographic group.

Limited evidence has been produced on the impacts of cost sharing on young children. Two noticeable exceptions are Han and Lien (2008) and Nilsson and Paul (2015). Han and Lien (2008) exploited a policy change that has exempted cost sharing for children aged 4-6 since October 1998 in Taipei City. They conducted a difference-in-differences estimation using children of the same age living in nearby but unaffected townships as a comparison group. Their results indicate the price elasticity of non-emergency care to be around -0.08. Nilsson and Paul (2015) utilized a reform in Sweden that abolished copayments for outpatient care for young people between 7 and 19 years of age. They implemented both a difference-in-differences model and an RD design using slightly younger and slightly older age groups as controls. They found that free outpatient care caused individuals to increase their number of visits to a doctor by 5-10%. However, there are several limitations of these two papers. First, neither one explored the impact of cost sharing on patients' choice of providers and utilization of inpatient care. Nor did they examine the health effect of cost sharing, which should be an important issue when evaluating such policies.[17]

tion drugs.

[16] Shigeoka (2014) found that inpatient admissions for non-surgery were less price sensitive than those for surgery, especially elective surgery (e.g. cataract surgery). Also, he found that admissions for the respiratory diseases typically treated with bed rest or medication did not respond to a change in cost sharing at age 70 in Japan. Card et al. (2008) obtained similar findings in relation to Medicare eligibility at age 65 in the U.S.

[17] A large literature uses the expansion of public insurance coverage for children in the U.S. to estimate the impact of health insurance on children's healthcare utilization and health. This stream of research mainly focuses on the effect of insurance provision rather than the generosity of the insurance (i.e. cost sharing). More importantly, the research design in these studies is unable to distinguish between these two effects since the expansion of public health insurance not only increases children's insurance coverage (insurance provision) but also leads to a large-scale substitution from private to public insurance, which changes the generosity of the insurance.

3 Policy Background

3.1 National Health Insurance in Taiwan

In March 1995, Taiwan established the NHI, which is a government-run, single-payer scheme administered by the Bureau of National Health Insurance. Prior to this, health insurance was provided through three main occupational forms — labor insurance for private-sector workers, government-employee insurance, and farmers' insurance. These systems accounted for only 57% of the Taiwanese population (Lien et al., 2008). The remainder of the population were not employed, consisting of people over 65, children under 14, and unemployed workers. The implementation of the NHI raised the coverage rate of health insurance sharply, to 92% by the end of 1995, and since 2000 it has stayed above 99%. The NHI provides universal insurance coverage, with almost all medical services covered, including outpatient, inpatient, dental, and mental health services, prescription drugs, and even traditional Chinese medicine.

3.2 Patient Cost Sharing

Patient cost sharing in Taiwan comprises two parts: (1) the copayment (coinsurance);[18] (2) other non-NHI-covered medical costs (e.g. registration fees for outpatient visits).[19]

3.2.1 Cost Sharing for Outpatient Care

With respect to outpatient care, a patient pays a copayment plus a registration fee for each visit.[20] The copayment is based on a national fee schedule. The registration fee reflects the provider's administrative costs and is determined by the provider.[21] The first two rows of Panel A in Table 1 summarize the fee schedule for outpatient care during our sample period (2005–2008). In general, both payments depend on the type of visit and the type of

[18] A copayment is a fixed fee paid by the insurance enrollee each time a medical service is accessed. Coinsurance is a percentage of the medical payment that the insured person has to pay. The NHI adopts copayments for outpatient care and coinsurance for inpatient care.

[19] More discretionary healthcare, such as plastic surgery, sex reassignment surgery, and assisted reproductive technology, is not covered by the NHI. Patients have to pay the full cost of such services.

[20] Both are fixed amounts. If a physician prescribes a drug at a visit and the drug cost is above 100 NTD, the patient will also need to pay a share of the cost of the prescription drug, which is 20% of the total drug cost. However, since most visits for children under the age of 3 incur drug costs below 100 NTD, the prescription drugs do not generally need to be paid for. The average out-of-pocket cost for outpatient prescription drugs (for patients under the age of 3) is quite small, at only 2.5 NTD per visit.

[21] Our main dataset lacks this information. However, the NHI has another database that provides information on the registration fees of all health providers during our sample period (2005–2008). For non-emergency care (emergency care), major teaching hospitals usually charge 200 (300) NTD, minor teaching hospitals 150 (250) NTD, community hospitals 100 (200) NTD, and clinics 50 (150) NTD. We use this information to impute the registration fees for the four types of providers.

provider. A patient pays a higher out-of-pocket price for an emergency visit than a non-emergency visit. A visit to a teaching hospital will cost the patient much more than one to a clinic/community hospital.

Assuming that more severe illnesses cost more, the fixed copayment amount for one outpatient visit implicitly requires patients to pay a higher share of the medical expenses when visiting a high-quality provider(i.e. a teaching hospital) for a minor illness. NHI uses tiered copayments to guide patients to choose healthcare providers based on the out-of-pocket price and the severity of their illness so as to better allocate medical resources to the patients who need them most. This design is essential because patients in Taiwan have complete freedom over their choice of provider. Patients can access specialists in teaching hospitals directly, without a referral from a primary-care physician.[22] This fact results in an interesting feature in Taiwans healthcare system, in that teaching hospitals, which should focus on inpatient care and emergency care, include sizeable outpatient departments that deal with non-emergency visits.[23] Table A1 (non-emergency care) and A2 (emergency care) compare major teaching hospitals, minor teaching hospitals, community hospitals, and clinics in terms of composition of medical expenses and treatment reasons. The average medical expenses per major teaching hospital visit are 1,176 NTD, three times as much as those per clinic visit. The majority of the difference is due to the fact that patients at teaching hospitals receive many more medical examinations. The average examination/treatment fee for a major teaching hospital is 540 NTD but that for a clinic is only 17 NTD. In addition, a patient pays a higher share of the medical expenses incurred in a visit to a teaching hospital than they do at a clinic (45% vs 23%).

3.2.2 Cost Sharing for Inpatient Care

For inpatient admissions, the patient cost sharing takes place through coinsurance. Depending on the length of the stay and the type of admission (acute or chronic), the coinsurance rate is between 10% and 30% of the total medical cost per admission. For example, a pa-

[22]In other words, NHI does not adopt a gatekeeper system. The gatekeeper system is common in North America and European countries. The National Health Service (NHS) in the United Kingdom requires a patient to get a referral from a primary-care physician in order to see a specialist or other doctor. The provincial health insurance in Canada, the Health Maintenance Organization (HMO) in the U.S. and the national health insurance in Norway also adopt gatekeeper systems.

[23]In 2013, more than 35% of the medical expenses of teaching hospitals were devoted to non-emergency visits. There are several incentives for patients to self-refer to the doctors at teaching hospitals. On the one hand, patients can access a greater range of treatments from the outpatient care in a hospital. For example, a physician in a teaching hospital can conduct more health examinations (e.g. X-rays) and offer more medical treatments (e.g. therapeutic radiology) than one in a clinic. On the other hand, it is widely believed that teaching hospitals are able to recruit better physicians.

tient must pay 10% of the hospitalization costs for the first 30 days of their stay in an acute admissions unit, and 20% for the next 30 days. Almost all inpatient admissions for young children (99.5%) are acute admissions, and the length of a stay in our sample is always less than or equal to 30 days.[24] Thus, the coinsurance rates for most admissions are around 10%. Panel C in Table 1 lists the coinsurance rates for inpatient services.[25]

Because inpatient care usually results in larger financial risks than outpatient care, the NHI has a stop-loss policy (i.e. maximum out-of-pocket cost) for inpatient admissions. The out-of-pocket cost must be no greater than the stop-loss, which is calculated annually as 10% of the gross domestic product per capita in Taiwan. The NHI covers all costs above the stop-loss.[26] According to NHI statistics, very few patients (less than 1%) reach this stop-loss. Thus, the non-linearity imposed by it should not seriously bias our estimates of price elasticity.[27] Moreover, in contrast to health insurance plans in the U.S. and other countries, the NHI does not require patients to pay deductibles before insurance coverage begins. The above two features substantially simplify our computation of the price elasticities.[28]

3.3 The Taiwan Children's Medical Subsidy Program

To reduce the financial burden on parents and ensure that every child obtains essential medical treatment in her early childhood, in March 2002, the Taiwan government enacted the Taiwan Children's Medical Subsidy Program (TCMSP). This program, through subsidies, exempts all copayments and coinsurance for outpatient care, prescription drugs, and inpatient care for children under the age of 3. A patient loses her eligibility for subsidies at her third birthday. Since the implementation of TCMSP, a patient under 3 years of age has only had to pay the medical costs not covered by the NHI (e.g. the registration fee for outpatient care and other non-covered medical services).[29]

Figures 1a and 1b plot the age profiles of the average out-of-pocket prices for non-emergency and emergency visits, respectively, and display them for the four types of provider.

[24] In our empirical analysis, we limit our estimated sample for inpatient services to cases of acute admissions with lengths of stay upto 30 days.

[25] Some parents might buy private health insurance for their children. Such insurance can cover the out-of-pocket costs of inpatient care. Nevertheless, private health insurance for young children is not popular in Taiwan.

[26] In 2008, the annual maximum out-of-pocket cost was about 50,000 NTD.

[27] This is because the NHI waives the cost sharing for patients with catastrophic illnesses (e.g. cancer), who would otherwise have a greater probability of reaching the stop-loss.

[28] In health insurance, the deductible is the amount that an insured person has to pay before an insurer (e.g. the insurance company) starts to pay.

[29] If they use medical services not covered by the NHI, they will have to pay all expenses. However, the NHI does cover most health services. Those that are not covered are mostly quite discretionary, such as plastic surgery, sex reassignment surgery, and assisted reproductive technology.

Each dot represents the ten-day average price of each visit at a given age. Due to the subsidy, the difference in copayments between teaching hospitals and community hospitals/clinics shrinks by a large amount before the third birthday. In other words, before their third birthday, patients will receive higher subsidies if they visit teaching hospitals than if they visit other types of provider.

Figure 1c presents the age profile of the average out-of-pocket cost per inpatient admission (180 days before and after the third birthday). The subsidy reduces the coinsurance rate for inpatient care from 10% to 0%, which results in a decrease in the average out-of-pocket price of around $1,300$ NTD before the third birthday.

4 Data and Sample

The data underlying our estimates come from two distinct sources: (1) the National Health Insurance Research Database (NHIRD); (2) Taiwan's National Health Interview Survey (TNHIS). Our first outcome is the healthcare utilization around the children's third birthdays. We linked information from four types of file in the NHIRD: outpatient claims files, inpatient claims files, enrollment files, and provider files. Outpatient (inpatient) claims files record information about payments and medical treatments for each visit. These files contain the enrollee ID, the provider ID, the visit date, the total expenses of each visit, the out-of-pocket costs of each visit, the diagnosis[30], and medical treatment.[31] Then we used the enrollee ID to merge the enrollment files and obtain each enrollee's demographic information, such as birth date, gender, insured income, and number of siblings. Finally, we used the provider ID to link the above to the information (e.g. provider's accreditation) in the provider files. We used birth date and visit date to precisely measure our key variable – patient's age at visit. The information on diagnosis and provider also allows us to conduct various subgroup analyses.

To avoid the effects of variation in cohort size on our estimation, we focused on the healthcare use within the same cohort (fixed panel). Our original sample was all NHI enrollees born between 2003 and 2004. The original sample size was 435,752 (see Table 2).[32] We further restricted our sample to those enrollees who were continuously registered in the NHI while aged 2 and 3, which reduced the sample size by 3,457. In addition, we eliminated

[30]Diagnoses are recorded in five digits according to the ICD9 (International Classification of Diseases, Ninth Revision, Clinical Modification).

[31]Inpatient claims files also include information about the length of stay.

[32]Since 99% of Taiwanese are covered by the NHI, this sample represents nearly the entire population of children born in 2003 and 2004 in Taiwan.

those enrollees in the sample with cost-sharing waivers, such as children with catastrophic illnesses and children from very low-income families, since these children would not have experienced any price change when turning 3. The above procedure reduced our original sample by 4.1%, making the final sample size for estimation 417,566. Table 2 provides summary statistics of the characteristics of the enrollees at age 3, in the original sample and in the final sample used in our empirical analysis. We find that the selected characteristics are quite similar between the two samples.

We used 2005–2008 NHIRD data to obtain all the records of outpatient visits and inpatient admissions for these children when aged 2 or 3.[33] Following Lien et al. (2008), we also excluded visits relating to dental services, Chinese medicine, and health check-ups with a copayment waiver.[34] Table 3 provides the descriptive statistics for the outpatient care (i.e. non-emergency care and emergency care) and inpatient care. We compare their characteristics within the 90 days before and after the third birthday.[35] The average visit rate for outpatient care is higher before the third birthday than after the third birthday. More than 85% of visits are clinics visits. However, teaching hospitals tend to be visited more frequently before the patient's third birthday than after it. With respect to inpatient care, the average admission rate for inpatient care does not show much of a difference from before to after the third birthday. More than half of all patients go to minor teaching hospitals. In contrast to the situation for outpatient care, patients' choice of provider is quite stable across the third birthday threshold.

Our second dataset is taken from the TNHIS, which has surveyed around 12,000 people in Taiwan every four years since 2001. We used this dataset to examine short-run health effects. The key outcome variable is children's health status as reported by their parents. These data also contain information on gender, age, household income, and parents' education. To match the sample period for healthcare utilization, we used 2005 and 2009 TNHIS data and restricted the sample to children aged 2 or 3. Thus, the final sample size was 1,041. Table 4 compares selected characteristics for children just before and just after the age of 3.

The last outcome we examine is children's long-run health, which is proxied by the inpatient rate at age 8 to 10. We linked the inpatient files with the enrollee files in the NHIRD to calculate the inpatient rate at age 8 to 10 for the children born between March

[33] The sample period was chosen because children born in 2003 were aged 2 in 2005–2006 and children born in 2004 were aged 3 in 2007–2008.

[34] The copayments for dental care and Chinese medicine are 50 NTD no matter which providers people visit. The NHI provides nine health check-ups with copayment waivers for children under the age of 7. Since patient cost sharing for these visits does not change at the third birthday, we eliminated them to avoid biased estimations.

[35] We made this choice because in our main results we used 90 days as the bandwidth.

1st 1998 and March 1st 2000. The final sample size was around 471,072. Table 5 compares the selected characteristics for the children born before and after March 1st 1999.

5 Results on Healthcare Utilization

In this section, we examine the impact of the increase in cost sharing that applies after a child's third birthday on healthcare expense and utilization. As mentioned above, our sample consists of the children born in 2003 and 2004 who were continuously enrolled in the NHI over the ages of 2 and 3. We follow these individuals across their third birthdays to estimate the change in patient cost sharing (i.e. treatment) and healthcare utilization (i.e. outcomes) at age 3. We will examine outpatient care first and then impatient care.

5.1 Identification Strategy

Our identification strategy is similar to that in recent studies utilizing an "age discontinuity" to identify the insurance coverage effect (Card et al., 2008; Card et al., 2009; Anderson et al., 2012) or patient cost-sharing effect (Shigeoka, 2014) on medical utilization by adults or the elderly. The general form of our estimated regression is as follows:

$$Y_{ia} = \beta_0 + \beta_1 Age3_{ia} + f(a;\gamma) + \varepsilon_{ia} \tag{1}$$

where Y_i is the outcome of healthcare utilization for child i at age a, namely (1) total medical expense; (2) the number of visits (admissions); (3) expense per visit (admission). The variable a_i is child i's age and is measured in days. The variable $Age3_{ia}$ is a treatment dummy that captures the lower level of patient cost sharing due to the subsidy before the third birthday and is equal to one if child i's age at the time of their visit is less than 3. Note that the third birthday is the 1,096th or 1,095th day after birth.[36] $f(a;\gamma)$ is a smooth function of age that controls the age profile of healthcare utilization. ε_{ia} is an error term that reflects all the other factors that affect the outcome variables.

Our primary interest is in β_1, which measures any deviation from the continuous relation between age and the outcomes Y_{ia} at child i's third birthday (i.e. when the treatment variable switches from 1 to 0). If no other factors change discontinuously around the child's third

[36] Since 2004 was a leap year, its February had 29 days. For the children born before February 29th 2004, their third birthday would have been the 1,096th day after birth (365 x 3 + 1 = 1096). For those born after March 1st 2004, their third birthday would have been the 1,095th day after birth.

birthday, that is, if $E[\varepsilon_i|a_i]$ is continuous at age 3, β_1 represents the causal effect of the cost-sharing subsidy on the children's healthcare utilization. For this age group, potential confounding factors could include vaccination and pre-school attendance. The recommended immunization schedule could mechanically increase healthcare spending and use for young children at age 3. However, this concern is alleviated since children in Taiwan do not need to have vaccines at age 3 and indeed are given most vaccines before they are 2 years of age (Center of Disease and Control, 2013).[37] On the other hand, entering pre-school could increase the chance of a child picking up illnesses (e.g. the flu), which would affect their healthcare use. This factor might not interfere with the cost-sharing change at age 3 because the age of entry for "public" pre-schools is 4 years of age and the government does not specify a statutory attendance age for "private" kindergartens. Most importantly, since we measure the children's age at a daily level, only factors that have daily variation can confound our estimation of the cost-sharing effect. This fact substantially alleviates the concern that our estimates could be biased by other factors. We will test this key assumption by using pre-reform (i.e. 1997–2001) data to examine whether there was any discontinuity in healthcare utilization at the third birthday before the introduction of the cost-sharing subsidy.

We capture the age trend of the healthcare use $f(a;\gamma)$ by estimating a linear function over a specific narrow range of data on either side of the threshold (i.e. the third birthday). The local linear estimates of the treatment effect are the differences between the estimated limits of the outcome variables on each side of the discontinuity. Because the policy variation occurs at the age level, following Card et al. (2009), Anderson et al. (2012) and Lemieux and Milligan (2008), we collapse the individual-level data into age cells (measured in days), which gives us the same estimates as the results from the individual-level data but substantially reduces the computational burden.[38] Our baseline specification is the age-cell version of Eq.(1):

$$Y_a = \beta_0 + \beta_1 Age3_a + \gamma_1(a-1096) + \gamma_2 Age3_a(a-1096) + \varepsilon_a \quad (2)$$

Y_a is the outcome of interest, aggregated at age a.[39] We obtain the estimated treatment effect β_1 by allowing the slope of the age profile to be different on either side of the third

[37] http://www.cdc.gov.tw/professional/page.aspx?treeid=5B0231BEB94EDFFC&nowtreeid=1B4BACA0D1FDDB84

[38] This also helps us to avoid the estimation problem of zero spending/visits when we take the log of our outcome variables, especially at per person-day level.

[39] In our empirical analysis, we take logs of Y_a to allow β_1 to be interpreted as the percentage change in the dependent variable.

birthday, by interacting the age variable fully with the intercept and $Age3_a$. Also, we recenter the age variable around the third birthday so that β_1 directly represents the treatment effect at the third birthday.[40] Equation (2) is estimated using a triangular kernel (i.e. giving more weight to the data points close to the third birthday). We restrict our sample to the 90 days before and after the third birthday. The choice of bandwidth and the polynomial specification for $f(a; \gamma)$ are important issues for RD design.[41] In the appendix, we examine whether our main results are sensitive to these choices.

5.2 Outpatient Care

5.2.1 Change in Patient Cost-Sharing at Third birthday

Table 6 displays the results for non-emergency care (Panel A) and emergency care (Panel B). Column 2 reports the RD estimates of the change in the average out-of-pocket price at age 3. On average, due to the subsidy, the average out-of-pocket price decreases by 58 NTD (i.e. a 46% reduction) before the age of 3. The change in the cost of an emergency visit is even larger since the emergency services are usually costly and are operated by hospitals. In addition, the subsidy leads to a reduction in the average out-of-pocket price per emergency visit of 298 NTD (i.e. a 52% decrease). We also conduct an RD estimation using the pre-reform data (1997–2001) and find no change in the average out-of-pocket price at the third birthday, showing that there are no other confounding factors apart from the cost-sharing subsidy affecting patients' out-of-pocket costs around the age of 3.

5.2.2 Change in Utilization of Outpatient Care at Third Birthday

Figure 2a presents the age profiles of medical expense for non-emergency care. Note that age profiles are based on the children born between 2003 and 2004. The dots in the figure represent the medical expense per 10,000 person-years, by the patient's age at each visit, which is measured in days from the third birthday.[42] The figure shows that patients spend

[40]For the children born before February 29th 2004, the age variable is $a - 1096$. For those born after March 1st 2004, the age variable is $a - 1095$.

[41]Deciding how "narrow" a range of data to use, namely, choice of bandwidth, is critical to local linear estimation. If the bandwidth were too wide, the local linear estimate β_1 could be biased due to misspecification. That is, the linear function would be unable to capture the age profile over such a "wide" range of data. If the bandwidth were too narrow, there would not be enough data for the estimation to produce a precise local linear estimate. Thus, the optimal bandwidth needs to balance bias and precision (variance) in estimating β_1. This is quite an active field in the nonparametric literature and there are many competing methods of selecting the optimal bandwidth, such as the plug-in approach (Imbens and Kalyanaraman, 2012; Cattaneo et al., 2014) and the cross-validation approach (Ludwig and Miller, 2007).

[42]We computed the total outpatient expense per 10,000 person-years by dividing the total medical expense at a particular age by the number of enrollees born in 2003 and 2004 and then multiplying this by 10,000.

more on non-emergency care just before the age of 3 than just after the age of 3, which corresponds to the lower level of cost sharing before the child's third birthday.

Next, we further decompose the medical expense into the number of visits and the medical expense per visit. Figures 2c and 2e present the age profiles of the visit rate[43] and medical expense per visit, respectively. The figures present evidence of a discrete change in the utilization of non-emergency care. Both the number of visits and expense per visit are higher immediately before the third birthday than immediately after it.

In addition, we use pre-reform data (1997–2001) to plot the related outcome variables in Figures 2b, 2d and 2f.[44] In sharp contrast to the graphs presented above, here, we find no visible discontinuity at the third birthday. We also conduct the same graphical analysis for emergency care. Figure 3 reveals that emergency care also sees a salient change in utilization around the third birthday during the post-reform period (2005–2008) but not the pre-reform period (1997–2001).

The first row of Table 6 (columns 3-5) presents estimates of the change in utilization of non-emergency care at age 3. The regressions in the table are estimated using equation (2) with a triangular kernel function and a bandwidth of 90 days for age.[45] Column 3 shows that the cost-sharing subsidy causes the medical expense of non-emergency care to increase significantly by 7.6%. The estimated price elasticity of the medical expense for non-emergency care is around -0.12.[46]

The change in medical expenses can be decomposed into two margins: (1) the number of visits (extensive margin); (2) the medical expense per visit (intensive margin). Column 4 reveals that the lower level of patient cost sharing raises the number of visits by 4.9%, which is smaller than the change in medical expenses. This is because the cost-sharing subsidy

This is a common way to present data in the health economics and public health literatures and helps us to compare the estimated results across different sample periods and subgroups. Each dot represents the 10-day average of the dependent variable.

[43] Again, each dot represents outpatient visits per 10,000 person-years at a given age, averaged over 10 days.

[44] We also follow the children born in 1995–1997.

[45] We only use observations for which age at the time of the visit is 90 days before of the third birthday and 90 days after it.

[46] This elasticity is calculated in the form of price elasticity. The standard formula for the price elasticity of demand is $((Q_2 - Q_1)/Q_1)/((P_2 - P_1)/P_1)$, where Q_1 and P_1 denote the baseline healthcare demand and patient cost sharing, respectively, and Q_2 and P_2 are the healthcare demand and patient cost sharing after the change in cost sharing. However, in the health economics literature, many studies (e.g. Leibowitz et al., 1985; Manning et al., 1981; Chandra et al., 2010a) also use an alternative form of price elasticity using the percentage change relative to the average, since P_1 could be zero in some cases (e.g. the free plan in Rand HIE or zero out-of-pocket costs for inpatient care in this paper) and then the denominator of the price elasticity would be undefined. That is, the alternative price elasticity is calculated as $((Q_2 - Q_1)/((Q_1 + Q_2)/2))/((P_2 - P_1)/((P_1 + P_2)/2)$.

also leads to a 2.7% increase in the medical expense per visit (column 5). The change in the medical expense per visit is likely to be a combination of two forces. First, the marginal patients who visit the doctor only because there is a subsidy in place are not as sick as those who would use healthcare services regardless of the subsidy. In other words, patients who visit the doctor before their third birthdays may have less serious illnesses than those who visit the doctor later. Therefore, the medical expense per visit could be lower before age 3.[47] Second, the cost-sharing subsidy also causes patients to choose high-quality providers (i.e. teaching hospitals) since the tiered copayment is eliminated before age 3, which substantially narrow down the difference in out-of-pocket price across providers. A visit to a high-quality provider usually incurs higher costs than one to a low-quality provider. Thus, the medical expense per visit could be higher before age 3. Our estimates imply that the latter force dominates the former. In the next section, we will discuss this issue in more detail.

To examine any confounding factors affecting our estimates, we repeat the above analysis using pre-reform data (1997–2001) as a placebo test. The results are shown in the second row of Table 6. Not surprisingly, we do not find any impact of being younger than age 3 on the utilization of non-emergency care in the period before the cost-sharing subsidy had been introduced. This result substantially reduces concerns about the impact of other confounding factors on our estimates.

We conduct the same analysis for emergency care. The last two rows of Table 6 show that the cost-sharing subsidy significantly raised the medical expense of emergency care by 5.6%. The estimated price elasticity of the medical expense for non-emergency care is around -0.08. Again, this change can be decomposed into a 6.6% increase in the number of visits (statistically significant) and a 1% decrease in the medical expense per visit (statistically insignificant).

Assuming our estimates can apply to healthcare utilization of all children under age 3. Our results imply the subsidy could induce extra medical expense for outpatient care by 0.4 billion NTD per year (not including subsidy itself). Among this extra expense, 0.3 billion NTD are devoted to non-emergency care and the rest are for emergency care.

In the appendix, we present a series of robustness checks for our main results: choice of bandwidth, empirical specification and the "stocking up" effect. We display results for both non-emergency care and emergency care. Table A3 and A4 systematically examine the sensitivity of our RD estimates to different bandwidths and orders of polynomial. Our main results are robust to these changes.

One caveat could threaten the validity of our RD design. Because every child eventually

[47] This assumes that healthcare providers spend less on treating more healthy patients.

"ages out" of her cost-sharing subsidy, parents may anticipate the sharp increase in the price of healthcare services after the child's third birthday and strategically "stock up" on outpatient care.[48] This behavioral response would represent an inter-temporal substitution of healthcare (i.e. substituting future healthcare with current healthcare) rather than a "real" change (increase) in utilization induced by the cost-sharing subsidy, which is our main point of interest. Such a behavioral response would tend to upwardly bias our estimates of the change in healthcare utilization at the third birthday. From Figures 2a and 2c, we indeed find that the medical expense and the number of visits suddenly rise, 20 days before the third birthday. In order to account for the possible anticipation effect, first, we decompose effect of the age 3 subsidy cutoff into inter-temporal substitution and true demand-response. We estimate the equation (2) but exclude the sample whose age are either 20 days before or 20 days after third birthday. Then we use the estimated regression (2) to predict counterfactual outcomes for those excluded ages as if there were no distorted response from strategic stock-up behaviors. Our decomposition result shows that only 7% of change in total medical expense can be attributed to inter-temporal substitution. Second, following previous studies (Barreca et al., 2011; Shigeoka, 2014), we conduct a "donut" RD by systematically excluding outpatient expenses and visits within 3–21 days of the third birthday (Table A6 and A7). Although there is no consensus on the optimal size of a donut hole, and while eliminating the sample around the threshold seems to contrast with the spirit of RD design, this type of estimation can still give us some sense of the "stocking up" effect's influence on our estimates. Table A6 and A7 indicates that the estimates from different sizes of donut hole are very similar to our main estimates.

5.2.3 Change in Choice of Provider at Third Birthday

In this section, we examine the impact of the cost-sharing subsidy on patients' choice of providers for outpatient care. Again, we firstly analyze results for non-emergency care and then discuss emergency care. As mentioned before, patients in Taiwan have complete freedom over their choice of provider. To avoid unnecessary treatment at teaching hospitals, NHI sets different copayments for different providers (i.e. tiered copayment) so as to allocate limited healthcare resources to the patients who need them the most. That is, patients with minor illnesses should be treated by low-quality providers (i.e. clinics/community hospitals) and those with major illnesses by high-quality providers (i.e. teaching hospitals). Since

[48] Since most visits of young children are for acute diseases (e.g. 74% of visits are for respiratory diseases), it is hard to believe that parents would be able to substitute children's outpatient care today for care in one month. However, it would be possible to substitute outpatient care within a few days.

the subsidy exempts all copayments for children under the age of 3, this gives us a unique opportunity to examine the impact of the tiered copayments on the patient's provider choice, by comparing the choices immediately before the third birthday (i.e. with no copayments) to those immediately after the third birthday (i.e. under tiered copayments).[49]

First, we observe patients whose previous non-emergency visits are high-quality providers are more likely to switch to low-quality providers after the third birthday when they have to pay tiered copayment. Figure XX displays the probability of transition from teaching hospitals to clinics/community hospitals at given age. We find before age 3 around 45% of patients whose previous visit are teaching hospitals would switch to clinics/community hospitals. Interestingly, this share jump sharply to 57% once patients passing age 3. Coincident with this finding, Figure XX shows that patients are less likely to switch from clinics/community hospitals to teaching hospitals after the third birthday. Before age 3, around 4.7% of patients whose previous visits are clinics/community hospitals would change their providers to teaching hospitals. After age 3, the probability drops to 3.2%.

Next, we present the age profiles of the visit rate for non-emergency care by type of provider. Figures 4a to 4d show that a substantially greater number of patients are treated at teaching hospitals before the age of 3 than after. Interestingly, the number of visits to community hospitals exhibits the opposite pattern, showing a substantially lower visit rate before age 3. In sum, the visual evidence suggests that the cost-sharing subsidy results in a significant redistribution of caseloads across different types of provider.

As in the figures, we estimate equation (2) separately by type of provider. Coinciding with the graphical evidence, Panel A of Table 7 presents the evidence that the cost-sharing subsidy causes patients to switch from low-quality providers (i.e. clinics/community hospitals) to high-quality providers (i.e. teaching hospitals) before age 3. The number of patients treated at major and minor teaching hospitals increases significantly, by 59% and 44.1%, respectively, when patients do not have to pay a copayment before age 3. In contrast, the number of patients treated at community hospitals decreases significantly, by 17.1%, and the caseloads of clinics increase only slightly, by 1.9%. This result indicates that patients can switch providers easily and their choices of provider are quite sensitive to the relative prices among providers. Interestingly, we also find that the average medical expenses for each visit at the major and minor teaching hospitals decrease significantly in the presence of a subsidy, by 18.5% and 5.8%, respectively. Assuming that more severe diseases will incur higher medical expenses, our results imply that patients tend to visit teaching hospitals for less serious

[49]Before the third birthday, patients still need to pay a registration fee. However, this does not vary substantially across providers.

illnesses before the age of 3 than after it.

To further explore this issue, we examine the change in the number of visits to teaching hospitals by seriousness of visit, proxied by the average medical expense of each visit. Firstly, we focus on the utilization of non-emergency care at teaching hospitals and estimate equation (2) separately for four categories of medical expenses per visit: (1) 0-600 NTD; (2) 601-1,200 NTD; (3) 1,201-1,800 NTD; (4) above 1,801 NTD. The dotted line in Figures 6a and 6b displays the coefficients on $Age3$ in equation (2) across the distribution of medical expenses (four categories). The effects of the cost-sharing subsidy on the utilization of non-emergency care at major teaching hospitals are largest for the lowest level of expenses and decrease monotonically across the expenses distribution. The number of non-emergency visits for those illnesses that cost less than 600 NTD increases by 82%. However, the increase in visits for illnesses that cost more than 1,800 NTD is only 12%. A similar pattern emerges for minor teaching hospitals. Our results suggest that visits to teaching hospitals for minor illnesses could be more elastic (i.e. price sensitive) than those for major illnesses. This is because patients can also go to community hospitals/clinics for minor illnesses, which implies that some visits to teaching hospitals induced by the cost-sharing subsidy could be unnecessary.

Regarding emergency care, we conduct the same analysis as above. Surprisingly, patients' choice of provider for emergency care is also discretionary, even though the choice of the emergency room largely depends on patient's situation and should not be selective. Similar to non-emergency care, Figure XX shows that patients are more likely to visit emergency room at teaching hospitals before age 3 than after it. Panel B of Table 7 shows that the copayment exemption raises the number of visits to major (minor) teaching hospitals by 10.9% (13.9%) but reduces the number of visits to community hospitals by 29.9%. In Figures 6c and 6d, we find that the response in emergency room use at teaching hospitals to the copayment exemption is concentrated on the visits that cost less than 2,400 NTD (i.e. for minor illnesses, such as the flu). In contrast, the copayment exemption has little impact on the visits that cost more than 2,400 NTD (i.e. major illnesses, such as open wounds).

To sum up, we find that eliminating tiered copayments (i.e. narrowing down price difference between providers) can incentivize patients to switch from low-quality providers to high-quality providers. In addition, the marginal patients are those with minor illnesses (e.g. the flu), which should be cured by low-quality providers (e.g. clinics or community hospitals). This indicates that there is a substantial moral hazard in terms of an increase in the use of high-quality providers when patients are not exposed to the full cost.

5.2.4 Subgroup Analysis

In this section, we investigate the heterogeneity of price responses across different reasons for treatment and various subgroups of young children. Tables 8 and 9 present the results for non-emergency care and emergency care, respectively. Each row displays the RD estimates (coefficients of $Age3$) for selected treatment reasons and various subgroups.

Panel A presents the results for selected treatment reasons. Most non-emergency visits are for respiratory diseases, which can account for 74% of visits[50]. The cost-sharing subsidy causes a relatively small change in medical expenses (5.4%) and number of visits (3.6%) for respiratory diseases compared to the overall estimates. The implied elasticity for respiratory diseases is -0.08. Other selected treatment reasons have relative large price responses, especially the medical treatments that are seen as more discretionary but which could improve living quality or reduce future healthcare costs, such as treatment for skin diseases, mental health services and preventive care. The copayment exemptions raise the medical expenses for skin diseases by 15.8%, those for mental illnesses by 23.3% and those for preventive care by 28.1%. The implied price elasticities for this type of healthcare are quite large (in absolute terms, -0.26 for skin diseases, -0.33 for mental health services, and -0.59 for preventive care). Our results suggest that preventive and mental care are quite price sensitive, which is quite interesting since preventive care and early treatment for children's mental disorders (e.g. autism) could result in better treatment outcomes and might substantially reduce future medical costs. In Table 9, we find a similar pattern for emergency care (i.e. respiratory diseases are less sensitive to the price change).

Panel B displays the results by birth order. First, we find that the copayment exemptions lead to a larger increase in the utilization of non-emergency care for non-first-born children than for first-born children (columns 3-5). Similar patterns can be seen in the case of emergency care (see Table 9). Previous studies have shown that parents are more cautious when raising their first child. Our results imply that parents might consider outpatient care more essential for their first child and be less willing to adjust their healthcare utilization in response to a price change, which would also be consistent with the findings of previous studies.

Panel C presents the results by gender. First, we find the visit rate for males to be higher than that for females in the case of both non-emergency and emergency care. This result is consistent with previous evidence that boys have lower birth weights and are more vulnerable to getting sick than girls. Second, our results indicate that the cost-sharing subsidy results in a larger increase in the utilization of non-emergency care for males than for females.

[50] $383/518 = 0.74$

However, the opposite pattern is observed in the utilization of emergency care.

Panel D presents the results based on household income.[51] This subgroup analysis can help us to get some sense of the income effect on children's outpatient utilization. If an income effect plays an important role in the patient's utilization decision, we would expect the utilization response to the cost-sharing subsidy to vary by household income and the utilization of healthcare by low-income children to exhibit larger changes before age 3, since the cost-sharing subsidy is more likely to help low-income children to obtain medical treatment, by relaxing their families' tight budgets. For non-emergency care, our results show that the copayment exemptions lead to similar increases across different income groups (around 7%). This implies that the income effect might play a limited role in the utilization of non-emergency care. However, we find that low-income children exhibit significantly larger increases in their utilization of emergency care than middle/high-income children (12% vs 2% and 4%), suggesting that the income effect could be an important factor explaining variations in the utilization of emergency care before the age of 3.

5.3 Inpatient Care

For young children, inpatient admissions are less common than outpatient visits. Among our sample at age 2, the average annual number of outpatient visits is 19.8 but the average annual number of inpatient admissions is only 0.14.[52] Nevertheless, the cost to the patient of one inpatient admission is 29 times the cost per outpatient visit, and 17% of healthcare spending for young children is attributed to inpatient care. More importantly, the cost-sharing subsidy induces a much larger change in out-of-pocket prices for inpatient care than outpatient care before age 3, in terms of both the level and the percentage change. Hence, inpatient care could have substantial impacts on overall healthcare spending and individuals' out-of-pocket prices. Understanding how young children's demand for inpatient care responds to cost sharing has important policy and welfare implications.

5.3.1 Changes in Patient Cost Sharing at the Third Birthday

Column 2 row 1 of Table 10 shows that the cost-sharing subsidy reduces the average out-of-pocket price by 1,288 NTD (i.e. 100%) below the age of 3. Column 2 row 2, for pre-reform data (1997–2001), shows that there is no change in the average out-of-pocket price at the

[51] A low-income household is defined as one with a monthly household income below 34,000 NTD. A middle-income household has a monthly household income between 34,001 and 73,000 NTD. A high-income household has a monthly household income of 73,001 NTD or higher.

[52] The number of outpatient visits is the sum of non-emergency visits and emergency visits.

third birthday. This eliminates the concerns about the existence of other confounding factors affecting patients' out-of-pocket price around age 3.

5.3.2 Changes in the Utilization of Inpatient Care at the Third Birthday

The effect of coinsurance exemptions on the utilization of inpatient care is theoretically ambiguous. On the one hand, children may have more inpatient admissions and incur greater expenses before the age of 3 because the coinsurance rate for inpatient care is zero below that age. On the other hand, the type of inpatient care that young children usually have might be price inelastic. Most admission diagnoses in early childhood, such as pneumonia and acute gastroenteritis, can be treated with medication or bed rest. Previous studies (Card et al., 2008; Shigeoka, 2014) have found that patient cost sharing or insurance coverage has little impact on this type of diagnosis for the elderly. In addition, for young children, admissions requiring surgery are seldom selective (e.g. osteoarthritis, hip and knee replacement) but more likely life threatening and essential (e.g. congenital heart disease). Thus, we should expect the utilization of inpatient care for young children to be less sensitive to the price changes that occur at the third birthday.

Figure 7a displays the age profile of medical expenses for inpatient care. Like in Figure 2, the dots represent medical expenses per 10,000 person-years by patient's age at admission, which is measured in days from the third birthday. Surprisingly, in contrast to the sharp change in the utilization of outpatient care from immediately before to immediately after age 3, Figures 7a, 7c, and 7e show that there is little visual evidence of any discontinuity in inpatient expenses, the number of inpatient admissions or the inpatient expenses per admission around a patient's third birthday. In fact, we find the age profiles of these outcome variables to be very similar to those obtained using pre-reform data (1997–2001).

As in the figures, columns 3-5 row 1 of Table 10 show that the coinsurance exemption has little impact on the utilization of inpatient care for young children. There is no significant change in the total medical expenses, the number of admissions, or the medical expenses per admission around the patient's third birthday. The estimated price elasticity of inpatient expenses is about -0.004, which implies that children's utilization of inpatient care is price inelastic. Our results are consistent with the findings in the prior literature. Shigeoka (2014) found that inpatient admissions treated with bed rest and medication do not respond to the price change at age 70 in Japan. Card et al. (2008) obtained similar findings for Medicare recipients in the U.S. Most admissions for young children involve these types of inpatient care. Our results suggest that inpatient care for young children may be quite essential. Patients (parents) do not adjust the utilization of inpatient care in response to a price change. In other words, full insurance coverage of children's inpatient care does not cause a moral hazard but substantially reduces the financial risk to households brought about by inpatient admissions.

In the appendix, we present similar robustness checks as those done for outpatient care (i.e. choice of bandwidth and empirical specification). Again, Our main results are robust to these changes (see Table A5).

6 Results on Children's Health

So far, we have found that the cost-sharing subsidy significantly increases the utilization of outpatient care and causes patients to switch from low-quality to high-quality providers, which implies that more patients may receive a better quality of medical care. However, we also find the marginal patients at high-quality providers induced by subsidy tend to get treatment of minor illness. In addition, subsidy has little impact on the utilization of inpatient care. Therefore, from the results on utilization, it is unclear whether cost-sharing subsidy can really benefit children's health.

In this section, we examine whether cost-sharing subsidy has any impact on a patient's health. To examine the short-run health effect, we compare the reported health status for the children immediately before and after age 3.[53] For the long-run health effect, we investigate whether the individuals who grew up with a longer period of copayment (coinsurance) exemptions between the ages of 0 and 3 have lower inpatient admission rates over ages 8 to 10 than those who experienced shorter periods of exemptions.

6.1 Short-Run Health Effect

We estimate the following regression to examine the effect of the cost-sharing subsidy on patients' health in the short-run:

$$H_i = \alpha_0 + \alpha_1 Age3_i + \alpha_2(a_i - 36) + \alpha_3 Age3_i(a_i - 36) + \alpha_4 X_i + \varphi_i \quad (3)$$

H_i is a dummy indicating whether the reported health status was "good" (i.e. $H_i = 1$) or not (i.e. $H_i = 0$). In the survey, a child's parent reports his/her health status, choosing from five categories: (1) very good; (2) good; (3) normal; (4) bad; (5) very bad. We combine (1) and (2) to denote an individual with "good" health status and use the remaining options

[53] The health status is reported by their parents.

to denote an individual who does not have "good" health status. Since we only know an individual's birth year and month, we combine the information about the survey year and month to measure an individual's age in months. In addition, since this survey uses a repeated cross-sectional design, we cannot compare the same individual's health status before and after age 3. To reduce the impact of other confounding effects on health status, we also control other covariates X_i, such as gender, an indicator for premature birth, and parents' education.

Table 11 shows that the individuals just under age 3 do not have better health than those just over age 3. Our result is robust to using different bandwidths and empirical specifications. This result is not surprising since the effect of the subsidy on healthcare utilization is concentrated on the outpatient visits to high-quality providers for treatment for minor illnesses. However, we also find the copayment exemptions to increase the use of preventive care, which might have a positive impact on health in the long run.

6.2 Long-Run Health Effect

In this section, we investigate the long-run health effect of the cost-sharing subsidy. Our identification strategy exploits the fact that the length of the period for which a patient is eligible for the cost-sharing subsidy is determined by their birth date.

Individuals born before February 28th 1999 were ineligible for the subsidy. Thus, these children were eligible for the cost-sharing subsidy for zero days between ages 1 and 3 (i.e. their birth date is unrelated to the length of the eligibility period). However, those born between March 1st 1999 and February 28th 2002 were eligible for the cost-sharing subsidy for between 1 and 1,096 days respectively between ages 1 to 3. Thus, for these children, the number of eligible days is an increasing function of their birth date. If cost sharing has any impact on health in the long run, we should find that the relationship between long-run health (i.e. the inpatient rate between ages 8 and 10) and the patient's birth date has a slope change at March 1st 1999. To examine this, we estimate the following regression:

$$I_i = \kappa_0 + \kappa_1 After99_i + \kappa_2 Distance1999_i + \kappa_3 After99_i * Distance1999_i + \kappa_4 X_i + \varsigma_i \quad (4)$$

Our outcome variable I_i is the inpatient rate for an individual i between ages 8 and 10. $Distance1999_i$ is a running variable that denotes the number of days between individual i's birth date and March 1st 1999. $After99_i$ is a dummy indicating that individual i's birth date is later than March 1st 1999. The key variable is the interaction term between $After99_i$

and $Distance1999_i$. Its coefficient κ_3 measures the difference in the slopes of the long-run health functions between those individuals born just before and those born just after March 1st 1999.

Table 12 reports the coefficients on $After99$, $Distance1999$, and its interaction term. None of estimates is statistically significant at conventional level and this result is robust across different empirical specifications. Therefore, our findings suggest the inpatient rate between ages 8 and 10 and the child's birth date do not exhibit any systematic relationship, which implies that the cost-sharing subsidy has little impact on children's long-run health.

7 Conclusion

In this paper, we provide convincing evidence on the causal effect of patient cost sharing on children's healthcare utilization and health. We exploit a cost-sharing subsidy that has exempted copayments and coinsurance for healthcare services for children under the age of 3 in Taiwan since 2002. This policy change results in a variation in the out-of-pocket price based only on the patient's age at the time of a visit to a healthcare provider. We use an RD design to estimate the impact of cost sharing on healthcare utilization and health in early childhood, and provide suggestive evidence on its effect on long-run health.

We reach three conclusions. First, the reduced out-of-pocket price significantly increases the total medical expenses for outpatient care. The estimated price elasticity of outpatient expenses is modest (at around -0.12). Further decomposing the change in medical expenses due to the subsidy, we find that patients exhibit an increase in visits for both non-emergency and emergency care. In addition, they switch from low-quality to high-quality providers when not paying a copayment before their third birthday and most of the additional visits to high-quality providers are for minor illnesses, suggesting there is a substantial moral hazard in terms of choosing healthcare providers. Second, the utilization of inpatient care does not respond to the price change. The implied price elasticity of inpatient expenses is close to zero. The RAND HIE found mixed evidence on this issue and could not draw strong conclusions. Our results largely support the view that inpatient care for young children is price insensitive. Finally, we find that patient cost sharing has little impact on children's short-run and long-run health.

Taken together, these results suggest that the level of patient cost sharing for young children should differ between healthcare services and healthcare providers. For example, our results imply that providing full insurance coverage for children's inpatient care can substantially reduce the financial risk for households but does not induce excessive utilization of inpatient care. On the other hand, our estimates suggest that having a higher level of copayments for outpatient care at high-quality providers (i.e. teaching hospitals) could reduce patients' moral hazard behavior when it comes to choosing healthcare providers, wherein they use high-quality providers when they do not need to do so.

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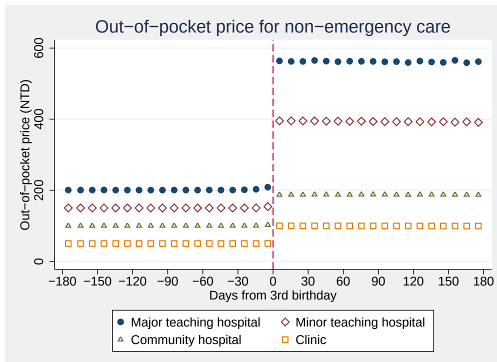
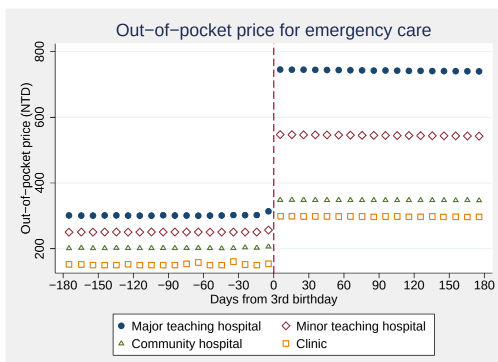
Figures

Figure 1: Age Profile of Out-of-Pocket Prices (NTD)

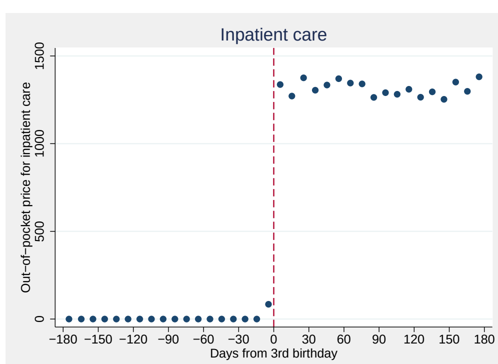
(a) Average out-of-pocket price (non-emergency care)



(b) Average out-of-pocket price (emergency care)



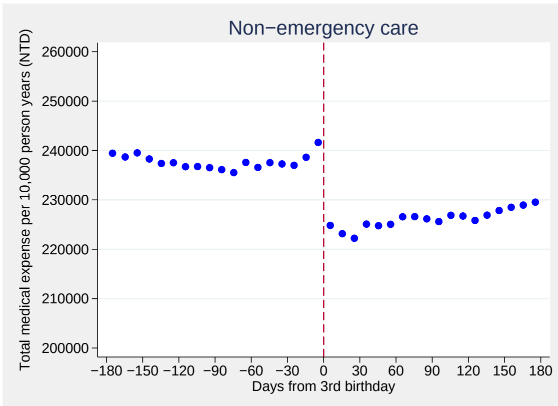
(c) Average out-of-pocket price (inpatient care)



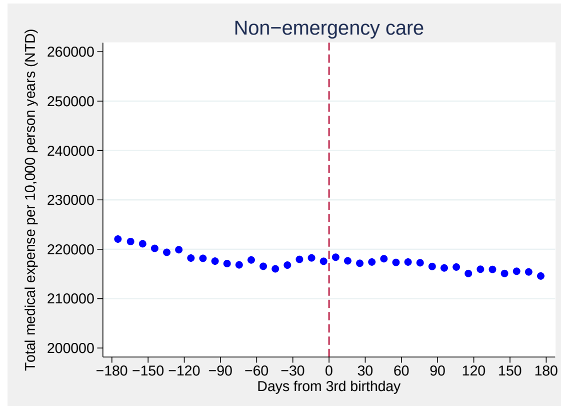
Notes: The dependent variable is average out-of-pocket price by patient's age at visit (measured in days, 180 days before and after the third birthday). Each dot represents the 10-day average of the dependent variable.

Figure 2: Age Profile of Utilization of Non-emergency care

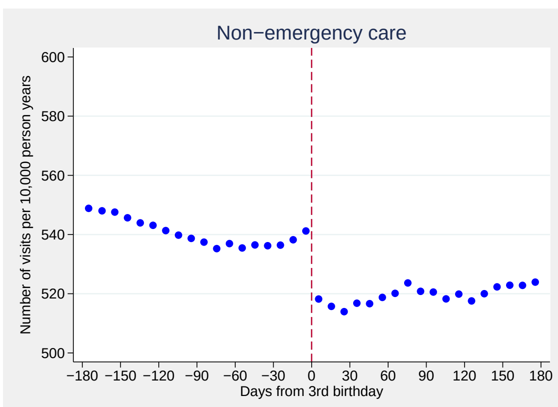
(a) Medical Expenses per 10,000 person-years: 2005–2008



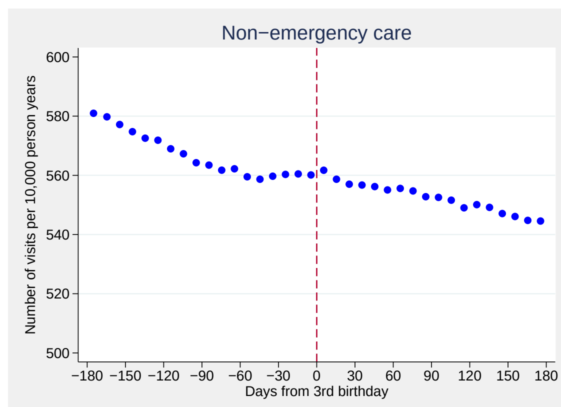
(b) Medical Expenses per 10,000 person-years: 1997–2001



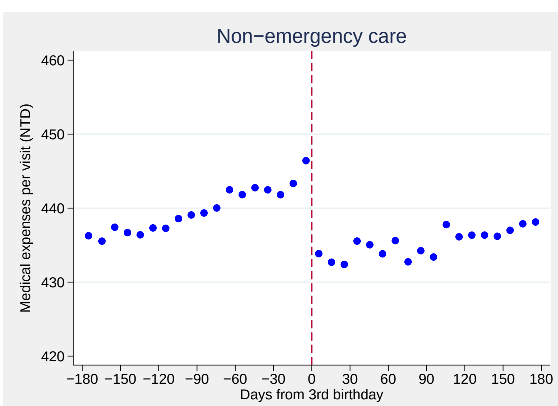
(c) Number of visits per 10,000 person-years: 2005–2008



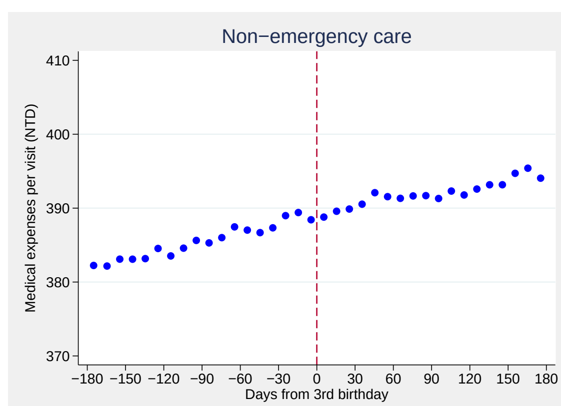
(d) Number of visits per 10,000 person-years: 1997–2001



(e) Medical expenses per visit : 2005–2008



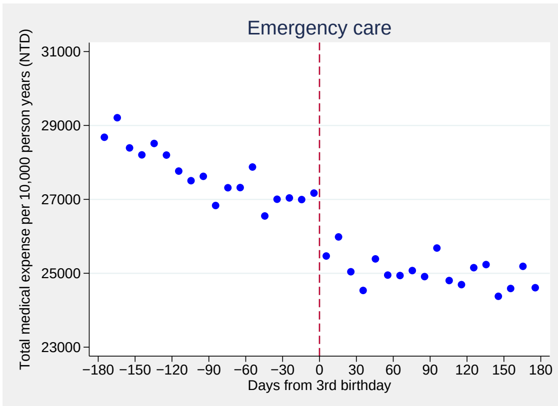
(f) Medical expenses per visit: 1997–2001



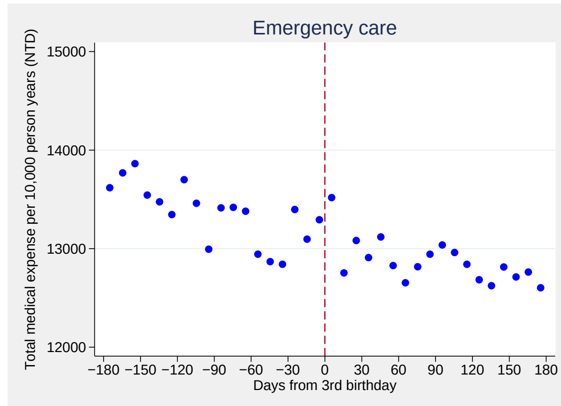
Notes: The line is from fitting a linear regression on age variables fully interacted with $Age3_i$, a dummy indicating after the third birthday (90 days bandwidth). The dependent variables are total medical expense per 10,000 person years, number of visits per 10,000 person years, and medical expense per visit by patient's age at visit (measured in days, 180 days before and after the third birthday). Each dot represents the 10-day average of the dependent variable.

Figure 3: Age Profile of Utilization of Emergency care

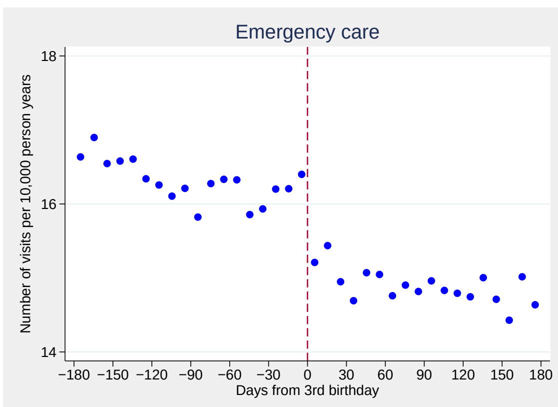
(a) Medical expenses per 10,000 person-years: 2005–2008



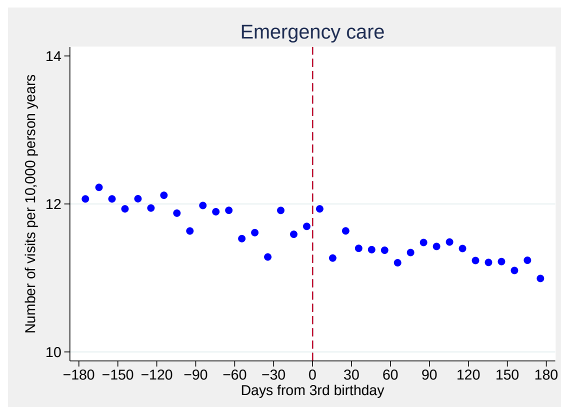
(b) Medical expenses per 10,000 person-years: 1997–2001



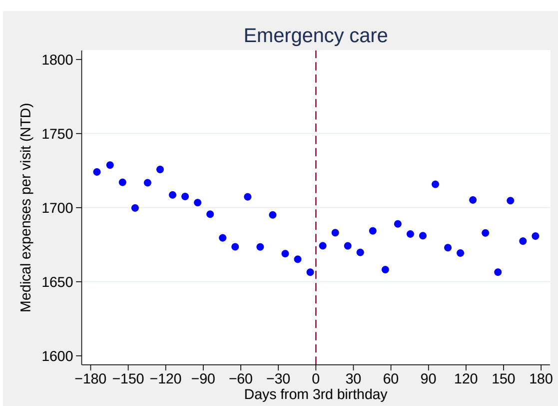
(c) Number of visits per 10,000 person-years: 2005–2008



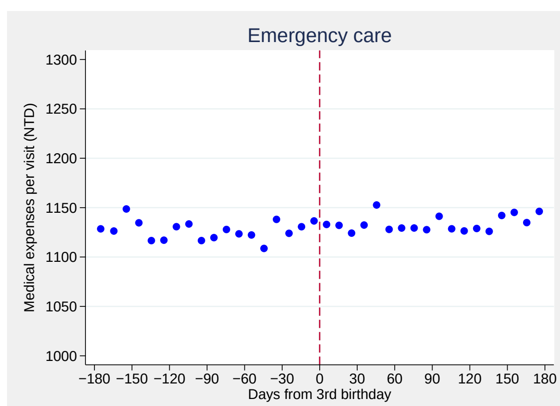
(d) Number of visits per 10,000 person-years: 1997–2001



(e) Medical expenses per visit : 2005–2008



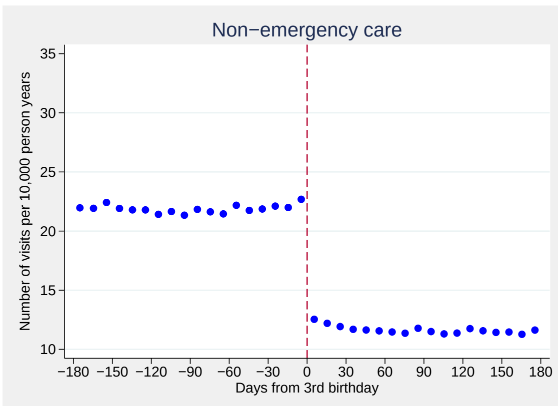
(f) Medical expenses per visit: 1997–2001



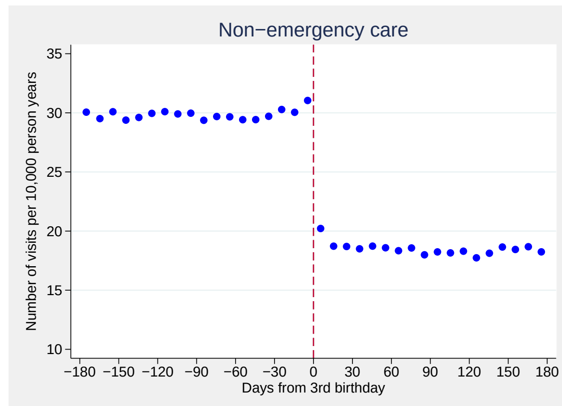
Notes: The line is from fitting a linear regression on age variables fully interacted with $Age3_i$, a dummy indicating after the third birthday (90 days bandwidth). The dependent variables are outpatient expense per 10,000 person years, outpatient visits per 10,000 person years, and outpatient expense per visit by patient's age at visit (measured in days, 180 days before and after the third birthday). Each dot represents the 10-day average of the dependent variable.

Figure 4: Age Profile of Non-emergency Visit per 10,000 Person Years: by Type of Provider

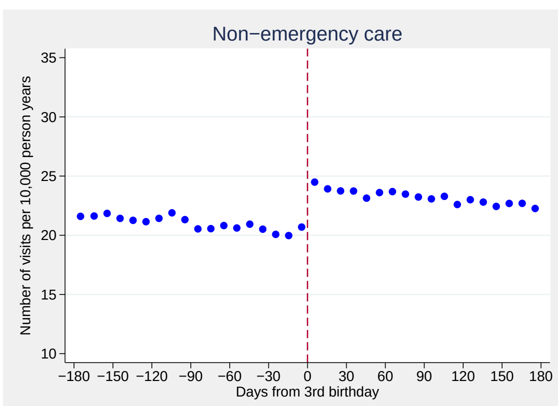
(a) Major Teaching Hospital



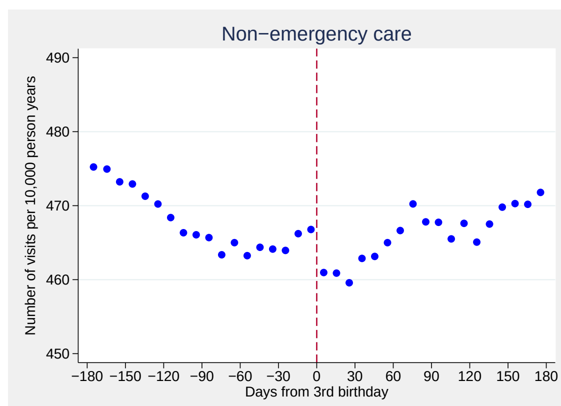
(b) Minor Teaching Hospital



(c) Community Hospital



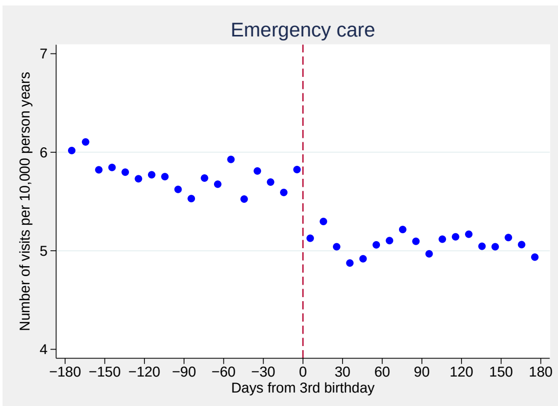
(d) Clinic



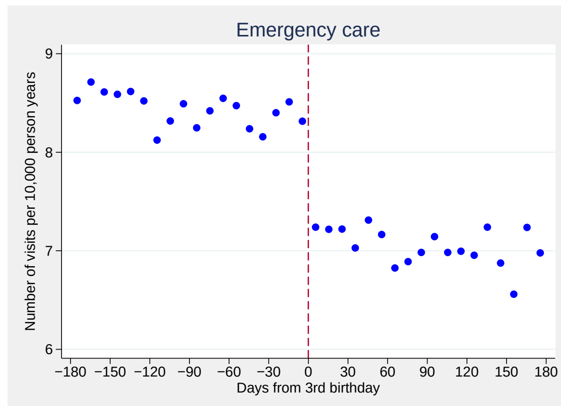
Notes: The line is from fitting a linear regression on age variables fully interacted with $Age3_i$, a dummy indicating after the third birthday (90 days bandwidth). The dependent variables are outpatient visits per 10,000 person years (measured in days, 180 days before and after the third birthday). Each dot represents the 10-day average of the dependent variable.

Figure 5: Age Profile of Emergency Visit per 10,000 Person Years: by Type of Provider

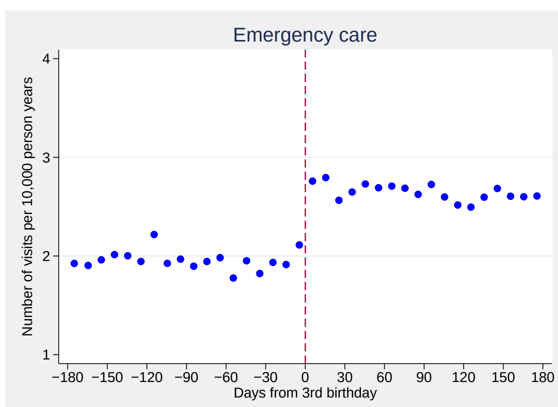
(a) Major Teaching Hospital



(b) Minor Teaching Hospital



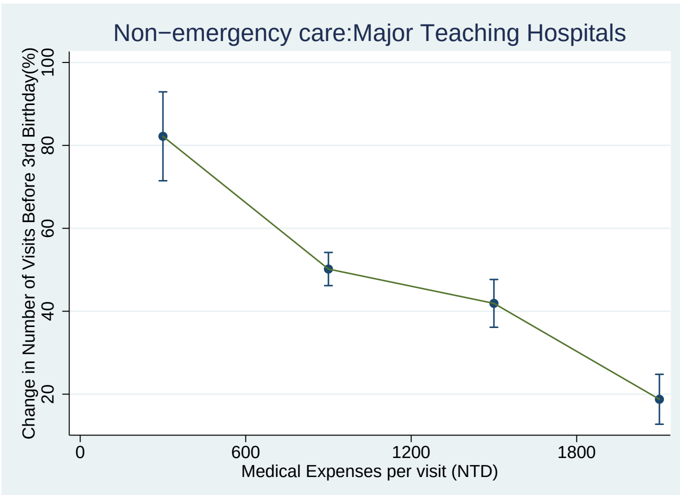
(c) Community Hospital



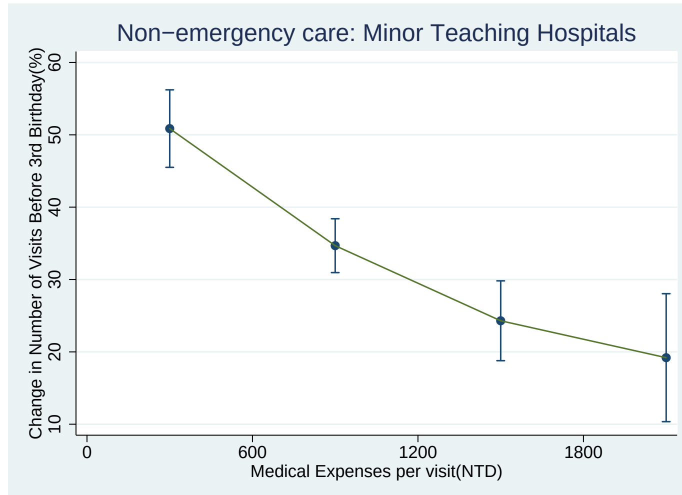
Notes: The line is from fitting a linear regression on age variables fully interacted with $Age3_i$, a dummy indicating after the third birthday (90 days bandwidth). The dependent variables are outpatient visits per 10,000 person years (measured in days, 180 days before and after the third birthday). Each dot represents the 10-day average of the dependent variable.

Figure 6: Utilization Resposes by the Expense per Visit

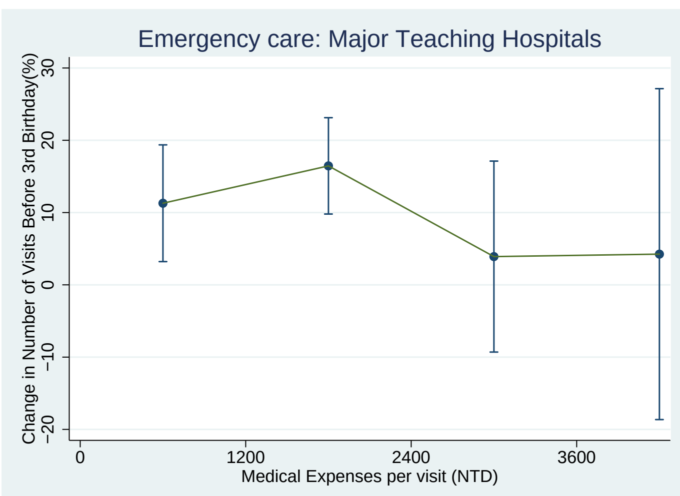
(a) Percent Change in Visits to Major Teaching Hospital: Non-emergency care



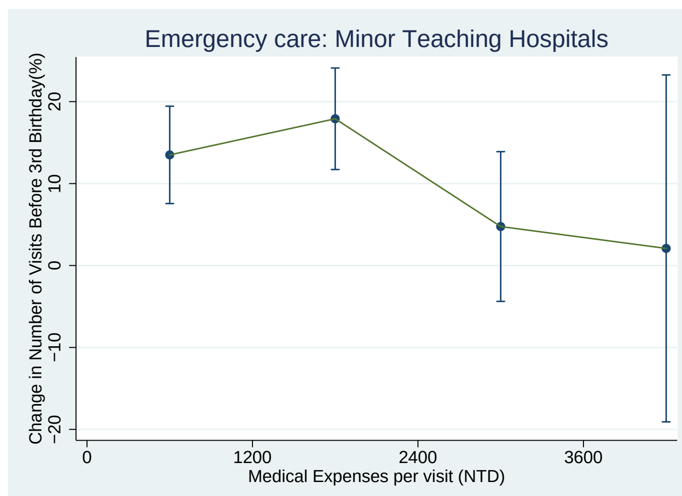
(b) Percent Change in Visits to Minor Teaching Hospital: Non-emergency care



(c) Percent Change in Visits to Major Teaching Hospital: Emergency care



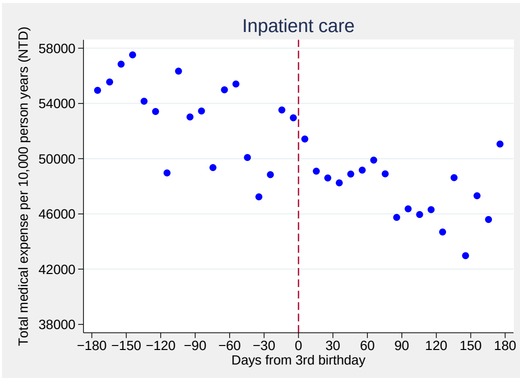
(d) Percent Change in Visits to Minor Teaching Hospital: Emergency care



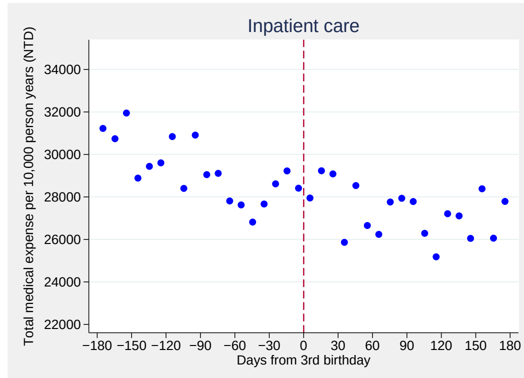
Notes: We estimate equation (2) separately for four categories of medical expenses per non-emergency (emergency) visit: (1) 0-600 (0-1,200) NTD ; (2) 601-1,200 (1,201-2,400) NTD; (3) 1,201-1,800 (2,401-3,600) NTD; (4) above 1,801 (3,601) NTD. The dotted line in Figures 6a and 6b displays the coefficients on *Age*3 in equation (2) across the distribution of medical expenses (four categories).

Figure 7: Age Profile of Utilization of Inpatient Care

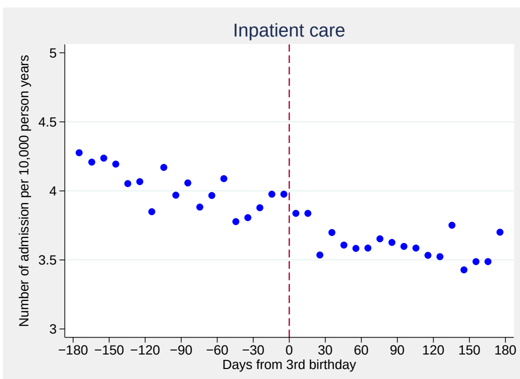
(a) Medical expenses per 10,000 person-years: 2005–2008



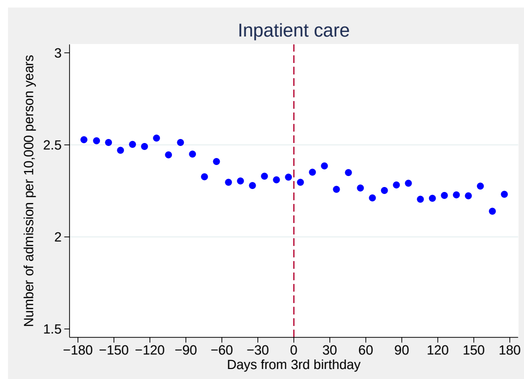
(b) Medical expenses per 10,000 person-years: 1997–2001



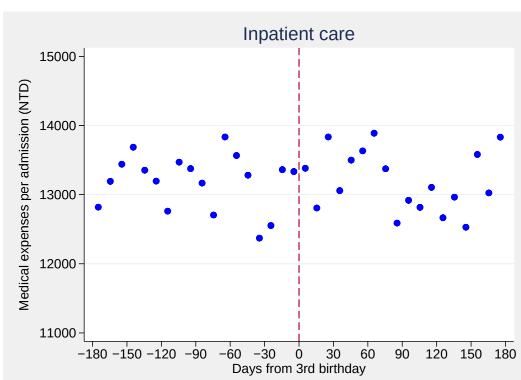
(c) Number of admissions per 10,000 person-years: 2005–2008



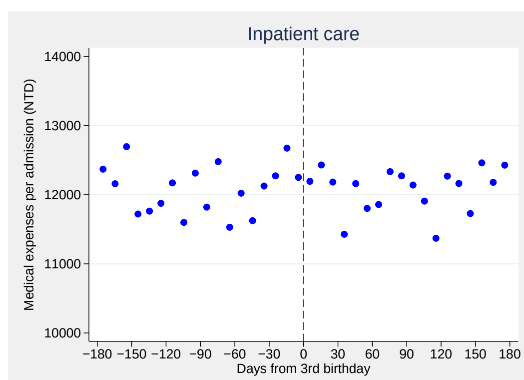
(d) Number of admissions per 10,000 person-years: 1997–2001



(e) Medical expenses per admission: 2005–2008



(f) Medical expenses per admission: 1997–2001



Notes: The line is from fitting a linear regression on age variables fully interacted with $Age3_i$, a dummy indicating after the third birthday (90 days bandwidth). The dependent variables are inpatient expense per 10,000 person years, inpatient admissions per 10,000 person years, and inpatient expense per visit by patient's age at visit (measured in days, 180 days before and after the third birthday). Each dot represents the 10-day average of the dependent variable.

Tables

Table 1: Patient Cost-Sharing in Taiwan NHI

	Patient Cost-Sharing			
	Major Teaching Hospital	Minor Teaching Hospital	Community Hospital	Clinic
Panel A: Outpatient care – non-emergency				
Copayment	360	240	80	50
Registration Fee	200	150	100	50
Panel B: Outpatient care – emergency				
Copayment	450	300	150	150
Registration Fee	300	250	200	150
Panel C: Inpatient care				
1-30 days		10%		
31-60 days		20%		
after 61 days		30%		

1 USD is 32.5 NTD in 2006. For outpatient care, patient cost-sharing is through copyment. A patient pays copayment plus registration fee for each visit. Information about copayment is from National Health Insurance Research Database codebook (2012). NHI implemented this fee schedule since July 2005. Since our sample period is from January 1st 2005 to December 31st 2008, most of outpatient visits in our sample, except visits on January 1st 2005 to June 30th 2005, are based on the above fee schedule. Before July 1st 2005, copayment for non-emergency (emergency) care is according to the following fee scheme: 210 (420) NTD for major teaching hospital, 140 (300) NTD for minor teaching hospital, 50 (200) NTD for community hospital, and 50 (150) NTD for clinic. Information about registration fee is from an online database of NHI registration fee survey: http://www.nhi.gov.tw/amountinfoweb/Search.aspx?Q5C1_ID=2&Q5C2_ID=900002&Hosp_ID=1131100010&rtype=2 For inpatient care, patient cost-sharing takes place through coinsurance. Depending on the days of stay and the type of admission (acute or chronic admission), a patient is required to pay 10% to 30% of the total medical expense per admission. The above fee schedule is only for acute admission since we eliminate all chronic admissions, which only accounts for 0.3% of inpatient admissions.

Table 2: Selected Characteristics at Age Three before and after Sample Selection

Variables	(1) Original Sample	(2) Continuous enrollment at age two and three	(3) Eliminating cost-sharing waiver
Children			
Male	0.52	0.52	0.52
Birth year:2003	0.51	0.51	0.51
Birth year:2004	0.49	0.49	0.49
1st birth	0.53	0.53	0.53
2nd birth	0.36	0.36	0.36
3rd birth	0.11	0.11	0.11
Number of siblings	1.88	1.88	1.87
	(0.00)	(0.00)	(0.00)
Insurers			
Public employee	0.09	0.09	0.09
Private employee	0.55	0.56	0.56
Self-employed	0.23	0.23	0.23
Male	0.55	0.55	0.55
Age	34.27	34.27	34.29
	(0.01)	(0.01)	(0.01)
Income	46395.68	46412.85	46585.66
	(45.40)	(45.51)	(46.49)
Number of children	435,752	432,295	417,566

Note: Column (1) presents the selected characteristics for original sample: all NHI enrollees born in 2003 and 2004. Column (2) restricts the sample to enrollees who continuously register in NHI at age 2 and 3.Column (3) eliminates observations with cosh-sharing waiver, such as children with catastrophic illness (e.g. cancer) and children from very low income families since these children do not experience any price change when turning three.

Table 3: Selected Chacteristics of Visits Before and After Third Birthday

	Non-emergency care		Emergency care		Inpatient care	
	Before 3rd birthday	After 3rd birthday	Before 3rd birthday	After 3rd birthday	Before 3rd birthday	After 3rd birthday
Utilization						
Visit rate	537.31	518.30	16.16	15.00	3.92	3.67
Avg. medical expenses	442.39	434.06	1679.74	1677.50	12931.15	13018.56
	(0.43)	(0.42)	(4.82)	(4.87)	(137.25)	(143.92)
Avg. OOP price	63.70	124.24	261.94	573.00	0	1288.66
	(0.03)	(0.06)	(0.16)	(0.61)	(0)	(12.33)
Share of OOP price	0.16	0.32	0.20	0.42	0	0.10
Choice of providers						
Major teaching hospital	0.04	0.02	0.35	0.34	0.28	0.30
Minor teaching hospital	0.06	0.04	0.52	0.47	0.59	0.59
Community hospital	0.04	0.05	0.12	0.18	0.13	0.12
Clinic	0.87	0.90	0.01	0.01	0.00	0.00
Treatment reasons						
Respiratory diseases	0.73	0.74	0.36	0.36	0.44	0.47
Digestive diseases	0.06	0.05	0.12	0.13	0.16	0.16
Skin diseases	0.04	0.03	0.02	0.02	0.02	0.02
Injury and poisoning	0.02	0.02	0.19	0.19	0.03	0.03
Mental disorders	0.01	0.01	0.00	0.00	0.01	0.01
Number of children	364,819	358,866	48,311	46,275	13,412	12,668
Number of children-visit	2,019,262	1,947,831	60,745	56,361	14,737	13,787

Note: Data are from 2005–2008 NHIRD. The above descriptive statistics are based on healthcare utilization happened within 90 days before the third birthday and 90 days after the third birthday. Average medical expenses and average out-of-pocket price are reported in New Taiwan Dollar (NTD). 1 USD is 32.5 NTD in 2006.

Table 4: Selected Chacteristics of TNHIS Sample Before and After Age 3

Variables	(1) Before age 3	(2) After age 3
Good health	0.81	0.80
Premature birth	0.11	0.08
Father's edu years	12.83	12.59
	(0.12)	(0.12)
Mother's edu years	12.59	12.31
	(0.12)	(0.12)
Age	2.51	3.49
	(0.01)	(0.01)
Number of children	511	530

Note: Data are from 2005 and 2009 TNHIS. We restrict our sample to those who are age 2 and age 3.

Table 5: Selected Chacteristics of NHIRD Sample Born Before and After March 1999

Variables	(1) Born before March 1999	(2) Born after March 1999
Children		
Inpatient rate	0.08	0.08
Male	0.52	0.52
1st born	0.47	0.45
2nd born	0.35	0.38
3rd born (above)	0.19	0.17
Insurer		
Public employee	0.07	0.07
Private employee	0.48	0.49
Self-employed	0.30	0.30
Male	0.51	0.50
Age	39.04	39.21
	(0.02)	(0.01)
Income	47235.18	47639.82
	(60.90)	(57.64)
Number of children	225,715	245,357

Note: Data are from 2006–2010 NHIRD when targeted cohort are age 8 to 10.

Table 6: The Effect of Cost-sharing Subsidy on Utilization of Outpatient Care at Age 3

Variables	(1) visit rate	(2) out-of-pocket price	(3) log(expense)	(4) log(# of visits)	(5) log(expense/visit)
Panel A: Non-emergency care					
Sample: 2005-2008					
Age3		-58.44***	7.64***	4.93***	2.71***
		(3.69)	(0.57)	(0.40)	(0.30)
	518.30				
Sample: 1997-2001					
Age3		-4.10	-0.04	-0.14	0.10
		(2.86)	(0.25)	(0.18)	(0.13)
	556.62				
Panel B: Emergency care					
Sample: 2005-2008					
Age3		-298.45***	5.63***	6.59***	-0.96
		(15.48)	(1.58)	(1.20)	(0.77)
	15.00				
Sample: 1997-2001					
Age3		-0.08	-1.34	-0.83	-0.51
		(1.07)	(1.26)	(1.14)	(0.83)
	11.45				

Note: We collapse the individual-level data into age cells and measure age in days. The results in the first and third row are based on the children born in 2003 to 2004 (use 2005-2008 NHIRD data to get their healthcare utilization around age 3).The results in the second and fourth row are based on the children born in 1995 to 1997 (use 1997-2001 NHIRD data to get their healthcare utilization around age 3).Column (1) displays visit rate – number of visit per 10,000 person years – at each age in days (take an average over 90 dyas before of the third birthday and 90 days after it). Column (2)-(5) present the RD estimate of the average treatment effect of cost-sharing subsidy on the outcome (estimated coefficient on $Age3$ in equation (2)). The dependent variables in all the regressions above are average out-of-pocket price (NTD), the log of total medical expenses, the log of visits, and the log of expenses per visit, at each age in days. For column (3) - (5), the estimated coefficients are multiplied by 100 to show the percentage change in the outcome. Robust standard errors are in parentheses. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

Table 7: The Effect of Cost-sharing Subsidy on Utilization of Outpatient Care at Age 3: By providers

Variables	(1) visit rate	(2) out-of-pocket price	(3) log(expense)	(4) log(# of visits)	(5) log(expense/visit)
Panel A: Non-emergency care					
Major teaching hospitals					
Age3		-340.93***	40.48***	58.98***	-18.49***
		(19.04)	(2.57)	(2.23)	(1.96)
	11.85				
Minor teaching hospitals					
Age3		-231.20***	38.32***	44.14***	-5.82***
		(13.18)	(2.58)	(2.10)	(1.72)
	18.79				
Community hospitals					
Age3		-82.34***	-16.63***	-17.13***	0.50
		(4.28)	(2.27)	(1.68)	(1.60)
	23.65				
Clinics					
Age3		-46.65***	2.12***	1.86***	0.26**
		(3.00)	(0.37)	(0.35)	(0.11)
	464.02				
Panel B: Emergency care					
Major teaching hospitals					
Age3		-421.19***	9.37***	10.85***	-1.48
		(20.63)	(2.61)	(2.26)	(1.41)
	5.09				
Minor teaching hospitals					
Age3		-280.42***	11.77***	13.85***	-2.08*
		(15.29)	(1.73)	(1.40)	(1.13)
	7.11				
Community hospitals					
Age3		-137.75***	-26.35***	-29.86***	3.51
		(7.31)	(4.97)	(3.97)	(2.63)
	2.68				

Note: We collapse the individual-level data into age cells and measure age in days. The above results are based on the children born in 2003 to 2004 (use 2005-2008 NHIRD data to get their healthcare utilization around age 3). We estiamte the equation (2) separately for each type of providers. Column (1) displays visit rate – number of visit per 10,000 person years – at each age in days (take an average over 90 dyas before of the third birthday and 90 days after it). Column (2)-(5) present the RD estimate of the average treatment effect of cost-sharing subsidy on the outcome (estimated coefficient on $Age3$ in equation (2)). The dependent variables in all the regressions above are average out-of-pocket price (NTD), the log of total medical expenses, the log of visits, and the log of expenses per visit, at each age in days. For column (3) - (5), the estimated coefficients are multiplied by 100 to show the percentage change in the outcome. Robust standard errors are in parentheses. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

Table 8: The Effect of Cost-Sharing Subsidy on Utilization of Non-emergency Care at Age 3 by treatment reasons, birth order, gender, and inocme

Variables	(1) visit rate	(2) out-of-pocket price	(3) log(expense)	(4) log(# of visits)	(5) log(expense/visit)
Panel A: By treatment reason					
Respiratory diseases		-56.15***	5.40***	3.60***	1.80***
		(3.58)	(0.45)	(0.39)	(0.15)
	383.60				
Digestive illness		-59.10***	11.16***	6.54***	4.62
		(3.81)	(3.41)	(1.11)	(2.99)
	28.22				
Injury and poisoning		-83.04***	9.06***	11.45***	-2.39
		(5.04)	(2.28)	(1.59)	(1.64)
	8.77				
Skin illness		-58.13***	15.83***	12.81***	3.02***
		(3.75)	(1.74)	(1.43)	(1.11)
	16.77				
Mental illness		-156.66***	23.35***	25.35***	-2.00
		(8.54)	(3.31)	(2.96)	(1.58)
	3.56				
Preventive care		-73.12***	28.11***	33.48***	-5.37
		(6.68)	(6.36)	(3.79)	(4.85)
	3.56				
Panel B: By birth order					
1st child		-60.23***	6.64***	4.67***	1.97***
		(3.80)	(0.57)	(0.38)	(0.42)
	522.14				
2nd child		-56.69***	8.58***	5.12***	3.46***
		(3.61)	(0.83)	(0.54)	(0.48)
	536.18				
3rd child (above)		-55.31***	9.55***	5.61***	3.94***
		(3.49)	(1.36)	(0.74)	(1.13)
	440.03				
Panel C: By gender					
Male		-59.27***	8.43***	5.04***	3.39***
		(3.71)	(0.74)	(0.46)	(0.47)
	544.12				
Female		-57.42***	6.62***	4.79***	1.83***
		(3.68)	(0.65)	(0.42)	(0.39)
	489.85				
Panel D: By income					
low-income		-56.70***	7.66***	4.75***	2.91***
		(3.61)	(0.86)	(0.63)	(0.66)
	520.38				
middle-income		-57.94***	7.55***	4.06***	3.49***
		(3.77)	(0.77)	(0.51)	(0.54)
	522.58				
high-income		-61.49***	7.46***	4.61***	2.85***
		(3.77)	(0.91)	(0.49)	(0.73)
	512.64				

Note: We collapse the individual-level data into age cells and measure age in days. The above results are based on the children born in 2003 to 2004 (use 2005-2008 NHIRD data to get their healthcare utilization around age 3). We estiamte the equation (2) separately for each subgroup. Column (1) displays visit rate – number of visit per 10,000 person years – at each age in days (take an average over 90 dyas before of the third birthday and 90 days after it). Column (2)-(5) present the RD estimate of the average treatment effect of cost-sharing subsidy on the outcome (estimated coefficient on *Age*3 in equation (2)). The dependent variables in all the regressions above are average out-of-pocket price (NTD), the log of total medical expenses, the log of visits, and the log of expenses per visit, at each age in days. For column (3) - (5), the estimated coefficients are multiplied by 100 to show the percentage change in the outcome. Robust standard errors are in parentheses. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

Table 9: The Effect of Cost-Sharing Subsidy on Utilization of Emergency Care at Age 3 by treatment reasons, birth order, gender, and inocme

Variables	(1) visit rate	(2) out-of-pocket price	(3) log(expense)	(4) log(# of visits)	(5) log(expense/visit)
Panel A: By treatment reason					
Respiratory diseases		-309.55***	3.24	4.69**	-1.45
		(15.93)	(2.39)	(2.23)	(0.91)
	5.39				
Digestive illness		-312.34***	6.90*	7.52**	-0.61
		(16.61)	(3.69)	(3.30)	(2.09)
	1.88				
Injury and poisoning		-264.19***	6.67*	7.46***	-0.79
		(14.89)	(3.45)	(2.34)	(2.23)
	2.86				
Panel B: By birth order					
1st child		-303.35***	3.36*	5.98***	-2.63***
		(15.68)	(1.89)	(1.69)	(1.01)
	17.68				
2nd child		-293.47***	8.51***	6.78***	1.73
		(15.26)	(2.98)	(2.29)	(1.69)
	12.48				
3rd child (above)		-278.29***	11.16**	10.87**	0.29
		(16.56)	(5.53)	(4.82)	(3.13)
	10.25				
Panel C: By gender					
Male		-300.51***	2.67	5.55***	-2.89***
		(15.62)	(2.19)	(1.62)	(0.92)
	16.39				
Female		-295.67***	9.75***	7.98***	1.77
		(15.39)	(2.31)	(1.61)	(1.36)
	13.46				
Panel D: By income					
low-income		-300.51***	12.00**	14.90***	-2.90*
		(15.85)	(4.66)	(3.90)	(1.68)
	15.35				
middle-income		-299.81***	1.74	3.26	-1.52
		(15.82)	(2.66)	(2.55)	(1.22)
	14.35				
high-income		-313.89***	3.67	2.46	1.22
		(15.01)	(3.84)	(3.28)	(1.83)
	14.36				

Note: We collapse the individual-level data into age cells and measure age in days. The above results are based on the children born in 2003 to 2004 (use 2005-2008 NHIRD data to get their healthcare utilization around age 3). We estiamte the equation (2) separately for each subgroup. Column (1) displays visit rate – number of visit per 10,000 person years – at each age in days (take an average over 90 dyas before of the third birthday and 90 days after it). Column (2)-(5) present the RD estimate of the average treatment effect of cost-sharing subsidy on the outcome (estimated coefficient on $Age3$ in equation (2)). The dependent variables in all the regressions above are average out-of-pocket price (NTD), the log of total medical expenses, the log of visits, and the log of expenses per visit, at each age in days. For column (3) - (5), the estimated coefficients are multiplied by 100 to show the percentage change in the outcome. Robust standard errors are in parentheses. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

Table 10: The Effect of Cost-Sharing Subsidy on Utilization of Inpatient Care at Age 3

Variables	(1) admission rate	(2) out-of-pocket price	(3) log(expense)	(4) log(# of admissions)	(5) log(expense/admission)
Sample: 2005-2008					
Age3(X100)		-1287.71***	0.72	1.08	-0.36
		(41.52)	(4.75)	(2.82)	(3.54)
	3.67				
Sample: 1997-2001					
Age3(X100)		-6.67	-0.93	-1.18	0.25
		(32.94)	(3.11)	(2.08)	(2.85)
	2.30				

Note: We collapse the individual-level data into age cells and measure age in days. The results in the first and third row are based on the children born in 2003 to 2004 (use 2005-2008 NHIRD data to get their healthcare utilization around age 3).The results in the second and fourth row are based on the children born in 1995 to 1997 (use 1997-2001 NHIRD data to get their healthcare utilization around age 3).Column (1) displays admission rate – number of admission per 10,000 person years – at each age in days (take an average over 90 dyas before of the third birthday and 90 days after it). Column (2)-(5) present the RD estimate of the average treatment effect of cost-sharing subsidy on the outcome (estimated coefficient on $Age3$ in equation (2)). The dependent variables in all the regressions above are average out-of-pocket price (NTD), the log of total medical expenses, the log of admissions, and the log of expenses per admission, at each age in days. For column (3) - (5), the estimated coefficients are multiplied by 100 to show the percentage change in the outcome. Robust standard errors are in parentheses. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

Table 11: The Effect of Cost-Sharing Subsidy on Reported Health Status at Age 3

	(1) Good health	(2) Good health	(3) Good health	(4) Good health	(5) Good health
Age3	-0.0145	-0.0008	-0.0023	-0.0018	0.0208
	(0.0372)	(0.0564)	(0.0553)	(0.0610)	(0.0595)
Linear spline	√	√	√	√	√
Quadratic spline		√	√	√	√
Premature birth			√	√	√
Parent's edu				√	√
Living county					√
sample size	1,041	1,041	1,041	1,041	1,041
R^2	0.003	0.004	0.007	0.022	0.046

Note: The dependent variable in all the regressions above is the reported health status. The parameter estimates (coefficient on $Age3$ in the equation (3)) in the table above are percentage point change in share of reported good health for the children immediately before age3. Standard errors are reported in parentheses and clusted at children's age. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

Table 12: The Effect of Cost-Sharing Subsidy on Inpatient Rate at Age 8 to 10

	(1) Inpatient rate	(2) Inpatient rate	(3) Inpatient rate	(4) Inpatient rate	(5) Inpatient rate
After1999	0.0023	0.0065	0.0064	0.0074	0.0062
	(0.0043)	(0.0050)	(0.0050)	(0.0051)	(0.0049)
Distance1999	-0.0069	-0.0586	-0.0578	-0.0525	-0.0507
	(0.0046)	(0.0541)	(0.0543)	(0.0542)	(0.0535)
After1999*Distance1999	0.0050	0.0043	0.0041	0.0041	0.0042
	(0.0084)	(0.0060)	(0.0061)	(0.0061)	(0.0061)
Birth month/year		√	√	√	√
Gender			√	√	√
Living county				√	√
Insurer's chacteristics					√
sample size	471,072	471,072	471,072	471,072	470,072
R^2	0.000	0.000	0.001	0.006	0.008

Note: The dependent variable in all the regressions above is the inpatient rate at age 8 to 10. Insurer's chacteristics includes insurer's gender, income, age and working sectors. Standard errors are reported in parentheses and clusted at birth cohort. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

Online Appendix

Tables

Table A1: Selected Chacteristics of Non-emergency Visits: By providers

Providers	Major Teaching Hospital	Minor Teaching Hospital	Community Hospital	Clinic
Composition of Medical Expenses				
Visit rate	16.89	24.30	22.09	464.45
Avg. medical expense	1176.14	838.39	618.86	381.90
	(6.43)	(3.29)	(2.21)	(0.10)
Avg. OOP price	540.08	351.90	162.90	90.70
	(0.51)	(0.29)	(0.12)	(0.01)
Share of OOP price	0.45	0.42	0.26	0.23
Avg. drug fee	192.24	132.10	84.68	50.23
Avg. treatment/examination fee	540.04	307.85	182.87	16.58
Avg. diagnosis fee	200.42	202.54	209.73	250.50
Avg. dispensing fee	43.44	45.90	41.58	14.59
Avg. drug days	6.92	5.18	3.86	3.10
Treatment reasons				
Respiratory diseases	0.48	0.59	0.63	0.76
Digestive diseases	0.07	0.06	0.05	0.06
Skin diseases	0.04	0.03	0.03	0.04
Injury and poisoning	0.04	0.06	0.11	0.01
Mental disorders	0.06	0.05	0.03	0.00
Number of children-visit	127,688	183,691	166,933	3,510,252

Note: Data are from 2005–2008 NHIRD. The above descriptive statistics are based on healthcare utilization happened within 90 days before the third birthday and 90 days after the third birthday. Average medical expenses and average out-of-pocket price are reported in New Taiwan Dollar (NTD). 1 USD is 32.5 NTD in 2006.

Table A2: Selected Chacteristics of Emergency Visits: By providers

Providers	Major Teaching Hospital	Minor Teaching Hospital	Community Hospital	Clinic
Composition of Medical Expenses				
Visit rate	5.39	7.74	2.31	0.14
Avg. medical expense	1865.89	1575.69	1607.65	1317.62
	(6.59)	(4.42)	(8.06)	(29.64)
Avg. OOP price	743.38	540.70	350.16	215.02
	(1.10)	(0.61)	(0.55)	(2.30)
Share of OOP price	0.39	0.34	0.21	0.16
Avg. drug fee	121.33	85.25	54.74	15.99
Avg. treatment/examination fee	741.65	545.98	682.01	587.93
Avg. diagnosis fee	650.35	642.95	626.17	549.10
Avg. dispensing fee	52.56	51.51	44.74	14.60
Avg. drug day	3.53	2.70	2.24	2.49
Treatment reasons				
Respiratory diseases	0.40	0.36	0.27	0.36
Digestive diseases	0.14	0.13	0.08	0.05
Skin diseases	0.02	0.02	0.02	0.02
Injury and poisoning	0.14	0.17	0.39	0.37
Mental disorders	0.00	0.00	0.00	0.00
Number of children-visit	40,772	58,489	17,431	1,024

Note: Data are from 2005–2008 NHIRD. The above descriptive statistics are based on healthcare utilization happened within 90 days before the third birthday and 90 days after the third birthday. Average medical expenses and average out-of-pocket price are reported in New Taiwan Dollar (NTD). 1 USD is 32.5 NTD in 2006.

Table A3: Sensitivity to Bandwidth and Polynomial Selection in RD Regressions: Non-emergency Care

	log(expenses)					
Bandwidth(days)	60	120	180	240	300	360
Polynominal						
1	7.62***	6.93***	6.25***	5.83***	5.32***	5.39***
	(0.61)	(0.40)	(0.32)	(0.27)	(0.25)	(0.22)
2	8.30***	7.96***	7.44***	6.99***	6.76***	6.06***
	(0.93)	(0.64)	(0.50)	(0.44)	(0.38)	(0.35)
3	8.30***	8.19***	8.24***	7.92***	7.69***	7.65***
	(0.93)	(0.87)	(0.69)	(0.58)	(0.52)	(0.48)
	log(# of visits)					
Bandwidth(days)	60	120	180	240	300	360
Polynominal						
1	4.90***	4.15***	3.56***	3.04***	2.50***	2.63***
	(0.42)	(0.27)	(0.22)	(0.19)	(0.18)	(0.16)
2	5.20***	5.39***	4.66***	4.36***	4.08***	3.26***
	(0.69)	(0.44)	(0.34)	(0.29)	(0.26)	(0.25)
3	5.20***	5.15***	5.57***	5.10***	5.00***	5.07***
	(0.69)	(0.63)	(0.49)	(0.40)	(0.35)	(0.33)
	log(expense/visit)					
Bandwidth(days)	60	120	180	240	300	360
Polynominal						
1	2.72***	2.78***	2.69***	2.79***	2.82***	2.76***
	(0.34)	(0.23)	(0.19)	(0.16)	(0.14)	(0.13)
2	3.10***	2.57***	2.77***	2.63***	2.68***	2.81***
	(0.48)	(0.35)	(0.29)	(0.25)	(0.22)	(0.20)
3	3.10***	3.04***	2.67***	2.82***	2.69***	2.58***
	(0.48)	(0.46)	(0.38)	(0.33)	(0.30)	(0.27)

Note: We collapse the individual-level data into age cells and measure age in days. The results are based on the children born in 2003 to 2004 (use 2005-2008 NHIRD data to get their healthcare utilization around age 3). The above table presents the RD estimate of the average treatment effect of cost-sharing subsidy on the outcome (estimated coefficient on *Age*3 in equation (2)). The dependent variables are the log of total medical expenses, the log of visits, and the log of expenses per visit, at each age in days. The estimated coefficients are multiplied by 100 to show the percentage change in the outcome. Robust standard errors are in parentheses. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

Table A4: Sensitivity to Bandwidth and Polynomial Selection in RD Regressions: Emergency Care

	log(total medical expense)					
Bandwidth(days)	60	120	180	240	300	360
Polynominal						
1	5.24***	5.78***	4.91***	3.94***	3.28***	2.53***
	(1.77)	(1.26)	(1.05)	(0.90)	(0.81)	(0.75)
2	7.01***	6.16***	6.28***	6.11***	5.71***	5.30***
	(2.59)	(1.85)	(1.54)	(1.34)	(1.19)	(1.10)
3	7.01***	4.96**	6.22***	6.44***	6.32***	6.42***
	(2.59)	(2.48)	(2.02)	(1.74)	(1.57)	(1.45)
	log(# of visit)					
Bandwidth(days)	60	120	180	240	300	360
Polynominal						
1	6.77***	6.53***	5.61***	4.63***	4.05***	3.31***
	(1.33)	(0.97)	(0.83)	(0.72)	(0.65)	(0.60)
2	7.89***	6.83***	6.97***	6.98***	6.45***	6.05***
	(1.88)	(1.43)	(1.18)	(1.04)	(0.94)	(0.87)
3	7.89***	6.86***	7.21***	6.95***	7.09***	7.14***
	(1.88)	(1.80)	(1.53)	(1.33)	(1.21)	(1.13)
	log(expense/visit)					
Bandwidth(days)	60	120	180	240	300	360
Polynominal						
1	-1.53*	-0.75	-0.70	-0.70	-0.77*	-0.78*
	(0.88)	(0.63)	(0.53)	(0.48)	(0.44)	(0.40)
2	-0.87	-0.66	-0.69	-0.87	-0.74	-0.76
	(1.33)	(0.93)	(0.76)	(0.67)	(0.61)	(0.57)
3	-0.87	-1.89	-0.99	-0.51	-0.77	-0.72
	(1.33)	(1.27)	(1.01)	(0.88)	(0.79)	(0.73)

Note: We collapse the individual-level data into age cells and measure age in days. The results are based on the children born in 2003 to 2004 (use 2005-2008 NHIRD data to get their healthcare utilization around age 3). The above table presents the RD estimate of the average treatment effect of cost-sharing subsidy on the outcome (estimated coefficient on *Age*3 in equation (2)). The dependent variables are the log of total medical expenses, the log of visits, and the log of expenses per visit, at each age in days. The estimated coefficients are multiplied by 100 to show the percentage change in the outcome. Robust standard errors are in parentheses. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

Table A5: Sensitivity to Bandwidth and Polynomial Selection in RD Regressions: Inpatient Care

	log(expenses)					
Bandwidth(days)	60	120	180	240	300	360
Polynominal						
1	-0.46	0.24	1.00	2.00	1.07	1.79
	(5.39)	(3.67)	(3.04)	(2.58)	(2.27)	(2.04)
2	6.91	-0.94	-2.13	-0.27	1.60	0.99
	(7.51)	(5.62)	(4.48)	(3.88)	(3.46)	(3.16)
3	2.09	6.42	3.51	-2.03	-1.72	-0.21
	(9.68)	(7.09)	(6.04)	(5.15)	(4.57)	(4.15)

	log(# of admissions)					
Bandwidth(days)	60	120	180	240	300	360
Polynominal						
1	0.37	2.69	2.56	2.96*	1.52	1.41
	(3.15)	(2.36)	(1.93)	(1.68)	(1.48)	(1.33)
2	0.63	0.42	1.92	2.29	3.85*	3.17
	(4.75)	(3.31)	(2.78)	(2.44)	(2.23)	(2.06)
3	-7.21	-0.27	1.02	1.05	1.20	2.65
	(6.39)	(4.35)	(3.58)	(3.12)	(2.83)	(2.62)

	log(expense/admission)					
Bandwidth(days)	60	120	180	240	300	360
Polynominal						
1	-0.83	-2.45	-1.55	-0.96	-0.46	0.38
	(4.00)	(2.62)	(2.16)	(1.81)	(1.62)	(1.47)
2	6.28	-1.36	-4.05	-2.56	-2.25	-2.18
	(5.50)	(4.22)	(3.31)	(2.81)	(2.49)	(2.25)
3	9.30	6.69	2.48	-3.08	-2.92	-2.86
	(6.78)	(5.28)	(4.50)	(3.88)	(3.40)	(3.06)

Note: We collapse the individual-level data into age cells and measure age in days. The results are based on the children born in 2003 to 2004 (use 2005-2008 NHIRD data to get their healthcare utilization around age 3). The above table presents the RD estimate of the average treatment effect of cost-sharing subsidy on the outcome (estimated coefficient on *Age*3 in equation (2)). The dependent variables are the log of total medical expenses, the log of admission, and the log of expenses per admission, at each age in days. The estimated coefficients are multiplied by 100 to show the percentage change in the outcome. Robust standard errors are in parentheses. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

Table A6: Donut RD for Utilization of Non-emergency Care

	log(expense)							
Size of Donut around 3rd birthday	0	3	6	9	12	15	18	21
Age3	7.64***	7.31***	7.38***	7.15***	6.78***	6.96***	7.18***	7.02***
	(0.57)	(0.47)	(0.51)	(0.54)	(0.55)	(0.58)	(0.66)	(0.79)
	log(# of visits)							
Size of Donut around 3rd birthday	0	3	6	9	12	15	18	21
Age3	4.93***	4.58***	4.59***	4.63***	4.59***	4.75***	4.86***	5.02***
	(0.40)	(0.27)	(0.26)	(0.28)	(0.29)	(0.35)	(0.42)	(0.45)

Note: We collapse the individual-level data into age cells and measure age in days. The results are based on the children born in 2003 to 2004 (use 2005-2008 NHIRD data to get their healthcare utilization around age 3). we conduct a "donut" RD (Barreca et al., 2011; Shigeoka, 2014) by systematically excluding outpatient expenditure and visits within 3–21 days before and after the 3rd birthday. The above table presents the RD estimate of the average treatment effect of cost-sharing subsidy on the outcome (estimated coefficient on *Age*3 in equation (2)). The dependent variables are the log of total medical expenses and the log of visits at each age in days. The estimated coefficients are multiplied by 100 to show the percentage change in the outcome. Robust standard errors are in parentheses. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.

Table A7: Donut RD for Utilization of Emergency Care

	log(expense)							
Size of Donut around 3rd birthday	0	3	6	9	12	15	18	21
Age3	5.63***	4.76***	4.74***	4.48**	4.27*	4.12	6.36**	7.11**
	(1.58)	(1.70)	(1.74)	(1.99)	(2.28)	(2.73)	(2.85)	(3.14)
	log(# of visits)							
Size of Donut around 3rd birthday	0	3	6	9	12	15	18	21
Age3	6.59***	5.92***	5.93***	5.50***	5.37***	5.16**	6.65***	6.60***
	(1.20)	(1.32)	(1.43)	(1.57)	(1.78)	(2.19)	(2.27)	(2.50)

Note: We collapse the individual-level data into age cells and measure age in days. The results are based on the children born in 2003 to 2004 (use 2005-2008 NHIRD data to get their healthcare utilization around age 3). we conduct a "donut" RD (Barreca et al., 2011; Shigeoka, 2014) by systematically excluding outpatient expenditure and visits within 3–21 days before and after the 3rd birthday. The above table presents the RD estimate of the average treatment effect of cost-sharing subsidy on the outcome (estimated coefficient on *Age*3 in equation (2)). The dependent variables are the log of total medical expenses and the log of visits at each age in days. The estimated coefficients are multiplied by 100 to show the percentage change in the outcome. Robust standard errors are in parentheses. *** significant at the 1 percent level, ** significant at the 5 percent level, and * significant at the 10 percent level.