



# Impact of medical subsidy disqualification on children's healthcare utilization: A difference-in-differences analysis from Japan



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## ABSTRACT

Financial support for children's medical expenses has been introduced in many countries. Limited work has been done on price elasticity in children's healthcare demand, especially in countries other than the United States. Moreover, it remains unclear how the effects of a change in the cost sharing rate on healthcare demand would differ by medical condition. We investigated the impact of an increase in the cost sharing rate on medical service utilization among school children as a whole and for each of nine common conditions, applying a difference-in-differences approach. The study period ranged from April 1, 2012, to March 30, 2014. Participants were elementary school children in an urban area who were eligible for National Health Insurance (a community-based public insurance) during the study period and who were enrolled in the 2nd, 3rd, or 4th grade in April 2013. We collected observations from 2896 persons and 69,504 (2896 × 24 months) person-months. When elementary school children were promoted to the 4th grade, they became disqualified for a municipal medical subsidy. The control group was the children promoted to the 2nd or the 3rd grade, who remained eligible for the subsidy. All data were obtained from health insurance claims. We identified the nine most common medical conditions among the subject children, and stratified the analyses by the condition diagnosed. We found that an increase in the cost sharing rate reduced outpatient service utilization as a whole. Also, we observed an increase in inpatient service utilization, not because of worsened health conditions, but rather due to substitution of inpatient service for outpatient service. The reductions in outpatient service were heterogeneous across medical conditions; declines were sharper for mild or chronic conditions. These findings may help to characterize how a change in cost sharing rate affects health outcomes in children.

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## 1. Introduction

Health status in childhood is important for learning, prospective health, and future human resources (Case et al., 2005; Condliffe and Link, 2008; Currie and Stabile, 2003; Glass et al., 2010). Multiple countries have introduced policies to reduce medical expenditures for children and households with children, including Egypt, Japan, the Philippines, the United States, and Vietnam (Bessho, 2012; Palmer et al., 2015; Quimbo et al., 2011; Racine, 2014; Yip and Berman, 2001). However, budgetary constraints preclude inexhaustible financial support. Additionally, excessive financial support may lead to a “moral hazard” (Arrow, 1963). To set an

appropriate rate of cost sharing, we need to quantify the effects of a change in cost sharing rate on medical demand and health outcomes.

Most studies on the effects of sharing rate on medical demand focus on adult healthcare demand (Card et al., 2008; Chandra et al., 2010; Finkelstein et al., 2012; Manning et al., 1987) rather than on children's healthcare. So far, few studies have investigated the effects of a change in cost sharing rate on children's medical demand experimentally or quasi-experimentally. The Rand Health Insurance Experiment (HIE) found an increase in outpatient service usage per year both in acute episodes and chronic episodes among children aged less than 14 as the cost sharing rate declined (Leibowitz et al., 1985). Empirical study is often not feasible because of budgetary constraints and ethical issues. When the state of New York introduced its Child Health Plus insurance plan, the effects were measured using the difference-in-differences (DID) approach (Holl et al., 2000; Zwanziger et al., 2000). More recently, Miller

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(2012) reported the impact of the Massachusetts health care reform program on health care usage among children. De La Mata (2012) reported the effects of eligibility change near income threshold for Medicaid on children's healthcare utilization using a regression discontinuity design. Although these quasi-experimental studies demonstrated an increase in outpatient service usage as a whole along with insurance enrollment, all of these studies focused only on observations in the United States. Few studies have investigated the effect of a change in the cost sharing rate in other countries (Skinner and Mayer, 2007). In Japan, in addition to public health insurance, a medical subsidy for children (MSC) is offered by municipalities, which reimburse out-of-pocket expenses that public insurance does not cover for children younger than a designated age. Although some studies investigated the effects of the subsidy, they were limited to cross-sectional designs or using self-reported data on service utilization (Bessho, 2012; Higashi et al., 2016; Takaku, 2016).

Moreover, prior studies have scarcely reported whether the effects of a change in sharing rate differed by medical issues. In the present study, we also investigated the effects of a change in sharing rate stratified by conditions. This attempt may clarify the pathway through which a change in outpatient service utilization induced by a change in the rate of cost sharing affects children's health outcomes. For example, refraining from utilizing outpatient services when children have a possibly serious disease may lead to aggravation of the condition, while an increase in outpatient service usage for mild cases may not lead to children's health improvement.

The aims of this study, therefore, were to investigate the effects of a change in the rate of cost sharing on outpatient service utilization as a whole and by each of nine common medical conditions among elementary school-age children in a Japanese urban setting.

## 2. Methods

### 2.1. Background

In Japan, all citizens are covered by public health insurance and have unrestricted access to medical providers (Kobayashi, 2009). Public health insurance underwriters reimburse patients for a portion of the cost of outpatient services, inpatient services, drug prescriptions, and dental services without any deductible. The co-insurance rate is fixed by beneficiaries' age. Between elementary school and the age of 69, the co-insurance rate was 30% across all official insurance underwriters, with a catastrophic coverage provision (i.e., no co-payments once the monthly expenditure exceeds a certain amount) (Ikegami et al., 2011).

In addition to public health insurance, each municipality offers MSC under different conditions. MSC is not a national uniform policy. Each municipality independently decides the beneficiaries, the amount, and the method of administering the subsidy. Japanese municipalities have recently expanded MSC eligibility, which was discussed in detail by Takaku (2016). In the present study, we used data from a city within the Tokyo metropolitan area (hereafter, C city), which had a population of approximately 1 million in 2016. In C city, MSC eligibility depended on children's grade level (Table 1). All children enrolled in the 3rd grade or below, who were 9 years old or younger at the end of the fiscal year, were eligible for MSC for outpatient service during the study period (April 1, 2012, to March 30, 2014). MSC reimburses the out-of-pocket medical expenses not covered by public health insurance. By offering MSC in the form of immediate reimbursement, all outpatient services cost patients at most 300 Japanese yen (JPY; 100 JPY = approximately 1 US dollar in 2013) out of pocket per visit. Children living under the poverty line are entitled to free services. When children were promoted to the

**Table 1**

Change in copayment for outpatient service by grade between April 2012 and March 2014 in C city.

School year in April 2013	Copayment for outpatient service	
	April 2012–March 2013	April 2013–March 2014
2nd grade	300 JPY maximum/visit <sup>b</sup>	300 JPY maximum/visit <sup>b</sup>
3rd grade	300 JPY maximum/visit <sup>b</sup>	300 JPY maximum/visit <sup>b</sup>
4th grade <sup>a</sup>	300 JPY maximum/visit <sup>b</sup>	30% co-insurance

<sup>a</sup> During the period April 2012–September 2013, children enrolled in 3rd or lower grade in elementary school were eligible for a medical subsidy for children (MSC). With promotion to 4th grade in April 2013, children were disqualified from MSC.

<sup>b</sup> No charge was imposed on children living under the poverty line. JPY, Japanese yen.

4th grade (typically in April), they were disqualified from receiving MSC for outpatient services and had to pay 30% of medical expenditure out of pocket. Consequently, in our main analyses, we defined children who became promoted to the 2nd or the 3rd grade in April 2013, aged 7 or 8 at the end of March 2013, as a control group, and children who were promoted to the 4th grade, aged 9 at the end of March 2013, as a treatment group.

### 2.2. Data source

All data were extracted from National Health Insurance (NHI) claim files in C city. NHI is a community-based public insurance managed by each municipality in Japan, which is offered to citizens who do not have regular employment; these include the self-employed, farmers, part-time workers, temporary workers, contract workers, and the unemployed or retired (Ikegami et al., 2011). The NHI system covered one third of the total population in Japan in 2012. Participants in this study were elementary school children who were enrolled in C city's NHI during the study period (April 1, 2012, to March 30, 2014), and who were promoted to the 2nd, 3rd, or 4th grade in April 2013. We extracted data on insured medical outpatient and inpatient service utilization during the study period. We did not include claims for prescription and dental services, so we could determine the pure effects on medical care use.

### 2.3. Ethical considerations

Under the research agreement between C city and our group, we obtained the above claim data in an anonymous format. Because claims are issued by each medical institution on a monthly basis, we combined all the claims for each patient during the study period by using a unique but anonymous identification number.

### 2.4. Exposure

MSC disqualification was a major exposure when children were promoted to the 4th grade. Other independent variables included dummy variables for the treatment group, gender, month, and residential area. In our dataset, we regarded children aged 8, 9, and 10 years old at the end of the fiscal year 2013 as 2nd, 3rd, and 4th grade elementary school students, respectively, because grade almost always follows age in Japan.

### 2.5. Outcomes

Our main measured outcomes in this study were the following: (1) number of outpatient visits per person per month, (2) dummy of outpatient service received per month (1 if a child received service; 0 if not), (3) total expenditure on outpatient services per person per

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