Cost sharing in healthcare

A comparative study of German and Chinese health insurance

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Summary:

The author compares cost sharing in German and Chinese health insurance from theoretical, empirical and historical perspectives. Theoretically, when cost sharing exceeds a certain number, healthcare utilization would stay constant at a relatively low level even with the decrease of cost sharing. Only when cost sharing has already been below a certain number, healthcare utilization would increase with the decrease of cost sharing.

Empirically, as shown in Chapter 2, since cost sharing in Germany keeps at a relatively low level, ambulatory care utilization for the older people significantly increased in the short run after copayment was abolished from the level of 10 €. And we have also detected a long-term negative effect on both ambulatory care and inpatient care utilization. Furthermore, as illustrated in Chapter 3, outpatient care utilization did not change for the older people in China when coinsurance for outpatient care was reduced from a relatively high level of 75% to 55%.

Historically, as shown in Chapter 1, the paths of health insurance system between Germany and China vary dramatically. In Germany, health insurance system starts with a relatively small coverage of population but comprehensive healthcare coverage and almost entire reimbursement for covered care, which is followed by more enrolled population and optimized benefit packages. In this whole process, cost sharing has mainly played as a means of controlling unnecessary healthcare utilization and containing health cost. In China, the full coverage of population has been given a priority, and the two other coverages have to give way to population coverage, that insufficient reimbursement for covered care (high cost sharing) and limited benefit packages. As a result, cost sharing has served as a financing means. In addition, as shown in Chapter 4 and Chapter 5, German and Chinese health insurance systems are in various developmental phases, which could be determined by economic development and health insurance policy design. The GDP per capita (purchasing power parity based) in China only accounted 20% of the one in Germany in 2017. Such economic background determines limited health expenditure, and health expenditure as a

percentage of GDP also only accounted far below 10% in China. Besides, drop-out issue still exists in the NCMS and the social health insurance in China is not yet mature, which reveals that there are some problems in health insurance policy design.

Key words: cost sharing, Germany, China, health insurance, the older people

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Chapter 1: Introduction

1. Definition and significance of cost sharing

Cost sharing in health insurance is the concept of sharing medical costs for products or services covered by insurance with the patients who are enrolled in the insurance and have utilized the healthcare. The amount of cost sharing charged for consumers could be determined based on various cost sharing mechanisms. In general, cost sharing adopts the following forms, deductible, copayment, coinsurance and sometimes ceiling which is set as the maximum reimbursement amount (Meng et al., 2011). Deductible is the amount borne by patients before health insurance scheme starts to pay for the expenses. Copayment is a set amount patients need to pay before getting access to certain products or services. Coinsurance is a percentage of the total medical expenses for covered healthcare that patients have to pay out-of-pocket (OOP). Here the OOP payment is slightly different with cost sharing though cost sharing is also a part of OOP. The OOP payment includes all the medical expenses paid by patients themselves for received medical products or services, including cost sharing and also expenses for healthcare not covered by health insurance. The OOP payment is a term from the perspective of patients, measuring their health expenses burden. As for cost sharing, it is a term from the perspective of health insurance and a means of managing health insurance funds.

Cost sharing plays a role in health insurance in two aspects. Firstly, it is aimed at controlling unnecessary healthcare utilization. In health insurance design, 100% reimbursement for certain services is often not recommended since moral hazard could not be avoided and overutilization would be expected in this circumstance (Ellis and Mcguire, 1990). In order to avoid wasting limited health resources, contain health costs and improve the efficiency of health insurance funds, cost sharing is usually adopted such as in the German health insurance. Secondly, cost sharing serves as another health financing means. This applies for such a setting, where health insurance pools are insufficient because of low

premiums and fragmented pools but more population and more healthcare need to be covered, such as in the Chinese health insurance. In this case, cost sharing is not initially regarded as a means of controlling unnecessary cost and utilization, but merely as a means of complementing the insufficient health insurance funding.

2. Cost sharing in the German healthcare system

With the rapid industrialization in the age of electricity in the mid-1800s, the German social structure and mode of production had dramatically changed. As a result, German economy had flourished. In order to keep the increasing working class healthy, both as a response to workers' protests and as a measure to improve productivity, Chancellor Bismarck proposed a national health system in 1881, based on Prussia health insurance system targeted at miners in 1840s, which originated from the mutual-aid societies of guilds after the middle ages. The statutory health insurance (SHI) law was passed in 1883, regulating that health insurance was mandatory for workers in certain industries. In 1885, 10% of the whole population was covered by the SHI, and the benefit packages were defined by the law. During this period, no cost sharing measures had been ever adopted in the SHI system (Altenstetter and Busse, 2005; Busse and Riesberg, 2004; Czada, 2004).

During the period of the Weimar Republic, the government had to pay the reparations and money borrowed for the First World War. The war debt was so massive for the government to pay it off. In order to tackle with it, the government decided to print more money, which aroused a severe hyperinflation in 1921. As a result, Germany could not afford the reparations for France in 1922, which gave France an excuse to occupy the Ruhr industrial region of Germany. As a policy of passive resistance, the government ordered a general strike in the Ruhr, which kind of unemployment also burdened the governmental finance. Against this background, the revenue of sickness fund was largely decreased and the cost sharing measure was first introduced in the SHI system in 1923, firstly in the form of 10-20% coinsurance for medicine and medical instruments, and then replaced by copayment for each

prescription and ambulatory care utilization in 1930. During this period, about 51% of the whole population was covered by the SHI (Busse and Riesberg, 2004; Feldman, 1997).

During the National Socialism period from 1933 to 1945, the SHI system had been maintained. After the Second World War, the Federal Republic of Germany (FRG) in western Germany continued with the SHI system, while the German Democratic Republic (GDR) in eastern Germany developed a new social health system based on the health systems in Soviet Union and the Weimar community healthcare system. Till 1960, 83% of the whole population had been covered by the SHI in the FRG and 100% population covered in the GDR. In 1966, the first cyclical economic crisis occurred in the FRG and afterwards, healthcare costs increased dramatically, owing to the rising wage costs and also the expansion of expensive health instruments. In addition, with the occurrence of the oil crisis and rising unemployment in 1975, the healthcare costs had continuously soared in the FRG. As a result, the German SHI had entered an era of cost-containment since 1977. The Health Insurance Cost-containment Acts were enacted in 1977, 1982 and 1983 respectively. In the Act of 1977, new cost sharing was introduced and existing cost sharing was increased for dentures, prescriptions drugs and patient transport. Then in 1982, cost sharing for prescription drugs was further increased. One year later, a new copayment of 5 DM per day for hospital stays and 10 DM per day for rehabilitation cures, and a new copayment of 2 DM per prescription were introduced (Altenstetter and Busse, 2005; Busse and Riesberg, 2004; Funk, 2012; Hurst, 1991; Schneider, 1991).

In order to further control health expenditure and improve technical efficiency, the FRG government enacted the Health Care Reform Act in 1989. It regulated that only efficient services should be included in the benefit packages, including some new preventive services and regulated expensive medical technologies. Meanwhile, some minor inefficient benefits were removed from the packages. Besides, enrollees would be charged differentiated copayments for dentures according to their regular dental examinations. For hospital stays, the copayment per day was increased from 5 DM to 10 DM, and for patient transport, the

cost sharing was also raised. In addition, a new income-related ceiling was also placed for each individual. After the reunification of the FRG and the GDR in 1990, the SHI system in the FRG was transferred to the GDR in the eastern part, and the 17 million citizens in the eastern part needed to be quickly integrated, which speeded up the health care reform legislation in the 1990s. The afterwards reform principles still included healthcare expenditure control. In the Health Care Structure Act of 1993, copayment was increased and also newly introduced for reference-priced pharmaceuticals. In the health reform in 1996-1997, cost sharing was regarded as a new means of putting private money into the healthcare system, not only as a measure of decreasing unnecessary utilization. In this reform, copayments for pharmaceuticals and rehabilitative care were increased, while two years later copayments for pharmaceuticals and dentures were lowered again in the Act to Strengthen Solidarity in SHI in 1998 with the government change from Kohl to Schröder (Altenstetter and Busse, 2005; Busse and Riesberg, 2004; Hurst, 1991; Schneider, 1991).

Since the reunification of the FRG and the GDR, the unemployed population had been sharply increasing till 2005 except for the short decline from 1997 to 2000. In the early 2000s, the number reached around 4.5 million. In addition, the GDP growth rate had reached its lowest point, -0.71% in 2003 since 1993. Meanwhile, health expenditure rose by 3.7% in 2001, twice more than the year's GDP growth rate (1.7%). Some experts had also criticized that healthcare had been overused and misused in Germany. In such background and in order to limit the irrational use of health services, to deal with the increasing sickness fund deficits and to keep the sustainable financing of the SHI system, the government had put limiting health expenditure as a priority. In 2004, the SHI Modernization Act was introduced, aiming to shift part costs to patients covered by the SHI. Firstly, new cost sharing was introduced. During each quarter, patients had to pay €10 for the first visit of a general practitioner without referral. Secondly, existing cost sharing was raised and standardized. Coinsurance for each good or service was 10% and copayment for each pack of prescription drugs was €8.1. Thirdly, the exemption rules were revised. Only exemption rules for children under 18 years

old and for antenatal and preventive care were retained. The exemption rules for poor people were abolished. Lastly, the annual cost sharing ceiling was also set up, which was 2% of annual gross household income for the SHI enrollees and 1% for people with chronic diseases. In this year, 88% of the whole population were covered by the SHI, and after this year, all the people receiving pensions should contribute to the SHI (Altenstetter and Busse, 2005; Blömer et al., 2015; Busse and Riesberg, 2004; Lisac et al., 2010).

In 2005, a new coalition government was formed, consisting of Christian Democratic Union (CDU) / Christian Social Union (CSU) and Social Democratic Party (SPD). Though it was tough for the two parties to reach an agreement, both of them had reached a consensus that German health care system needed to be reformed due to the changing structure of diseases, progress in medical technology and etc. Finally in 2007, the Act to Strengthen Competition in the SHI was passed and became law, whose fundamental purpose was to reduce the revenue base of the sickness funds, replacing the original aim of costs reduction in the Health Care Structure Act of 1992 and the SHI Modernization Act of 2003. It was regulated that people were obliged to be enrolled in either the SHI or in a private health insurance, and the benefit basket was not cut down but added with some preventive and palliative care. After the coalition of CDU/CSU and the Free Democratic Party took office in 2009, the German health care system was further reformed by enacting the SHI Financing Act in 2010 and the SHI Care Structures Act in 2011, aiming to fundamentally reform the financing of the SHI and improve the structure of healthcare provision respectively. Until 2009, Germany had achieved complete universal health coverage by expanding the coverage to welfare benefits receivers, and 85% of the whole population was covered by the SHI (Busse and Blümel, 2014).

With the quick recovery from the global financial crisis in 2008 and the lowered unemployment rates after the crisis, German health care reforms' focus has been drawn away from costs containment. In the end of 2012, the quarterly copayment for ambulatory care was abolished through unanimous votes after Germany public finance achieving a balanced

budget. In the 2013 German federal election, the CDU/CSU and the SPD formed a grand coalition with Hermann Gröhe (CDU) as the health minister. In their term, German health care system was further reformed aiming to improve healthcare quality and healthcare accessibility with the enact of Act to Further Develop the Financial Structures and Quality in the SHI in 2014, the SHI Care Provision Strengthening Act in 2015 and Hospital Structure Reform Act in 2016 (Busse et al., 2017; Siegel and Busse, 2018).

3. Cost sharing in the Chinese healthcare system

In 1949, the new China was established. During that time, the majority of the Chinese population was rural population, accounting nearly 90% of around 542 million people. Therefore, the health issue of rural population was given priority. A government owned and operated health system was created, which consisted of three parts. Firstly, the Cooperative Medical Scheme (CMS) appeared in rural areas in the late 1950s and covered almost all the rural population in over 90% of villages in the mid-1970s based on the agricultural commune system. This scheme was financed through tax by communes, local and central governments, and enrollees did not need to directly pay premiums. During this era, a special profession, barefoot doctors emerged, who undertook the major healthcare tasks including public health and primary care in rural areas though they may not possess official certificates. Secondly, workers for state-owned enterprises were covered by the Labor Insurance Scheme (LIS) since 1951. Thirdly, the Government Insurance Scheme (GIS) covered public sectors officials since 1952. For all the three schemes, enrollees almost did not need to pay any cost sharing. Even though in such a background with a low GDP, the new China still maintained the basic health status of numerous population by according preventive care a high priority, which was also praised by the World Health Organization (Blumenthal and Hsiao, 2015; Hillier and Shen, 1996; Soares, 2009; Wagstaff et al., 2009b).

In 1978, the Reform and Opening up, initiated by Deng Xiaoping appeared on the scene. Ever since, the traditional command and control economy has been replaced by market-

oriented economy. This was even though the trigger of the future blooming economy, but also the start of the health system nightmare. Health care should have been regarded as social welfare, while instead it was put into market after 1978. On the one hand, with rural lands allocated to households and the collapse of communes in rural areas, the CMS collapsed since no revenues could support the rural health care system. As a result, barefoot doctors had to seek solutions by themselves and started up private and for-profit clinics. At the same time, with the collapse of the CMS, nearly all the rural population were revealed in the financial risk for healthcare since they had to pay OOP when with no health insurance. In the mid-1980s, the Chinese population soared to 1.06 billion and the rural population accounted for about 76%, which means over 800 million rural people were not protected by health insurance. On the other hand, with the shift of the governments' financing responsibility for state-owned enterprises, urban health facilities were forced to find their own way to survive the market, and in the end became for-profit ones. To make ends meet, healthcare prices had to be raised, which for one thing crowed out the poorer people without health insurance, and for another dramatically added more burden on the LIS and the GIS. In order to control the soaring cost in the urban health insurance system, demand-side cost sharing was introduced. In the 1980s, around 144 million people were covered by the LIS and 29 million by the GIS, with around 77 million urban residents without health insurance (Blumenthal and Hsiao, 2015; Hillier and Shen, 1996; Wagstaff et al., 2009b).

In 1990s, the LIS crippled after the thorough reforms on state-owned enterprises due to their inefficiencies. In addition, catastrophic health expenses dramatically increased during this period. Distrust and conflicts between patients and doctors soared and unstabilized factors emerged especially in urban areas. Therefore, healthcare reforms had to be implemented and the government had given priority to urban health insurance. Since 1993, reforms on urban health insurance were initiated in two pilots, Jiujiang and Zhenjiang. In 1998, the Basic Insurance Scheme (BIS) was nationwide introduced in urban areas, replacing both the LIS and the GIS. This new scheme expanded its coverage to private enterprises and

smaller public enterprises, which means all urban formal-sector workers could be covered. It was financed by premium contributed by both employers and employees. Due to the political emphasis on wide population coverage, demand-side cost sharing was inevitable because of limited contributions and small risk pools. First, deductibles were set through medical savings accounts for individuals, which had to be spent out before being eligible to get access to public funding pool. Second, coinsurance was up to 50% for outpatient care and about 20% for inpatient care. Third, there was also expenses ceiling, which was four times the annual average wage in a certain region (Atella et al., 2015; Wagstaff et al., 2009b).

In 2003, the weakness of Chinese health system was entirely revealed after the outbreak of the severe acute respiratory syndrome (SARS). Policymakers also publicly announced the limitations of this system and the failure of former reforms. A comprehensive health reform was urgently called upon. Meanwhile, the rural population was facing a difficult situation that many households fell into poverty because of illnesses, in coping with which the New Rural Cooperative Medical Scheme (NCMS) was introduced mainly aimed at reducing catastrophic health expenses in 2003, when the rural population accounted 59% of the whole population (1.29 billion). The NCMS was a voluntary-based scheme targeted at rural residents and was financed by enrollees' contributions and heavy government subsidies (about 80%). Later on in 2007, the Urban Resident Basic Medical Insurance scheme (URBMI) was further introduced, covering the rest of population in the urban such as the unemployed, children and the disabled, also voluntary-based and with heavy government subsidies (roughly 70%). In order to be distinguished, the original BIS was renamed as the Urban Employee Basic Medical Insurance scheme (UEBMI). Since the initial motivation of the introduction of the NCMS and the URBMI was to cope with the severe poverty issue caused by illnesses, benefit packages only included inpatient services since most health expenses happened in inpatient sectors, but still only limited inpatient services were covered compared with the relatively comprehensive coverage of the UEBMI. In the beginning, no outpatient services were covered at all but they were gradually added to the packages based on risk

pools and policy focus in different regions later on. For both the NCMS and the URBMI, patients had to pay high deductibles and high coinsurances of around 70% for the NCMS and 60% for the URBMI. Besides, ceilings were pretty low even compared with the low ceiling of the UEBMI (Blumenthal and Hsiao, 2015; Hipgrave and Mu, 2015; Meng et al., 2015; Yu, 2015).

In 2016, the State Council released a new regulation on integrating the NCMS and the URBMI, as an interval step to integrate the three insurances. In addition, the pooling level was raised to the city level, enhancing the pool's ability against financial risk and making it possible to gradually enlarge benefit packages and lower demand-side cost sharing. The March of 2018 was a historical and significant moment for the Chinese health insurance system due to the foundation of the National Healthcare Security Administration. Prior to this, the UEBMI, the NCMS and the URBMI were administrated and managed by different public sectors, bringing about kinds of obstacles for health insurance reforms. While since 2018, all the administration and management for the three insurances and other relevant responsibilities were assembled into one sector, the National Healthcare Security Administration, making it possible to implement health insurance reforms with lower transaction costs.

4. Comparison of cost sharing concepts in Germany and China

Based on the above background, the German health system and the Chinese health system are in entirely different developmental stages. As a result, cost sharing plays varied roles in the two countries currently. In Germany, there is a continuous and progressive health insurance system in the past 136 years. The system starts with a relatively small coverage of population but comprehensive healthcare coverage and almost entire reimbursement for covered care. Later on, more and more population are enrolled in the system and benefit packages are also adjusted based on social circumstances and diseases structures. Meanwhile, cost sharing is introduced, abolished or adjusted with time going on, but mainly as a means

of controlling unnecessary healthcare utilization and containing health cost, seldom as a financing means. In China, there is no similar health insurance tradition. And even after the foundation of the new China in 1949, different attempts have been done and there is a period when the majority of population is not covered by a health insurance. A similar health insurance system with the German one has only been constructed for 20 years. In order to achieve fairness to the most extent, the full coverage of population has been given a priority. As a result, the majority of population has currently been covered by one of the three insurances. However, benefit packages are limited for the majority of people and cost sharing is too high since it has to be adopted as a financing means due to the limited health insurance funding.

All in all, the German health insurance system has entered a relatively mature developmental stage and the function of cost sharing is definite and stable. In the future, more efficient cost sharing setting would probably be achieved. In contrast, the Chinese health insurance system is still in the primary stage and has a long way to go. In turn, the role of cost sharing would also change with time. In the future, cost sharing would be gradually reduced with the filling of insurance pools due to the economic development, until the change of the function of cost sharing from financing to containing cost. Then there would be a relatively mature health insurance system with a more efficient cost sharing in China.

Chapter 2: Did copayment abolition affect health care utilization for the older people in Germany?

Abstract:

In 2004, Germany introduced, due to a problematic situation of public finances, a copayment scheme for ambulatory care visits. This scheme regulated that patients needed to pay €10 for the first doctor contact per quarter. In 2012, Germany achieved a balanced budget and the copayment was abolished on 1.1.2013.

Against this background, the author explores the impact of copayment abolition on ambulatory care and inpatient care utilization among people over 50 in Germany, using data from the Survey of Health, Aging and Retirement in Europe by adopting fixed-effects Poisson model and difference-in-differences approach with matching method. The author also investigates the differential impacts among subgroups by income, marital status, health status and age.

The results illustrate that copayment abolition increased the frequency of ambulatory care utilization only in the short run, which disappeared when we looked at the long run effect. In addition, we have found a negative effect on inpatient care utilization in the long run, i.e., a hospitalization offsetting effect among the older in Germany. Additionally, results show that the effects of copayment abolition were heterogeneous among different groups. The married, the older and people with better health status were relatively more sensitive to copayment abolition.

Keywords:

Ambulatory care utilization, copayment abolition, the older people, Germany, fixed-effects regression, difference-in-differences

1. Introduction

Cost sharing mechanisms have been frequently used in health insurance systems in recent years. Theoretically, when cost sharing is charged for enrollees, their demand for healthcare services or products would decrease, while the decreasing might be minor due to the inelastic nature of healthcare. If the original demand for healthcare exceeds the need of enrollees, the introduction of cost sharing could reduce the occurrence of moral hazard and lower healthcare expenditures by restricting improper utilization. If the original demand is already below the actual need of enrollees, the decreased demand for healthcare caused by introducing cost sharing would make matters worse. Therefore, whether a cost sharing introduction would arouse a significantly decreased healthcare utilization or not, and whether the decreased healthcare utilization would benefit patients or not, really depend.

The following literature on impacts of cost sharing introduction or cost sharing increasing draws various conclusions as expected based on the above theoretical inference. In the Rand Health Insurance Experiment (HIE), logistic regression techniques were used and results show that cost sharing lowered the probability of obtaining care for the HIE participants. Preventive diagnostic categories and the acute conditions were more likely effected by cost sharing than the chronic conditions, possibly because patients with chronic conditions have more inelastic and consecutive demand. Besides, impacts for children were stronger than for adults, for the poor than for the non-poor, since vulnerable groups might be more sensitive to price changing. In addition, cost sharing had no selective effect in influencing use of medically effective care and less effective care, which means with the decline of less effective care use, the use of effective care was also improperly reduced (Lohr et al., 1986).

After the Rand HIE, many more empirical studies have focused on impacts of cost sharing introduction and increasing. In 2008, the Czech Republic enacted a new rule that patients needed to pay some copayments for outpatient care and some inpatient care. Kalousova (2015) constructed the difference-in-differences (DID) regression models to

research on the impact among people over 50. The author found that after the policy was insituted the likelihood and the predicted number of primary care visits both declined. However, the likelihood of hospitaization and number of nights in hospital did not decrease. Besdies, they seemed to find greater effect among those 65 or older, among those who believed their health status good and among those with lower education level. In 2011, the coinsurance for prescription drugs in general or tertiary hospitals was increased in Korea. Lee et al. (2017) examined the impact of the policy on outpatient care utilization by performing a segmented regression analysis. Results show that outpatient use in general or tertiary hospitals decreased while the use in other hospitals and clinics increased, but outpatient medical costs for both categories decreased.

Compared with the above literature, some other studies found that the increase of cost sharing was associated with side effects among vulnerable people. Tamblyn et al. (2001) conducted a study on the impact of prescription drug cost sharing introduction in Quebec in 1996 among the elderly and welfare recipients by adopting interrupted time-series analysis. Results illustrate that essential drugs utilization decreased after the policy for both the elderly and welfare recipients. As a result, emergency department visit decreased and serious adverse events such as hospitalization, nursing home admission and mortality increased. In order to examine whether the elderly would forgo important outpatient care when copayments were increased, Trivedi et al. (2010) compared the longitudinal changes in both outpatient and inpatient care utilization between enrollees in Medicare plans with increased copayments and plans with no copayments changes. The authors conclude that the increased copayments among the elderly may have adverse effects since inpatient care use increased with the decrease of outpatient care use, and the total spending on both outpatient and inpatient care increased with the increase of copayments. In addition, magnified effects were found among enrollees with lower income and education and enrollees with chronic diseases such as hypertension and diabetes. According to the possible side effects caused by cost sharing among vulnerable people such as the elderly, in this article the author is interested to look at the elderly, as they are due to their health care needs particularly affected by copayment policies.

Compared with massive literature on impacts of cost sharing introduction and increasing, literature on impacts of cost sharing abolition is much less. In high income countries, cost sharing abolition policies are either targeted at certain healthcare services, medications[1], or certain groups of people. Concerning healthcare services, most studies focus on the impacts of cost sharing abolition for recommended preventive care in the US. In 2004, in order to reduce the total health expenditure, Alcoa abolished cost sharing for preventive care and meanwhile increased cost sharing for some other services. Busch et al. (2006) took advantage of this unique natural experiment and studied on impacts of the policies by calculating utilization rate, but they found little impact on preventive care use. However, different conclusions are drawn in other studies. The Affordable Care Act (ACA) enacted in September 2010 required most private health insurers and Medicare program to eliminate cost sharing for recommended preventive services. Han et al. (2015) evaluated changes in recommended preventive service utilization using multivariable logistic regression. They draw the conclusion that positive benefits were observed from eliminating cost sharing for preventive services. Against the same background of the ACA enacting, Fedewa et al. (2015) investigated whether the prevalence of colorectal cancer and breast cancer screening among adults by socio-economic status changed after the ACA. Their findings suggest that colorectal cancer screening increased only among the low socio-economic status groups but breast cancer screening did not. They believe that the Act possibly removed financial barriers for people with low social-economic status. Similarly, Trivedi et al. (2018) conducted a DID study based on this enacting of the ACA. They also detect an increase in use of screening mammography after cost sharing elimination among older women, however, which was not applied for women with lower education or Hispanic women.

As for cost sharing abolition policies targeted at certain groups of people, the available literature often investigates children. In 2009, children were exempted from doctor visits copayments in Czech. Zápal (2010) used this policy change as a natural experiment to

[1] Cost sharing abolition on medications is not relevant to my study. Therefore, literature in this field is not reviewed here.

analyze the impact on children's doctor visits. The adult was treated as a control group in a DID estimation. They approximated the number of doctor visits with the consumed amount of prescription drugs. The results reveal no impacts on the number of children's doctor visits. Votapkova and Zilova (2016) also studied on the effect of this copayment abolition on children's doctor visits but utilized micro-level data. By using zero-inflated negative binomial model and employing the DID approach, they came to a similar conclusion of no significant effects from copayment abolition on children's doctor visits. The authors suggest that this was either because cost sharing was ineffective in the health insurance system of the Czech Republic or because the value of cost sharing was too low. In 2010, the adolescents' exemption threshold for copayment for general practitioner (GP) services was raised from 12 to 16 years old in Norway. Zeratsion (2013) did a study to investigate the impact of this policy change by fitting a Poisson regression model. The author found that the change of exemption threshold for copayment was significantly associated with an increase in GP contacts for the targeted group of children. Furthermore, Olsen and Melberg (2018) also tried to estimate whether exemption from copayments would lead to increases in GP visits. They used the elastic net regression to construct a relevant counterfactual by applying the synthetic control method, and got similar significant results, which indicate that adolescents between 12 and 15 years old were sensitive to copayments and females were more sensitive than males. In Japan, the national government set a maximum 20% coinsurance for outpatient health care and drug prescriptions for preschool children, and local governments could further reduce this amount. As a source of financial support, a subsidy program named Medical Subsidy for Children and Infants was initiated and later yearly expanded. In 2010, in around 50% of the municipalities the eligibility was expanded to elementary-school-age children, and even expanded to over school-age in Tokyo. With the eligibility, the coinsurance could be reduced to zero. In this background, Takaku (2015) studied on the impact of children's coinsurance abolition on their inpatient utilization and health status in Japan, by specifying a parametric model. The author found no significant hospitalization reduction

among either preschool-age or school-age children, but found significant improvement of health status only among preschool-age children.

In the current literature, no studies are on impacts of cost sharing abolition polices covering all outpatient services or all population. In addition, there are also no studies focusing on the elderly. Indeed, it is meaningful to see the impact for the elderly since studies have shown that the elderly are price sensitive for healthcare (Fukushima et al., 2016; Nishi et al., 2012; Shigeoka, 2014).

Concerning relevant literature in low and middle income countries, where in the majority of cases no social health insurance exists, many researchers have paid high attention to effects of user fee abolition. In 2001, Uganda government abolished user fee in public health facilities with the financial support of international aid agencies. Studies show that use of outpatient services was increased and user fee abolition was pro-poor (Burnham et al., 2004; Nabyonga Orem et al., 2005; Yates, 2009). Generally speaking, positive effects on healthcare utilization were found, but some issues could not be neglected, such as unpredictable and insufficient funding, lack of knowledge on implementation and administration (Meessen et al., 2011; Ridde et al., 2012; Ridde and Morestin, 2011). These studies have some but minor relevance to my study due to the following two reasons. First, user fee and cost sharing are different since the latter is a notion in the framework of health insurance while the former is not, which would lead to varied effects by abolition. Second, the economic situation, social background and healthcare system vary much between low income countries and high income countries, which would result in different impacts brought by abolition.

Prior to 2004, Germany experienced significant fiscal deficits, which reached 4.2 percent of GDP in 2003. In particular, like other European countries, Germany accumulated large budget deficits in sickness funds of the SHI system. To generate savings for and improve the efficiency of the SHI system, the German government enacted the SHI Modernization Act in 2004. In this Act, copayment for ambulatory care visits was newly introduced, which regulated that patients had to pay €10 for the first

doctor contact per quarter or subsequent contact without referral. The targeted group was members of the SHI system and only children under age 18 were exempt from the copayment (Busse and Blümel, 2014; Lisac et al., 2010; Mossialos et al., 2015). In addition, copayment for hospital stays and inpatient rehabilitation was increased from €8.7 to €10 per day. Some former studies have demonstrated that the copayment implementation in 2004 had no significant impacts on ambulatory care visits. For instance, Augurzky et al. (2006) used this reform as a natural experiment to examine the effect of copayment on ambulatory care utilization with youths exempted from copayment and individuals covered by private health insurance (PHI) as control groups in a DID approach. Contrary to their expectations, they found no significant effects on the decision of visiting a doctor. Besides, Schreyögg and Grabka (2010) also used a DID approach to examine the effects on the overall demand for physicians and also to explore whether copayment deterred vulnerable groups. They also observe no significant effects on ambulatory care utilization, either no deterrent impacts among vulnerable individuals. They propose that this is possibly due to the copayment design, which would only be paid for the first contact of doctor per quarter. When taking into account the special design of copayment scheme, some other studies have reached inconsistent conclusions. Farbmacher (2009) reveals that the true effect of copayment was diluted because of its special characteristic that patients had to pay €10 for the first doctor contact per quarter or subsequent contact without referral. He found that copayments introduction had a significant impact on the probability of seeing a doctor by adopting random variation in the interview date. In contrast, Kunz et al. (2015) do not find an effect on demand for doctor visits. They developed a new model to estimate the impacts on doctor visits per quarter using a DID strategy. In this model, the mismatch between the reporting period and the calendar quarter was considered.

In 2012, Germany achieved a balanced budget and also quickly recovered from the economic and fiscal crisis around 2009. Based on this public financial situation, the German Bundestag passed a unanimous vote to abolish the copayment scheme. Subsequently, copayment for ambulatory care was abolished on 1.1.2013, but other

copayments including copayment for hospital stay and inpatient rehabilitation remained (Busse and Blümel, 2014; Mossialos et al., 2015). This copayment abolition policy has covered all outpatient services and all population in the SHI system. The German example serves as a good quasi-experimental research setting. However, the impact of the copayment abolition in Germany on healthcare utilization has not been thoroughly studied so far. Lostao et al. (2018) did a study on the differentiated health services based on different income groups before and after copayment abolition in Germany. This study, however, investigated only percentage ratios of physician consultation by household income group, for 2009 and 2014. Neither econometric methods nor longitudinal approaches are adopted to show the correlation or causality between healthcare utilization and copayment abolition. In addition, the sample of this study is adults aged 16 and older and not specifically the older people.

In order to fill these gaps, the author conceives this study. The objective is to explore the impact of copayment abolition on ambulatory care and inpatient care utilization among people over 50 in Germany, providing evidence for policy making in other countries.

2. Data and methods

2.1. Data source and study population

Our individual-level data is from the Survey of Health, Aging and Retirement in Europe (SHARE), which is a representative survey targeted at the population aged over 50, collecting panel data on health, socio-economic status and social and family networks covering 28 countries (see www.share-project.org). The author utilizes German data from wave 2 (2006/2007 (Börsch-Supan, 2019a; Börsch-Supan et al., 2008)), wave 4 (2011/2012 (Börsch-Supan, 2019b; Malter and Börsch-Supan, 2013)), wave 6 (2015 (Börsch-Supan, 2019c; Malter and Börsch-Supan, 2017)) and wave 7 (2017 (Börsch-Supan, 2019d)). The author excludes wave 5 (2013) from our study since certain variables reflect the status in both 2012 and 2013. For instance, for healthcare utilization,

interviewees were asked about the situation in the last 12 months. As the interviews of wave 5 have been largely conducted in the first half of 2013, much information on healthcare utilization pertains to 2012 and thus, before the policy change. Wave 1 (2004) is excluded for a similar reason since much information on healthcare utilization pertains to 2003 while copayment was introduced in 2004. Wave 3 (2008/2009) is excluded since it is data on life histories. Therefore, the final sample includes two waves before copayment abolition and two afterwards.

The treatment and control groups should be classified based on the type of health insurance, because the copayment enacting and abolition policies concerned only individuals insured via the SHI, i.e. excluding individuals insured via a PHI. However, the observations' insurance type information is unavailable in SHARE Germany dataset. Thus, the author cannot exactly distinguish whether an individual is enrolled in the SHI or PHI. In order to tackle this issue, the author utilizes the employment type as a proxy of health insurance type, since only civil servants, the self-employed and employees with income above an upper limit could select to be enrolled in a PHI in Germany. In the end, the author classifies civil servants and the self-employed as the control group and the other employees as the treatment group in this study since civil servants and the self-employed form a large fraction of the PHI population. As the SHI population accounts for 89.3% of the total population in Germany in 2015, after excluding civil servants and the self-employed, our treatment group presumably comprises 93.3% of individuals insured via the SHI (Financial report for private healthcare insurance 2012, 2012). As a drawback, since neither the entire treatment group is enrolled in the SHI, nor the entire control group is enrolled in the PHI, the effect of copayment abolition would be underestimated in this study.

The detailed inclusion criteria are shown as follow: 1) aged 50 or above; 2) doctor visits below 70 times in the past year (details seen in 2.3-matching); 3) employment type is non-missing, and is not switched between employees and civil servants/the self-employed within year 1 and year 2. For instance, if an individual was an employee in year 1 and became self-employed in year 2, then he/she was dropped from the sample; 4)

individuals who have been enrolled in all the four waves. In order to avoid disturbance caused by unbalanced random effect terms (Baltagi, 2005; Cameron and Trivedi, 2009), the author uses a balanced panel in the main context. In addition, since the sample size could be largely expanded if unbalanced panel is adopted, the author also does a robustness check by adopting unbalanced panel.

To deal with other variables' missing data except for the variable of employment type, the author adopts the multiple imputation methodology. Currently, SHARE provides five imputations for the variables used in my model. Finally, 1,868 observations are included for each imputation.

2.2. Measures and variables

The treatment classifier is based on the current employment type if not retired, and on the last employment type in history if retired. Individuals whose employment type is employee or civil servants/the self-employed in both year 1 and 2 are classified as the treatment or control group respectively.

Dependent variables. The author aims to firstly examine the impact of copayment abolition on ambulatory care utilization, and secondly examine the impact on inpatient care utilization. The dependent variable is therefore firstly the number of doctor visits[2], and secondly total nights in hospital[3].

Covariates. In line with similar literature, the author selects the following covariates, quartiles of individual income, marital status, number of chronic diseases, and self-perceived health status in the fixed-effects model (Andersen and Newman, 1973; Belloni et al., 2016; Shigeoka, 2014).

[2] The number of doctor visits (variable code of HC002_STtoMDoctor) is derived by asking "Now please think about the last 12 months. About how many times in total have you seen or talked to a medical doctor or qualified nurse about your health? Please exclude dentist visits and hospital stays, but include emergency room or outpatient clinic visits."

[3] Total nights in hospital (variable code of HC014_TotNightsinPT) is derived by asking "How many nights altogether have you spent in hospitals during the last twelve months?"

Individual income is calculated by dividing household income by square root of household size (OECD, 2011a). Quartiles of individual income is a categorical variable, where quartile 1 and 4 represent the lowest and highest 25%, respectively. Marital status is a categorical variable with 1 denoting "married and living together with spouse and registered partnership", for short, [married], and 2 denoting "married but living separated from spouse, never married, divorced and widowed", for short, [single]. Number of chronic diseases and self-perceived health status are adopted in the model to measure evaluated and perceived health status respectively. Self-perceived health status is a categorical variable. 1 represents excellent and very good, 2 represents good and 3 represents fair and poor.

To see the raw effect of policy change and to avoid the problem of bad controls, the author first includes only the treatment dummy, the time dummy and the DID estimator in the model (Angrist and Pischke, 2008). Then the author adds consecutively variables that might influence the DID estimator. Thus, the author controls additionally for quartiles of individual income and marital status in second and third regressions. In a fourth regression, the author also adds the number of chronic diseases and self-perceived health status.

2.3. Design and statistical analysis

The author uses fixed-effects Poisson model by adopting DID approach combined with matching method to explore the impact of copayment abolition on ambulatory and inpatient care utilization. The author combines a DID approach with matching method since it has been demonstrated by literature that this combination could lower the bias compared with a single method of regression or matching (Glazerman et al., 2003; Ravallion, 2007). All analyses are conducted using Stata V.13.1 (StataCorp, College Station, Texas, USA). Detailed discussions are included in the following part.

1) Matching method

In analyzing observational data, selection bias between treatment and control groups is inevitable. In order to minimize selection bias caused by potentially non-identical characteristics between the two groups and maximize the probability of identical trend, matching method is adopted in the study. The author first does trimming of the data by cutting off the highest 0.5% (more than 70 times) of doctor visits to better match two groups. According to matching quality, the author selects propensity score matching (PSM) in the end. Probit model is utilized to calculate the propensity score for each individual to be treated. The following observed characteristics are considered in balancing the treatment and control groups: time-invariant variables include birth year and gender, and time-variant variables include number of doctor visits, marital status, quartile of equivalent income, self-perceived health status, number of chronic diseases and household size. As for time-variant variables, the author has controlled their values in all the pre-treatment years, year 1 and 2. The matching algorithm is kernel matching, which allows controls with smaller distance metric given larger weights (Jann, 2017a). PSM is done using Stata module-KMATCH (Jann, 2017b).

2) DID approach

In order to investigate the causal relationship between copayment abolition and healthcare use, the author adopts DID approach. By detecting the difference between the treatment and control groups in differences before and after treatment, we could get the average treatment effect on the treated (ATT) when conditional independence assumption (CIA) and identical trend assumption are met (Lechner and Miquel, 2010; Wooldridge, 2012). The CIA requires that the variables that affect treatment assignment and outcome variable simultaneously are observable. By conditioning on these observable variables, we could remove the confounding caused by the dependence between treatment assignment and outcome variable. Our individual fixed-effects variable could control all the time-invariant confounding and the covariates could control all these observable time-variant confounding as shown in equation (1). As for the identical trend assumption, the

author has done a parallel trend test based on pre-treatment data. Results are presented in section 3.3.

Since our post-treatment data could reflect the healthcare use two years and also four years after copayment abolition, we are wondering whether the effect of copayment abolition would differ with time. Therefore, the author does both analyses, first assuming a constant ATT that the effect of copayment abolition is the same in year 3 and 4, and then allowing varied ATTs that this effect is different in year 3 and 4 (Callaway and Sant'Anna, 2018; Wooldridge, 2012).

3) Fixed-effects Poisson model

For the econometric investigation the author adopts a fixed-effects Poisson regression model because this model is best suited to model count data in a panel setting with fixed effects, especially since this estimator is very robust to distributional assumptions (Silva and Tenreyro, 2006; Wooldridge, 1999).

Since the abolished copayment was originally paid for ambulatory care use, the author is interested in exploring whether this abolition would affect people's ambulatory care use. Furthermore, since ambulatory care and inpatient care are substitution products, i.e., more ambulatory care use may prevent the deterioration of diseases and further avoid possible inpatient care use, copayment abolition may also affect people's inpatient care use. Accordingly, the author analyzes further the impact on inpatient care utilization. The model could be expressed as:

When assuming a constant ATT:

$$y_{it} = \exp\left(\gamma Treat_i + \lambda Post_t + \delta(Treat_i * Post_t) + X_{it} + \nu_i + \mu_{it}\right) \quad (1)$$

When allowing varied ATTs:

$$y_{it} = \exp\left(\gamma Treat_i + \lambda Year_t + \delta(Treat_i * Post_t * Year_t) + X_{it} + \nu_i + \mu_{it}\right) \quad (2)$$

In these two models, *y* represents either doctor visits or total nights in hospital. *Treat* is the treatment dummy, with 1 denoting the treatment group and 0 the control. *Post* is the time dummy, with 1 denoting the time after copayment abolition and 0 the time before it. Year denotes in which year the sample was surveyed with values of 1 to 4. *X* represents the additional covariates, such as quartiles of individual income, marital status, the number of chronic diseases, and self-perceived health status. *v* is the individual fixed effect, which controls all the time-invariant individual characteristics such as birth year, gender and etc. μ is the idiosyncratic error term, and δ shows the DID estimate. *i* and *t* denote the individual and time subscripts.

As our sample was collected across around ten years (2006/2007-2017), our estimates indicate a relatively longer term's effect. With the purpose of considering a short-term effect, the author does additionally the analyses based on data from year 2 and 3, which is across three years (2011/2012-2015). The model used here is shown in equation (1) when assuming a constant ATT since there is only one wave after treatment.

Furthermore, the author would like to inspect whether there exist heterogeneous impacts among subgroups by individual income, marital status, health status and ages. In order to realize this purpose, the author conducts additional analyses by adding interaction terms between the DID estimator and the subgroup indicators (Imbens and Wooldridge, 2007). The model is shown as:

$$y_{it} = \exp\left(b_1 Treat_i + b_2 Post_t + b_3 Z_{it} + b_4 Treat_i * Post_t + b_5 Treat_i * Z_{it} + b_6 Post_t * Z_{it} + \delta(Treat_i * Post_t * Z_{it}) + X_{it} + v_i + \mu_{it}\right) \quad (3)$$

In this model, Z denotes the subgroup indicators and the coefficient of the three-way interaction term δ denotes the heterogeneous impacts of copayment abolition on healthcare use.

4) Robustness check

In order to test the robustness of the above estimates, the author does the following two checks: first by excluding part of pre-treatment data, i.e., analyzing the sample from year 2, 3 and 4; second by utilizing unbalanced panel to increase the sample size, i.e., individuals surveyed in not all the four waves are also included in our sample.

3. Results

3.1. Descriptive statistics

Descriptive statistics for the raw sample before and after copayment abolition are presented in Table 1. Generally speaking, people enrolled in the SHI tended to seek more healthcare than people enrolled in the PHI. Before controlling for other factors, the actual doctor visits and total nights stayed in hospital had both increased for both groups with time.

Based on the individual income statistics, people enrolled in the PHI were relatively wealthier and gaps among different quartiles of people narrowed with time. As shown in the marital status statistics, the single were more likely to be enrolled in the SHI, and the proportion of the single increased by over 5% after copayment abolition, which aligns with the social phenomenon that divorce rate has been increasing (Esser, 1993). As for the health status of our sample, people enrolled in the PHI had shown a better health, and people's average health status had deteriorated with time. First, it is in line with the general background of altered disease structure, that chronic diseases have dominated the disease spectrum since the detective rate of chronic diseases is higher and the life expectancy increases. Second, the morbidity would increase when people get older. In our sample, the average age increased with time since the author adopts balanced panel. Besides, the average age for our control group was slightly higher than the treatment group, and the male were more likely to be enrolled in a PHI in Germany.

As stated above and also as expected, the treatment and control groups are unbalanced in terms of the means of these variables. Descriptive statistics for the matched sample are listed in Table 2, which indicates that two groups before copayment abolition have been more balanced after matching.

Table 1. Descriptive statistics for the raw sample across four waves

	Before copayment abolition Mean (SD)		After copayment abolition Mean (SD)	
	Treatment	Control	Treatment	Control
Doctor visits	7.445 (7.913)	5.898 (6.292)	8.184 (8.540)	6.176 (6.454)
Total nights in hospital	2.037 (7.059)	1.102 (3.133)	2.139 (6.519)	1.930 (6.380)
Individual income, €				
Quartile (25%)	13576.45	19940.41	14849.24	21477.43
Quartile (50%)	19200	28128.51	19516.15	29822.45
Quartile (75%)	27730.68	42426.41	25455.84	41139.28
Marital status, %				
The married	75.51	83.76	69.49	78.50
The single	24.49	16.24	30.51	21.50
No. of chronic diseases	1.575 (1.366)	1.073 (1.271)	2.264 (1.713)	1.532 (1.464)
Self-perceived health status, %				
Excellent and very good	19.43	35.94	13.50	28.17
Good	43.80	45.74	42.61	47.18
Fair and poor	36.77	18.32	43.89	24.65
Age	64.17 (7.668)	64.98 (7.427)	71.29 (7.416)	72.11 (7.145)

	Before copayment abolition Mean (SD)		After copayment abolition Mean (SD)	
	Treatment	Control	Treatment	Control
Gender, %				
Male	43.80	64.79	43.80	64.79
Female	56.20	35.21	56.20	35.21
Obs	1,096	284	1,096	284

Notes. Results are pooled amount for wave 2 and 4 in column 1&2 and for wave 6 and 7 in column 3&4. SD=Standard deviation (in parentheses); *Obs*=Observations.

Table 2. Descriptive statistics for the matched sample across four waves

	Before copayment abolition Mean (SD)		After copayment abolition Mean (SD)	
	Treatment	Control	Treatment	Control
Doctor visits	6.943 (8.126)	7.422 (6.275)	8.335 (7.930)	9.779 (8.234)
Total nights in hospital	2.109 (6.903)	2.049 (4.625)	1.240 (4.613)	3.842 (9.585)
Individual income, €				
Quartile (25%)	20364.68	15697.77	19516.15	16970.56
Quartile (50%)	27712.81	19200	24607.32	22910.26
Quartile (75%)	38183.77	25455.84	32244.07	31395.54
Marital status, %				
The married	81.76	78.19	77.52	74.04
The single	18.24	21.81	22.48	25.96
No. of chronic diseases	1.216 (1.153)	1.675 (1.512)	1.925 (1.509)	2.386 (2.170)

	Before copayment abolition Mean (SD)		After copayment abolition Mean (SD)	
	Treatment	Control	Treatment	Control
Self-perceived health status, %				
Excellent and very good	27.95	14.38	16.46	13.15
Good	49.38	42.17	45.74	40.50
Fair and poor	22.66	43.45	37.81	46.35
Age	65.21 (7.633)	63.87 (6.111)	72.30 (7.373)	71.09 (5.716)
Gender, %				
Male	69.55	50.12	69.55	50.12
Female	30.45	49.88	30.45	49.88
Obs	784	156	784	156

Notes. Results are pooled amount for wave 2 and 4 in column 1&2 and for wave 6 and 7 in column 3&4. SD=Standard deviation (in parentheses); *Obs*=Observations.

3.2. Matching quality

The author does PSM to balance the treatment and control groups. The matching quality is measured based on match rates, standardized difference and the density of propensity score distribution. Propensity score matching statistics is listed in Table 3, which shows that the match rates for the treatment and control groups are both above 95%. This indicates that the majority information in our sample has been used in our final regression, which could help maintain the representativeness of our sample after matching.

Table 3. Propensity score matching statistics

	Matched	Total	Match rate
Treatment group	2,364	2,406	98.3%
Control group	467	491	95.1%
Combined	2,831	2,897	97.7%

The standardized mean difference and variance ratio between two groups before and after matching are shown in Figure 1 and Table 4. As shown in Figure 1, after matching, the standard mean difference moves closer towards zero compared with the raw data. The detailed changes in standard mean difference for each variable are listed in Table 4, which illustrates that the two groups have been well balanced after matching, since all the differences after matching are controlled around 0.1, within an accepted level (Rosenbaum and Rubin, 1985).

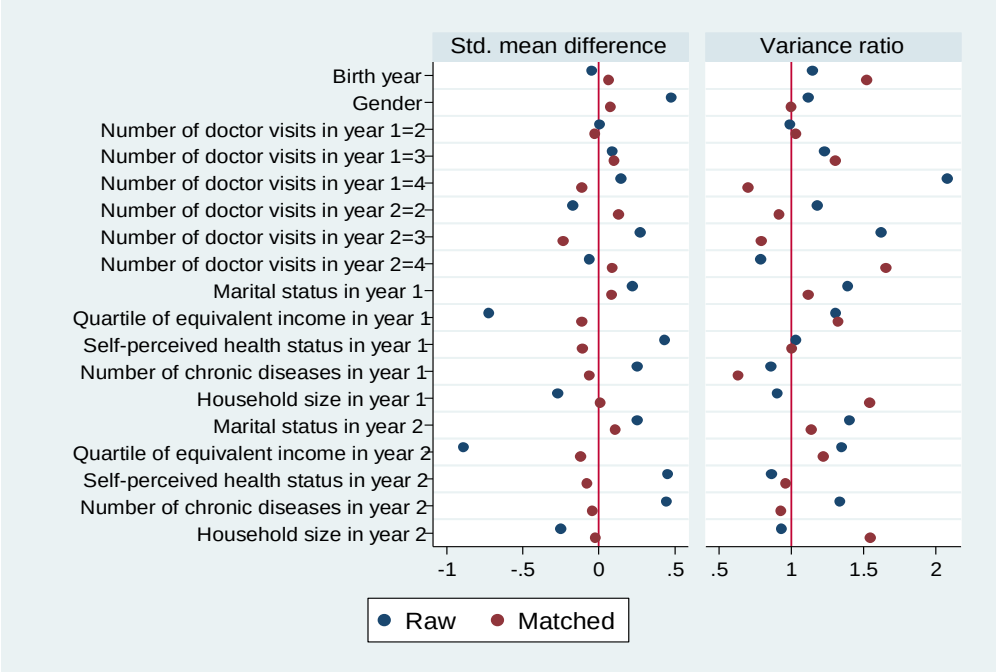


Figure 1. Standardized mean difference and variance ratio between the treatment and control groups before and after matching. The number of doctor visits is a categorical variable (1. zero; 2. 1-10; 3. 11-20; 4. Above 20).

Table 4. Summary of standardized mean difference between the treatment and control groups before and after matching

	Raw			Matched		
	Treatment	Control	SD	Treatment	Control	SD
Birth year	1944.9	1944.6	-0.046	1944.8	1945.2	0.067
Gender	1.559	1.328	0.477	1.511	1.473	0.078
Doctor visits Y1, 2	0.748	0.745	0.006	0.752	0.764	-0.027
Doctor visits Y1, 3	0.137	0.108	0.089	0.129	0.095	0.103
Doctor visits Y1, 4	0.052	0.024	0.146	0.047	0.068	-0.112
Doctor visits Y2, 2	0.678	0.756	-0.172	0.692	0.634	0.129
Doctor visits Y2, 3	0.224	0.122	0.272	0.207	0.295	-0.235
Doctor visits Y2, 4	0.047	0.061	-0.061	0.049	0.029	0.088
Marital status Y1	1.247	1.159	0.220	1.237	1.204	0.084
Q of equivalent income Y1	2.317	3.071	-0.722	2.454	2.571	-0.112
Self-perceived health status Y1	2.160	1.853	0.433	2.114	2.190	-0.107
No. of chronic diseases Y1	1.481	1.147	0.251	1.421	1.504	-0.062
Household size Y1	2.055	2.267	-0.272	2.069	2.060	0.011
Marital status Y2	1.274	1.171	0.250	1.263	1.218	0.108
Q of equivalent income Y2	2.309	3.193	-0.889	2.462	2.583	-0.122
Self-perceived health status Y2	2.287	1.963	0.452	2.225	2.279	-0.075
No. of chronic diseases Y2	1.743	1.167	0.447	1.637	1.690	-0.041
Household size Y2	1.915	2.084	-0.250	1.927	1.941	-0.022

Note. Y1=in year 1, Y2=in year 2, Q=Quartile, SD=Standardized difference.

The density of propensity score distribution for the treatment and control groups before and after matching is presented in Figure 2. We could see that for the raw data the distributions of propensity score are very different between two groups but for the matched data the distributions of the two groups match each other very well. In addition, we could also detect that the two groups do share a relatively wide range of common support (from around 0.3 to 1) based on the plot for the raw data.

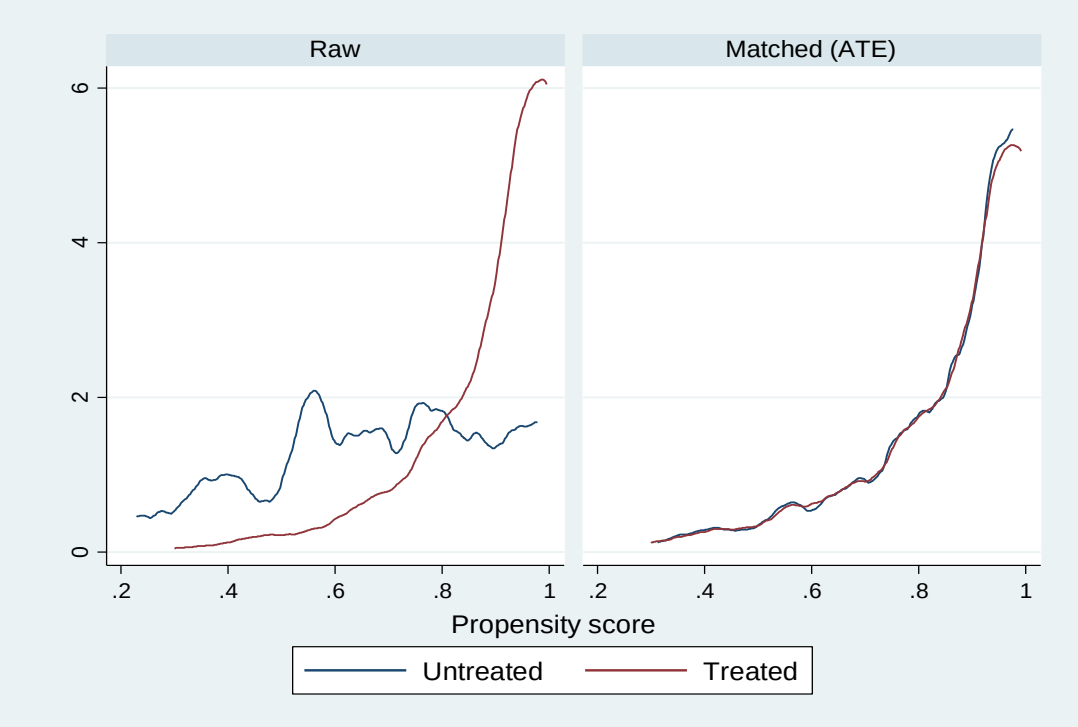


Figure 2. Density of propensity score distribution for the treated and untreated groups before and after matching

3.3. Parallel trend test

In order to do causal inference and achieve unbiased estimates with DID approach, parallel trend between the treatment and control groups before the treatment should be

satisfied. Therefore, the author did parallel trend test for the two groups based on pre-treatment data. Results are shown in Table 5, which illustrates that the parallel trend assumption was met since there were no significant differences between the treatment and control groups.

Table 5. Parallel trend test before and after matching

	Doctor visits	
	Before matching	After matching
Year*treatment	-0.0795 (-1.42)	0.0647 (0.96)
Year 1 (2006/2007, ref)		
Year 2 (2011/2012)	0.133*** (2.60)	0.115*** (4.17)
Individual income:		
Quartile 1 (ref)		
Quartile 2	0.0658 (0.79)	-0.0871 (-1.02)
Quartile 3	0.0181 (0.17)	-0.528*** (-7.97)
Quartile 4	-0.0961 (-0.73)	-0.342*** (-4.44)
Marital status:		
The married (ref)		
The single	0.150 (1.06)	-0.485*** (-2.97)
No. of chronic diseases	0.110*** (7.37)	0.120*** (6.40)
Self-perceived health status:		
Excellent and very good (ref)		
Good	0.346*** (5.86)	0.0713 (0.82)
Fair and poor	0.464*** (6.86)	0.252** (2.40)
Obs	1,354	926

Notes. Standard errors are in parentheses. Significance levels: ***p<0.01; **p<0.05; *p<0.1.

3.4. Impact on ambulatory care utilization in four years

In this section, the author tries to explore the impact of copayment abolition on the frequency of doctor visits. In section 3.4.1, a constant ATT between year 3 (2015) and year 4 (2017) is assumed. In section 3.4.2, varied ATTs are allowed.

3.4.1. Assuming a constant ATT

Table 6 shows the DID estimates for the impact on ambulatory care utilization in four years after copayment abolition with fixed-effects Poisson model by adding covariates in sequence when assuming a constant ATT between year 3 (2015) and year 4 (2017). Generally speaking, copayment abolition was statistically significantly related to the decrease of doctor visits in the long run, which was very robust when covariates were sequentially controlled. Results here illustrate that copayment abolition in 2013 would have a negative influence on doctor visits when the author explores the long-run effect by including the data from 2006 to 2017.

Concerning the results of covariates, the poorest in the 1st quartile of individual income significantly saw more doctors than the other subgroups. Besides, the single possibly visited around 39.5%[4] -52.3% more doctors than the married. Furthermore, the worse people's self-perceived health status was, the higher doctor visits people would have (26%-91.7%). All in all, the vulnerable tend to seek more care.

Table 6. Impact of copayment abolition on doctor visits in four years- assuming a constant ATT

	(1)	(2)	(3)	(4)
Post*treatment	-0.0927**	-0.0867*	-0.0931**	-0.0992**
	(-2.08)	(-1.84)	(-1.98)	(-2.10)

[4] This is calculated by ((e^0.333)-1)*100%, same with the other coefficients drawn with Poisson or negative binomial model in the thesis. See the notes in Table 6 for details.

	(1)	(2)	(3)	(4)
Post	0.276***	0.264***	0.251***	0.208***
	(15.89)	(13.47)	(12.81)	(9.91)
Individual income:				
Quartile 1 (ref)				
Quartile 2		-0.627***	-0.653***	-0.647***
		(-14.27)	(-14.74)	(-14.72)
Quartile 3		-0.565***	-0.572***	-0.567***
		(-13.72)	(-13.86)	(-13.52)
Quartile 4		-0.438***	-0.474***	-0.447***
		(-5.80)	(-6.34)	(-5.95)
Marital status:				
The married (ref)				
The single			0.421***	0.333***
			(6.45)	(4.94)
No. of chronic diseases				0.0454***
				(5.72)
Self-perceived health status:				
Excellent and very good (ref)				
Good				0.228***
				(5.28)
Fair and poor				0.174***
				(3.61)
Obs	1,868	1,868	1,868	1,868

Notes. Estimates stem from conditional fixed-effects Poisson specifications. They are all multiple-imputation estimates. Coefficients could be interpreted as multiplicative factors. Specifically, the dependent variable increases by ((e^c)-1)*100% when the independent variable increases by one unit, where c denotes the values of coefficients. Standard errors are in parentheses. Significance levels: ***p<0.01; **p<0.05; *p<0.1. *Obs*=Observations.

3.4.2. Allowing varied ATTs over time

Table 7 illustrates the DID results when allowing varied ATTs between year 3 (2015) and year 4 (2017). Results show that there exist indeed varied ATTs between year 3 and 4. In year 3, copayment abolition was significantly associated with 16.3-18.5% increase of doctor visits, which is robust when more covariates were added in the model. While in year 4, we have observed a 24.8-26.4% negative influence on doctor visits, which was also robust. As for the results of the covariates, consistent estimates with the ones in the section 3.4.1 were achieved.

Table 7. Impact of copayment abolition on doctor visits in four years- allowing varied ATTs

	(1)	(2)	(3)	(4)
Year 3*treatment	0.152***	0.170***	0.160***	0.151***
	(2.82)	(3.06)	(2.87)	(2.71)
Year 4*treatment	-0.305***	-0.285***	-0.285***	-0.307***
	(-5.64)	(-5.10)	(-5.11)	(-5.44)
Year 1 (2006/2007)	-0.121***	-0.145***	-0.144***	-0.150***
	(-4.97)	(-5.79)	(-5.74)	(-5.89)
Year 2 (2011/2012, ref)				
Year 3 (2015)	0.0154	-0.00276	-0.00254	-0.0321
	(0.62)	(-0.11)	(-0.10)	(-1.19)
Year 4 (2017)	0.384***	0.342***	0.327***	0.286***
	(16.86)	(13.18)	(12.51)	(10.01)
Individual income:				
Quartile 1 (ref)				
Quartile 2		-0.602***	-0.623***	-0.623***

	(1)	(2)	(3)	(4)
		(-14.64)	(-14.93)	(-14.82)
Quartile 3		-0.530***	-0.539***	-0.543***
		(-13.20)	(-13.37)	(-13.21)
Quartile 4		-0.370***	-0.399***	-0.381***
		(-5.78)	(-6.20)	(-5.82)
Marital status:				
The married (ref)				
The single			0.276***	0.182***
			(4.22)	(2.69)
No. of chronic diseases				0.0353***
				(4.41)
Self-perceived health status:				
Excellent and very good (ref)				
Good				0.252***
				(5.77)
Fair and poor				0.236***
				(4.86)
Obs	1,868	1,868	1,868	1,868

Notes. Estimates stem from conditional fixed-effects Poisson specifications. They are all multiple-imputation estimates. Coefficients could be interpreted as multiplicative factors. Specifically, the dependent variable increases by ((e^c)-1)*100% when the independent variable increases by one unit, where c denotes the values of coefficients. Standard errors are in parentheses. Significance levels: ***p<0.01; **p<0.05; *p<0.1. *Obs*=Observations.

3.5. Impact on ambulatory care utilization in two years

Enlighted by the results in the section 3.4.2 when allowing varied ATTs between year 3 (2015) and year 4 (2017), the author hypothesizes that copayment abolition may only arouse short-term positive effect on doctor visits. Therefore, the author further analyzes the model by only including data in year 2 (2011/2012) and year 3 (2015) to examine the short-term effect of copayment abolition. As shown in Table 8, the DID estimate shows that copayment abolition significantly aroused 12.7-30.2% increase of doctor visits after abolishing copayment for two years.

Table 8. Impact of copayment abolition on doctor visits in two years

	(1)	(2)	(3)	(4)
Post*treatment	0.120*	0.260***	0.264***	0.185***
	(1.95)	(3.98)	(4.03)	(2.71)
Post	0.0203	-0.0686**	-0.0682**	-0.128***
	(0.80)	(-2.44)	(-2.42)	(-4.12)
Individual income:				
Quartile 1 (ref)				
Quartile 2		-0.508***	-0.509***	-0.684***
		(-7.54)	(-7.54)	(-9.24)
Quartile 3		-0.0396	-0.0390	-0.166**
		(-0.59)	(-0.58)	(-2.35)
Quartile 4		0.122	0.122	0.118
		(1.54)	(1.55)	(1.39)
Marital status:				
The married (ref)				

	(1)	(2)	(3)	(4)
The single			-0.216	-0.0710
			(-0.75)	(-0.24)
No. of chronic diseases				0.0767***
				(5.66)
Self-perceived health status:				
Excellent and very good (ref)				
Good				0.333***
				(4.46)
Fair and poor				0.753***
				(7.44)
Obs	924	924	924	924

Notes. Estimates stem from conditional fixed-effects Poisson specifications. They are all multiple-imputation estimates. Coefficients could be interpreted as multiplicative factors. Specifically, the dependent variable increases by ((e^c)-1)*100% when the independent variable increases by one unit, where c denotes the values of coefficients. Standard errors are in parentheses. Significance levels: ***p<0.01; **p<0.05; *p<0. *Obs*=Observations.

3.6. Heterogeneous impacts on ambulatory care utilization in two years

According to the above results, a significant positive short-term effect on ambulatory care utilization was aroused for the whole sample in two years after copayment abolition. The author is wondering whether the effect differs for subgroups according to individual income, marital status, health status or age. In this section, the author explores the heterogeneous effects in the short run according to these subgroups, by utilizing data in year 2 and 3.

Heterogeneous results are presented in Table 9. Coefficients of three-way interaction terms reflect the heterogeneous effects. As shown in the first three rows, the impacts of copayment abolition on doctor visits did not vary among people with different levels of income when all the covariates were controlled. This finding tells us that copayment abolition has equally affected all the people enrolled in the SHI, no matter the rich or the poor. In other words, both the rich and the poor have benefited from copayment abolition in regard of ambulatory care use in the short term.

In the fourth row Table 9, the heterogeneous results according to marital status are shown by adding the three-way interaction term. It illustrates that the positive impact of copayment abolition on the married was significantly higher than on the single. The coefficients could be interpreted as the married were 67.2% more positively influenced by copayment abolition than the single, which is to say the married benefited more from the increased ambulatory care utilization caused by copayment abolition.

The heterogeneous DID estimate according to the number of chronic diseases is listed in the fifth row Table 9, to show whether different impacts exist among people with various numbers of chronic diseases. Results tell us people with less chronic diseases were more easily impacted by copayment abolition. In details, copayment abolition would lead to a 21.0% more increase in doctor visits for people with one less chronic disease, which is to say people with less chronic diseases benefit more from the increased ambulatory care utilization due to copayment abolition.

As presented in the sixth row Table 9, heterogeneous results according to age were detected. Specifically, with one year older, doctor visits would be 3.9% more influenced by copayment abolition. This shows that the older would benefit more from the increased care aroused by copayment abolition.

Table 9. Heterogeneous impacts of copayment abolition on doctor visits in two years

	(1) Individual income	(2) Marital status	(3) Chronic diseases	(4) Age
Post*Treatment*Individual income (1: ref)				
Post*Treatment*Individual income (2)	-0.197			
	(-0.66)			
Post*Treatment*Individual income (3)	0.0853			
	(0.32)			
Post*Treatment*Individual income (4)	-0.0966			
	(-0.35)			
Post*Treatment*Marital status (the married: ref)				
Post*Treatment*Marital status (the single)		-1.114***		
		(-6.56)		
Post*Treatment*Chronic diseases			-0.236***	
			(-4.37)	
Post*Treatment*Age				0.0379***
				(3.68)
Post*Treatment	0.112	0.321***	0.618***	-8.147***
	(0.50)	(4.26)	(4.83)	(-5.94)
Post *Individual income (1: ref)				
Post *Individual income (2)	-0.275**			
	(-2.36)			
Post *Individual income (3)	-0.719***			
	(-5.74)			

	(1) Individual income	(2) Marital status	(3) Chronic diseases	(4) Age
Post *Individual income (4)	0.152			
	(1.10)			
Treatment*Individual income (1: ref)				
Treatment*Individual income (2)	0.882***			
	(2.96)			
Treatment*Individual income (3)	0.308			
	(1.01)			
Treatment*Individual income (4)	-0.269			
	(-0.84)			
Post *Marital status (the married: ref)				
Post *Marital status (the single)		0.913***		
		(11.65)		
Treatment*Marital status (the married: ref)				
Treatment*Marital status (the single)		2.266***		
		(2.83)		
Post *Chronic diseases			-0.0648***	
			(-2.89)	
Treatment*Chronic diseases			0.171***	
			(2.60)	
Post *Age				-0.0226***
				(-3.29)
Treatment*Age				1.435***
				(5.38)

	(1) Individual income	(2) Marital status	(3) Chronic diseases	(4) Age
Post	0.107	-0.316***	0.00160	6.141***
	(1.13)	(-9.09)	(0.03)	(6.82)
Age				-1.189***
				(-7.63)
Individual income:				
Quartile 1 (ref)				
Quartile 2	-0.710***	-0.671***	-0.810***	-0.792***
	(-7.02)	(-8.55)	(-9.22)	(-10.46)
Quartile 3	0.0119	-0.320***	-0.280***	-0.122*
	(0.13)	(-4.31)	(-3.49)	(-1.65)
Quartile 4	-0.0923	-0.245**	0.0307	0.0586
	(-0.73)	(-2.41)	(0.32)	(0.70)
Marital status:				
The married (ref)				
The single	0.298	-1.820**	-0.129	-0.105
	(1.00)	(-2.54)	(-0.44)	(-0.36)
No. of chronic diseases	0.0822***	0.117***	0.148***	0.109***
	(5.44)	(8.38)	(5.30)	(6.99)
Self-perceived health status:				
Excellent and very good (ref)				
Good	0.414***	0.499***	0.341***	0.515***
	(5.28)	(6.49)	(4.54)	(6.52)
Fair and poor	0.869***	0.887***	0.728***	0.715***
	(7.59)	(8.75)	(7.02)	(6.86)

	(1) Individual income	(2) Marital status	(3) Chronic diseases	(4) Age
Obs	924	924	924	924

Notes. Estimates stem from conditional fixed-effects Poisson specifications. They are all multiple-imputation estimates. Coefficients could be interpreted as multiplicative factors. Specifically, the dependent variable increases by ((e^c)-1)*100% when the independent variable increases by one unit, where c denotes the values of coefficients. Standard errors are in parentheses. Within VCE type: OIM. Significance levels: ***p<0.01; **p<0.05; *p<0.1. *Obs*=Observations.

3.7. Impact on inpatient care utilization in four years

In this section, the author tries to inspect whether hospitalization offsetting effect has appeared after copayment abolition, say whether copayment abolition for ambulatory care has caused the change of inpatient care use. Only effects in four years were investigated in our study since the author expects that the increased doctor visits caused by copayment abolition would not influence inpatient care use in a short run. In section 3.7.1, a constant ATT between year 3 (2015) and year 4 (2017) is assumed. In section 3.7.2, varied ATTs are allowed.

3.7.1. Assuming a constant ATT

Table 10 shows the DID estimates for the impact on inpatient care utilization within four years with fixed-effects Poisson model when assuming a constant ATT between year 3 (2015) and year 4 (2017). Generally speaking, copayment abolition was statistically significantly related to the decrease of total nights in hospital in the long run (62.7-68.7%), which was

very robust when covariates were added in the model in sequence. This finding illustrates that hospitalization offsetting effect has shown up in the long run.

Table 10. Impact of copayment abolition on total nights in hospital in four years-assuming a constant ATT

	(1)	(2)	(3)	(4)
Post*treatment	-1.161***	-0.986***	-1.035***	-1.158***
	(-12.10)	(-9.13)	(-9.64)	(-10.43)
Post	0.629***	0.619***	0.547***	0.313***
	(20.40)	(12.79)	(12.26)	(5.61)
Individual income:				
Quartile 1 (ref)				
Quartile 2		1.184***	1.170***	1.169***
		(11.54)	(12.02)	(12.13)
Quartile 3		-0.0133	0.0374	-0.128
		(-0.09)	(0.28)	(-0.93)
Quartile 4		2.233***	1.836***	1.818***
		(15.32)	(13.94)	(13.21)
Marital status:				
The married (ref)				
The single			1.818***	1.261***
			(11.61)	(6.80)
No. of chronic diseases				0.310***
				(14.30)
Self-perceived health status:				
Excellent and very good (ref)				

	(1)	(2)	(3)	(4)
Good				2.085***
				(14.65)
Fair and poor				1.889***
				(13.24)
Obs	924	924	924	924

Notes. Estimates stem from conditional fixed-effects Poisson specifications. They are all multiple-imputation estimates. Coefficients could be interpreted as multiplicative factors. Specifically, the dependent variable increases by ((e^c)-1)*100% when the independent variable increases by one unit, where c denotes the values of coefficients. Standard errors are in parentheses. Significance levels: ***p<0.01; **p<0.05; *p<0.1. *Obs*=Observations.

3.7.2. Allowing varied ATTs over time

Table 11 shows the DID results when allowing varied ATTs between year 3 (2015) and year 4 (2017). Based on results here, the author found that hospitalization offsetting effect had even appeared in year 3 (decrease by 46.4-56.0%), i.e. after abolishing copayment for two years. Moreover, this effect became stronger after copayment was abolished for four years (decrease by 74.3-77.5%).

Table 11. Impact of copayment abolition on total nights in hospital in four years-allowing varied ATTs

	(1)	(2)	(3)	(4)
Year 3*treatment	-0.780***	-0.623***	-0.700***	-0.822***
	(-6.60)	(-4.43)	(-5.11)	(-5.78)
Year 4*treatment	-1.490***	-1.360***	-1.399***	-1.469***
	(-11.84)	(-9.77)	(-10.09)	(-10.57)
Year 1 (2006/2007)	-0.523***	-0.420***	-0.469***	-0.233***
	(-11.13)	(-8.59)	(-9.69)	(-4.38)
Year 2 (2011/2012, ref)				
Year 3 (2015)	0.118***	0.196**	0.188**	0.172**
	(2.78)	(2.52)	(2.82)	(2.33)
Year 4 (2017)	0.621***	0.667***	0.519***	0.273***
	(16.29)	(14.63)	(11.08)	(5.01)
Individual income:				
Quartile 1 (ref)				
Quartile 2		1.239***	1.216***	1.135***
		(11.65)	(12.01)	(11.27)
Quartile 3		0.0555	0.0638	-0.148
		(0.36)	(0.47)	(-1.10)
Quartile 4		2.270***	1.891***	1.779***
		(17.17)	(14.40)	(12.08)
Marital status:				
The married (ref)				
The single			1.710***	1.296***
			(10.27)	(6.46)
No. of chronic diseases				0.292***

	(1)	(2)	(3)	(4)
				(13.85)
Self-perceived health status:				
Excellent and very good (ref)				
Good				2.024***
				(14.05)
Fair and poor				1.836***
				(12.45)
Obs	924	924	924	924

Notes. Estimates stem from conditional fixed-effects Poisson specifications. They are all multiple-imputation estimates. Coefficients could be interpreted as multiplicative factors. Specifically, the dependent variable increases by ((e^c)-1)*100% when the independent variable increases by one unit, where c denotes the values of coefficients. Standard errors are in parentheses. Significance levels: ***p<0.01; **p<0.05; *p<0.1. *Obs*=Observations.

3.8. Robustness check

The author does two robustness checks firstly by excluding part of pre-treatment data (data in year 1) from the sample, and secondly by adopting unbalanced panel to increase the whole sample size.

3.8.1. By excluding part of pre-treatment data

Table 12 shows the robustness check results by excluding data in year 1 from the sample, in order to check how ATT differs with less pre-treatment period. When assuming a constant ATT, results show that copayment abolition did not influence doctor visits significantly, demonstrating that the pattern of treatment effects are not sensitive to less pre-treatment period. When allowing varied ATTs over time, similar with the results shown in Table 7, the

author still found a positive relation between copayment abolition and doctor visits in year 3 and a negative relation in year 4, which shows varied ATTs are also not sensitive to less pre-treatment period.

Table 12. Robustness check by excluding data in year 1

	(1) constant ATT	(2) varied ATTs
Post*treatment	-0.0168 (-0.27)	
Year 3*treatment		0.202*** (2.98)
Year 4*treatment		-0.204*** (-2.98)
Post	0.0269 (0.83)	
Year 2 (2011/2012, ref)		
Year 3 (2015)		-0.0960*** (-3.10)
Year 4 (2017)		0.154*** (4.18)
Individual income:		
Quartile 1 (ref)		
Quartile 2	-0.880*** (-14.39)	-0.807*** (-13.38)
Quartile 3	-0.551*** (-9.07)	-0.497*** (-8.83)
Quartile 4	-0.481*** (-4.96)	-0.381*** (-4.33)
Marital status:		
The married (ref)		
The single	0.793*** (9.12)	0.604*** (6.78)
No. of chronic diseases	0.112*** (10.04)	0.0935*** (8.27)
Self-perceived health status:		
Excellent and very good (ref)		
Good	0.260*** (4.73)	0.286*** (5.24)
Fair and poor	-0.00259 (-0.04)	0.0647 (1.08)

	(1) constant ATT	(2) varied ATTs
Obs	1,389	1,389

Notes. Estimates stem from conditional fixed-effects Poisson specifications. They are all multiple-imputation estimates. Coefficients could be interpreted as multiplicative factors. Specifically, the dependent variable increases by ((e^c)-1)*100% when the independent variable increases by one unit, where c denotes the values of coefficients. Standard errors are in parentheses. Significance levels: ***p<0.01; **p<0.05; *p<0.1. *Obs*=Observations.

3.8.2. For unbalanced panel

With unbalanced panel, our sample size has been expanded from 1,868 to 2,885. As stated in Table 13, copayment abolition would not cause a change in doctor visits on average when assuming a constant ATT, which is consistent with the above findings. When varied ATTs over time are allowed, a positive relation between copayment abolition and doctor visits in year 3 and a negative relation in year 4 were found, which illustrates varied ATTs are also not sensitive to our unbalanced panel.

Table 13. Robustness check for unbalanced panel

	(1) constant ATT	(2) varied ATTs
Post*treatment	0.0811 (1.09)	
Year 3*treatment		0.233*** (3.24)
Year 4*treatment		-0.0853 (-0.89)
Post	0.113***(5.93)	
Year 1 (2006/2007)		-0.0134 (-0.68)
Year 2 (2011/2012, ref)		

	(1) constant ATT	(2) varied ATTs
Year 3 (2015)		0.0259 (1.14)
Year 4 (2017)		0.210*** (8.64)
Individual income:		
Quartile 1 (ref)		
Quartile 2	-0.0263 (-0.13)	-0.0550 (-0.31)
Quartile 3	-0.230 (-1.30)	-0.238 (-1.48)
Quartile 4	0.0977 (0.56)	0.0787 (0.48)
Marital status:		
The married (ref)		
The single	-0.333***(-4.01)	-0.391***(-4.70)
No. of chronic diseases	-0.0648***(-6.58)	-0.0760***(-7.31)
Self-perceived health status:		
Excellent and very good (ref)		
Good	0.135***(3.84)	0.164***(4.65)
Fair and poor	0.798***(21.73)	0.794***(22.20)
Obs	2,885	2,885

Notes. Estimates stem from conditional fixed-effects Poisson specifications. They are all multiple-imputation estimates. Coefficients could be interpreted as multiplicative factors. Specifically, the dependent variable increases by ((e^c)-1)*100% when the independent variable increases by one unit, where c denotes the values of coefficients. Standard errors are in parentheses. Significance levels: ***p<0.01; **p<0.05; *p<0.1. *Obs*=Observations.

4. Discussion

4.1. The impact of copayment abolition on health care utilization

According to the results, copayment abolition increased the demand for ambulatory care only in the short run among people over 50 in Germany, which disappeared and was even followed by a decreased trend when the author looked at the long run effect. With a copayment, certain amount of people would be reluctant to seek ambulatory care even having health needs. While with the abolishment of copayment, these delayed demands from the previous period would be instantly met in the current period. Besides, health needs for this amount of people in the current period would also be satisfied without delays. Furthermore, the amount of abolished copayment is ten Euros, which is not a big figure, only accounting approximately 0.2% of the median income (21,213 Euros) of German population in 2013. Such a limited amount of copayment would not be expected to stimulate a longer effect on care use. Therefore, ambulatory care use would increase after copayment abolished only for a short time.

Based on our findings, a copayment abolition has caused an increase in doctor visits in a short run, though we do not know whether these increased visits are necessary or unnecessary, i.e. whether moral hazard has occurred. But we have observed a decreasing trend of doctor visits and also inpatient care use in the long run, which could be called hospitalization offsetting effects. In some cases, ambulatory care and inpatient care are substitutes, such as for moderately severe diseases. For example, for people with moderately severe hypertension or diabetes, if they could regularly get access to ambulatory care and receive tertiary prevention, the proportion of diseases deterioration could be dramatically reduced and consequently, potential hospitalization care could be avoided. This finding seems to demonstrate that a zero copayment is beneficial for both the older and the health system. Through the increased care use shortly after copayment abolition, previous unmet health needs could be further met and some minor diseases could be timely treated, cured and

prevented to deteriorate. In this way, the older benefits because unnecessary sufferings from severe diseases could be avoided and more welfare could be obtained, and the health system also benefits in the regard that unnecessary waste of medical resources and capital resources could be avoided.

Our findings are inconsistent with the RAND HIE study done in the US in 1987, which shows ambulatory and inpatient care were complements and no offset was detected (Manning et al., 1987). This inconsistency could be probably attributed to the non-elderly sample in RAND study, since the older are more sensitive to price change as shown in our heterogeneous results, and more likely to get more severe diseases if health needs cannot be timely satisfied and health care use has been delayed, i.e., a delayed care use may more easily lead to the deterioration of health status for the older, but may have little impact on the non-elderly. When compared with more recent studies, consistent findings are shown. In Japan, the coinsurance rate was reduced from 30% to 10% for people aged over 70. Researchers found out that the elderly were sensitive to this policy in both outpatient and inpatient care use (Shigeoka, 2014). Besides, much previous research found that initial reductions in ambulatory visits might increase the need for subsequent hospitalizations (Trivedi et al., 2010; Wharam et al., 2013).

Based on our findings, the older have indeed benefited from this copayment abolition policy. Some diseases may have been prevented to deteriorate and they do not have to suffer evitable inpatient care. According to this, we could possibly infer that ambulatory care utilization before the copayment abolition was kind of insufficient for the older compared with their actual healthcare needs because their needs have been better met by avoiding diseases deterioration after ambulatory care utilization increased. In addition, based on loss aversion theory in behavioral economics, people would rather avoid losses than acquire equivalent gains. In our case, copayment abolition in 2013 could be regarded as “gains” and copayment enaction in 2004 as “losses”. We could speculate that the copayment enaction policy in 2004 possibly had significant and more severe influences on ambulatory healthcare

utilization for the older, which is to say the older may have reduced their ambulatory utilization after copayment introduction in 2004 (Dawes, 2004). However, this is not consistent with previous studies on copayment introduction in Germany in 2004, probably because their sample is the whole population (Augurzky et al., 2006; Schreyögg and Grabka, 2010).

Based on the traditional assumption in economic models, modelling human beings as rational, an accurate cost-benefit calculation before purchasing healthcare goods or services would be expected. In this sense, medical insurance would induce people's demands for healthcare since the amount of OOP is lower than the equilibrium price, which would lead to overuse of healthcare. According to this logic, various policies have been adopted to limit the overuse, such as introducing copayment in ambulatory care. The ideal pathway would be as follows: proper copayment increase would reduce unnecessary use of healthcare in ambulatory care and no other side effects would be aroused, such as hospitalization offsets. However, all of this is based on the assumption of rationality, which might be too strong to predict real life behaviors. Individuals will do "psychic" cost-benefit calculus instead of economic calculus when deciding on healthcare utilization. Due to the asymmetric information in the field of healthcare, people tend to underestimate the benefit when making decisions possibly because some benefits could only appear in the future. This would prevent people to make optimal choices. Therefore, instead of overuse, the "non-rational" people would possibly underuse healthcare services. If so, copayment increase would undoubtedly worsen the situation, further reduce their insufficient utilization and other side effects such as hospitalization offsets would be possibly brought about (Congdon et al., 2011).

4.2. Heterogeneity of copayment abolition's impacts

According to the heterogeneous results, we found no differences in impacts on people with different income. Specifically, the older enrolled in the SHI, no matter poorer or richer, are all equally sensitive to the copayment abolition policy. Zero copayment is important for

the vulnerable elderly to seek care timely whenever it is needed. While this conclusion is inconsistent with some previous studies. The WHO conducted research on the impact of eliminating user fees on healthcare utilization and found that utilization among the poor increased at a higher rate than the non-poor after the abolition of fees in Uganda (Xu et al., 2006). The inconsistency may be due to the extremely different background settings and quite varied income levels between the two countries.

Secondly, when compared with the single, a significantly larger impact on doctor visits for the married was shown according to our heterogeneous results. This is possibly because healthcare needs of the single are relatively more rigid since the married could be cared by their couples when they have mild illness.

Thirdly, people with less number of chronic diseases are more easily influenced by copayment abolition policy. For people with better health status, they are more sensitive to price change because they have less rigid needs for healthcare compared with people with poorer health status. Besides, for people with chronic diseases, the more their disease burdens are, the more they could deduct from taxes, which would in turn mitigate the impact of copayment abolition. Furthurmore, people with poorer health status, who were already high-volume users of doctor visits before copayment abolition, are less impacted by this policy because patients only need to pay 10 Euro per quarter and no more copayment would be charged if more visits happen within the same quarter, and high-volume patients would less be influenced by copayment charging and in turn less be influenced by copayment abolition. The finding illustrates that copayment abolition benefits people with less chronic diseases and better health status most.

Fourthly, the coefficient of the interaction term between age and DID estimator shows that impacts of copayment abolition on doctor visits for people with different ages are varied. The impact of copayment abolition on people's doctor visits becomes larger with the increase of age. This shows that the older people turn, the more vulnerable and more sensitive to price people become. This is possible because the older have lost their labor ability, their expected

income or pension would become lower relative to inflation rate with time, and their potential medical expenses would increase with the deterioration of their health status when compared with the younger. Therefore, policy-makers should always give priority and special attention to the older among the older.

5. Conclusion

According to the findings, copayment abolition could only arouse a short-term positive effect on ambulatory care utilization for the older people, but a long-term negative effect on both ambulatory care and inpatient care utilization. We have found a hospitalization offsetting effect among the older in Germany when copayment was abolished in 2013. It provides implications for other countries that zero copayment for outpatient care is crucial for the older people to help satisfy their necessary care needs instantly, which would not only benefit the older but also benefit the health system. However, we should also bear in mind that there exist some limitations in this study. For instance, we cannot distinguish whether a person is enrolled in the SHI or in a PHI, and we could only determine the treatment based on individuals' employment status. This would result in that some SHI enrollees are regarded as the control and also some PHI enrollees are regarded as the treatment. Therefore, the true impact of copayment abolition would be underestimated.

Chapter 3: Did cost sharing reduction affect outpatient care utilization for the older people in China

Abstract:

In order to examine whether cost sharing reduction has an impact on outpatient care utilization among the older people in China, the author selected enrollees aged 45 and above in the Basic Medical Insurance for Urban and Rural Residents from Taizhou in Zhejiang province and Maoming in Guangdong province as the treatment and control group respectively, because coinsurance for outpatient care services was decreased from 75% to 55% in Taizhou while unchanged in Maoming in 2015. The author adopted fixed-effects negative binomial model and fixed-effects Poisson model with the difference-in-differences design to see the impact.

The author reaches a conclusion that a 20% coinsurance reduction had little effect on outpatient care utilization among these enrollees in China, probably because the current cost sharing is still too high, limiting the proper healthcare utilization. Compared with people with the lowest net worth, people with higher net worth tended to use more outpatient care when considering about the other disturbing factors, such as health status and other demographic factors. This reflects the inequity in accessibility of outpatient care among the enrollees in the Basic Medical Insurance for Urban and Rural Residents. Households with more members tended to use less outpatient care services, which is possibly because people with minor illnesses would avoid to see doctors when care from their families is available.

Key words:

Cost sharing reduction, outpatient care utilization, the older people, China

1. Introduction

The author has reviewed literature on cost sharing abolition in Chapter 2. Here the author would further review on cost sharing reduction literature. In 2001, it was regulated that coinsurance should be reduced from 30% to 10% for the elderly over 70 years old in Japan. Relevant studies have focused on this cost sharing reduction policy for the elderly. Nishi et al. (2012) assessed the impact of reduced cost sharing on OOP medical spending and both physical and mental health status using a regression discontinuity design. Results show that the reduced cost sharing was significantly associated with lower OOP medical spending and better mental health among the elderly in Japan. However, Fukushima et al. (2016) found no significantly improved short-term health outcomes. Shigeoka (2014) used a regression discontinuity design to see the influence on utilization, health and medical spending. He found that the elderly were price sensitive for both outpatient care and inpatient care, and the reduced coinsurance was associated with lower OOP payment but not with mortality or other health outcomes. In addition, some scientists did a research on the impact of reduced copayments on outpatient mental health services use among the elderly. They adopted a DID design to compare the use of enrollees in Medicare plans, where mental health copayment was decreased, with the use of enrollees in Medicare plans that kept unchanged. They get the conclusion that effects on the likelihood of utilizing outpatient mental health care were negligible (Ndumele and Trivedi, 2011). Besides, other scientists paid attention to a subsidy policy for children's outpatient care in Japan and investigated the impact of reducing cost sharing for outpatient care on inpatient care use. They found no significant effects on inpatient care, which however was significantly reduced in lower income regions but increased in higher income regions. The results suggest that outpatient care and inpatient care were substitutes in lower income regions but not in higher income ones (Kato and Goto, 2017). As for cost sharing reduction in the setting of Chinese health system, the author finds seldom research on it.

As introduced in chapter 1, there are three different health insurances in China depending on the employment conditions and residence regions, the rural or the urban. The urban employees are enrolled in the UEBMI, which has relatively comprehensive benefit packages and is pooled at the city level. The rural residents are enrolled in the NCMS and the urban unemployed residents are enrolled in the URBMI. The latter two health insurances share many similarities such as both providing limited benefit packages and both being pooled originally at the county level in most cities. In my study, the author only focuses on the URBMI and the NCMS due to the limited sample size of enrollees in the UEBMI and the big gap between the UEBMI and the other two insurances. Because of the low pooling level of the URBMI and the NCMS, there are big gaps among different cities and even counties concerning financing level, cost sharing level and many other relevant health policies, which could be determined by regional economic development and attached importance to healthcare. Therefore, even though the State Council just released a nationwide regulation on integrating the NCMS and the URBMI in 2016, many provinces or cities have already announced the integrating policies beforehand, which could also be regarded as an example for other regions. Because of the big gaps among cities, the author could only regard city as a maximum unit to do my analysis. In the study, the author selected the city of Taizhou in Zhejiang province and the city of Maoming in Guangdong province as the study objects.

In Zhejiang Province, the pooling was at the county level in both 2013 and 2015, which makes health insurance policies in the same city vary among different counties. Therefore, the author has to check the detailed health insurance policies in Huangyan county of Taizhou city, where my sample is selected. Besides, the URBMI and the NCMS were integrated as the Basic Medical Insurance for Urban and Rural Residents (RBMI) in 2015. In 2013, the URBMI and the NCMS were separately managed in Taizhou, but the coinsurance for outpatient care was the same for enrollees in the two insurances in Huangyan, Taizhou, which was 75%. There were no deductibles but the ceiling was set as 500 RMB per year. Two years later in 2015, the two insurances were integrated and health insurance policies were further

improved. Coinsurance for outpatient care was reduced to 55% and the ceiling was increased to 600 RMB per year. At the same time, there were still no deductibles.

In order to analyze whether the cost sharing reduction has caused a change of health care utilization in Taizhou, the author selects the city of Maoming in Guangdong as the control group. Unlike Zhejiang Province, the URBMI and the NCMS in Guangdong Province were integrated as the RBMI in 2012 and the pooling was heightened to the city level in 2012. Coinsurance for outpatient care in Maoming City of Guangdong province was 50% and the ceiling was only 40 RMB per year. There were also no deductibles in Maoming. However, there were no changes for these policies between 2013 and 2015. All in all, the author regards Taizhou as the treatment group due to the policy changes and Maoming as the control group due to the unchanged policies in the study.

Taizhou and Maoming share many similarities though with some differences. They are both prefecture-level cities with around 10,000 square kilometers and around 6 million population. The GDP per capita in Taizhou is 72,175 RMB in 2017, while in Maoming it is only 47,134 RMB, around 65.3% of the one in Taizhou. The structures of primary industry, secondary industry and tertiary industry are 6.5:44.2:49.3 in Taizhou and 15.7:41.2:43.1 in Maoming, which shows that the proportion of primary industry is larger in Maoming than in Taizhou. In order to minimize the heterogeneity, the matching method was adopted in my study concerning the differences between the two cities.

Based on the United Nations standards, the definition of an ageing society is a country or a region where the population aged over 65 exceeds 7% of the whole population (World Bank, 2019). In 2000, this proportion has reached 7% for the first time in history and China has entered an ageing society. In the following years, the proportion has been increasing continuously and reached 10% in 2014. With the changing of population structure, health insurance policies should also be adjusted simultaneously and special attentions should be paid to the elderly. In the study, the author focuses on both the late-middle age and the elderly

population, to explore whether cost sharing reduction would influence their outpatient care utilization.

2. Methods

2.1. Data source and study population

The author utilizes data from China Health and Retirement Longitudinal Study (CHARLS), which aims to collect nationally representative sample of population aged 45 and the above in China and provides individual-level panel data on health, socio-economic status and social and family networks every two years (Zhao et al., 2013). Wave 2 (2013) and wave 3 (2015) are adopted in this study. Wave 1 (2011) is excluded since its inclusion would reduce the number of eligible individuals due to attrition and new enrollment. This study adopts balanced data to avoid disturbance caused by unbalanced random effect terms (Baltagi, 2005; Cameron and Trivedi, 2009). CHARLS 2014 is excluded since it surveys life-history data. Therefore, the author uses data of wave 2 and wave 3 in the study. In order to explore the impact of cost sharing reduction on outpatient care utilization, the author selects the sample in Taizhou in Zhejiang province and Maoming in Guangdong province as the treatment and the control group respectively since coinsurance for outpatient care was decreased in 2015 in Taizhou while no change in Maoming. Due to the big gap between the UEBMI and the other two insurances, the similarity and later integration of the URBMI and the NCMS, and the majority of the interviewees are enrolled in either the URBMI or the NCMS, my sample only includes enrollees in the URBMI and the NCMS (or in the form of integrated health insurance, RBMI). Finally, the author gets 682 observations in the study, among which 380 are in the treatment group. Here the author could not enlarge the sample because health insurance policies are very different in different cities in China since the pooling level before 2015 is only at the city level or even the county level in many cities.

2.2. Measures and variables

Dependent variables. The purpose is to examine whether cost sharing reduction has impact on outpatient care utilization in the setting of Chinese health insurance system, where existing cost sharing for outpatient care is very high especially for enrollees in the URBMI and the NCMS. Therefore, my dependent variable is the number of doctor visits in the last four weeks[5], showing people's outpatient care utilization.

Independent variables. Our core independent variable is the DID estimator (by adding interaction term between the year dummy and the treatment dummy). Besides, the author also controls the following covariates: quartiles of net worth, marital status, household number, number of chronic diseases and self-perceived health status.

The year dummy indicates in which year the observation was interviewed (0 denotes in 2013 and 1 denotes in 2015). The treatment dummy variable indicates which city the individual comes from and whether the policy changes or not (0 indicates the control group from Maoming without policy changes, and 1 indicates the treatment group from Taizhou with policy changes). Individual net worth is calculated by dividing household net worth by square root of household size (OECD, 2011a). Quartiles of individual net worth is a categorical variable. People in the first quartile is the poorest and people in the fourth quartile is the wealthiest. Marital status is also a categorical variable, with 1 representing "married with spouse present, married but not living with spouse temporarily for reasons such as work, and cohabitated", for short, [married], and 2 representing "separated, divorced, widowed and never married", for short, [single]. Number of chronic diseases and self-perceived health status indicate objective and subjective health status respectively. And Self-perceived health

[5] The number of doctor visits in the last month is calculated with the following two variables. The first is with variable code of ED004, by asking "Which types of medical facilities have you visited in the last 4 weeks for outpatient treatment?" The second is with variable code of ED005, by asking "How many times did you visit/been visited by […] during the last month?"

status is a categorical variable, with 1 representing excellent and very good, 2 representing good and 3 representing fair and poor.

To see the raw DID estimates and control the possible endogenous problems, the author first includes only the DID estimator in the model (Angrist and Pischke, 2008). Then covariates that might influence the DID estimates are added in the model in sequence. Thus, the author controls in a second regression for quartiles of individual net worth, marital status and household number. In the third regression, the author also adds the number of chronic diseases or self-perceived health status in the model.

2.3. Design and statistical analysis

The author first estimates the impact of cost sharing reduction on outpatient care utilization with a DID approach, and then estimates the impacts by combining the DID and matching methods since it has been demonstrated by literature that combining DID and matching methods could lower the bias compared with a single method of regression or matching (Glazerman et al., 2003; Ravallion, 2007).

The author adopts both fixed-effect Poisson model and fixed-effect negative binomial model to analyze the impact on outpatient care utilization since the dependent variable is count data. A fixed-effects Poisson model is more consistent to data distribution while a fixed-effects negative binomial model could allow overdispersion and improve efficiency (Gardner et al., 1995; Silva and Tenreyro, 2006; Wooldridge, 1999). For each regression, the author adopts a DID approach. The model is shown as follow:

$$y_{it} = \exp(\alpha + \gamma Treat_i + \lambda Post_t + \delta(Treat_i * Post_t) + X_{it} + \nu_i + \varepsilon_{it}) \quad (4)$$

In this model, *y* denotes doctor visits, *Treat* denotes the treatment group when *Treat*=1 and the control when *Treat*=0, *Post* denotes the year of 2015 when *t*=1 and the year of 2013 when *t*=0, *i* denotes each individual, *X* denotes covariates, which include quartiles of individual net worth, marital status, household number, number of chronic diseases and self-perceived health status. *v* is the individual fixed effect, which controls all the time-invariant individual characteristics. ε is the error term. δ shows the estimated treatment effect.

In order to meet the identical trend assumption for a DID approach, and to minimize selection bias caused by potentially non-identical characteristics between the treatment and the control, the author adopts multivariate-distance matching (MDM) method in the study (Rubin, 1979). We match the two groups based on the Mahalanobis distance between two observations in 2013 (wave 2), which is before the policy change. The following variables are used in calculating the distance: gender, age, hukou[6], insurance, doctor visits, marital status, self-perceived health status, chronic diseases, household number, net worth and education. The matching statistics are shown in Table 14.

Table 14. Multivariate-distance kernel matching statistics

	Matched			Controls			Bandwidth
	Yes	No	Total	Used	Unused	Total	
Treated	183	6	189	230	12	242	5.192
Untreated	232	10	242	185	4	189	5.559
Combined	415	16	431	415	16	431	.

[6] Hukou refers to registered permanent residence in a certain city in China.

3. Results

Descriptive statistics are presented in Table 15. It shows the average doctor visits per month in Taizhou was much smaller than in Maoming. The CHARLS survey reveals that about 26.3% people who got illness chose not to see a doctor, among whom 12.5% were due to the poverty and 54.2% believed that the illness was not serious and they did not need to see a doctor. Besides, people in Taizhou had more net worth than people in Maoming, and more people in Taizhou perceived themselves to have better health status. Therefore, there exist indeed slight differences between Taizhou and Maoming. In order to improve the comparability between the two groups, the author gave respective weight to each individual by matching as shown in the following part.

Table 15. Descriptive statistics of 682 observations across wave 2 and 3

	Taizhou, Mean (SD)		Maoming, Mean (SD)	
	Wave 2 (2013)	Wave 3 (2015)	Wave 2 (2013)	Wave 3 (2015)
Doctor visits	0.20 (.835)	0.25 (.931)	0.80 (1.850)	0.73 (1.554)
Net worth, RMB				
Quartile (25%)	2,166.68	3,325.17	1,100.00	2,808.471
Quartile (50%)	21,373.51	42,440.55	19,459.16	30,622.3
Quartile (75%)	87,290.01	144,055.6	82,328.71	152,876.5
Marital status, %				
The married	84.77	84.76	86.32	85.27
The single	15.23	15.24	13.68	14.73
Household number	4.13 (1.694)	2.74 (1.444)	5.46 (2.618)	3.45 (1.959)

	Taizhou, Mean (SD)		Maoming, Mean (SD)	
	Wave 2 (2013)	Wave 3 (2015)	Wave 2 (2013)	Wave 3 (2015)
No. of chronic diseases	0.96 (1.960)	1.37 (1.335)	0.94 (1.235)	1.34 (1.404)
Self-perceived health status, %				
Excellent and very good	35.10	20.69	11.17	12.36
Good	24.50	33.79	34.57	28.09
Fair and poor	40.40	45.52	54.26	59.55
Age	61.57 (9.983)	63.57 (9.983)	60.05 (10.109)	62.05 (10.109)
Gender, %				
Male	47.02	47.02	45.79	45.79
Female	52.98	52.98	54.21	54.21
Obs	151	151	190	190

Notes. SD=Standard deviation (in parentheses); *Obs*=Observations.

Table 16 and Table 17 show the results of impacts of demand-side cost sharing decreasing on outpatient care utilization with Poisson model and negative binomial model respectively. In column 1, the author only included the DID estimator in the model in order to see the raw effect. In column 2 to column 4, covariates were added step by step in order to avoid the problem of bad controls. In the Poisson model, the author excluded the independent variable of marital status due to its extremely large standard errors.

Generally speaking, no statistically significant impacts were found, which means 20% reduction of coinsurance in Taizhou would not significantly increase the utilization of outpatient care when comparing with Maoming. As for the difference between the two years, almost no significant and robust estimates were shown. It indicates that the utilization of outpatient care in 2015 did not change in Taizhou and Maoming when comparing with 2013.

Table 16. Estimates of Poisson model

	Doctor visits			
	(1)	(2)	(3)	(4)
Treatment*year	0.294	0.308	0.413	0.275
	(0.273)	(0.296)	(0.304)	(0.308)
Treatment	0	0	0	0
	(omitted)	(omitted)	(omitted)	(omitted)
Year 1 (2013, ref)				
Year 2 (2015)	-0.085	-0.312*	-0.191	-0.231
	(0.119)	(0.172)	(0.182)	(0.180)
Net worth:				
Quartile 1 (ref)				
Quartile 2		0.203	0.138	0.158
		(0.228)	(0.233)	(0.238)
Quartile 3		1.203***	1.267***	1.444***
		(0.309)	(0.310)	(0.338)
Quartile 4		0.490***	0.495***	0.601***
		(0.191)	(0.191)	(0.201)
Household number		-0.124**	-0.119**	-0.118**
		(0.057)	(0.057)	(0.059)

	Doctor visits			
	(1)	(2)	(3)	(4)
Number of chronic diseases			-0.300**	
			(0.147)	
Self-perceived health status:				
Excellent and very good (ref)				
Good				0.012
				(0.410)
Fair and poor				0.644
				(0.403)
Obs	240	228	228	220

Notes. Estimates stem from conditional fixed-effects Poisson specifications. Coefficients could be interpreted as multiplicative factors. Specifically, the dependent variable increases by ((e^c)-1)*100% when the independent variable increases by one unit, where c denotes the values of coefficients. Standard errors are in parentheses. Significance levels: ***p<0.01; **p<0.05; *p<0.1. *Obs*=Observations.

Table 17. Estimates of negative binomial model

	Doctor visits			
	(1)	(2)	(3)	(4)
Treatment*year	0.293	0.285	0.280	0.275
	(0.402)	(0.426)	(0.430)	(0.441)
Treatment	-1.162	-1.567*	-1.554*	-1.895**
	(0.743)	(0.835)	(0.845)	(0.856)
Year 1 (2013, ref)				
Year 2 (2015)	-0.120	-0.215	-0.217	-0.180
	(0.175)	(0.224)	(0.225)	(0.235)
Net worth:				
Quartile 1 (ref)				
Quartile 2		0.236	0.241	0.143
		(0.305)	(0.310)	(0.143)
Quartile 3		0.837**	0.836**	1.081***
		(0.396)	(0.396)	(0.416)
Quartile 4		0.293	0.294	0.421
		(0.299)	(0.300)	(0.318)
Marital status:				
The married (ref)				
The single		-0.329	-0.337	-0.563
		(0.986)	(0.986)	(1.027)
Household number		-0.060	-0.059	-0.043
		(0.069)	(0.069)	(0.071)
No. of chronic diseases			-0.013	
			(0.137)	

	Doctor visits			
	(1)	(2)	(3)	(4)
Self-perceived health status:				
Excellent and very good (ref)				
Good				-0.364
				(0.513)
Fair and poor				0.497
				(0.499)
_cons	-0.342	0.058	0.023	-0.208
	(0.358)	(0.590)	(0.692)	(0.754)
Obs	240	228	228	220

Notes. Estimates stem from conditional fixed-effects Negative binomial specifications. Coefficients could be interpreted as multiplicative factors. Specifically, the dependent variable increases by ((e^c)-1)*100% when the independent variable increases by one unit, where c denotes the values of coefficients. Standard errors are in parentheses. Significance levels: ***p<0.01; **p<0.05; *p<0.1. *Obs*=Observations.

The author also did Poisson and negative binomial regression with DID approach for matched sample from Taizhou and Maoming. Table 18 and Table 19 show the impacts of coinsurance decreasing on outpatient care utilization with Poisson model and negative binomial model respectively. Similarly, no significant effects are presented in both models, as well for the difference between the two years. The author also got similar results for covariates.

Table 18. Estimates of Poisson model for matched data

	Doctor visits			
	(1)	(2)	(3)	(4)
Treatment*year	0.041	-0.099	-0.046	-0.168
	(0.276)	(0.307)	(0.311)	(0.328)
Treatment	0	0	0	0
	(omitted)	(omitted)	(omitted)	(omitted)
Year 1 (2013, ref)				
Year 2 (2015)	0.268	0.034	0.178	0.082
	(0.166)	(0.223)	(0.239)	(0.241)
Net worth:				
Quartile 1 (ref)				
Quartile 2		0.077	0.031	0.048
		(0.295)	(0.297)	(0.310)
Quartile 3		1.102***	1.146***	1.450***
		(0.397)	(0.396)	(0.450)
Quartile 4		-0.138	-0.191	-0.171***
		(0.277)	(0.281)	(0.289)
Household number		-0.215***	-0.215***	-0.271***
		(0.077)	(0.078)	(0.085)
Number of chronic diseases			-0.280*	
			(0.162)	
Self-perceived health status:				
Excellent and very good (ref)				
Good				0.234
				(0.487)
Fair and poor				0.846*
				(0.487)

	Doctor visits			
	(1)	(2)	(3)	(4)
Obs	220	216	216	210

Notes. Estimates stem from conditional fixed-effects Poisson specifications. Observations are matched and importance weights are assumed. Coefficients could be interpreted as multiplicative factors. Specifically, the dependent variable increases by ((e^c)-1)*100% when the independent variable increases by one unit, where c denotes the values of coefficients. Standard errors are in parentheses. Significance levels: ***p<0.01; **p<0.05; *p<0.1. *Obs*=Observations.

Table 19. Estimates of negative binomial model for matched data

	Doctor visits			
	(1)	(2)	(3)	(4)
Treatment*year	0.218	0.092	0.090	0.041
	(0.393)	(0.413)	(0.414)	(0.431)
Treatment	-0.856	-1.379	-1.370	-1.711*
	(0.762)	(0.949)	(0.942)	(0.982)
Year 1 (2013, ref)				
Year 2 (2015)	0.073	-0.048	-0.060	-0.022
	(0.220)	(0.262)	(0.273)	(0.280)
Net worth:				
Quartile 1 (ref)				
Quartile 2		0.123	0.128	0.025
		(0.366)	(0.368)	(0.376)
Quartile 3		0.718*	0.706	0.979**
		(0.437)	(0.444)	(0.463)
Quartile 4		-0.091	-0.091	-0.112
		(0.358)	(0.359)	(0.375)
Marital status:				

	Doctor visits			
	(1)	(2)	(3)	(4)
The married (ref)				
The single		-2.244	-2.239	-2.527
		(1.695)	(1.692)	(1.740)
Household number		-0.091	-0.135	-0.166*
		(0.358)	(0.090)	(0.092)
Number of chronic diseases			0.029	
			(0.197)	
Self-perceived health status:				
Excellent and very good (ref)				
Good				-0.187
				(0.584)
Fair and poor				0.687
				(0.574)
_cons	-0.387	0.569	0.511	0.339
	(0.506)	(0.845)	(0.926)	(0.984)
Obs	220	216	216	210

Notes. Estimates stem from conditional fixed-effects Negative binomial specifications. Observations are matched and importance weights are assumed. Coefficients could be interpreted as multiplicative factors. Specifically, the dependent variable increases by ((e^c)-1)*100% when the independent variable increases by one unit, where c denotes the values of coefficients. Standard errors are in parentheses. Significance levels: ***p<0.01; **p<0.05; *p<0.1. *Obs*=Observations.

4. Discussion

The results illustrate that 20% reduction of coinsurance had little effect on outpatient care utilization among people over 45 in China. On the one hand, it could be explained as there is no moral hazard as a response to cost sharing reduction among the middle-aged and the older in China. On the other hand, the insignificant effect is more probably due to the high cost sharing, which includes a 500 RMB ceiling per year though with no deductibles, and a 55% coinsurance even after reduction. Too high cost sharing may block the necessary healthcare utilization and limited reduction of cost sharing cannot trigger the increase of necessary healthcare use. Besides, the results are consistent with some previous literature, which shows that about $17 reduction of copayments for mental care had little impact on mental healthcare utilization among the elderly in US, possibly because copayment still remains at about $8 even after reduction (Ndumele and Trivedi, 2011). However, some other literature is not consistent with my findings. Some researchers in Japan study on the influence of coinsurance reduction from 30% to 10%, which is also a 20% reduction, but they found out that the elderly were price sensitive and their healthcare utilization would be significantly influenced (Fukushima et al., 2016; Shigeoka, 2014). This is probably because of the much lower coinsurance level in Japan compared with China.

There are some limitations for this study. Firstly, since the financing level of the URBMI and the NCMS (also in the form of integrated health insurance, RBMI) is city or county, and cost sharing policies vary among cities and counties, our treatment group or control group could only be drawn from the same city or county, which would limit the sample size. Secondly, the author could not examine whether the coinsurance reduction for outpatient care has an impact on inpatient care utilization since cost sharing policies for inpatient care were also changed between 2013 and 2015.

5. Conclusion

By selecting Taizhou in Zhejiang province and Maoming in Guangdong province as the treatment and control group respectively, the author reaches a conclusion that a limited cost sharing reduction has little effect on the outpatient care utilization among the enrollees over 45 in the URBMI and the NCMS (also in the form of integrated health insurance, RBMI) in China. The current cost sharing is still too high, which would probably limit the proper healthcare utilization.

Chapter 4: Dropping out of the New Cooperative Medical Scheme for the older people in China

Abstract:

The drop-out issue in voluntary health insurance markets has been both theoretically and empirically demonstrated as inevitable. However, there is no research on dropping out of the New Cooperative Medical Scheme in China, which is voluntary-based. The present study examines who tend to drop out of the scheme and the impact of drop-out on outpatient care utilization.

The author adopts logistic regression to analyze who tend to drop out by presenting odds ratio. Fixed-effects negative binomial regression model is utilized to analyze impacts of drop-out on outpatient care utilization by combining the difference-in-difference-in-differences approach and multivariate-distance kernel matching methods. Panel data (wave 2 in 2013 and wave 3 in 2015) from the China Health and Retirement Longitudinal Study is used and 22,982 observations aged over 45 are included.

The results indicate that adverse selection exists in the New Cooperative Medical Scheme, that the healthier and the vulnerable tended to drop out. Significant and negative impact on outpatient care utilization is found, especially for those with worse health status and living in poorer provinces. We also found the impact of dropout on outpatient care utilization is more pronounced at secondary and tertiary hospitals than at primary care clinics. We urge policy makers to rethink the design of the NCMS from the following perspectives: to introduce various health packages; to transform the New Cooperative Medical Scheme into compulsory insurance; to replace the flat rate premium with a progressive one; to increase the subsidies and introduce discriminatory subsidies in favor of the vulnerable; to increase reimbursement rate for outpatient care utilization at secondary and tertiary hospitals.

Key words: Drop-out, the New Cooperative Medical Scheme, China, adverse selection, fixed-effects negative binomial regression

1. Introduction

Voluntary health insurance (VHI) plays different roles in different categorized countries. In European countries with relatively mature health insurance markets, VHI is often privately provided and plays a supplementary role targeted at the rich, aiming at covering more services, paying for cost sharing by patients, reducing waiting time and broadening choice of providers and etc. By contrast, in low-income and lower-middle-income countries, VHI is mainly publicly financed and targeted at people working in informal economy, such as farmers or self-employees. VHI has been adopted as an interim strategy in some countries where there are constraints to extend compulsory insurance nationally at present, such as in Vietnam (Jowett et al., 2003). In other countries, VHI also serves as a political tool to deal with an urgent political problem, such as in Lebanon (El-Jardali et al., 2014).

Due to the inherent flaw of adverse selection in VHI markets, drop-out seems to be inevitable (Akerlof, 1970; World Health Organization, 2013). Theoretically, insurers in VHI markets would charge a community-rated premium owing to the failure in risk selecting caused by asymmetrical information. In this regard, a negative externality has been exerted on the low-risk individuals, that the available premium cannot reflect their risk (Rothschild and Stiglitz, 1976). This may force the low-risk individuals to drop out of the insurance and only keep the high-risk individuals enrolled in the insurance. In order to maintain the equilibrium, insurers have to raise premium and the new relatively low-risk individuals would drop out until the entire failure of the market (Mossialos and Thomson, 2004).

Empirically, a great deal of research has found consistent results with theoretical inference, that drop-out is not uncommon for VHI (Atinga et al., 2015; Boateng et al., 2017; Herberholz and Fakihammed, 2017; Iqbal et al., 2017; Mladovsky, 2014). In a pilot program done by the Nicaraguan government in 2007, the social security health insurance was extended to the informal sector on a voluntary basis. Thornton et al. (2009) found the overall enrollment rate was low, which was only 20%. What's more, even already enrolled people

would possibly opt to drop out, making retention in health insurance a tough and severe issue in these countries. Mebratie et al. (2015) indicate that one of the greatest challenges community-based health insurance (CBHI) schemes were facing was low contract renewal rates. The authors used longitudinal data to examine the drop-out in the CBHI scheme in Ethiopia. They found that 18% enrollees opted to drop out of the pilot CBHI scheme in 2013, mainly because they lacked awareness about the details of how the scheme worked and they cannot afford the premiums. Among enrollees who had experienced prolonged illness, the drop-out rate was lower. Another research done for the CBHI scheme in India shows that 80% initial enrollees did not maintain their membership in 2013, and only people that had benefited from the scheme tended to renew the membership. The drop-out was mostly due to limited coverage in the following two dimensions: health services coverage (benefit packages) and health expenditure coverage (high cost sharing), which could partly be attributed to the third limited coverage: population coverage, since low population coverage would lead to small financing pool to some degree (Panda et al., 2016). Dong et al. (2009) did a similar study in Burkina Faso, but mainly focused on the reason why people decided to drop out. The drop-out rate for CBHI in Burkina Faso was high ranging from 30.9% to 45.7%, the reasons for which were possibly related to affordability, health needs, healthcare quality and etc. The authors put forward the concern on the sustainability of CBHI schemes and proposed that it was even more important to understand what motivated people to keep consecutively enrolled than to understand what motivated them to be first enrolled (Dong et al., 2009).

Most of the above relevant studies are done in the setting of CBHI. CBHI is a newly emerged form of health insurance which is community-based or based on a group of people who share geographical or occupational commons. CBHI aims to provide quality healthcare and lower financial risk for low-income people or people in informal sectors, mainly in low-income and lower-middle-income countries. Generally, CBHI is voluntary-based and people need to pay flat rate premiums. However, due to the low administrative level and small financing pool, financial protection of CBHI is moderate. In addition, vulnerable people who

cannot afford the premiums would be excluded from the schemes and could not be protected by this insurance since there are no subsidization for vulnerable people (Donfouet and Mahieu, 2012; World Health Organization, n.d.).

Currently, VHI is adopted by the Chinese government to cover the rural population, called the NCMS, while literature on the drop-out of NCMS is little, making the entire and objective picture of NCMS not unveiled yet. With the founding of new China in 1949, the CMS targeted at the rural population was established, which operated at the village level. While afterwards with the enacting of reform and opening-up policy in 1978, the scheme has actually collapsed. During the following two to three decades, the rural population had faced severe financial risk since they had to pay large amount of OOP for healthcare. Many families had faced catastrophic health expenditure and returned to poverty after receiving healthcare. As a result, poor rural families had to give up healthcare because of poverty. Against this background, the NCMS was rolled out in 2003, which operated originally at the county level, and had covered all the counties until 2012.

A large body of empirical research has investigated the impact of NCMS introduction, either on healthcare expenditure or on healthcare utilization (Li and Zhang, 2013; Xu et al., 2018; Yu et al., 2010). Some evaluated on the impact of introducing the NCMS on healthcare expenditure, which indicates that enrollee' expenditure was surprisingly raised after they were enrolled possibly due to the induced health demand by doctors (Wagstaff and Lindelow, 2008). Some evaluated on its impact on healthcare utilization. Some researchers illustrate that both outpatient and inpatient utilization were increased after the introduction of the scheme by adopting a DID approach combined with matching methods (Wagstaff et al., 2009a). Besides, some other researchers demonstrate that improving the scheme coverage was associated with less delaying inpatient care (Zhang et al., 2016).

However, little has paid attention to the drop-out of NCMS, though some literature has attached importance to the voluntary nature of NCMS. Wang et al. (2006) found out the existence of adverse selection in NCMS due to its voluntary nature from the perspective of

enrollment that people with worse health status tended to be enrolled in the scheme. In order to fill the research gap and contribute to the entire picture of NCMS, this article examines adverse selection in NCMS from the perspective of drop-out by finding out its reasons and analyzing who tend to drop out, and explores the impact of drop-out on outpatient care utilization (Xu and Yang, 2020).

2. Methods

2.1. Data source and study population

The author adopts data from the CHARLS, which aims to collect nationally representative sample of population aged over 45 in China and provides individual-level panel data on health, socio-economic status and social and family networks every two years (Zhao et al., 2013). Data from wave 2 (2013) and wave 3 (2015) is used in my study. Wave 1 (2011) is excluded since its inclusion would reduce the number of eligible individuals due to attrition and new enrollment. This study adopts balanced data to avoid disturbance caused by unbalanced random effect terms (Baltagi, 2005; Cameron and Trivedi, 2009). CHARLS 2014 is excluded since it surveys on life-history data. Since the purpose is to explore the impact of drop-out of NCMS, the author selects the sample who were enrolled in the NCMS in 2013 and dropped out in 2015 as the treatment group, and the sample who were enrolled in both 2013 and 2015 as the control group. We also merge data from CHARLS with economic data (provincial GDP per capita) from the National Bureau of Statistics of China (2019).

Chinese health insurance schemes mainly consist of UEBMI, URBMI, NCMS and Government Medical Insurance (GMI) before 2016, among which URBMI and NCMS are VHI (Meng et al., 2015). The State Council officially released a nationwide regulation on integrating NCMS and URBMI into Urban and Rural Resident Medical Insurance (URRMI) in 2016, but the progress has been uneven and some individuals in our sample were enrolled

in URRMI even before 2016. Table 20 shows the insurance type of individuals enrolled in both years after excluding 285 participants (1.5%) in 2013 and 845 (4.0%) in 2015 due to missing data on insurance type. Among the 15,669 individuals, the majority were enrolled in NCMS (over 70%). The sample sizes for URBMI and URRMI enrollees were relatively small (both less than 5%). Therefore, considering the heterogeneity of enrollees in NCMS, URBMI and URRMI, we select NCMS as an example for VHI in our study. As shown in the 3rd row Table 20, the majority of the enrollees in NCMS in 2013 did not change their insurance type in 2015, while some dropped out of the NCMS (with no insurance). In order to explore the impact of drop-out, our study sample only included those who were enrolled in NCMS in 2013 and dropped out in 2015 (treatment group) and those who were enrolled in NCMS in both years (control group). We finally selected 22,982 observations across two waves in the study by further excluding people aged below 45, among which 1,710 were in the treatment group. Since participation of the NCMS is household-based, the enrollees may not be necessarily rural residences (around 95.7% are the rural).

Table 20. The number of individuals with each insurance type across two waves for 15,669 individuals enrolled in both CHARLS 2013 and 2015

2015 / 2013	UEBMI	URBMI	NCMS	URRMI	GMI	None	Total (%)
UEBMI	1,181	89	43	9	208	137	1,667 (10.6)
URBMI	105	419	87	29	15	74	729 (4.7)
NCMS	82	107	10,718	267	52	879	12,105 (77.3)
URRMI	9	45	214	22	2	24	316 (2.0)
GMI	111	8	11	2	110	17	259 (1.7)
None	28	46	283	10	15	211	593 (3.8)
Total	1,516	714	11,356	339	402	1,342	15,669
(%)	(9.7)	(4.6)	(72.5)	(2.2)	(2.6)	(8.6)	

2.2. Variable specifications

We include the below dependent variables in the study. Firstly, whether a person has dropped out from the NCMS to explore the characteristics of people who drop out. This is a binary variable with 1 indicating the respondent participating in the NCMS in 2013 but not 2015, 0 indicating the respondent participating in both years. Secondly, number of outpatient doctor visits during the last month is included. In order to explore the impact of drop-out on visits at different levels of health facilities, we conducted the analyses at primary care clinics, secondary and tertiary hospitals and all health facilites.

We include a number of health needs and non-needs variables in the analyses. Health needs variables include number of chronic diseases and self-perceived health status. These variables are likely to impact people's decision in participating in an insurance and healthcare utilization (Andersen and Newman, 1973; de Boer et al., 1997). We further control age,

gender, marital status, region and three socioeconomic status indicators- equivalent income, education and occupation. Equivalent income is equal to household income divided by square root of household size (OECD, 2011b). Self-perceived health status (1. Excellent; 2. Very good; 3. Good; 4. Fair; 5. Poor), education attainment (1. No education; 2. Elementary, middle school; 3. High school and above), and occupation (1. Agricultural work; 2. Employed; 3. Self-employed; 4. Retired/receded; 5. Unemployed) are categorical variables. Marital status comprises a binary variable- married/cohabiting as 0 and single as 1. We assign 28 provinces, where the sample comes from, into three regions according to the order of provincial GDP per capita in 2015- region 1 indicating provinces with the highest GDP per capita, region 2 with the middle and region 3 with the lowest (Yang and Tan, 2019; Zhu and Österle, 2017).

2.3. Empirical strategies

The empirical strategies used in the paper involve two parts. We first use a logistic regression model to examine the characteristics of those who are likely to drop out from the NCMS. We then use fixed-effects negative binomial regression model with a Difference-in-Difference-in-Differences (DDD) approach (Imbens and Wooldridge, 2007; Wooldridge, 2006) and MDM method to understand the impacts of dropping out on outpatient visits. All analyses are conducted using Stata V.13.1 (StataCorp, College Station, Texas, USA). MDM is done using Stata module-KMATCH (Jann, 2017b). We include a detailed discussion on how these strategies are performed.

Analyzing characteristics of those who are likely to drop out from the NCMS

A logistic regression is used to understand the characteristics of those who are likely to drop out based on the data of 2015 when the drop-out happened, and then on the data of 2013 before the drop-out happened. By utilizing the data of 2015, reverse causality between drop-out and health status may happen, that is drop-out may affect health status. We know the

deterioration of health status, especially chronic diseases would take some time. Therefore, if we assume the increased number of chronic diseases caused by drop-out itself would not appear within up to two years (since drop-out may happen any time between 2013 and 2015), then our estimates based on the data of 2015 would be unbiased. Furthermore, if our assumption is violated, we could further replicate the analysis based on the data of 2013. By utilizing the data of 2013, reverse causality could be avoided since drop-out has not happened yet, though estimates for other independent variables may be biased. For instance, we may misidentify the association between occupation and drop-out if a drop-out individual was employed in 2013 and retired in 2015. Therefore, we conduct both analyses in order to acquire more accurate understanding of this issue. We estimate the following regression:

$$\begin{cases} \ln \frac{p_i}{1-p_i} = \alpha + \beta X_i, 0 < p_i < 1 \\ \Pr(Treat_i = 1) = p_i \end{cases} \quad (5)$$

In this model, *Treat* indicates whether individual i drops out in 2015 (dropout when *Treat* = 1), p is the probability of drop-out, $\frac{p}{1-p}$ is the odds of drop-out. X denotes covariates, including number of chronic diseases, self-perceived health status, age, gender, marital status, region and three socioeconomic status indicators-equivalent income, education and occupation. i is individual indicator.

Analyzing the impacts of drop-out on outpatient care utilization

We use DDD with MDM to analyze the impacts of dropping out on outpatient care utilization. Negative binomial regression model is adopted since the dependent variable is a count variable and there exists overdispersion issue (Gardner et al., 1995). Our model is shown as follow:

$$y_{it} = \exp\left(b_0 + b_1 Treat_i + b_2 Post_t + b_3 Z_{it} + b_4(Treat_i * Post_t) + b_5(Treat_i * Z_{it}) + b_6(Post_t * Z_{it}) + b_7(Treat_i * Post_t * Z_{it}) + X_{it} + \nu_i + \varepsilon_{it}\right) \quad (6)$$

In this model, *y* denotes the number of doctor visits, *Treat* denotes the treatment group when *Treat*=1 and control group when *Treat*=0. *Post* controls time fixed effects, which denotes the year after treatment when *t* = 1 and the year before when *t* = 0, *Z* denotes either number of chronic diseases or regions, and *X* denotes the following time-varying covariates, including marital status, number of chronic diseases, self-perceived health status, provincial GDP per capita, equivalent income, education and occupation. *t* is year indicator. ν controls the individual fixed effects, which includes both observable (such as gender and birth of year) and unobservable fixed effects. ε is the idiosyncratic error term. b_7 shows the DDD estimates.

We run a series of sub-group analyses to understand the heterogeneous impacts. Superficially, we run regressions to explore the heterogeneity among the below sub-groups: 1) People with different number of chronic diseases (by adding the interaction term among *Treat*, *Post* and chronic diseases). Literature has revealed that when without health insurance, people with chronic diseases tend to seek less care, encounter catastrophic health expenditure and have higher mortality (Bittoni et al., 2015; Rice et al., 2005; Sun et al., 2009). 2) People living in different regions (by adding the interaction term among *Treat*, *Post* and region); 3) people utilizing outpatient care at different levels of health facilities: primary care clinics (i.e. township hospitals and village clinics), secondary and tertiary hospitals and all health facilities.

Since drop-out is an endogenous choice made by individuals, the possibilities of outpatient care utilization and other characteristics may not be balanced between treatment and control groups, introducing selection bias. Following the approach by Wagstaff, Lindelow, et al. (2009) who have adopted DID with matching method to explore the association between healthcare utilization and self-select enrolment of the NCMS, we estimate the impacts of drop-out by combining the DDD approach with MDM. By doing this,

we could eliminate all the differences in observables between two groups, such as the level of outpatient care utilization before drop-out. Our estimates would be unbiased if we assume there are no time-varying unobservables (Wagstaff et al., 2009a). In order to reduce model dependence and minimize selection bias caused by potentially non-identical characteristics between the treatment and control, we adopt MDM with Mahalanobis distance in the study (Rubin, 1980). We do not adopt the frequently used Propensity Score Matching (PSM) due to the fact that this method approximates complete randomization which brings higher imbalance, model dependence and bias. PSM matches only on one-dimensional propensity score achieved based on information in multi-dimensional covariates (Rubin and Thomas, 1996). Hence, PSM fails to use all the information in covariates, which would increase imbalance between two groups (King and Nielsen, 2019). By contrast, MDM approximates more efficient fully blocked randomized experiment. The idea of MDM is to match observations with 'close' distance metric of all covariates by measuring the Mahalanobis distance between two observations in the multivariate space (Rubin, 1979). Thus, MDM can detect all differences in multi-dimensional covariates and help reduce imbalance until all information in covariates have been exhausted. The matching algorithm we used is kernel matching, which allows control variables with smaller distance metric given larger weights (Jann, 2017a).

In order to avoid selection bias and balance outpatient care utilization and other characteristics between the treatment and control groups, we match the two groups on the following variables in the pre-treatment period (2013): doctor visits, marital status, equivalent income, number of chronic diseases, self-perceived health status, gender, age, provincial GDP per capita, education and occupation. The match rates for both groups are around 98% as shown in Table 21. We use the standardized difference to do the balance diagnostics instead of t-test. The standardized difference is not affected by sample size and allows us to compare the relative balance of variables with different units (Austin, 2009). According to the results shown in Table 22, the two groups have been well balanced after

matching, since all the differences are less than 0.1, within an accepted level (Rosenbaum and Rubin, 1985).

Table 21. Multivariate distance matching statistics

	Matched	Total	Match rate
Treatment group	730	751	97.2%
Control group	9,695	9,881	98.1%
Combined	10,425	10,632	98.1%

Table 22. Summary of standardized difference between the treatment and control group before and after matching

	Raw			Matched		
	Treatment group	Control group	SD	Treatment group	Control group	SD
Doctor visits	0.417	0.516	-0. 076	0.319	0.340	0.016
Marital status (ref: The married)						
The single	0.194	0.101	0.265	0.098	0.088	0.029
Equivalent income	10,539	10,622	-0.004	8,649	8,948	-0.013
No. of chronic diseases	1.220	1.280	-0.047	1.091	1.200	-0.081
Self-perceived health status (ref: Excellent)						
Very good	0.097	0.110	-0.040	0.093	0.099	-0.017
Good	0.313	0.315	-0.004	0.331	0.329	0.005

	Raw			Matched		
	Treatment group	Control group	SD	Treatment group	Control group	SD
Fair	0.354	0.368	-0.029	0.386	0.381	0.010
Poor	0.189	0.161	0.075	0.145	0.159	-0.034
Gender (ref: The male)						
The female	0.586	0.520	0.133	0.549	0.533	0.032
Age	61.5	59.0	0.264	59.7	59.2	0.052
Provincial GDP per capita	4.520	4.365	0.095	4.337	4.309	0.017
Education attainment (ref: No education)						
Elementary, middle school	0.550	0.646	-0.200	0.613	0.664	-0.104
High school and above	0.037	0.068	-0.138	0.061	0.040	0.097
Occupation (ref: Agricultural work)						
Employed	0.117	0.149	-0.095	0.128	0.144	-0.049
Self-employed	0.075	0.096	-0.077	0.083	0.078	0.016
Retired/receded	0.020	0.015	0.041	0.012	0.007	0.037
Unemployed	0.298	0.199	0.231	0.195	0.201	-0.013

Note. SD=Standardized difference

3. Results

3.1. Descriptive statistics

Descriptive statistics for the drop-out group and the control group before and after the drop-out are presented in Table 23. The author includes 11,491 individuals in the research, who had already been enrolled in the NCMS in 2013. Among them, 855 (7.44%) chose to drop out of the scheme in 2015.

Firstly, when comparing the statistics in 2013 and 2015, the author found that the mean of outpatient care utilization slightly decreased, the proportion of the single rose, and the average number of chronic diseases per person increased. In addition, the proportion of the unemployed increased with time for both the drop-out and the control groups.

Secondly, when comparing the characteristics between the drop-out group and the control group, the author found out that on average people in the drop-out group received less outpatient care. Suggested from the equivalent income, the drop-out group was relatively poorer. As for the marital status, the drop-out group consisted of over 10% more single observations. Besides, the drop-out group seemed to have less known chronic diseases. In addition, people in the drop-out group were about three years older than the control group on average, and there were over 6% more females in the drop-out group. We got another interesting finding that in the drop-out group, there were more than 10% individuals that have never received education than the control group.

Table 23. Descriptive statistics of 22,982 observations in 2013 and 2015

	2013, Mean (SD)		2015, Mean (SD)	
	Drop-out group	Control group	Drop-out group	Control group
Doctor visits				
All health facilities	0.42 (1.07),	0.52 (1.54)	0.38 (1.30)	0.47 (1.52)
Secondary & tertiary hospitals	0.14 (0.61)	0.13 (0.67)	0.14 (0.78)	0.13 (0.67)
Primary care clinics	0.24 (0.82)	0.34 (1.32)	0.22 (0.96)	0.31 (1.28)
Equivalent income, RMB				
Quartile (25%)	587.9	750.6	0	115.5
Quartile (50%)	2,840.6	4,780	1,000	1,500
Quartile (75%)	12,990.4	14,433.8	9,263.1	11,547.0
Marital status, %				
The married	77.2	88.4	75.4	86.6
The single	22.8	11.6	24.6	13.4
No. of chronic diseases	1.22 (1.29)	1.28 (1.33)	1.27 (1.31)	1.41 (1.41)
Self-perceived health status, %				
Excellent	4.45	4.69	5.04	5.96
Very good	9.26	10.9	11.1	9.97
Good	31.9	31.1	26.7	30.3
Fair	34.9	36.8	37.2	36.2
Poor	19.5	16.6	20.0	17.6
Age	62.2 (10.6)	59.5 (9.39)	64.2 (10.7)	61.4 (9.39)

	2013, Mean (SD)		2015, Mean (SD)	
	Drop-out group	Control group	Drop-out group	Control group
Gender, %				
Male	40.6	46.9	40.6	46.9
Female	59.4	53.1	59.4	53.1
Education attainment, %				
No education	43.6	29.9	43.2	30.0
Elementary, middle school	52.5	63.4	46.7	54.6
High school and above	3.86	6.67	10.2	15.4
Occupation				
Agricultural work	48.4	53.6	44.8	47.7
Employed	11.5	15.0	9.41	17.2
Self-employed	7.45	9.39	8.52	8.38
Retired/receded	2.02	1.45	2.04	1.34
Unemployed	30.7	20.6	35.2	25.3
Prop. of drop-out, %	7.44			
n	n=855	n=10,636	n=855	n=10,636

Notes. SD=Standard deviation (in parentheses).

3.2. Adverse selection and who tend to drop out of the NCMS?

Descriptive statistics are presented in Table 23. It shows that 7.44% (855/11,491) enrollees aged 45 and above in the NCMS chose to drop out in 2015. Logistic regression results and odds ratios (OR) of drop-out are shown in Table 24. The results suggested that adverse selection did exist in the NCMS and people with less chronic diseases (the low-risk

individuals) tended to drop out. Results showed that having one more chronic disease was significantly associated with 8.9%-13% ((1-0.911)*100%; (1-0.870)*100%) decrease of the odds to drop out, meaning that people with less chronic diseases were more likely to drop out. However, the choice of drop-out seems not to rely on individuals' self-perceived health status, which is a subjective perception, but rely more on objective diagnosis (number of chronic diseases).

We have also found that vulnerable people were more likely to drop out, namely the poorest, people with no formal education, the retired/receded and unemployed, the single, and the old. The coefficients show that the poorest were more likely to drop out compared to the other groups, though estimates for some quartiles are not statistically significant based on traditional significance criteria. For people attaining education above high school, their odds of drop-out are around 0.6 times of people with no formal education. Compared with people doing agricultural work, the employed (OR=0.7) are less likely to drop out, while the retired/receded (OR=1.8) and the unemployed (OR=1.3) are more likely. The odds for the single to drop out was around 1.7 times of the married. The possibility to drop out increased significantly with age.

Table 24. Odds ratios of dropping out from the NCMS

	Odds ratios of drop-out/standard errors	
	2015	2013
Equivalent income (ref: Quartile 1)		
Quartile 2	0.783** (-2.28)	0.931 (-0.69)
Quartile 3	0.818* (-1.87)	0.818* (-1.81)
Quartile 4	0.918 (-0.77)	0.933 (-0.62)
No. of chronic diseases	0.870*** (-4.40)	0.911*** (-2.91)
Self-perceived health status (ref: Excellent)		

	Odds ratios of drop-out/standard errors	
	2015	2013
Very good	1.187 (0.83)	0.861 (-0.70)
Good	1.048 (0.25)	1.010 (0.05)
Fair	1.242 (1.19)	0.949 (-0.28)
Poor	1.378 (1.63)	1.137 (0.63)
Education attainment (ref: No education)		
Elementary, middle school	0.730*** (-3.48)	0.710*** (-3.86)
High school and above	0.598*** (-3.60)	0.538*** (-2.95)
Occupation (ref: Agricultural work)		
Employed	0.699** (-2.57)	1.024 (0.19)
Self-employed	1.222 (1.40)	0.949 (-0.35)
Retired/receded	1.803** (2.14)	1.718** (1.97)
Unemployed	1.256** (2.40)	1.379*** (3.36)
Marital status (ref: The married)		
The single	1.678*** (5.02)	1.621*** (4.49)
Age	1.015*** (3.06)	1.012** (2.41)
Gender (ref: The male)		
The female	1.046 (0.52)	1.107 (1.18)
Region (ref: The middle provinces)		
The richest provinces	1.981*** (6.18)	2.024*** (6.45)
The poorest provinces	1.489*** (3.92)	1.543*** (4.32)
n	11,491	11,491

Notes. Estimates are derived from logistic regression models. Exponentiated coefficients. Standard errors are in parentheses. Significance levels: ***p<0.01; **p<0.05; *p<0.1.

3.3. The impact of dropping out of the NCMS on outpatient care utilization

Table 25 shows the impacts of drop-out on outpatient care utilization in all health facilities. In column 1, the DID estimate shows that drop-out was significantly associated with 24.9% ([e^(-0.222)-1]*100%) decreased number of doctor visits.

In column 2, three-way interaction term among treatment, year and number of chronic diseases was added in the model, in order to explore whether drop-out effect varies among people with different health status. Results show that the impact of drop-out on outpatient care utilization in all health facilities was significantly related to the number of chronic diseases. Specifically, doctor visits of people with one more chronic disease were 26.5% ([e^(-0.308)-1]*100%) more negatively impacted by drop-out.

We further explored whether the impacts of drop-out vary between regions as China has seen uneven economic development among different provinces. In column 3 Table 25, the estimates of the three-way interaction show that the impacts of drop-out on doctor visits significantly depend on the region. In particular, doctor visits in region 2 were most negatively impacted by the drop-out (decrease by 62.4%, calculated with [e^(-0.978)-1]*100%). Compared with region 2, the negative impact of drop-out on doctor visits in region 3 with the lowest GDP per capita was lower. When adding the DID estimate and the estimate of the three-way interaction of region 3, we get the drop-out effect in region 3 ([e^(-0.978+0.851)-1]*100%=-11.9%). It means people in region 3 with the lowest GDP per capita would have 11.9% reduction in doctor visits caused by drop-out. While people in region 1 with the highest GDP per capita seem not to be negatively impacted by drop-out. Results show that people in region 1 would slightly increase their doctor visits due to drop-out (5.4%, calculated with [e^(-0. 978+1.031)-1]*100%).

Table 25. Impacts of drop-out on outpatient care utilization at all health facilities

	(1)	(2)	(3)
Treatment*year	-0.222*(-1.65)	0.176(0.77)	-0.978***(-3.65)
Treatment	-0.290(-1.08)	-0.891**(-2.48)	0.527(0.94)
Year, 1 (2013, ref)			
Year, 2 (2015)	0.183(1.40)	0.403*(1.82)	0.299(1.14)
Treatment*year*Chronic diseases		-0.308***(-2.82)	
Treatment*Chronic diseases		0.386***(2.79)	
Year*Chronic diseases		-0.0991(-0.96)	
Treatment*year*1.region			1.031**(2.44)
Treatment*year*2.region (ref)			
Treatment*year*3.region			0.851***(2.64)
1.region			0.615(0.67)
2.region (ref)			
3.region			-0.417(-0.66)
Treatment*1.region			-1.334(-1.42)
Treatment*2.region (ref)			
Treatment*3.region			-0.925(-1.39)
Year*1.region			0.482(1.19)
Year*2.region (ref)			
Year*3.region			-0.0696(-0.23)
Equivalent income (ref: Quartile 1)			
Quartile 2	0.752***(10.31)	0.799***(10.88)	0.875***(11.70)
Quartile 3	0.335***(4.28)	0.451***(5.59)	0.405***(5.09)
Quartile 4	0.686***(8.11)	0.879***(9.97)	0.763***(8.79)

	(1)	(2)	(3)
Marital status (ref: The married)			
The single	0.0766(0.40)	0.203(1.04)	0.0239(0.12)
No. of chronic diseases	0.255***(7.01)	0.134(1.02)	0.279***(7.41)
Health status (ref: Excellent)			
Very good	-2.182***(-9.27)	-2.008***(-8.29)	-2.093***(-8.73)
Good	-1.095***(-5.52)	-0.778***(-3.77)	-1.018***(-5.03)
Fair	-1.391***(-6.79)	-1.200***(-5.68)	-1.244***(-5.96)
Poor	-0.953***(-4.60)	-0.771***(-3.60)	-0.879***(-4.17)
Education attainment (ref: No education)			
Elementary, middle school	-0.0241(-0.21)	-0.00121(-0.01)	0.200(1.64)
High school and above	0.502***(2.74)	0.479**(2.53)	0.526***(2.61)
Occupation (ref: Agricultural work)			
Employed	-0.599***(-5.04)	-0.677***(-5.59)	-0.597***(-4.90)
Self-employed	-0.717***(-7.02)	-0.708***(-6.77)	-0.742***(-7.12)
Retired/receded	-2.008(-1.53)	-1.908(-1.46)	-1.858(-1.39)
Unemployed	-0.725***(-8.66)	-0.761***(-9.01)	-0.728***(-8.44)
Provincial GDP per capita	-0.136***(-2.81)	-0.159***(-3.28)	-0.426***(-3.26)
_cons	0.396(1.03)	0.395(0.89)	1.408*(1.73)
n	22,982	22,982	22,982

Notes. Estimates stem from conditional fixed-effects negative binomial specifications. Coefficients could be interpreted as multiplicative factors. Specifically, the dependent variable increases by ((e^c)-1)*100% when the independent variable increases by one unit, where c denotes the values of coefficients. Standard errors are in parentheses. Significance levels: ***p<0.01; **p<0.05; *p<0.1.

As shown in Table 26, we conducted further analyses on outpatient care utilization in primary care clinics and secondary and tertiary hospitals. Results suggest that the impacts of drop-out occur only in secondary and tertiary hospitals, while no significant effects were observed in primary care clinics. After drop-out, people's doctor visits in secondary and tertiary hospitals would significantly decrease by 38.2% [e^(-0.482)-1]*100%).

Table 26. Impacts of drop-out on outpatient care utilization at different health facilities

	Primary care clinics	Secondary & tertiary hospitals
	(1)	(2)
Treatment * year	0.0627 (0.35)	-0.482** (-2.04)
Treatment	-0.700** (-2.04)	0.467 (0.82)
Year, 1 (2013, ref)		
Year, 2 (2015)	0.0919 (0.53)	0.262 (1.14)
Equivalent income (ref: Quartile 1)		
Quartile 2	0.606*** (6.24)	0.892*** (6.93)
Quartile 3	0.301*** (2.87)	0.524*** (4.02)
Quartile 4	0.520*** (4.59)	0.396*** (2.68)
Marital status (ref: The married)		
The single	0.435 (1.64)	-0.414 (-1.15)
No. of chronic diseases	0.196*** (4.21)	0.357*** (4.60)
Health status (ref: Excellent)		
Very good	-2.223*** (-5.38)	-1.468*** (-4.37)
Good	-0.768** (-2.08)	-1.019*** (-3.40)
Fair	-1.201*** (-3.26)	-1.298*** (-4.14)
Poor	-1.198*** (-3.19)	-0.712** (-2.29)

	Primary care clinics	Secondary & tertiary hospitals
	(1)	(2)
Education attainment (ref: No education)		
Elementary, middle school	-0.0418 (-0.27)	-0.206 (-0.85)
High school and above	0.640* (1.90)	0.320 (1.06)
Occupation (ref: Agricultural work)		
Employed	-0.289* (-1.78)	-0.724*** (-3.56)
Self-employed	-1.464*** (-7.29)	-0.360** (-2.37)
Retired/receded	-1.367 (-0.47)	-2.534 (-1.46)
Unemployed	-0.991*** (-8.16)	-0.343** (-2.46)
Provincial GDP per capita	-0.135* (-1.67)	-0.0703 (-0.90)
_cons	-0.0723 (-0.12)	-1.141 (-1.61)
n	22,982	22,982

Notes. Estimates stem from conditional fixed-effects negative binomial specifications. Coefficients could be interpreted as multiplicative factors. Specifically, the dependent variable increases by ((e^c)-1)*100% when the independent variable increases by one unit, where c denotes the values of coefficients. Standard errors are in parentheses. Significance levels: ***p<0.01; **p<0.05; *p<0.

3.4. Robustness checks

In the main text, we use equivalent income to measure economic status of individuals since income is less complex to measure and can therefore be more accurately observed. Another measurement for economic status is consumption expenditure (International Labour Organization, 2003). In order to demonstrate whether the above analyses are robust to

measurement selection, we conduct this robustness check by replacing household equivalent income with equivalent expenditure in the regression model. We found robust results both for the odds ratios of drop-out and impacts of drop-out on doctor visits in all health facilities, that is the healthier and the vulnerable tend to drop out. Specifically, drop-out would significantly arouse 21.3% ([e^(-0.239)-1]*100%) less doctor visits in all health facilities as shown in Table 27, which figure is 24.9% in the main text.

Table 27. Robustness checks

	Odds ratios of drop-out		Impacts at all health facilities
	(1) 2015	(2) 2013	(3)
Treatment * year			-0.239*(-1.83)
Treatment			-0.132(-0.50)
Year, 1 (2013, ref)			
Year, 2 (2015)			0.236*(1.85)
Equivalent income (ref: Quartile 1)			
Quartile 2	0.813*(-1.94)	1.013(0.12)	1.063***(13.92)
Quartile 3	0.692***(-3.25)	0.966(-0.31)	0.936***(11.34)
Quartile 4	0.844(-1.55)	0.865(-1.28)	1.014***(11.35)
No. of chronic diseases	0.870***(-4.44)	0.911***(-2.90)	0.217***(6.12)
Health status (ref: Excellent)			
Very good	1.193(0.86)	0.854(-0.73)	-2.133***(-9.52)
Good	1.032(0.17)	0.999(-0.01)	-0.857***(-4.49)
Fair	1.220(1.09)	0.936(-0.35)	-0.907***(-4.66)
Poor	1.339(1.48)	1.130(0.60)	-0.545***(-2.74)
Education attainment (ref: No education)			
Elementary, middle school	0.728***(-3.50)	0.705***(-3.93)	

	Odds ratios of drop-out		Impacts at all health facilities
	(1) 2015	(2) 2013	(3)
High school and above	0.607***(-3.52)	0.539***(-2.94)	
Occupation (ref: Agricultural work)			
Employed	0.698***(-2.63)	0.997(-0.03)	
Self-employed	1.253(1.59)	0.953(-0.32)	
Retired/receded	1.852**(2.24)	1.590*(1.65)	
Unemployed	1.297***(2.75)	1.370***(3.27)	
Marital status (ref: The married)			
The single	1.629***(4.73)	1.652***(4.66)	-0.0891(-0.48)
Age	1.012**(2.43)	1.011**(2.23)	
Gender (ref: The male)			
The female	1.038(0.43)	1.105(1.16)	
Region: 1	2.059***(6.54)	2.111***(6.78)	
Region: 2 (ref)			
Region: 3	1.493***(3.95)	1.570***(4.45)	
Provincial GDP per capita			-0.254***(-5.58)
_cons			-0.103(-0.28)
n	11,491	11,491	22,982

Notes. Estimates stem from logistic specifications and conditional fixed-effects negative binomial specifications. Standard errors are in parentheses. Obs=Observations. Significance levels: ***p<0.01; **p<0.05; *p<0.1. In column 2, coefficients could be interpreted as multiplicative factors. Specifically, the dependent variable increases by ((e^c)-1)*100% when the independent variable increases by one unit, where c denotes the values of coefficients.

3.5. Reasons for drop-out of the NCMS

Based on the subjective answers of interviewees who dropped out of the NCMS in 2015, the author summarizes and lists the reasons in the following Figures. Figure 3 shows subjective reasons for drop-out for the whole sample, and Figure 4 and Figure 5 present the reasons for subgroups according to age and region respectively.

As presented in Figure 3, the reason that contributed most to drop-out for the whole sample was lack of affordability, which accounts over one fourth of the whole sample. The second main reason was no need, followed by no awareness as the third main reason. No awareness means the observations do not know about the scheme or how to be enrolled in it. In addition, small amount of people did not trust in the institutions or thought that there were no suitable schemes.

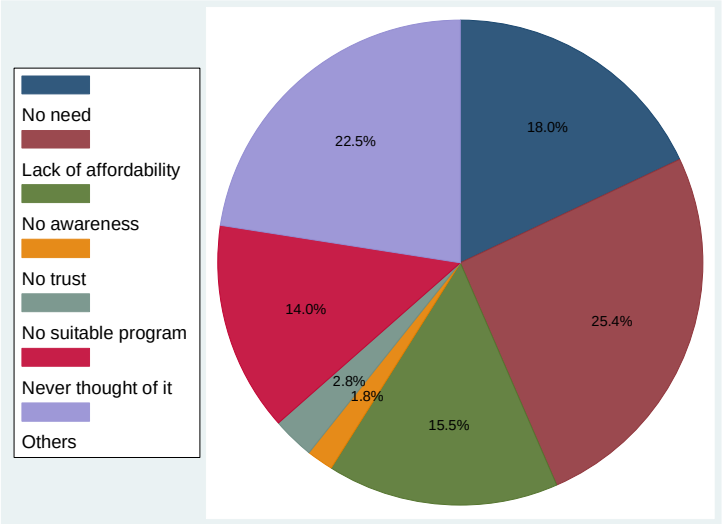


Figure 3. Reasons for drop-out of the NCMS for the whole sample

In Figure 4, the author aims to detect the contrasted reasons for drop-out for people aged between 45 and 65 and for people aged over 65, say the middle-aged and the elderly. Compared with the elderly, more than 7% of the middle-aged people answered that they did

not need the scheme, which reveals that they do not realize the importance of health insurance since they are currently relatively healthier. As for the elderly, more than 5% were because of no awareness when compared with the middle-aged, which reminds policy makers that the older people should be more informed of the scheme.

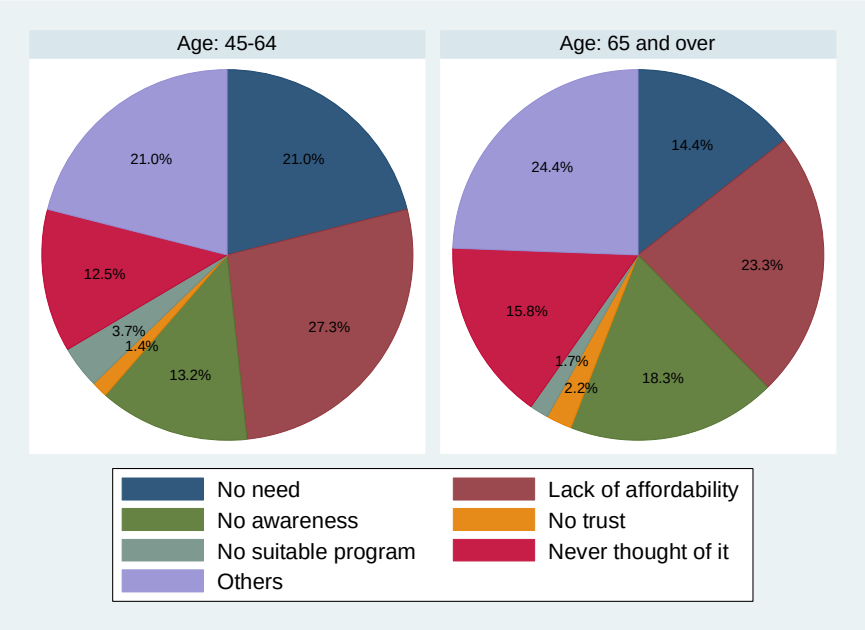


Figure 4. Reasons for drop-out of the NCMS for subgroups by age

When coming to the varied reasons among different regions, the author found out that there indeed existed differences as shown in Figure 5. The most important reason for the three regions was lack of affordability. On one hand, it reveals the burden of premium on most rural residents. On the other hand, it should also be attributed to wrongly assigned mental accounts (Thaler, 1990). Currently, these drop-out people spend the premium from their basic mental account and they believe it is unworthy since no short-term benefits would be received. However, spending for health insurance should be regarded as an investment on health, which should be paid from their investment mental account and the benefits would

perhaps be lagged. Besides, no need and no awareness were also important reasons for drop-out, which reminds that people should be more aware of the importance of a health insurance.

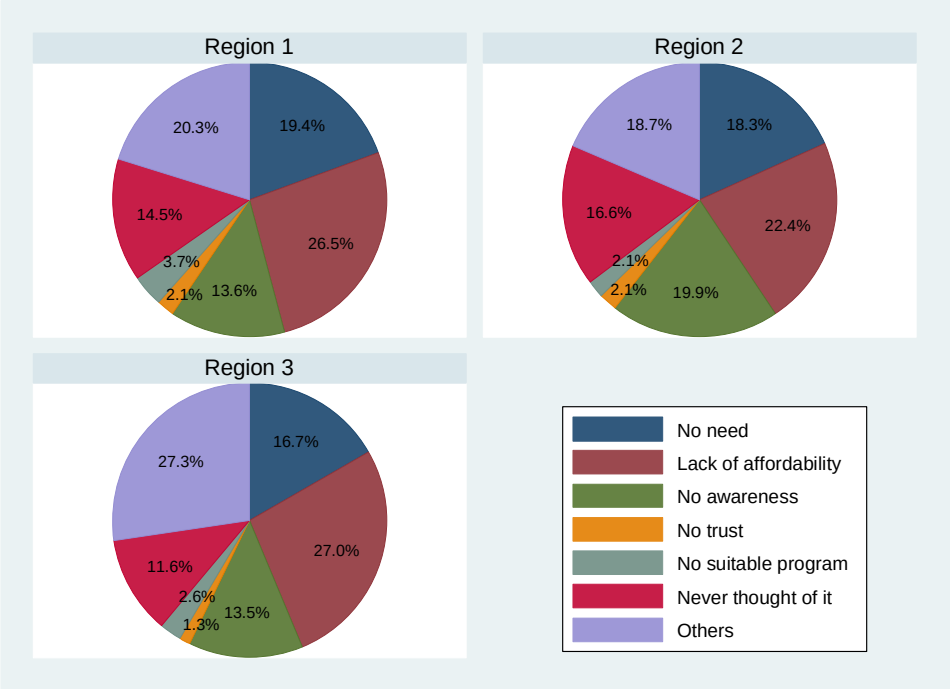


Figure 5. Reasons for drop-out of the NCMS for subgroups by region

4. Discussion

Till 2012 all the population in rural China, in total 576.61 million, had been exposed to the NCMS, while in 2004 only 18.4% rural counties could offer it. Great achievement had been made within the first decade since the enactment of the scheme. Meanwhile, however, some severe issues should not be neglected. According to the above results, over 7% of enrollees in NCMS aged over 45 chose to drop out in 2015, which is not a big figure when compared with the literature but should not be neglected since severe impacts have been or would be aroused. In light of my results, the healthier (the low-risk individuals) and the vulnerable (the poorer, people with no education, the retired and the unemployed, the single, the older and the female) tend to drop out. Firstly for the healthier, they are regarded as the low-risk individuals and tend to drop out due to the inherent flaw of adverse selection in VHI markets as illustrated in the introduction part. Secondly for the vulnerable, they are not the true low-risk but the self-perceived low-risk individuals. When health risk is evaluated as lower than a community-rated premium, individuals are regarded as the low-risk (Rothschild and Stiglitz, 1976). In this case of the vulnerable, the value of the premium would be magnified in their psychology when compared with limited disposable income (for the poorer) or with limited expected income (for people with no education, the retired and the unemployed, the single, the older and the female), making themselves more possible to be perceived as the low-risk individuals (Brown and Oates, 1987; Lazear and Rosen, 1990; Smock et al., 1999; Stoller and Stoller, 2003; World Bank, 2000).

Drop-out has brought about and also would bring about severe impacts on individuals and health insurance system. First for individuals, the accessibility of outpatient care has been worsened for the drop-out individuals, especially for people with worse health status, people in poorer provinces, and people's utilization of healthcare with higher quality. As a result, fairness of healthcare utilization has been damaged. According to my results, people with more chronic diseases were more negatively affected by drop-out. One possible explanation

is because these people need to visit doctors more frequently, they are more likely to incur greater financial burdens if not covered by insurance. Therefore, they may choose not to seek care if not covered by any insurance.

In addition, we also found that the negative effect of drop-out on outpatient utilization was more pronounced for those from the poor regions (region 2 and 3). One explanation of the high sensitivity for the poorer could be due to their limited disposable income and they are indeed unable to afford the expenses. People from the deprived rural villages may encounter greater access barriers and have fewer financial resources to pay for their treatments. Without the NCMS which offers some degrees of financial protections, these people may be less willing to seek outpatient care even if they need it. Similar findings are demonstrated by other studies (Arcury et al., 2005; Axelson et al., 2009; Erlyana et al., 2011; Jütting, 2003; Nemet and Bailey, 2000). In addition, people from region 2 seem to be most negatively affected after drop-out, probably because people from the richest region could more possibly afford the healthcare expenditure after drop-out, and people from the poorest region have got relatively more financial support from the Chinese central government.

We conducted further analysis to examine the effects of drop out at different levels of health facilities, and found that drop-out only affected their outpatient utilization at secondary and tertiary hospitals but not at primary care clinics. This is not surprising as services are often more costly at secondary and tertiary level. For those without any insurance coverage, seeking care at secondary and tertiary hospitals may become too expensive to afford. Similar findings are also found by others (Sun et al., 2009; Van Oostrom et al., 2014; Zhang et al., 2014).

As for the impact on health insurance system, adverse selection from the perspective of drop-out has been detected in NCMS and the sustainability of this health insurance pool is a matter of concern, which is due to the inherent flaw of adverse selection in VHI. Without the sustainable insurance pool, the missions of health insurance cannot be fulfilled, which include preventing financial risk and redistributing financial burden, and then the road to

universal health coverage would be blocked (Akerlof, 1970; Mossialos and Thomson, 2004; World Health Organization, 2013).

All in all, it has become quite important to keep people enrolled in NCMS especially for the poorer elderly due to potentially more pronounced impacts brought about by drop-out. Preventing drop-out could help improve healthcare accessibility, stable the pool of NCMS, and prevent financial risk for the poor and the sick.

5. Policy implications

In order to prevent or minimize the drop-out, respective measures targeted at the healthier (the low-risk individuals) and the vulnerable (the poorer, people with no education, the retired and the unemployed, the single, the older and the female) should be adopted.

First, to attract the healthier enrolled in NCMS, various health packages could be introduced in the short term. The documented target of NCMS is to cover severe diseases, which leads that only parts of inpatient care services could be partly reimbursed, while outpatient care can hardly be reimbursed. Such package does not apply for the healthier since their chances of receiving inpatient care are quite low. Therefore, additional packages should be provided targeted at the healthier, which could more focus on outpatient care. Besides, stimulating policies could also be introduced, such as longer and consecutively enrollees could always benefit more.

Second, to keep the healthier enrolled, NCMS should be transformed into compulsory health insurance in the long run. To rapidly provide a basis health insurance system for rural population that accounts over 40% of the whole population, voluntary take-up has been adopted for NCMS by the Chinese government, which, however, should only be an interim plan. Adverse selection in NCMS has been both theoretically and empirically demonstrated in the above. In order to maintain the sustainability of NCMS and benefit the large amount of rural population, an ingenious method of transforming NCMS into compulsory health

insurance should be adopted in the right time. However, a compulsory health insurance may encounter high administrative cost or compliance issues. In tackling these problems, examples from some developed countries, such as Germany could be followed. We propose that with the development of Chinese economy, the increase of rural population's disposable income, the improvement of health insurance system, and the maturity of electronic medical record system in the long run, registration at reception in care clinics or hospitals with electronic health insurance card should be mandatory whenever and wherever seeking care. This would force people enrolled in a health insurance scheme and solve the high administrative cost or compliance issues.

Third, the other enrollees could provide help for the enrollment of the vulnerable by replacing the flat rate premium with a progressive premium. The latter is more effective and fairer in health insurance financing. An individualized premium could be determined by comprehensively evaluating the vulnerability of an individual. The premium could be reduced with the increase of the vulnerability.

Fourth, the government could provide help for the enrollment of the vulnerable by increasing the subsidies and introducing discriminatory subsidies. Currently, the government provides a flat rate subsidy of around 520 RMB for each individual each year (Chinese National Healthcare Security Administration, 2019). On one hand, this amount is not enough compared with actual healthcare needs. On the other hand, a flat rate subsidy is easy-operated but low-efficient in the sense of improving the affordability of healthcare. Therefore, discriminatory subsidies could be introduced and the amount of subsidies could be adjusted according to the vulnerability of an individual.

Fifth, reimbursement rate for outpatient care utilization at secondary and tertiary hospitals should be increased. Numerous studies showed that the quality of services provided at the primary care clinics in the vast rural areas in China are often poor. Many patients with chronic health conditions prefer to go to secondary or tertiary hospitals to seek care. Although a higher service pricing system and lower reimbursement rate at secondary and tertiary

hospitals is effective in keeping patients at primary care clinics and avoiding crowding out resources at higher level health facilities, it also means that the poor may find it difficult to afford such high charges, and those from socially disadvantaged groups would have less patient choice and may have to use cheap services even though they are of low quality.

We need also bear in mind some limitations to this study. Firstly, we cannot eliminate the bias caused by time-varying unobservables. Therefore, we can only explore the association between drop-out and outpatient care use. Secondly, some self-reporting bias could not be avoided. For instance, the reporting of household income may be subjected to social desirability bias. Both the poorest and the richest may possibly report towards-mean biased income since the poorest may be reluctant to show their straitened circumstances and the richest may not want to reveal their wealth. Coping with this issue, we use the quartiles of income in the model, which could minimize the aroused bias. Thirdly, though a negative impact of drop-out on doctor visits is observed, we cannot further evaluate its impact on health status since we only have two years' data, which may not be long enough to capture the health status change.

6. Conclusion

The drop-out issue in NCMS is unneglectable and needs more attention from all parties because drop-out has aroused severe impacts on the individuals' accessibility of outpatient care, especially for the elderly, the poorer and people in poorer provinces, on the sustainability of the health insurance pool. In order to cope with the drop-out, the following measures could be taken. First, various health packages could be introduced in the short run. Second, NCMS should be transformed into compulsory health insurance in the long run. Third, the flat rate premium should be replaced with a progressive premium. Fourth, the government should increase the subsidies and introduce discriminatory subsidies in favor of the vulnerable. Fifth, reimbursement rate for outpatient care utilization at secondary and tertiary hospitals should be increased.

Chapter 5: Conclusion

Cost sharing plays different roles in German and Chinese health insurance. In German health insurance, the aim of introducing cost sharing is to control unnecessary healthcare utilization and lower health expenses, while in Chinese health insurance, cost sharing is regarded as a method of health financing, barely influencing healthcare utilization or health expenses. Then why does cost sharing mechanism function differently in German and Chinese health insurance? The author would explain it from the following three perspectives: theoretically, empirically and historically.

Theoretically, when cost sharing exceeds a certain number, healthcare utilization would stay constant at a relatively low level even with the decrease of cost sharing. Only when cost sharing has already been below a certain number, healthcare utilization would increase with the decrease of cost sharing (Ellis and Mcguire, 1990). Based on this theory, since cost sharing in Germany keeps in a relatively low level, healthcare utilization would change with the changing of the amount of cost sharing. However, since cost sharing in China, especially for outpatient services for enrollees in the NCMS, is too high, even exceeding this certain number, healthcare utilization would not change with the minor changing of cost sharing, unless the amount of cost sharing would be dramatically reduced below this number.

Empirically, the findings in Chapter 2 and Chapter 3 demonstrate that when cost sharing exceeds a certain number, healthcare utilization would stay constant at a relatively low level even with the decrease of cost sharing. Only when cost sharing has already been below a certain number, healthcare utilization would increase with the decrease of cost sharing. Since cost sharing in Germany keeps at a relatively low level, healthcare utilization would change with the changing of the amount of cost sharing. However, since cost sharing in China, especially for outpatient services for enrollees in the NCMS, is too high, healthcare utilization would not change with the minor changing of cost sharing, unless the amount of cost sharing would be dramatically reduced below this certain number. As shown in Chapter 2, for people

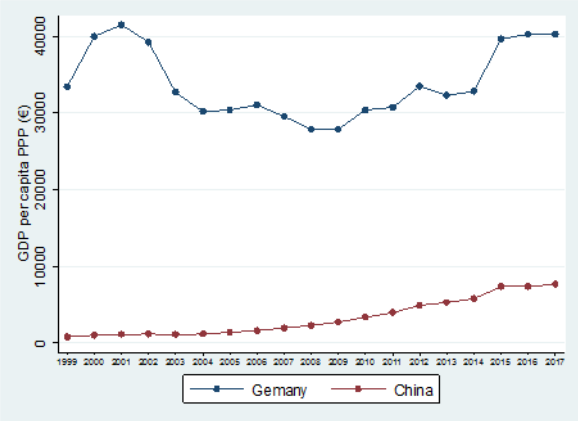
over 50 in Germany, ambulatory care utilization increased in the short term after copayment was abolished from the relatively low level of 10 €. By contrast, in Chapter 3, for people over 45 in China, outpatient care utilization did not change when coinsurance for outpatient care was reduced from a relatively high level of 75% to 55%. We could see that in the real world cost sharing plays varied roles when the amount of cost sharing varies.

Last but not least, the historical paths and developmental phases of health insurance system between Germany and China vary dramatically. In Germany, health insurance system has a continuous and progressive 136 years' history, which starts with a relatively small coverage of population but comprehensive healthcare coverage and almost entire reimbursement for covered care, and continues with more enrolled population and optimized benefit packages. In this whole process, cost sharing has mainly played as a means of controlling unnecessary healthcare utilization and contain health cost, seldom as a financing means. In China, a similar health insurance system has only been constructed for 20 years. Different with the historical path of Germany, the full coverage of population has been given a priority in order to achieve fairness. Due to the limited health funding, the two other coverage have to give way to population coverage, that insufficient reimbursement for covered care (high cost sharing) and limited benefit packages. As a result, cost sharing has served as a financing means.

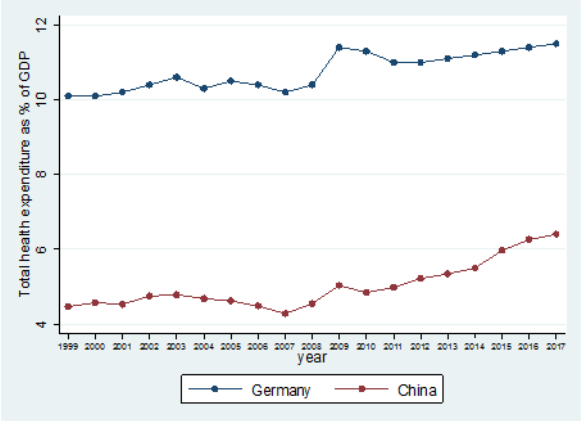
As for the various developmental phases of health insurance system, the author would illustrate it by comparing the following figures. Figure 6 (1) shows the GDP per capita (purchasing power parity based) in Germany and China from 1999 to 2017. Though it has been steadily increasing in China but it still only accounted 20% of the one in Germany in 2017. Such economic background determines limited health expenditure, since many other more basic and rigid demands need to be given priorities. Just as presented in Figure 6 (2), total health expenditure as a percentage of GDP accounted far below 10% in China, though the trend is promising. Besides, when we pay attention to the OOP, we could find that the OOP accounted still over 30% of the total health expenditure through it has been decreasing

while the figure in Germany stayed around 10% as shown in Figure 6 (3). When further exploring the OOP as a percentage of GDP, the author found that the burden of Chinese people was even larger than in Germany, which reveals some design problems existed in the current social health insurance to some degree. As illustrated in Chapter 4, drop-out issue still exists in the NCMS and the social health insurance is not yet mature. Therefore, economic development and health insurance policy design could both determine developmental phase of health insurance system. Thus, it would not be surprising that cost sharing mechanism functions differently in health insurance systems in different developmental phases.

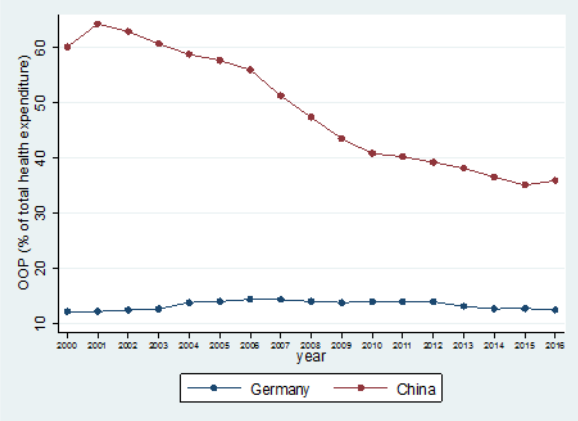
Based on the above comparison of cost sharing in German and Chinese health insurance from the theoretical, empirical and historical perspectives, the author proposes that the ultimate purpose of cost sharing design in the future should be to meet people's healthcare needs, minimize health inequality and improve life expectancy instead of saving health insurance revenues since caused disease deterioration by postponed healthcare use may even lead to more healthcare use and health expenses.



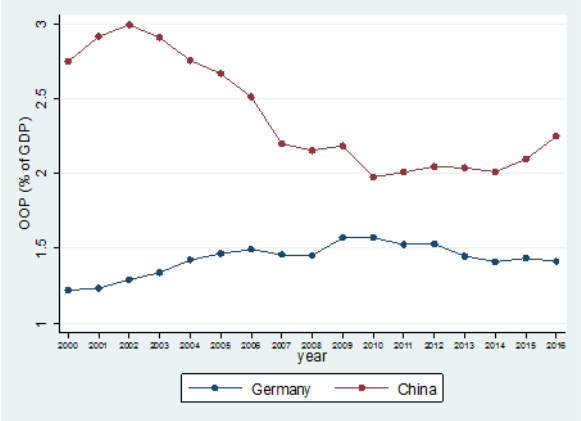
(1)



(2)



(3)



(4)

Figure 6. (1) GDP per capita (purchasing power parity based) in Germany and China (1999-2017); (2) Total health expenditure as a percentage of GDP in Germany and China (1999-2017); (3) OOP as a percentage of total health expenditure in Germany and China (2000-2016); (4) OOP as a percentage of GDP in Germany and China (2000-2016)

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