The Power of Public Insurance With Limited Benefits: Evidence from China's New Cooperative Medical Scheme*

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December 2022

Abstract

Low-income people in low- and middle-income countries (LMICs) have insufficient health care access when they are sick. To address this issue, the governments of LMICs have initiated health insurance programs that target these poor populations. However, due to the resource constraints in LMICs, these programs often provide limited health benefits. In this paper, we study the New Cooperative Medical Scheme (NCMS), a limited coverage insurance program for rural residents in China, to explore its effectiveness, and the mechanisms that contribute to its successes, if any. In a plausibly random design, we exploit the variation in the provincial NCMS enrollment rate from 2004 to 2011 to identify the average treatment effects of the NCMS on healthcare use, healthcare expenditures, and health outcomes. We find that although the NCMS's benefits are limited, inpatient care use increases significantly and this increase is mainly driven by inpatient care delivered by primary care providers, as the NCMS reimbursement rates are highest for this form of care. We show that half of the increase in inpatient care use is attributable to the NCMS's healthcare investments in rural providers. For outpatient services, we find that while the total effect is not statistically significant, the utilization pattern across providers is consistent with the differential payment design of the NCMS: rural residents use more outpatient care delivered by primary care institutions with higher reimbursement rates. In addition, we present evidence that rural residents substitute cheaper services at township health centers for expensive hospital outpatient services. Lastly, our results on healthcare expenditures and health outcomes indicate that the introduction of the NCMS does not affect out-of-pocket medical expenses or all-cause mortality rates among rural residents, but it does reduce mortality for specific diseases, such as AIDS and infectious diseases.

Keywords: Healthcare Utilization, NCMS, Health Insurance, Poor Populations

JEL classification: H51, I12, I13, I18

*We thank Katharina Blankart, Lingguo Cheng, Jin Feng, Wenhao Hu, Jun Hyung Kim, Kaixin Liu, Peter Redler, Arndt Reichert, Ju Shi, Lixin Tang, Zhi Wang, Yuan Zhang, and seminar participants at the 8th Workshop of dggö Health Econometrics, Fudan University, Nanjing University, and IESR at Jinan University for helpful comments. Patrik Harnisch and Zhenyuan Liu provided excellent research assistance. Lin gratefully acknowledges funding support from Fundamental Research Funds for the Central Universities (grant number 2021ECNU-YYJ023). All errors are our own.

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1 Introduction

Low-income people, and especially the rural poor in low- and middle-income countries (LMICs), are less likely than people with higher incomes to seek treatment when they get ill (WHO et al. 2012), and are more likely to incur catastrophic health expenditures when they do use healthcare. Limited access to healthcare services among poor populations has long-term consequences, including persistent poverty, constraints on economic growth, and high rates of crime and social violence (Smith 1999; Wagstaff 2002; Thoa et al. 2013; Bondurant et al. 2018; Deza et al. 2022). To encourage poor individuals who are sick to seek healthcare and protect them from catastrophic health expenditures, governments in LMICs have been expanding health insurance coverage to the rural uninsured since the 1990s.[1] However, because these LMICs face fiscal resource constraints, the benefits these insurance programs provide are often limited (Dong et al. 2003; Asgary et al. 2004; Mataria et al. 2004; Yi et al. 2009; Pavel et al. 2015). Thus, the rural poor covered by these limited-benefit programs generally have higher out-of-pocket (OOP) payments than are typical in OECD countries.[2] How effective are health insurance programs with limited benefits in increasing access to healthcare among the rural poor in LMICs? In this paper, we study the New Cooperative Medical Scheme (NCMS), a limited coverage insurance program for rural residents in China, to explore its effectiveness in terms of healthcare use, OOP expenses, and health outcomes. We also examine the mechanisms behind the NCMS's successes, if any.

As a response to the financial burdens on the rural poor due to increasing OOP costs, the Chinese government launched the NCMS in a few pilot counties in 2003, and started expanding it nationally in 2004.[3] The NCMS is similar to the health insurance programs

[1] For example, expansions of national insurance programs to cover poor residents were initiated in Columbia in 1993; in Ghana, Vietnam, and China in 2003; in Mexico in 2005; in Georgia in 2006; and in Nicaragua in 2007. See Acharya et al. (2013) for a detailed review of these programs.

[2] In 2014, on average, 36.26% of medical spending was out of pocket in LMICs, compared to only 13.63% in OECD countries. See the WHO Global health expenditure database at https://apps.who.int/nha/database for more details.

[3] In 2003, 303 out of 1,642 counties were selected for the pilot program.

designed to fully cover poor individuals that were introduced in other LMICs starting in the 1990s.[4] Like the programs in most other LMICs, the benefits the NCMS provides are restricted. While all counties provide coverage for inpatient services, the inpatient reimbursement rate is limited. Moreover, most counties do not cover outpatient visits (Yi et al. 2009; Zhang et al. 2017).[5] However, enrollment in the program increased rapidly and covered 640 million rural residents by 2008.[6] Another unique feature of the NCMS is that it also increased investments in rural healthcare institutions as a supporting policy. Healthcare resources, such as hospital beds and medical equipment, expanded in tandem with NCMS enrollment. Given that the NCMS fully covers the rural population of China, but only provides limited insurance benefits, we investigate how rural residents in China respond to the NCMS, in terms of healthcare use, OOP medical expenditures, and mortality, between 2004 and 2011.

To identify the causal effects of the NCMS, we use information on provincial NCMS enrollment provided in a report by Chen and Zhang (2013), and detailed information on healthcare use, healthcare expenditures, and mortality provided by China's statistical yearbooks in a plausibly random design. Our identification relies on the within-province variation in NCMS enrollment in a province-year panel for the 2004-2011 period. Since the NCMS was phased in gradually and achieved full enrollment by 2010, there are fewer self-selection issues in the later years of our study period. However, endogeneity issues might arise in the earlier years, when the provincial governments were rolling out their NCMS programs at different speeds. The results of a battery of tests suggest that less developed provinces (lower GDP per capita or higher unemployment rate) have larger enrollment gains from the NCMS expansion. However, our event-study estimates show that

[4]For example, countries in the Caribbean area have adopted the British national health system model, or the models of socialist countries such as Cuba, China, and Vietnam.

[5]Yi et al. (2009) find that individuals using inpatient care were reimbursed for 15% of their expenditure between 2004 and 2007.

[6]There are many reasons to explain this rapid expansion of the NCMS. One big reason is that the funding provided by the central government to local governments was determined by the enrollment level. See detailed description in section 2.

the divergence in economic conditions does not lead to differential time trends in healthcare utilization before the introduction of the NCMS, which supports our common trend assumption. To further remove any plausible differential behavioral patterns at the regional level, we include region-by-year fixed effects, which slightly reduces the effect magnitude. Our estimates are also robust across different specifications.

First, we find that over our study period, the introduction of the NCMS significantly increases inpatient care use nationwide, despite the limited insurance benefits it has offered. Specifically, our estimates show that a one-percentage-point increase in the NCMS enrollment rate increases the use of inpatient services by 0.1 percent (about 0.5 hospital stays per 10,000 people). The sub-sample analysis by provider shows that the increased inpatient care use is mainly delivered by primary care providers at community health centers (1.6 percent) and township health centers (0.4 percent), as rural patients are reimbursed most generously for care received from these providers, and less generously for care received at county hospitals (0.1 percent). Our event-study estimates indicate that the effects on inpatient services use are largest in 2007-2009 and become weaker after 2009 when the NCMS rollout is nearly complete.

Second, we find that the NCMS does not affect rural residents' use of outpatient care, presumably because the NCMS reimbursement rate for outpatient services is lower than that for inpatient care. Our analysis of the NCMS's effects on the use of outpatient care by provider shows that the rural residents are indeed price-sensitive, as their patterns of healthcare use reflect the differential reimbursement scheme of the NCMS. In particular, rural residents' outpatient visits to city hospitals decline, while their outpatient visits to rural providers, such as township health centers, increase. When we analyze the sample by hospital outpatient department, we find that the largest declines in rural residents' hospital outpatient visits are in the general medicine (with statistical significance), preventive medicine, and rehabilitation departments. To investigate whether the introduction of the NCMS leads rural residents to shift from using city hospitals (with lower reimbursement rate) to using

primary care providers (with higher reimbursement rate) for outpatient care, we look at how the NCMS's effects on hospital outpatient services use differ by the likelihood of using primary care providers. We find that hospital outpatient visits decrease more in provinces where rural patients are more likely to have outpatient visits or inpatient stays at primary care providers. Overall, these results suggest that the rural residents substitute outpatient services at city hospitals that are reimbursed less generously under the NCMS with both outpatient and inpatient services delivered by primary care providers that are reimbursed more generously.

To understand the role of the NCMS's supply-side supporting policy in inducing the inpatient/outpatient effects, we conduct an intermediate analysis. We find that the number of inpatient beds at rural providers increases significantly in tandem with the NCMS enrollment rate. After controlling for hospitals beds, the magnitude of the NCMS's effect on overall inpatient care use and outpatient use at county hospitals is reduced by half. Our findings indicate that half of the NCMS's success in increasing healthcare use can be attributed to the supporting policy of increasing investment in rural medical resources, which improves both the quantity and the quality of the healthcare supply.

Third, we find that the introduction of the NCMS does not lead to increases in OOP costs as inpatient care use rises. In addition, we observe that the rollout of the NCMS has no effect on the all-cause mortality rates among rural residents in China. These close-to-null estimates are shown to be robust across specifications. Moreover, our analysis of mortality rate by disease shows that the NCMS significantly reduces the incidence of infectious disease and the mortality rate of AIDS.

Our findings contribute to several branches of literature. First, our paper is directly related to several empirical papers that estimate the effects of the NCMS, which generate conflicting findings. Some of these studies find that the NCMS's effects on healthcare utilization are very small or close to null. In particular, Lei and Lin (2009) analyze the 2000, 2004, and 2006 data from the longitudinal China Health and Nutrition Survey

(CHNS) using multiple research designs, such as fixed effects, instruments, and difference-in-difference (DID) approaches, to correct for the endogenous participation in the NCMS. They find that while the introduction of the NCMS leads to increases in preventive care use, particularly in the number of general physical examinations, it has little effects on the numbers of inpatient stays or outpatient visits, OOP expenses, or health improvements. Yip et al. (2008) conduct a longitudinal survey in 2002 and 2005, and employ a DID method to show that the introduction of the NCMS does not result in an increase in outpatient visits. Babiarz et al. (2012) also estimate a DID model using two waves of survey data for five provinces in China in 2005 and 2008, and find little evidence that being enrolled in the NCMS increases the likelihood of visiting healthcare providers when sick.[7]

In contrast, other studies find that the implementation of the NCMS significantly increases healthcare utilization. For example, an analysis by Wagstaff et al. (2009), using a DID design and data from the National Health Service Survey (NHSS) for 2003 and 2005 covering 15 counties in 12 provinces, shows that the NCMS rollout increases inpatient stays and outpatient visits, and mainly affects township health centers, but has no impact on OOP payments. An analysis by Liu (2016) of data from the CHNS for 1993 to 2011 using a DID design shows that the NCMS is effective in insuring households against health shocks, and in helping them invest in their children's education. The most recent study by Huang and Wu (2020) exploits the enhancement of insurance benefits since the integration of rural-urban insurance in 2009 in a staggered DID design, and shows that the increased reimbursement rates lead to higher inpatient care utilization by middle-aged and older residents. Of the studies that examine the NCMS's effects on medical OOP expenditures, some find that it reduces OOP expenses only slightly (Lei and Lin 2009; Wagstaff et al. 2009; You and Kobayashi 2009; Cheng and Zhang 2012; Cheng et al. 2015), while others show that it reduces them substantially (Babiarz et al. 2012).

There are several potential explanations for these mixed findings. First, as the

[7]The five provinces are Jiangsu, Sichuan, Shaanxi, Jilin, and Hebei.

NCMS's effects may have been heterogeneous across regions, studies that use samples from different local areas have inconsistent findings. Second, the NCMS evolves as the program is rolled out. For example, as the program develops, not only does the enrollment increase rapidly, the reimbursement rates for healthcare services also keep improving. Thus, studies that focus on different phases of the implementation of the NCMS may yield conflicting findings. For example, studies that explore the effects of the NCMS in the years immediately following its introduction (2004-2006), when the NCMS has low reimbursement rates and moderate enrollment levels, are very likely to find small or close-to-null estimates in healthcare utilization; whereas studies that focus on the later stages of the NCMS rollout are more likely to yield significant findings. In contrast to the previous literature on the NCMS, our paper draws on a national sample that spans an eight-year period after the program was expanded in 2004, employs a random design utilizing variation in NCMS enrollment rate over time, examines a broader range of the NCMS's effects on healthcare use by provider and service type, and explores the mechanisms through which the NCMS increases healthcare access among rural residents in China.

Our findings are also related to the branch of literature on the effectiveness of health insurance. Studies conducted in developed countries have shown that the expansion of health insurance coverage increases healthcare use (Currie and Gruber 1996a; 2001; Finkelstein 2007; Card et al. 2008; 2009; Chay et al. 2010; Finkelstein et al. 2012; Kolstad and Kowalski 2012; Sommers et al. 2012), protects against catastrophic healthcare expenditures (Finkelstein et al. 2012), and significantly reduces mortality (Currie and Gruber 1996a;b; Hanratty 1996; Card et al. 2009; Chay et al. 2010; Miller et al. 2021; Finkelstein et al. 2012; Sommers et al. 2012; Chou et al. 2014; Goodman-Bacon 2018; Swaminathan et al. 2018; Khatana et al. 2019; Borgschulte and Vogler 2020; Goldin et al. 2021). The conclusions of these studies apply to both poor and non-poor populations. The studies that focus on non-poor populations are papers that examine the impact of health

insurance on Medicare beneficiaries (Finkelstein 2007; Card et al. 2008; 2009; Chay et al. 2010), on patients with specific diseases such as end-stage renal disease (Swaminathan et al. 2018) or cardiovascular disease (Khatana et al. 2019), and on the general public (Kolstad and Kowalski 2012). The studies that focus on poor populations include Currie and Gruber (1996a;b); Hanratty (1996); Chou et al. (2014); Currie and Gruber (2001); Goodman-Bacon (2018), which look at the effects of health insurance on low-income mothers and children, and Finkelstein et al. (2012); Sommers et al. (2012); Borgschulte and Vogler (2020); Goldin et al. (2021); Miller et al. (2021), which examine the impact of health insurance on poor adults. Utilizing Medicaid expansion as a natural experiment that allows for a rigorous empirical design, these studies focus on poor populations in developed countries (especially the United States). They all find that the expansion of insurance coverage leads to increases in healthcare use and mortality improvements.

In contrast, research findings on the effects of insurance expansion on healthcare use in developing countries are mixed. For example, studies that examine the impact of the Subsidized Regime in Columbia find that the program increases the use of preventive services and curative care (Miller et al. 2013; Trujillo et al. 2005; Giedion et al. 2009; Gaviria et al. 2006). However, a number of studies that look at the impact of insurance programs in other developing countries report only limited effects. For example, a study on the impact of an insurance program in Ghana finds that while the program leads to an increase in the use of pregnancy care (Mensah et al. 2010), it has no significant effect on OOP expenditures once self-selection is controlled for (Brugiavini and Pace 2016). King et al. (2009) find that the Seguro Popular program in Mexico does not lead to increases in the utilization of healthcare, whereas Sosa-Rubí et al. (2009) report that it leads to increases in diabetic care use. Other studies find that health insurance for the poor does not lead to increased use of healthcare or lower OOP costs in Nicaragua (Thornton et al. 2010), in Georgia (Bauhoff et al. 2011), or in India (Karan et al. 2017). Assessments of the impact of the Health Care Funds for the Poor program in Vietnam have also been mixed: Wagstaff (2007) finds that the use of

inpatient and outpatient care increases; Axelson et al. (2009) report a small increase in the overall healthcare use; and Wagstaff (2010) finds a null effect of this program on healthcare utilization.[8] We extend this literature by investigating the effects on healthcare utilization of the NCMS, one of the biggest insurance programs for the rural poor in China. More importantly, we explore the mechanisms behind its effectiveness, from which we derive some policy implications for the design and implementation of large-scale insurance programs in LMICs.

The paper is organized as follows. Section 2 introduces the institutional background of the NCMS. Section 3 describes the data, explains key dependent variables, and presents summary statistics. Section 4 introduces the empirical models and potential threats to our identification. Section 5 reports the NCMS's effects on healthcare utilization, investigates heterogeneous effects, explores mechanisms, and presents robustness checks. Section 6 presents estimates of the NCMS's effect on medical expenses and mortality. Section 7 concludes.

2 Institutional Background

2.1 The Healthcare System in Rural China

China's rural healthcare system is a three-tiered medical system (Wang 2004; Babiarz et al. 2012). Village health clinics are the first level of contact, and provide outpatient services only. Township health centers (THCs) represent the middle tier, and provide basic inpatient and outpatient healthcare. In some urbanized provinces, such as Zhejiang and Jiangsu, rural residents also visit community health centers (CHCs), which typically serve urban residents in neighboring communities and function similarly to the THCs in rural areas. The top tier of the rural healthcare system is county hospitals, which provide relatively specialized and better-quality care. Rural patients with complicated conditions

[8] See Acharya et al. (2013) for a comprehensive review.

can be referred to city hospitals. In this three-tier rural medical system, THCs play an important role in mediating between village clinics and county hospitals. The types of services provided at THCs include preventive healthcare, basic medical care, health surveillance, health education, rehabilitation, and family planning (Wang 2004). Although city hospitals are technically not part of the rural healthcare system, rural residents (especially those living in the areas adjacent to cities) often go to city hospitals for treatment because they have much better staff and equipment than other healthcare facilities. Rural residents may go to a nearby city hospital because they want better-quality services, or because their condition cannot be treated at THCs or county hospitals.[9]

2.2 The New Cooperative Medical Scheme (NCMS)

While the poor in developed countries mainly live in cities, poor people in China tend to be concentrated in rural areas, and especially in remote and mountainous rural areas far away from cities. However, in the 1990s, only 20% of China's rural population, who accounted for about 70% of the country's total population, had any form of health insurance (MHCHSI 2004). Rural Chinese who lacked health insurance had to pay the full amount for the medical care they received. To reduce the financial burden associated with healthcare use, the Chinese government initiated one of the largest health insurance programs in history in 2002, the New Cooperative Medical Scheme (NCMS). The NCMS was designed to fully cover the 640 million otherwise uninsured rural residents of China by 2008.

The NCMS was rolled out on a staggered basis, first through a pilot program in 300 counties in 2003, and then through an expansion to over 600 counties by 2005 (Liu 2004).[10] In 2003, each provincial government had to choose at least two to three counties for the pilot program based on the financial conditions of county governments, the needs of the

[9] In addition, some rural patients with chronic or rare diseases may go to city hospitals outside of their home province for treatment.

[10] For example, Beijing had 13 pilot counties, Shanghai had 10 pilot counties, Zhejiang had 27 pilot counties, Jiangsu had 10 pilot counties, and Shandong had 26 counties. More details on each province can be found in Appendix Table A1.

local rural population, and the status of the medical care delivery system. Thus, a small number of counties with better economic conditions were chosen to participate in the pilot stage, and the program was expanded to the majority of counties later on. As a result of this process, provinces with better economic conditions achieved full coverage earlier and more quickly than other provinces. Appendix Table A1 shows the year when each province fully covered its rural population, and the number of counties participating in the pilot stage of the NCMS. All provinces achieved full coverage of their rural residents by 2008, and economically developed provinces reached full (or nearly full) coverage earlier, including Beijing and Shanghai in 2004, Jiangsu and Qinghai in 2005, and Zhejiang and Hainan in 2006.

Although participation in the NCMS was voluntary for rural residents, the program offered sufficient incentives to ensure full enrollment. In establishing the premium payments, the central government set a minimum contribution for participants and a minimum subsidy for local governments.[11] As a result, participants paid only around one-fifth of total premiums, with local and central governments subsidizing the rest. For example, an enrollee paid a minimum contribution of 10 to 80 yuan in the 2004-2011 period. In addition, the central government's budget transfers to local governments were conditional upon achieving a target enrollment rate, and enrollment levels were tied to promotions for government officials (Vilcu et al. 2016). Thus, local governments heavily promoted enrollment in the program. For example, village leaders often visited the non-participating households in person to help them enroll. As a result of the heavily subsidized premiums and the extensive promotion efforts by local governments, rural residents responded positively to the NCMS, as shown in Figure 1. The program expanded rapidly from 2004 to 2007, with the enrollment rate increasing from 18 percent to 86 percent. The coverage rate rose to over 95 percent in 2008, flattened in 2009, and reached full coverage in 2010 and 2011.

[11] In particular, the minimum contribution set by the central government was 10 yuan in 2006, 20 yuan in 2007, 30 yuan in 2008, 50 yuan in 2009, 60 yuan in 2010, and 80 yuan in 2011.

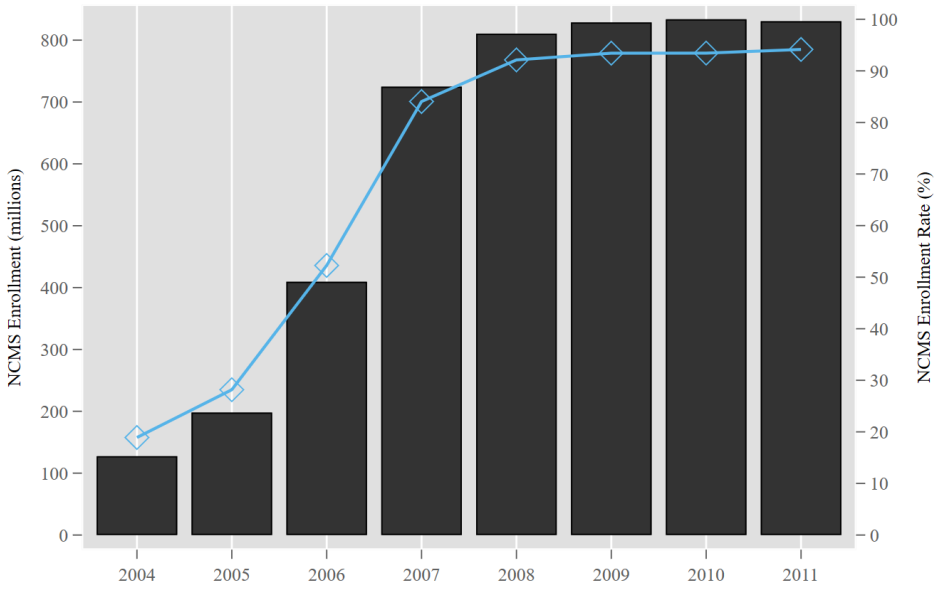


Figure 1: NCMS Enrollment over Time

Notes: The data source is the NCMS development report by Chen and Zhang (2013). The y-axis on the left is the number of enrollees. The y-axis on the right is the enrollment rate, which is calculated by dividing the rural population by the number of enrollees over the 2004-2011 period.

Provinces might have chosen to expand the NCMS based on their economic conditions. To show this, we regress our NCMS enrollment rate on province economic variables such as the unemployment rate, GDP per capita (2014 yuan), and the average income per capita (2014 yuan), while controlling for province and year fixed effects in a province-year panel of the 2004-2011 period. Appendix Table A2 reports the results using flexible forms of these economic controls. Column 1 estimates a simple relationship between the unemployment rate and the NCMS enrollment rate. Column 2 adds the basic demographic controls for each province, such as population, education, age structure, percentage married and female, and the ratio of dependent persons. Column 3 allows for flexible quadratic and cubic forms of the unemployment rate. Column 4 adds other economic conditions in cities, such as consumption, medical expenses, and the average income in 2014 yuan. Column 5 includes all possible economic controls, and takes flexible forms of the unemployment rate and the average income per capita (2014 yuan) in rural areas. Column 1 estimates that a

one-percentage-point increase in the unemployment rate is correlated (without statistical significance) with an approximate 0.06 percentage point increase in the NCMS enrollment rate. The flexible forms in columns 4 and 5 point to a potential relationship between the average income per capita of rural residents and the NCMS enrollment rate. We address the endogeneity concern regarding the NCMS enrollment rate in sections 4.3 and 5.4. Although it appears that the more developed provinces have lower NCMS enrollment gains, there are no systematic differences between more developed and less developed provinces in the trend in rural residents' healthcare utilization. For further evidence, Appendix Table A3 shows that the lagged economic conditions are not correlated with the NCMS rollout.

As the NCMS is implemented at the county level, local governments have discretion in choosing the benefit packages and the administrative arrangements offered in their areas. Thus, the deductibles, coinsurance rates, and ceilings of the scheme can vary across counties (You and Kobayashi 2009). However, the benefit designs of the NCMS in different counties have some similar features. First, the NCMS provides more generous benefits for inpatient care than for outpatient care: all counties cover inpatient care, while only a quarter of counties cover outpatient care on a pooling basis (Wagstaff et al. 2009). Second, to control medical expenses, the NCMS generally adopts a hierarchical reimbursement scheme that offers more generous benefits for care delivered by lower-level providers, and less generous reimbursements for care delivered by higher-level providers. In 2011, the highest coverage rates (at 65 to 90 percent) were for care delivered by primary care providers, such as THCs and CHCs; the second-highest coverage rates (at 60 to 80 percent) were for care provided by county hospitals; and the lowest coverage rates (at 45 to 70 percent) were for care provided by city hospitals (Zeng et al. 2019). Third, the range of benefits offered by the NCMS has improved since its initial implementation in 2003. More infectious diseases and catastrophic diseases, such as congenital heart disease, leukemia, and cancer, are covered. Since 2007, outpatient services associated with chronic diseases, such as kidney dialysis and diabetes,

have also been reimbursed.[12]

On the supply side, the NCMS does not determine provider payment rates.[13] However, medical resources in rural areas were increased in parallel with the introduction of the program. From 2004 to 2011, the number of hospital beds at county hospitals grew quickly, while the number of hospital beds at CHCs and THCs increased slightly (Appendix Figure A1). In addition, more healthcare providers have been established: the number of CHCs increased significantly and the number of county hospitals expanded rapidly starting in 2010, while the number of THCs decreased from 2004 to 2011 (Appendix Figure A2). Overall, the quantity and the quality of the medical resources in rural areas have improved as a result of the NCMS program.

3 Data

To explore the NCMS's effects, we rely on three sources of data with annual information in each province of China. Our healthcare utilization and health resources data are collected from the annual China Health Statistical Yearbook (CHSY) for the 2004-2011 period. The CHSY is a national yearbook published by the Health Department of China that reports detailed information on the health of the residents of all Chinese provinces. First, the CHSY provides the total numbers of outpatient and inpatient visits at all hospitals, and the corresponding numbers of health services delivered by each provider at city hospitals, county hospitals, CHCs, and THCs. In addition, the CHSY includes data on outpatient visits at hospitals by specialty from 2007 to 2011, which we use to explore the impact of the NCMS on substitution behavior across services and providers among rural residents. Second, the CHSY provides detailed information on household consumption and medical expenses in the

[12]The co-payment for the treatment of such diseases is about 10 percent, and is fully reimbursed for some poor households.

[13]Although county governments have some discretion in setting premium and reimbursement levels, they do not negotiate with healthcare providers. The payment rates for healthcare providers are based on the payment design of the local public insurance for employees, which is, in turn, based on the standard set up by the national bureau of health insurance.

rural and urban areas of a province, which allows us to estimate the impact of the NCMS on OOP costs.[14] Third, the CHSY contains detailed information on the health resources across provinces. We use two dimensions of health resources to explore the mechanisms of the effects of the NCMS in our paper: the number of providers and the number of beds offered by providers at different levels, such as county hospitals, CHCs, and THCs, in rural areas in each province.

The second data source is the annual China Statistical Yearbook (CSY) for the years 1996 to 2011. The CSY contains demographic information for each province, including information on the total population; the rural population; the share of married individuals; the share of female individuals; the share of individuals with different levels of education, such as high school and college; the share of individuals belonging to different age groups, such as the proportion of people aged 14 and above and the proportion of people aged 64 and above; and the ratio of dependent people (children and elderly parents) in a household.[15] In addition, the CSY contains detailed information on the economic characteristics of each province, including the gross domestic product (GDP) per capita, the unemployment rate, the average income in rural areas, and the household disposable income in cities. These variables are exploited as controls in our estimation model. The CSY also provides information on all-cause mortality (deaths per 1,000 people) in each province. We collect information on incidence and death rates by disease for each province from the Chinese Center for Disease Control and Prevention (CCDC) to further explore whether the NCMS is beneficial for treating certain conditions to estimate the health effects of the NCMS.

Our data on the NCMS policy are derived from the report on the NCMS's development by Chen and Zhang (2013). The report presents information on NCMS enrollment, NCMS beneficiaries, and the program's reimbursements for inpatient care in graphs for each province

[14]Medical expenses include payments for medical equipment, medications, hospital bills, and doctors' consultation services (Zeng et al. 2019).

[15]The population is based on *hukou* status, China's household registration system: if a person's *hukou* is registered in a rural area, he or she is counted in the rural population.

from 2004 to 2011. While the report explicitly provides the values of these variables for some years, it shows other years only in graphs. Therefore, we impute the specific values for the years in the graphs based on the exact numbers given for other years in the report. For example, the report provides specific NCMS enrollment numbers for Beijing in 2004, 2005, 2006, and 2011. For the rest of the years, the corresponding numbers are plotted from 2004 to 2011 in a scattered graph. We use the y-scale information and a software tool to proportionately calculate the NCMS enrollment in all years from 2004 to 2011.[16] The main independent variable of interest is the NCMS enrollment rate constructed by the ratio of NCMS enrollment and the rural population in each province over the 2004-2011 period.

We also supplement these data with another data source, the China Health Yearbook (CHY) from 1996 to 2003, to test our identification strategy. The CHY provides information on healthcare in the years prior to the NCMS implementation.[17] The variables of interest in the CHY are the number of healthcare providers, the number of hospital beds, the numbers of outpatient visits and emergency visits, and healthcare spending across the provinces. We employ the supplemental data in section 4 to test the parallel trend assumption in a framework with a continuous treatment variable.

3.1 Key Dependent Variables

The first set of outcomes is on healthcare use by service and by provider. We construct the total number of outpatient visits and the total number of inpatient stays using the information on the population in each province from 2004 to 2011. We then calculate the healthcare use in the form of outpatient visits and inpatient stays by provider at city hospitals, county hospitals, CHCs, and THCs in order to investigate how the NCMS affects the healthcare-seeking behavior across healthcare providers with different levels of quality. We also combine the information on outpatient visits by hospital department, which allows

[16] We use CorelDRAW, which is a powerful graphics tool for vector illustration, layout, and editing. More information about CorelDRAW can be accessed on its website.

[17] The annual CHY reports are available in a scanned version, and we manually collected the data for each province in the reports. The cleaned data are available upon request.

us to investigate the substitution behavior among rural residents. All of these outcomes are scaled at per 10,000 people.

The second set of outcomes is on rural healthcare resources by provider, which we exploit to explore the mechanisms of the impact of the NCMS on the healthcare use of rural residents. We examine two types of healthcare resources: hospital beds and number of care providers. For the first two dimensions, we calculate the number of hospital beds per 10,000 people and the number of institutions per 10,000 people for city hospitals, county hospitals, CHCs, and THCs, respectively.

The third set of outcomes is on medical expenses and mortality rates in rural areas. The average medical expenditures of rural residents are inflation-adjusted (2014 yuan). The share of medical expenses is defined by dividing the medical expenses (2014 yuan) by the total consumption expenses (2014 yuan) in rural areas. The all-cause mortality rate in CSY is measured as the number of deaths per 1,000 people. The incidence rate and mortality rate for infectious diseases in CCDC is calculated per 100,000 people.

The fourth set of outcomes is on the NCMS beneficiaries and the reimbursement rates for inpatient care. We calculate the share of NCMS users as the ratio of NCMS beneficiaries and enrollment levels for each province in each year. The reimbursement rates for inpatient care use are drawn directly from the report, and do not distinguish between providers at different types of hospitals.

3.2 Sample Statistics

On average over our study period, 70 percent of rural residents are covered by the NCMS, and the coverage rate in 2004 is about 19 percentage points. Over the 2004-2011 period, the average increase in the NCMS enrollment rate is approximately 75 percentage points.[18] The average number of claims filed per rural resident is about one, indicating that an average

[18]Some provinces have a maximum NCMS enrollment rate that is higher than one. This is mainly driven by the urbanization process: as some rural residents turn into urban residents, the size of the rural population (the denominator for calculating the enrollment rate) decreases even through these people are still covered by the NCMS.

enrollee uses the NCMS at least once during the analyzed sample period. In terms of healthcare utilization, rural residents visit a doctor twice a year on average, and about eight out of 100 people use inpatient services. Across providers, city hospitals rank first in both outpatient and inpatient care use. THCs rank second in outpatient visits and third in inpatient stays. The CHCs are used much less frequently than other providers for inpatient services, which is not surprising given that CHCs mainly offer outpatient services. On average, rural residents spend 321 yuan (2014 yuan) on medical services, which account for seven percent among total consumption. Average healthcare spending per year in cities is about 856 yuan (2014 yuan), accounting for about seven percent of total consumption, which shares a similar proportion as rural people. The average disposable income in cities is close to 17,000 yuan (2014 yuan), while the average income in rural areas is around 6,000 yuan (2014 yuan). See Appendix Table A4 for more details.

4 Estimation Model

In this section, we describe our identification strategy to estimate the effects of the NCMS in a two-way fixed effect (TWFE) framework and a flexible event-study specification, as well as possible identification threats. The TWFE model uses a continuous NCMS enrollment rate across provinces over years as the key independent variable and exploits the within-province variation in the NCMS enrollment rate over time to quantify the effects on potential outcomes of interest. To show dynamic effects, we also estimate an event-study design, which utilizes a continuous value of the initial NCMS enrollment rate in 2004 across provinces as the treatment variable and compares province-level outcomes after 2004 between provinces with higher and lower total NCMS enrollment gains.

4.1 TWFE Specification

$$ln(Y_{pt}) = \beta_0 + \delta NCMS_{pt} + \eta_p + \mu_{rt} + X_{pt}^{'}\beta + \epsilon_{pt} \quad (1)$$

where Y_{pt} is the potential outcome in province p in year t: healthcare use by service and by provider, rural medical expenses, and mortality rate. Unless otherwise specified, all dependent variables are in natural logarithmic form. $NCMS_{pt}$ is the continuous NCMS enrollment rate in province p in year t. η_p, the province fixed effect, controls for unobserved time-invariant province characteristics, such as the political environment for promoting the NCMS and some unobserved preferences for healthcare use among the residents in each province. μ_{rt}, the region-by-year fixed effect, controls for common shocks across regions and convergence in outcomes across regions uncorrelated with the NCMS (Stephens Jr and Yang 2014; Goodman-Bacon 2021).[19] X_{pt} is a vector of covariates that includes the province-level demographic characteristics, such as population size, age structure, education levels, percentage married and female, and the ratio of dependent persons in a household; and a vector of economic controls that include the unemployment rate, GDP per capita (2014 yuan), disposable income in rural and urban areas (2014 yuan), and consumption and medical expenses in cities (2014 yuan). The demographic controls are our basic controls. The full controls include both demographic and economic variables. ϵ_{pt} is the standard error, which is clustered by province. All regressions are weighted by the rural population in 2003 to remove the endogenous urbanization process across provinces from 2004 to 2011.

4.2 Event-Study Specification

$$ln(Y_{pt}) = \alpha_0 + NCMS_p^{2004} \times \left[\sum_{y=-6}^{9} \theta_y \mathbf{1}\{t - 2002 = y\}\right] + \eta_p + \mu_{rt} + X_{pt}'\beta + \epsilon_{pt} \qquad (2)$$

where $NCMS_p^{2004}$ is the continuous NCMS enrollment rate in 2004 in province p. To better interpret our results, we re-define the treatment variable as the differences between the NCMS enrollment rate in 2011 and the NCMS enrollment rate in 2004, which captures the possible differential effects of NCMS enrollment accumulation on health service utilization

[19] China's 31 provinces are divided into five regions according to geographical location and economic conditions: eastern region, northern region, middle region, southern region, and western region.

across provinces.[20] The larger the value of this treatment variable, the greater the accumulated increase in the NCMS enrollment rate. The event-year dummies $\mathbf{1}\{t - 2002 = y\}$, are equal to one when the year of observations is $t = 1996 \ldots, 2002, 2003 \ldots, 2005 \ldots, 2007, \ldots, 2010, 2011$, respectively. We use 2002, the year before the NCMS begins, as the reference year; thus, it is omitted in the model. Based on the characteristics of the NCMS implementation outlined in section 2, we group the years 2005 to 2006 as the rapid expansion stage of the program, the years 2007 to 2009 as the close-to-full coverage stage with flattening enrollment rates, and the years 2010 to 2011 as the full coverage stage. All other variables are the same as those in equation (1). The estimates of interest are the coefficients on the interaction terms between $NCMS_p^{2004}$ and event-year dummies, θ_y, which capture the differences in outcome Y in year t as compared to 2002 between provinces with larger NCMS enrollment gains (smaller initial $NCMS_p^{2004}$) and provinces with smaller NCMS enrollment gains (larger initial $NCMS_p^{2004}$) over the 1996-2011 period.

4.3 Identification Threats

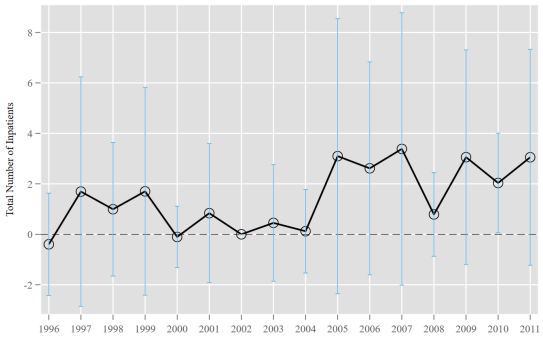
Our empirical TWFE model and event-study design rely on two identification assumptions: provinces with larger total NCMS enrollment gains show dynamics similar to those of provinces with smaller gains absent the NCMS policy; and provinces where the NCMS expands faster display a time trend similar to that of provinces where the program expands more slowly absent the NCMS policy. Although there is no consensus in the literature on the methods for testing the parallel trend assumption in a model with a continuous treatment, we use two strategies to address this issue here.

First, we estimate an event-study model and show the results for the years 1996-2011. Specifically, we obtain the pre-NCMS data for the years 1996-2003 from the CHY and

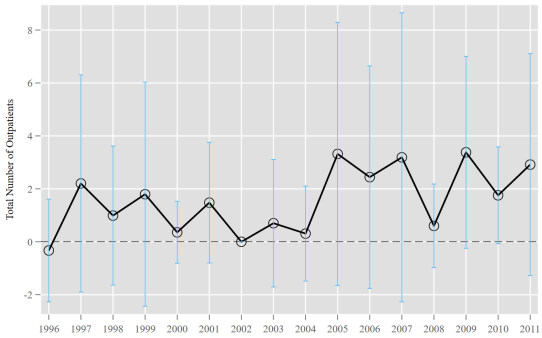
[20] The results are almost identical when using the alternative differences between 100 percent coverage and the initial NCMS enrollment rate in 2004. The treatment variable also reflects the possible timing effects of the NCMS, if there are any.

combine it with the post-NCMS outcome data for the years 2004-2011 from the CHSY and CSY.[21] To test the first identification assumption, we regress our outcomes of interest for the 1996-2011 period on the 2004 NCMS enrollment rate, employing the specification (2). Figure 2 shows the respective estimates of the NCMS's effects on inpatient stays and outpatient visits, and Appendix Figure A3 shows the corresponding estimates without region-by-year fixed effects in the years 1996-2011 (2002 is the omitted year). All estimates

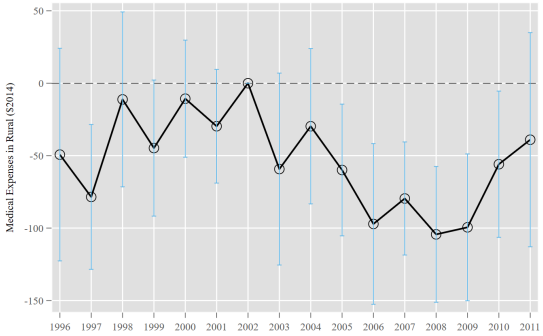
(a) Inpatient, baseline



(b) Outpatient, baseline



(c) OOP Expenses, baseline



(d) Mortality, baseline

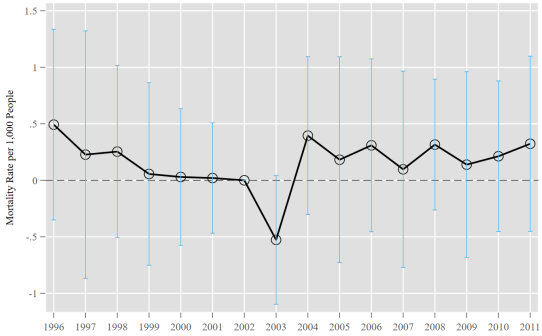


Figure 2: Event-Study Estimates of Total NCMS Enrollment Gains

Notes: The data sources are the 1996-2003 CHY and the 2004-2011 CHSY and CSY. Each figure plots the event-study estimates in specification (2) with the baseline estimates. The y-axis is the dependent variable in log form for inpatient and outpatient care use. The interval is the 95 percent confidence interval of each estimate.

[21]The data for the years 1996-2003 are derived from the CHY. The data for our working sample are from the CHSY for the years 2004-2011. Although the CHY and the CHSY both document the healthcare outcomes of interest, there might be some inconsistencies between the two data sources. See section 3 for details of the description of each data source. In addition, the CHY does not report outcome data by provider and by department. To be conservative and to allow for a more comprehensive analysis, we do not combine the data sample in our main analysis. Instead, we use the pre-NCMS data mainly for identification assumption tests.

before 2002 lie around the zero line and are statistically insignificant with and without region-by-year fixed effects. The evidence suggests that the growth rates of healthcare utilization, medical expenses, and health outcomes before the NCMS rollout are similar for rural residents of provinces with both smaller and larger enrollment gains, although their utilization levels often differ. It is noteworthy that while the utilization of both inpatient and outpatient services rises after 2003, OOP expenses decrease in 2004-2009, and then increase slightly in 2010-2011. Appendix Figure A4 further shows the event-study estimates on other healthcare outcomes for emergency visits and hospital discharges, and Appendix Figure A5 plots the estimates on detailed healthcare spending in 1996-2003. These estimates provide more evidence supporting the parallel trend assumption.

To test whether the NCMS enrollment expansion speed is exogenous, we estimate an event-study model that delineates each province with the expansion rate instead of the pre-NCMS insurance rate. The annual expansion rate is calculated by dividing the total enrollment gains between 2004 and 2011 by the number of years each province takes to achieve full coverage. Figure 3 shows the respective estimates of the NCMS's effects on inpatient stays, outpatient visits, OOP expenses, and mortality; and Appendix Figure A6 shows the estimates without region-by-year fixed effects in the years 1996-2011 (2002 is the omitted year) by comparing provinces with faster and slower expansion speeds. The statistically insignificant estimates before 2002 support the validity of our second identification assumption: the provinces that expand the NCMS faster have dynamics in rural residents' healthcare utilization, OOP expenses, and health outcomes similar to those of provinces that expand the program at a slower speed. Appendix Figures A7 and A8, which plot the dynamic estimates on other healthcare use (such as emergency visits and hospital discharges) and detailed healthcare resources in 1996-2003, provide more evidence supporting this assumption.

Second, following the methods used in Bailey and Goodman-Bacon (2015) and Goodman-Bacon (2018), we estimate the effects of the NCMS enrollment gains from 2004

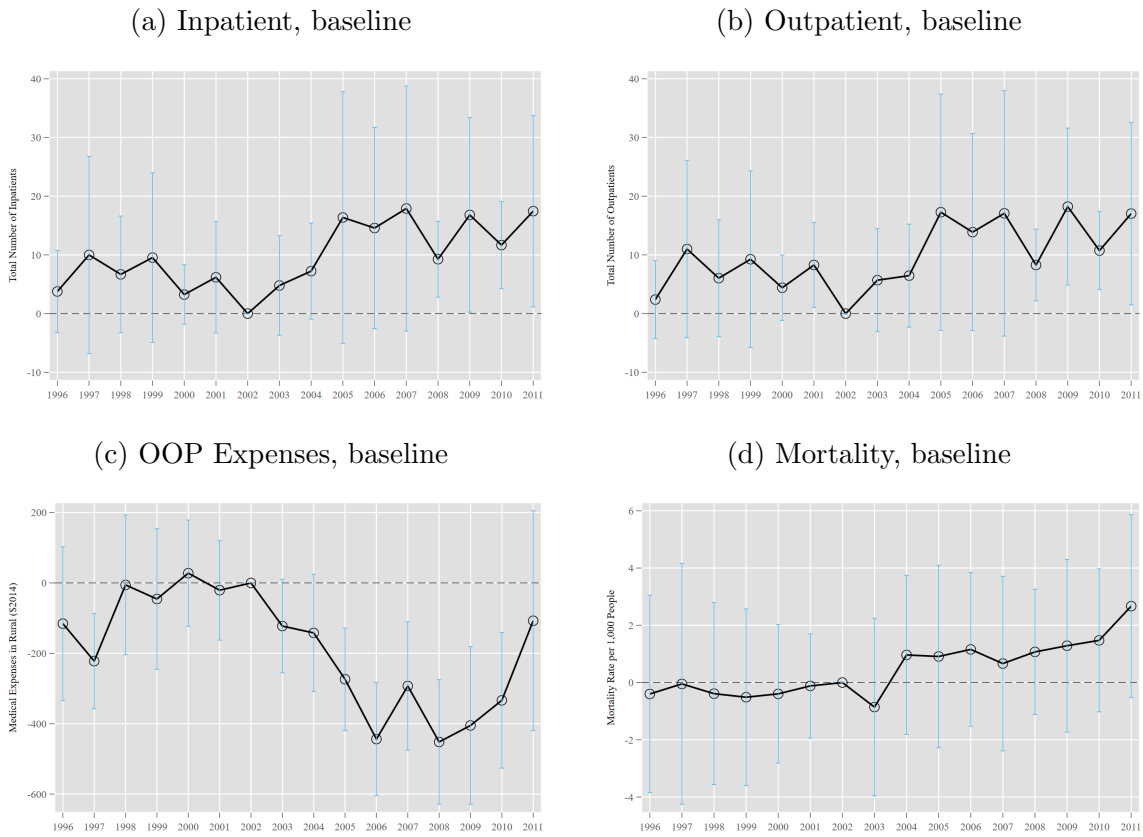


Figure 3: Event-Study Estimates by NCMS Expansion Speed

Notes: The data source are the 1996-2003 CHY and the 2004-2011 CHSY and CSY. Each figure plots the event-study estimates in specification (2). The y-axis is the dependent variable in log form for inpatient and outpatient care use. The interval is the 95 percent confidence interval of each estimate.

to 2011 on a range of economic variables in 1996-2004 and healthcare variables in 1996-2003.[22]

$$y_{pt} = \alpha + \beta_0 NCMS_p^{2004} + \beta_1 NCMS_p^{2004} \times (t - 2004) + \xi_{pt} \tag{3}$$

where y is the dependent variable to be tested against the NCMS enrollment rate in 2004 when the program expansion began. We test for balance both in levels ($H_0 : \beta_0 = 0$) in 2004 and in linear pre-2004 trends ($H_0 : \beta_1 = 0$).

Table 1 presents the tests of the potential effects of economic conditions and healthcare

[22]As discussed, the results of the NCMS enrollment gains from 2004 to 2011 are almost identical to the results of the NCMS enrollment rate in 2004. Results are available upon request.

Table 1: Balance Test: Relationship Between the NCMS Enrollment Rate in 2004 and the Pre-NCMS Levels and Trends of Socio-economic Characteristics and Healthcare Variables

	(1)	(2)	(3)	(4)	(5)
		Without Region-Year FE		With Region-Year FE	
Dependent Variable	Mean in 1996	Level ($NCMS_p^{2004}$)	Trend ($NCMS_p^{2004} \times Year$)	Level ($NCMS_p^{2004}$)	Trend ($NCMS_p^{2004} \times Year$)
		Panel A. Economic Conditions (1996-2004)			
Rural income (K)	2.81	-4.016***	-0.140	-3.653***	-0.133*
		(1.317)	(0.108)	(0.985)	(0.067)
GDP per capita (K)	7.5	-19.67***	-1.416**	-29.879**	-2.257**
		(6.321)	(0.550)	(11.554)	(0.865)
Food consumption share in rural (%)	57.32	1.617	-0.751*	4.799	-0.139
		(5.959)	(0.414)	(4.560)	(0.425)
Food consumption share in urban (%)	48.95	-0.225	0.036	2.378	0.339
		(1.833)	(0.246)	(2.380)	(0.349)
Share of medical expenses in rural (%)	3.66	0.203	0.053	-1.380	-0.095
		(1.300)	(0.102)	(1.242)	(0.091)
Share of medical expenses in urban (%)	3.63	0.724	0.157	0.060	0.111
		(1.252)	(0.108)	(1.370)	(0.118)
Unemployment rate	3.26	0.339	-0.088	0.903	0.063
		(0.598)	(0.102)	(0.997)	(0.134)
		Panel B. Healthcare (1996-2003)			
Outpatient visits (10K)	216.9	-1.074	0.160	-0.016	0.049
		(1.418)	(0.107)	(0.947)	(0.067)
Emergency visits (10K)	18.25	-2.593*	0.077	-0.891	0.039
		(1.343)	(0.167)	(1.159)	(0.084)
Inpatient (10K)	5.21	-0.415	0.183	0.583	0.070
		(1.525)	(0.165)	(1.034)	(0.072)
Hospital discharge (10K)	5.07	-0.390	0.188	0.636	0.080
		(1.517)	(0.164)	(1.041)	(0.072)
Healthcare spending (10K)	8.57	-0.285	-0.186	-0.136	-0.304**
		(0.884)	(0.185)	(0.920)	(0.132)
Medical fixed capital (10K)	150.4	-0.796	-0.098	-0.475	-0.238
		(0.803)	(0.188)	(0.912)	(0.207)
Number of institutions (K)	0.83	-0.260	-0.073	1.075	0.083
		(0.544)	(0.051)	(0.705)	(0.063)
Number of hospitals (K)	0.26	-0.300	-0.012	0.695	0.059
		(0.824)	(0.130)	(0.620)	(0.090)
Number of beds (10K)	13.98	0.088	-0.014	1.709*	0.114
		(0.499)	(0.031)	(0.870)	(0.090)

Notes: The data used are from the 1996-2004 CSY. The first column reports the mean of each dependent variable tested in 1996. Columns 2 and 3 estimate the relationship between the NCMS enrollment gains and the outcomes without region-year fixed effects; columns 4 and 5 include region-year fixed effects, from the model weighted using the rural population in 2003: $y_{pt} = \alpha + \beta_0 NCMS_p^{2004} + \beta_1 NCMS_p^{2004} \times (t-2004) + \xi_{pt}$. The dependent variables in panel B are in log form. Standard errors are clustered at the province level and are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

variables on the NCMS enrollment rate. The results show that before 2003, provinces with lower insured rates in 2004 tend to have worse economic conditions in terms of level (lower rural income and lower GDP per capita) and trend (lower GPD per capita growth rate). However, the differences in the pre-NCMS economic conditions are mitigated after removing region-by-year variations. More importantly, Panel B of Table 1 shows that the 2004 insured rate has little correlation with the levels and trends of pre-NCMS healthcare utilization, which reinforces our confidence that the provinces with both larger and smaller gains have similar healthcare utilization trend absent the NCMS program. Thus, the results alleviate the concern that the NCMS enrollment rate at the beginning of the period might be selected for provinces with differential health resources.

5 The NCMS's Effects on Services Utilization

5.1 The NCMS's Effects on Inpatient Services Use

As the NCMS reimburses inpatient care more generously than outpatient care, we expect to find that its effect on inpatient services utilization is significant and positive. Panel A of Table 2 shows the estimates from the baseline model (1) and its alternative specifications. The baseline estimate in column 1 suggests that a one-percentage-point increase in the NCMS enrollment rate significantly increases rural residents' inpatient services use by 0.1 percent (about 0.5 hospital stays per 10,000 people). The larger estimate in column 2, 0.16 percent as compared to the baseline estimate of 0.1 percent, implies that omitting region-level characteristics (e.g. the expansion of health insurance among urban residents) might lead to an overestimation of the NCMS's effect on inpatient services utilization by around 0.05 percent. Column 3 provides further evidence that omitting economic controls for urban residents leads to an overestimation of the NCMS's effect by 0.02 percent. Column 4 indicates that omitting both demographic controls and economic controls leads to an overestimation by about 0.09 percent, which points to the importance of controlling for

Table 2: Baseline Estimates of the NCMS's Effects on Inpatient Services Utilization

	Panel A. Total Inpatient Services Utilization				
	(1)	(2)	(3)	(4)	(5)
	Baseline	No Region-Year FE	No Economic Controls	No Controls	Unweighted Baseline
NCMS rate	0.114*	0.160**	0.134**	0.200***	0.126**
	(0.065)	(0.073)	(0.065)	(0.058)	(0.046)
Mean	479.4	479.4	479.4	479.4	479.4
	Panel B. Inpatient Services Utilization by Provider				
		(1)	(2)	(3)	(4)
		City hospital	CHC	County hospital	THC
NCMS rate		0.032	1.647*	0.116***	0.360*
		(0.041)	(0.850)	(0.041)	(0.184)
Mean		183.4	0.995	169.1	127.6

Notes: Each cell reports estimates from a separate specification. The dependent variable is inpatient visits per 10,000 people. Panel A reports the NCMS's effect on inpatient care use in all hospitals. Column 1 reports estimates from the baseline equation (1), with full controls of both time-varying demographic covariates and economic covariates for each province, province fixed effects, and region by year fixed effects. Column 2 replaces region by year fixed effects with year fixed effects. Column 3 removes economic covariates including the unemployment rate, GDP per capita (2014 yuan), disposable income in rural and urban areas (2014 yuan), and consumption and medical expenses in cities (2014 yuan). Column 4 further drops demographic covariates including population, age structure, education level, percentage of married and female, and the ratio of dependent persons in a household. The estimates of columns 1 to 4 are weighted by the rural population in 2003. Standard errors are clustered by province and are shown in parentheses. Column 5 indicates the unweighted results of the baseline specification. Panel B reports the NCMS's effect on outpatient visits at city hospitals, CHCs, county hospitals, and THCs, respectively using the baseline model (1). The mean of each dependent variable is the average in 2004 per 10,000 people and is weighted by the rural population in 2003. *** p<0.01, ** p<0.05, * p<0.10.

time-varying demographic and social-economic conditions across provinces and regions. The similar unweighted coefficient presented as the baseline estimate in column 5 implies that the NCMS's effect on inpatient care is robust to dropping the analytical weights for the rural population in 2003.

5.1.1 Heterogeneous Effects of the NCMS on Inpatient Services by Provider

Given the hierarchical reimbursement scheme under the NCMS, we hypothesize that the NCMS creates larger incentives for rural residents to use the inpatient services of primary healthcare providers. Panel B of Table 2 shows that the positive effect of the NCMS on inpatient services utilization is mainly produced by the increased inpatient stays in primary

care providers at CHCs and THCs, and at county hospitals. The largest effect is at CHCs with a 1.6 percent increase; followed by at THCs, with a 0.4 percent increase; and at county hospitals, with a 0.1 percent increase. The NCMS does not lead to increased inpatient stays at city hospitals. As explained in section 5.2.1, the observed increase in inpatient stays of the NCMS in primary care providers and county hospitals may be driven by the distribution of disease severity: as the majority of newly covered rural patients have mild conditions, most of their inpatient stays are more likely to be at lower-level care providers than at city hospitals. While we cannot rule out the possibility of patient sorting in choosing medical providers, we argue that the observed heterogeneous inpatient effects across care providers are at least partly driven by the differential reimbursement design of the NCMS. Table 3 shows that the NCMS significantly reduces rural residents' likelihood of being hospitalized at city hospitals, which is unlikely to be driven by changes in the distribution of disease severity. Instead, rural residents seem to substitute inpatient stays at city hospitals with less

Table 3: Estimates of the NCMS on the Likelihood of Inpatient Stays by Provider

Dependent Variable	(1)	(2)	(3)	(4)
Share of Inpatient Stays	City hospital	CHC	County hospital	THC
NCMS rate	-0.038*	0.005	-0.001	0.029
	(0.020)	(0.005)	(0.018)	(0.030)
Observations	216	216	216	210
Mean	0.366	0.00174	0.352	0.281

Notes: The dependent variable, the share of inpatient stays, is calculated by dividing inpatient stays at each medical provider by total inpatient stays. The mean of each dependent variable is the average in 2004 per 10,000 people, and is weighted by the rural population in 2003. *** p<0.01, ** p<0.05, * p<0.10.

expensive hospitalizations at lower-level medical providers.

5.1.2 Dynamic Effects of the NCMS on Inpatient Services Use

Appendix Figures A11 and A12 plot the dynamic effects of the NCMS on inpatient services utilization for inpatient services in total and by provider, respectively. Appendix Figure A11 shows that during the rapid expansion stage (2005-2006), the decline in total inpatient

services utilization was relatively small in the provinces that experienced a larger NCMS expansion. During the close-to-full coverage stage (2007-2009), inpatient care use caught up rapidly in the provinces with a larger NCMS expansion, but this increasing momentum slowed and began to decline during the full coverage stage (2010-2011). The pattern of inpatient care use across providers displayed in Appendix Figure A12 indicates that the NCMS significantly increases inpatient stays at county hospitals, CHCs, and THCs. While the NCMS's effects on inpatient care at city hospitals fail to achieve statistical significance in Table 2 (column 1 of panel B), Appendix Figure A12 shows an upward trend. The inconsistency between the event-study estimates of equation (2) and the estimates of equation (1) is due to the smaller intent-to-treat (ITT) estimand defined in the event-study specification. The ITT estimates shown in Figures A11 and A12 are smaller than the average treatment effect on the treated (ATT) shown in the specification (1). Overall, the patterns of these two estimands are consistent.

5.1.3 Other Heterogeneity Analysis

In this section, we analyze the heterogeneous effects of the NCMS on inpatient services use by level of urbanization and NCMS coverage generosity. First, we expect to see that the effects of the NCMS on inpatient care use are smaller in more urbanized provinces. Rural residents in more urbanized provinces have access to better welfare programs and more medical assistance programs provided by governments and social organizations,[23] and may therefore be less likely to respond to the NCMS. Panel A of Table 4 reports the coefficients of the interaction term between the NCMS enrollment rate and the average share of urban population in our sample period. Consistent with our hypothesis, rural residents in more urbanized provinces are less likely to use inpatient services in general (column 1), particularly

[23]For example, in Shanghai, the average urbanization rate from 2004 to 2011 is about 86 percent, and the share of inpatients among the total population in 2004 is about 75 percent; and in Beijing, the urbanization rate is close to 76 percent, and the 2004 share of inpatients is close to 77 percent. In contrast, in Yunnan, the urbanization rate is around 16 percent, and the 2004 share of inpatients is about 11 percent; and in Guizhou, the urbanization rate is approximately 16 percent, and the 2004 share of inpatients is as low as eight percent.

at city hospitals and county hospitals.

Table 4: Heterogeneous Effects of the NCMS on Inpatient Services Utilization

	(1) Total	(2) City hospital	(3) CHC	(4) County hospital	(5) THC
Panel A. Heterogeneous NCMS Effects by Urbanization					
NCMS rate	0.342**	0.271***	1.264	0.317***	0.392
	(0.138)	(0.067)	(1.440)	(0.096)	(0.363)
NCMS rate*urbanization	-0.007*	-0.007***	0.011	-0.006**	-0.001
	(0.004)	(0.002)	(0.032)	(0.003)	(0.010)
Panel B. Heterogeneous NCMS Effects by Inpatient Reimbursement Rate					
NCMS rate	-0.245	-0.077	3.189	-0.370	0.333
	(0.482)	(0.263)	(2.931)	(0.330)	(1.025)
NCMS rate*reimbursement	0.011	0.003	-0.047	0.014	0.002
	(0.014)	(0.007)	(0.086)	(0.010)	(0.029)
Panel C. Heterogeneous NCMS Effects by Older Population Share					
NCMS rate	-0.244	-0.290**	3.429	0.073	-0.309
	(0.196)	(0.127)	(2.093)	(0.213)	(0.399)
NCMS rate*age 65 percentage	3.887**	3.411**	-17.501	0.639	7.240*
	(1.865)	(1.267)	(18.504)	(2.277)	(3.570)

Notes: Each cell reports estimates from a separate specification using the baseline model (1), with full controls of time-varying demographic covariates and economic covariates for each province, province fixed effects, and region-by-year fixed effects. The dependent variable is inpatient visits per 10,000 people by provider: city hospitals, CHCs, county hospitals, and THCs. Panel A reports the heterogeneous effects of the NCMS on inpatient care use by the average of the within-province urbanization rate, which is captured by the share of urban population. Panel B reports the heterogeneous effects of the NCMS on inpatient visits by the generosity of inpatient reimbursement, measured as the mean of the within-province reimbursement rate from 2004 to 2011. The demographic covariates include population, age structure, education level, percentage married and female, and the ratio of dependent persons in a household. The economic covariates include the unemployment rate, GDP per capita (2014 yuan), disposable income in rural and urban areas (2014 yuan), and consumption and medical expenses in cities (2014 yuan). All estimates are weighted by the rural population in 2003. Standard errors are clustered by province, and are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Second, we examine how the NCMS's effects on inpatient care use are influenced by the generosity of inpatient care benefits. The NCMS's reimbursement rate for inpatient stays determines rural residents' OOP expenses. Therefore, rural beneficiaries in provinces with better inpatient benefits are expected to use more inpatient services. Contrary to our expectations, Panel B of Table 4 shows that the estimates of the interaction term between the NCMS enrollment rate and the NCMS inpatient reimbursement rate, measured as the mean of the provincial reimbursement rate from 2004 to 2011, are statistically insignificant.

To explore the reasons why more generous benefits do not lead to more inpatient care use, Appendix Figure A13 shows that the variation in the inpatient reimbursement rate across provinces is not economically generous enough. The reimbursement rate ranges from 25 to 45 percent, which suggests that, given that the average cost of an inpatient stay is about 10,600 RMB in 2020, the differences in the OOP expenditures across provinces are less than 2,200 RMB. Given the insufficient variation in the inpatient reimbursement rate, it is not surprising that the NCMS does not generate sufficient incentives for rural residents to use significantly more inpatient services in response to more generous reimbursements.

Third, as the elderly use the majority of inpatient services, we expect to find that the NCMS's effect on inpatient stays also differs by the share of elderly population in a province, which is defined as the share of people aged 65 and above. In Panel C of Table 4, we interact the NCMS's effects with the share of the elderly, and show positive and significant estimates on the coefficients of the interaction terms: provinces with a larger elderly share use significantly more inpatient care in total, at city hospital, and at THCs, which implies that rural elderly tend to rely on city hospitals and THCs for inpatient services.

5.2 The NCMS's Effects on Outpatient Services Use

Although the NCMS provides restricted benefits for outpatient visits, outpatient care constitutes a fundamental and essential part of healthcare. Thus, We begin by examining the relationship between the NCMS enrollment rate and outpatient services utilization by rural residents. Generally, we do not find a significant increase in rural residents' use of outpatient services following the NCMS rollout, which is not surprising given that most provinces do not offer outpatient coverage during our sample period.

In particular, Panel A of Table 5 reports baseline estimates of the model (1) and other estimates of various specifications. The baseline estimate in column 1 suggests that a one-percentage-point increase in the NCMS enrollment rate leads to a statistically insignificant 0.06 percent decrease in outpatient visits among rural residents (approximately 9 visits per

10,000 people). Column 2 replaces region-year fixed effects with year fixed effects, and shows similar result to the baseline estimate. The insensitivity of the baseline estimate to the removal of the region-level time trend suggests that time-varying regional changes, such as changes in socio-economic conditions and the convergence of local policies, do not drive the baseline results. Concerns might also be raised that the baseline estimate could capture the confounding effects from contemporaneous urbanization, economic development, and health insurance expansion in cities, which could coincide with the rollout of the NCMS across provinces over time. Column 3 drops the economic controls, including the unemployment rate, GDP per capita (2014 yuan), the disposable income in rural and urban areas (2014 yuan), and consumption and medical expense in cities (2014 yuan) in the baseline model and yields similar estimate. This alleviates the concern that the baseline estimates can be influenced by the healthcare utilization behavior of urban residents. Column 4 further drops the demographic controls, and the estimate barely changes as compared to the baseline estimates. Column 5 shows a similar estimate from the unweighted regression.

5.2.1 Heterogeneous Effects of the NCMS on Outpatient Visit by Provider

Panel B of Table 5 reports the heterogeneous effects of the NCMS across providers of different levels: i.e., primary care providers (THCs and CHCs), county hospitals, and city hospitals, ranked from the lowest to the highest in terms of both service price and service quality. We find that the NCMS has smaller effects on outpatient visits at higher-level medical providers: a one-percentage-point increment in the NCMS enrollment rate increases outpatient visits to county hospitals by 0.08 percent (about 3 visits per 10,000 people) and THCs by 0.07 percent (about 4 visits per 10,000 people), but decreases outpatient visits to city hospitals by 0.03 percent (about 2 visits per 10,000 people) and CHCs by 0.08 percent (about 1 visit per 10,000 people), respectively. All of the coefficients are statistically insignificant, presumably because of the insufficient incentives to use outpatient services under the restrictive NCMS benefit design for outpatient visits.

Table 5: Estimates of the NCMS's Effects on Outpatient Services Utilization

	Panel A. Total Outpatient Services Utilization				
	(1) Baseline	(2) No Region-Year FE	(3) No Economic Controls	(4) No Controls	(5) Unweighted Baseline
NCMS rate	-0.060	-0.053	-0.063	-0.078	-0.025
	(0.050)	(0.041)	(0.050)	(0.047)	(0.054)
Mean	15293	15293	15293	15293	15293
	Panel B. Outpatient Services Utilization by Provider				
		(1) City hospital	(2) CHC	(3) County hospital	(4) THC
NCMS rate		-0.030	-0.076	0.077	0.070
		(0.040)	(0.433)	(0.056)	(0.149)
Mean		5726	602.4	3599	5365

Notes: Each cell reports estimates from a separate specification. The dependent variable is outpatient visits per 10,000 people. Panel A reports the NCMS's effects on outpatient visits in all hospitals. Column 1 reports estimates from the baseline equation (1), with full controls of both time-varying demographic covariates and economic covariates for each province, province fixed effects, and region by year fixed effects. Column 2 replaces region by year fixed effects with year fixed effects. Column 3 removes economic covariates including the unemployment rate, GDP per capita (2014 yuan), disposable income in rural and urban areas (2014 yuan), and consumption and medical expense in cities (2014 yuan). Column 4 further drops demographic covariates including population, age structure, education level, percentage married and female, and the ratio of dependent persons in a household. The estimates in columns 1 to 4 are weighted by the rural population in 2003. Standard errors are clustered by province and are shown in parentheses. Column 5 displays the unweighted results of the baseline specification. Panel B reports the NCMS's effects on outpatient visits at city hospitals, CHCs, county hospitals, and THCs, respectively using the baseline model (1). The mean of each dependent variable is the average in 2004 per 10,000 people and is weighted by the rural population in 2003. *** p<0.01, ** p<0.05, * p<0.10.

There are two possible explanations for the pattern of heterogeneous effects on medical providers of different levels. First, it could reflect patient sorting in choosing medical providers: given that higher-level medical facilities offer better treatment quality while lower-level medical providers offer greater proximity, rural patients with different levels of disease severity and treatment quality preferences could end up going to different medical providers to receive outpatient care. Assuming that rural patients, who are on average more likely to have mild conditions, value proximity more than care quality when choosing healthcare providers, we would expect to observe that the NCMS's effects on outpatient care use are larger for basic medical providers (THCs and CHCs) than for county hospitals, which are even larger than for city hospitals. Second, besides reflecting patient sorting as a

result of disease severity and preferences for treatment quality, the heterogeneous effects across medical providers could also be explained by the differential payment scheme of the NCMS: given the distribution of patients' preferences for quality, more patients should go to lower-level medical providers for services that are more generously reimbursed if, on average, they put more value on price.

We show that the differential payment scheme of the NCMS does play a role in inducing the heterogeneous effects of the NCMS across providers of different levels. On the one hand, as shown in Table 6, rural residents are more likely to use lower-level medical providers: the probability of using outpatient care at county hospitals are significant and increases by 0.03 percentage point if the NCMS enrollment rate increases by one percentage point. We attribute the increased likelihood of patients visiting county hospitals for outpatient care largely to cost-sharing considerations, rather than to the distribution of patients' disease severity.

Table 6: Effect of the NCMS on the Likelihood of Outpatient Visits Across Providers

Dependent Variable	(1)	(2)	(3)	(4)
Share of Outpatient Visits	City hospital	CHC	County hospital	THC
NCMS rate	0.021	-0.032	0.029***	-0.018
	(0.018)	(0.029)	(0.010)	(0.032)
Observations	231	231	231	225
Mean	0.352	0.033	0.251	0.365

Notes: The dependent variables, the share of outpatient visits, is calculated by dividing outpatient visits to each medical provider by total outpatient visits. The mean of each dependent variable is the average in 2004 per 10,000 people and is weighted by the rural population in 2003. *** p<0.01, ** p<0.05, * p<0.10.

On the other hand, we present evidence that rural patients make fewer outpatient visits to city hospitals, and substitute them with outpatient visits or inpatient care provided by lower-level medical providers. The substitution pattern is more a response to differential reimbursement across providers than a consequence of patient sorting on disease severity. First, to provide evidence that the NCMS does reduce outpatient visits to city hospitals, we split hospital outpatient visits by department and examine the heterogeneous effects of the

NCMS across outpatient specialties. Table 7 reports the estimates by specialty at hospitals from regressing the department visits per 10,000 people on the NCMS enrollment rate using the baseline model (1). While the NCMS leads to an insignificant increase in outpatient visits at internal medicine, gynecology, and ophthalmology departments, which are popular among rural residents (with a higher mean); it reduces outpatient visits to general medicine (with statistical significance), preventive medicine, rehabilitation departments, and among other specialities (9 out of 12). These findings support the observation that the NCMS reduces rural residents' incentives to visit outpatient departments at hospitals, especially the general department.

Second, we show that rural residents make fewer visits to city hospitals in response to the differential payment scheme of NCMC by substituting them for more generously reimbursed outpatient and inpatient care at lower-level medical providers.[24] If rural residents substitute care at primary care providers for outpatient services at city hospitals, we should observe that the reduction in hospital outpatient visits is greater in provinces where rural patients are more likely to use services delivered by primary care providers. Table 8 shows the estimates of the heterogeneous effects of the NCMS on hospital department visits by interacting the share of inpatient stays/outpatient visits at primary care providers with the NCMS enrollment rate from the baseline model (1). Eight out of nine interactive estimates in Panel A are negative, which implies that rural residents use inpatient care from primary care providers at CHCs and THCs as a substitute for outpatient visits to city hospitals. The substitution effect is stronger and most noticeable for the emergency department. Similarly, Panel B of Table 8 shows that rural patients make fewer outpatient visits to expensive city hospitals after the NCMS rollout, and replace them with more outpatient visits to the more affordable THCs. More specifically, six out of nine interactive terms are negative, with the coefficients

[24]Rural residents might substitute the more generously reimbursed inpatient stays at primary care providers for the more expensive outpatient services in city hospitals, which can also be provided at the inpatient settings. For example, an ultrasound guided puncture procedure can be performed at both outpatient and inpatient departments. Absent the NCMS, rural residents can go to the outpatient department of a city hospital for the procedure; whereas after the NCMS is implemented, rural patients can get treated at the inpatient department of CHCs or THCs with lower OOP costs.

Table 7: Estimates of the NCMS's Effects on Outpatient Services Utilization by Department

	(1) General	(2) Preventive	(3) Rehabilitation	(4) Pediatrics	(5) Physical	(6) Emergency	(7) Otolaryngology	(8) Oral	(9) Dermatology	(10) Internal	(11) Gynecology	(12) Ophthalmology
NCMS rate	-0.577*	-0.530	-0.321	-0.094	-0.061	-0.052	-0.041	-0.035	-0.009	0.079	0.050	0.015
	(0.307)	(0.428)	(0.259)	(0.067)	(0.074)	(0.188)	(0.064)	(0.105)	(0.099)	(0.074)	(0.081)	(0.069)
Mean	364.5	116.1	94.85	1109	1137	493.7	366.1	372.1	376.3	2640	1122	381.2
Observations	145	145	145	145	145	145	145	145	145	145	145	145
R-squared	0.960	0.950	0.957	0.996	0.994	0.988	0.995	0.992	0.992	0.994	0.996	0.995

Notes: The data on outpatient department visits are from 2007 to 2011. The dependent variable is log outpatient visits per 10,000 people by department. The model used is the baseline equation (1), with full controls of both time-varying demographic covariates and economic covariates for each province, province fixed effects, and region-by-year fixed effects, weighted by the rural population in 2003. Standard errors are clustered by province and are shown in parentheses. The mean of each dependent variable is the average from 2007 to 2011 per 10,000 people, and is weighted by the rural population in 2003. *** p<0.01, ** p<0.05, * p<0.10.

Table 8: Substitution Effects of the NCMS on Healthcare Utilization

	(1) General	(2) Preventive	(3) Rehabilitation	(4) Pediatrics	(5) Physical	(6) Emergency	(7) Otolaryngology	(8) Oral	(9) Dermatology
Panel A. Interacting the NCMS With Prob. of Inpatient Stays in CHCs and THCs									
NCMS* Prob. of Inpatient Stays	-0.903	-1.149	0.300	-0.603	-0.999	-2.930**	-0.682	-1.358	-1.436
	(2.364)	(3.349)	(2.502)	(0.770)	(0.591)	(1.321)	(0.745)	(1.103)	(1.038)
Panel B. Interacting the NCMS With Prob. of THC Outpatient Visits									
NCMS* Prob. of THC Outpatient Visits	1.846	2.666	-0.223	0.361	-1.059*	-1.989	-1.230	-2.355**	-1.801
	(3.619)	(3.590)	(2.127)	(0.719)	(0.552)	(1.495)	(0.782)	(1.050)	(1.192)
Mean	364.5	116.1	94.85	1109	1137	493.7	366.1	372.1	376.3
Observations	144	144	144	144	144	144	144	144	144

Notes: The data on outpatient department visits are from 2007 to 2011. The dependent variable is log outpatient visits per 10,000 people by department. The model used is the baseline equation (1), with full controls of both time-varying demographic covariates and economic covariates for each province, province fixed effects, and region-by-year fixed effects, weighted by the rural population in 2003. Standard errors are clustered by province and are shown in parentheses. The mean of each dependent variable is the average from 2007 to 2011 per 10,000 people, and is weighted by the rural population in 2003. *** p<0.01, ** p<0.05, * p<0.10.

on physical and oral departments statistically significant, which implies that the decreasing effect of the NCMS on outpatient use is stronger if the likelihood of using outpatient services provided by THCs is greater. In general, given that city hospitals provide the best-quality services, the findings above suggest that rural residents are generally responsive to price and willing to trade off quality care at city hospitals for lower cost-sharing care at lower-level medical facilities.

5.2.2 Dynamic Effects of the NCMS on Outpatient Services Use

To show the dynamic effects of the NCMS, we divide our working period into three stages according to the rollout of the NCMS: the rapid expansion stage (2005-2006), the close-to-full coverage stage (2007-2009), and the full coverage stage (2010-2011). Appendix Figure A9 plots the estimates of the NCMS's effects on total outpatient care utilization from the event-study equation (2). Outpatient visits by rural residents decreased quickly during the rapid expansion stage in reference to 2004, caught up slightly during the close-to-full coverage stage, and declined during the full coverage stage. Appendix Figure A10 plots the estimates on outpatient use by levels of healthcare provider. The results indicate that the patterns of dynamic effects are similar at city hospitals and at CHCs: outpatient visits increased slightly during the close-to-full coverage stage compared to the rapid expansion stage, and continued to decrease during the full coverage stage (however, outpatient visits pick up slightly at CHCs). In contrast, the outpatient visits to THCs increased steadily over the entire period from 2005 to 2011. The rate of increase continued even during the full coverage stage.

Overall, the dynamic patterns shown in Appendix Figures A9 and A10 are consistent with the estimates in Table 5 employing the TWFE model in equation (1). While the NCMS increases outpatient visits to THCs and county hospitals, it reduces the overall number of outpatient visits by rural residents, mainly due to the larger share of outpatient visits to city hospitals (35 percent).

5.3 Mechanism Analysis

In this section, we investigate the mechanisms through which the NCMS leads to significant increases in inpatient services use at county hospitals, CHCs, and THCs (Panel B of Table 2), as well as in outpatient visits to county hospitals and THCs (Panel B of Table 5), despite lacking statistical power due to insufficient benefits. One straightforward mechanism is through the improved insurance benefits: the NCMS provides coverage for healthcare services and reduces OOP costs, leading to increased demand for healthcare. We have confirmed the role of insurance reimbursement benefits in rural patients' healthcare use when examining the heterogeneous effects across providers of different levels in sections 5.2.1 and 5.1.1.

We emphasize that there is another possible explanation for the increase in healthcare use: the supply-side supporting policy of increased healthcare investments in rural providers.[25] To quantity the contribution of the supply-side supporting policy to the NCMS's effects, we evaluate two dimensions of healthcare investments in rural providers: the number of healthcare providers and the number of inpatient beds. First, we examine the effect of the NCMS enrollment rate on rural healthcare investments using the baseline specification (1). Appendix Table A5 shows that the NCMS's supply-side supporting policy leads to the establishment of more and larger rural healthcare providers. As the NCMS enrollment rate increases by one percentage point, the number of county hospitals and THCs increases by approximately 0.13 percent and 0.06 percent, respectively (Panel A), and the number of inpatient beds grows significantly by 0.3 percent (0.02 beds per 10,000 people) at THCs (Panel B). However, it appears that the NCMS allocates fewer health resources to urban primary healthcare provider than to rural providers, as the number of CHCs decreases by around 0.3 percent, though the estimates are not statistically significant. In brief, the NCMS improves both the quantity and the quality of rural healthcare supply.

Next, we re-estimate the NCMS's effects on healthcare use after controlling for

[25] Refer to the policy background section 2 for more details.

healthcare resources. Column 1 of Table 9 reports the baseline estimate of the NCMS's effects on outpatient visits to county hospitals, and columns 2 to 4 report the estimates after controlling for inpatient beds, the number of providers, and both, respectively. The

Table 9: The NCMS's Effects on Outpatient Visits at County Hospitals Controlling for Rural Healthcare Resources

	(1)	(2)	(3)	(4)
NCMS rate	0.077	0.060	0.022	0.039
	(0.056)	(0.043)	(0.039)	(0.035)
THC beds		-0.059		-0.028
		(0.042)		(0.069)
County hospital beds		0.666***		0.467***
		(0.073)		(0.100)
CHC beds		0.001		-0.003
		(0.007)		(0.007)
Number of THCs			0.013	0.017
			(0.051)	(0.085)
Number of county hospitals			0.419***	0.194***
			(0.062)	(0.070)
Number of CHCs			-0.009	0.005
			(0.016)	(0.015)
Mean	3599	3599	3599	3599

Notes: Each cell reports estimates of the NCMS's on outpatient visits at county hospitals after controlling for each set of healthcare resources: hospital beds and number of providers in rural areas using the baseline model (1). The mean of the dependent variable is the average of outpatient visits in 2004 per 10,000 people and is weighted by the rural population in 2003. All estimates are weighted by the rural population in 2003. Standard errors are clustered by province and are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

results are in line with our expectations: outpatient services utilization at county hospitals is positively correlated with the supply of medical resources in rural areas. After controlling for these medical resources, the magnitude of the baseline effect becomes smaller, which suggests that the increase in outpatient visits to county hospitals can be attributed to improvements in the rural healthcare supply. In total, column 4 shows that the supply-side health resources account for about half of the baseline effects of the NCMS on outpatient visits at county hospitals.[26]

[26]The mechanisms are similar for outpatient visits at THCs. Results are available upon request.

Lastly, we describe the NCMS's effects on inpatient care utilization after controlling for rural healthcare resources in Table 10. Panel A shows that controlling for hospitals

Table 10: The NCMS's Effects on Inpatient Care Use Controlling for Rural Healthcare Resources

	(1) Total	(2) CHC	(3) County hospital	(4) THC
		Baseline Estimates		
NCMS rate	0.114*	1.647*	0.116***	0.360*
	(0.065)	(0.850)	(0.041)	(0.184)
Mean	479.4	0.99	169.1	127.6
		Panel A. Number of Beds at Hospitals		
NCMS rate	0.052	0.892**	0.070**	-0.023
	(0.057)	(0.414)	(0.026)	(0.124)
THC beds	0.242	-0.020	0.086	1.162***
	(0.143)	(0.495)	(0.056)	(0.135)
County hospital beds	0.343**	0.120	0.759***	0.324
	(0.150)	(0.840)	(0.077)	(0.272)
CHC beds	-0.005	1.050***	-0.007	0.003
	(0.010)	(0.127)	(0.005)	(0.021)
		Panel B. Number of Healthcare Providers		
NCMS rate	0.096	1.767**	0.075*	0.278
	(0.066)	(0.716)	(0.043)	(0.178)
Number of THCs	0.137	0.720	0.125	1.283***
	(0.118)	(0.607)	(0.098)	(0.165)
Number of county hospitals	0.081	-0.116	0.326***	0.076
	(0.128)	(0.876)	(0.077)	(0.221)
Number of CHCs	0.021	0.645**	0.002	0.060
	(0.022)	(0.314)	(0.014)	(0.054)

Notes: Each cell reports estimates of the NCMS's effects on inpatient care use after controlling for each set of healthcare resources: hospital beds, number of providers, and number of medical staff in rural areas using the baseline model (1). Each column corresponds to the estimates of inpatient care at specific hospitals. The mean of the dependent variable is the average of inpatient care use in 2004 per 10,000 people and is weighted by the rural population in 2003. *** p<0.01, ** p<0.05, * p<0.10.

beds decreases the baseline estimate of the NCMS's effect on total inpatient stays by 0.06 percent (0.30 inpatient stays per 10,000 people), by 0.75 percent (0.07 inpatient stays per 10,000 people) at CHCs, by 0.05 percent (0.08 inpatient stays per 10,000 people) at county

hospitals, and by 0.38 percent (0.49 inpatient stays per 10,000 people) at THCs, compared to the baseline estimates. It is noteworthy that the NCMS's effects on inpatient services utilization at THCs is close to zero after controlling for hospitals beds (Column 4), which suggests that the baseline effect at THCs is mainly driven by the increase in hospital beds. Panel B shows further evidence that the number of providers also plays a role in the NCMS's effect on inpatient care use, but smaller than the role of hospital beds, which is reasonable given that the number of hospital beds directly impacts the capacity for inpatient services. Appendix Table A6 reports the effect of the NCMS on inpatient use after controlling for all rural healthcare resources. Compared to the baseline estimates, total medical resources account for about 65 percent of the NCMS's effect on total inpatient services utilization, 27 percent of the NCMS's effects at CHCs, and 32 percent of the NCMS's effects at county hospitals; they absorb all of the NCMS's effects at THCs.

The supply-side supporting policy of increasing rural health investments contributes to the NCMS's success in increasing rural residents' healthcare use through two possible channels: the increased rural healthcare supply may improve care quality, which, in conjunction with NCMS coverage, increases rural healthcare use; or it may simply increase care providers' incentives to induce patient demand for unnecessary healthcare. The two channels have completely different policy implications regarding the use of the supply-side supporting policy of increasing healthcare supply to complement the demand-side insurance coverage expansion. While we cannot completely rule out the presence of supply-induced demand, we present several pieces of evidence that it is not a dominant force that drives the NCMS's effects. First, we observe that the NCMS effects on both inpatient and outpatient care use have grown weaker since 2009 when the NCMS has achieved nearly full coverage, and when the THCs and CHCs begin to implement the zero-markup policy (ZMP), in which the government mandates zero markups for drugs sold in public hospitals. Fang et al. (2021) and Zhou et al. (2021) show that the ZMP decreases drug expenses, but increases expenses for non-drug services. If supply-induced demand

plays a dominant role in rural healthcare utilization, we would observe that the NCMS's effects on healthcare use become stronger after 2008, when healthcare providers have larger incentives for inducing patients' use of non-drug services. Sections 5.2.2 and 5.1.2 provide evidence that after 2009 the dynamics of the NCMS's effects on outpatient and inpatient care use, respectively, weaken. Second, the following section 6 shows that the NCMS produces real health benefits for rural patients by reducing the incidence and mortality rates of infectious diseases and AIDS. To conclude, we believe that the supporting policy of increasing rural health investments improves health care quality and works with expanded coverage to encourage rural patients' use of healthcare service.

5.4 Robustness Checks

Outcomes of Interest in Aggregate Levels: In this paper, we are interested in estimating the treatment effects of the NCMS on the healthcare utilization of rural residents. The ideal measures of healthcare outcomes for rural residents would be the number of outpatient visits and inpatient stays among them. However, due to data limitations, we instead use healthcare measures for the total population as our outcome variables in our estimation model. To make our estimates reflect the treatment effects on the treated, the implicit assumption of the identification strategy is that the healthcare utilization behavior of urban residents can be perfectly absorbed by the city-level controls, such as medical expenditures, consumption, the average disposable income of city residents, and region-by-year fixed effects. If the healthcare use patterns in cities or the effects of insurance on urban residents converge at the regional level, the region-by-year fixed effects can capture those differential time trends across regions. Nevertheless, concerns may be raised that unobservable characteristics of city residents might bias our results. We employ as many flexible forms of city-level controls as possible to check the sensitivity of our results. Appendix Table A7 shows the results of the NCMS's effects on total outpatient and inpatient services utilization with flexible controls in quadratic and cubic forms, as well as with flexible lagged controls. All of the

results are quite robust across specifications (baseline estimates in column 1) which alleviates the concern about using outcomes of the total population as proxies for outcomes of rural residents.

Contemporaneous Policy: It is possible that our results are driven by other contemporaneous policies. The New Rural Pension Scheme (NRPS), a large social pension reform in China, is rolled out in 2009. Older people aged 60 and above can receive a fixed pension every month from the program. In 2011, the last year of our study period, the Chinese government spends about $41 billion on the NPRS, which benefits 89 million rural residents. Therefore, concerns could be raised that our estimates on increased healthcare utilization are confounded by the income effect from the NRPS or by the increasing healthcare demand among the older population. However, the analysis of the NRPS by Huang and Zhang (2021) suggests that the confounding effect from the NRPS may not be an issue, as they find no significant effects of the NRPS on inpatient or outpatient use, our outcomes of interest; or on other health outcomes, such as smoking and any medical services use. In addition, they find no health behavior changes among people who are eligible for the NPRS. Overall, the power of the NRPS is not reflected in any healthcare-related outcomes. Second, we re-estimate our results using data from 2004-2009 in which our outcome of interest is free from NRPS in Appendix Table A8.[27] The estimates on outpatient visits and inpatient care use are very robust to the main estimates in Tables 5 and 2. If anything, the magnitudes of the coefficients on total healthcare use and healthcare use at CHCs are larger than those of the baseline estimates. In summary, our baseline estimates are not biased by the contemporaneous rollout of the NRPS policy.

Economic Controls: Our identification assumption relies on the variation in NCMS enrollment within provinces. As discussed in section 2, one potential identification threat is that the NCMS's development might be endogenous to economic conditions, which may, in turn, be correlated with healthcare utilization. The balance tests in Table 1 show little

[27]The NRPS started in September 2009, so we keep 2009 in the analyzed periods. The results of excluding the year 2009 are almost the same. Results are available upon request.

evidence of significant relationships between the NCMS enrollment rate and a battery of controls except for the income variables, such as GDP per capita and income of rural residents. To address this concern, column 2 of Appendix Table A9 reports the estimates after including an interaction term between GDP per capita and time trends in our baseline specification (1). In addition, Table A2 shows that rural income might be correlated with our treatment variable, which may bias our findings. To check the sensitivity of our results, column 3 further controls for average rural income in flexible forms. Columns 4 to 5 show the results of the NCMS's effects on healthcare utilization after controlling for unemployment rate, lagged unemployment rate, GDP per capita, lagged GDP per capita, medical expenses of urban residents, and lagged medical expense by urban residents. These results suggest that our estimates are not sensitive to the demand-side controls, although there is a loss in statistical significance for inpatient services due to larger standard errors, which suggests that these controls might absorb too much variation in the NCMS enrollment rate given our small sample size. Reassuringly, the magnitude of these coefficients is similar to that of our baseline estimates (column 1).

6 Effects on Medical Expenses and Health Outcomes

6.1 The NCMS's Effects on Medical Expenses

Our previous findings that the NCMS increases healthcare services utilization among rural residents, could decrease or increase their OOP medical expenses, defined as all OOP expenditures on health-related items, such as insurance premiums and co-payments. On the one hand, NCMS beneficiaries might pay less for healthcare because they have insurance coverage, which lowers their average medical expenditures. On the other hand, the NCMS may increase beneficiaries' average medical expenditures through two channels: by encouraging rural beneficiaries to consume more healthcare, and by requiring previously uninsured rural residents to pay insurance premiums. Therefore, the OOP expenses of

rural residents are negatively correlated with the generosity of the NCMS benefits, and are positively correlated with premiums and with the healthcare utilization of rural residents. Table 11 shows the estimates of the NCMS's effects on medical expenditures and on the share of medical expenditures, separately. Column 1 of Panel A shows that the NCMS does

Table 11: Estimates of the NCMS's Effects on Medical Expenditures in Rural Areas

	(1) Baseline	(2) No Region-Year FE	(3) No Economic Controls	(4) No Controls	(5) Unweighted Baseline
			Panel A. Medical Expenditures per Capita		
NCMS rate	-0.021	0.013	0.126	0.165	-0.026
	(0.068)	(0.063)	(0.105)	(0.102)	(0.073)
R-squared	0.980	0.976	0.973	0.972	0.976
Mean	173.7	173.7	173.7	173.7	173.7
			Panel B. Ratio of Medical Expenditures to Consumption		
NCMS rate	-0.000	0.002	0.007	0.009	-0.003
	(0.004)	(0.004)	(0.006)	(0.006)	(0.005)
R-squared	0.925	0.916	0.911	0.907	0.913
Mean	0.0578	0.0578	0.0578	0.0578	0.0578

Notes: Each cell reports estimates from a separate specification. Column 1 reports estimates from the baseline equation (1), with full controls of both time-varying demographic covariates and economic covariates for each province, province fixed effects, and region-by-year fixed effects. Both dependent variables in Panels A and B are without log form. Column 2 replaces region-by-year fixed effects with year fixed effects in a standard TWFE specification. Column 3 removes economic covariates, including the unemployment rate, GDP per capita (2014 yuan), disposable income in rural and urban areas (2014 yuan), and consumption and medical expenses in cities (2014 yuan). Column 4 further drops demographic covariates, including population, age structure, education level, percentage married and female, and the ratio of dependent persons in a household. The estimates of columns 1 to 4 are weighted by the rural population in 2003. Standard errors are clustered by province, and are shown in parentheses. Column 5 displays the unweighted results of the baseline specification. The mean of each dependent variable is the average in 2004, weighted by the rural population in 2003. *** p<0.01, ** p<0.05, * p<0.10.

not lead to significant changes in the average medical expenditures of rural residents using the baseline specification (1). The baseline estimate is statistically insignificant and robust to replacing region-by-year fixed effects with year fixed effects (column 2), removing city-level controls (column 3), dropping all province-level time-varying covariates (column 4), and dropping weights (column 5). Consistent with the close-to-null findings on medical expenditures in Panel A, Panel B finds that the NCMS does not change the percentage of

medical expenses in total consumption among rural residents. This result is quite robust across specifications in columns 2 to 5. Appendix Figures A14 and A15 plot the dynamic effects of the NCMS on medical expenses per capita and share of medical expenditures to consumption using the specification (2). If anything, the NCMS seems to reduce rural residents' medical spending and lower the portion of consumption on medical expenses for most of the working period. In summary, the NCMS improves the healthcare utilization of rural residents without adding to their financial burdens.

6.2 The NCMS's Effects on Mortality

Table 12 reports the NCMS's effects on all-cause mortality. Overall, the rollout of the insurance program does not affect all-cause mortality rates. Column 1 shows that the NCMS has little effect on the all-cause mortality rate of rural residents using the baseline specification (1). The estimate is statistically insignificant and robust to replacing

Table 12: Estimates of the NCMS's Effect on All-cause Mortality Rates

	(1) Baseline	(2) No Region-Year FE	(3) No Economic Controls	(4) No Controls	(5) Unweighted Baseline
NCMS rate	0.199	0.231	0.111	0.237**	0.091
	(0.161)	(0.149)	(0.109)	(0.114)	(0.135)
R-squared	0.917	0.906	0.913	0.888	0.914
Mean	6.162	6.162	6.162	6.162	6.162
Observations	231	231	232	232	231

Notes: Each cell reports estimates from a separate specification on the dependent variable without log form, the mortality rate defined as deaths per 1,000 people. Column 1 reports estimates from the baseline equation (1), with full controls of both time-varying demographic covariates and economic covariates for each province, province fixed effects, and region-by-year fixed effects. Column 2 replaces region-by-year fixed effects with year fixed effects in a standard TWFE specification. Column 3 removes economic covariates, including the unemployment rate, GDP per capita (2014 yuan), disposable income in rural and urban areas (2014 yuan), and consumption and medical expense in cities (2014 yuan). Column 4 further drops demographic covariates, including population, age structure, education level, percentage married and female, and the ratio of dependent persons in a household. The estimates of columns 1 to 4 are weighted by the rural population in 2003. Standard errors are clustered by province, and are shown in parentheses. Column 5 displays the unweighted results of the baseline specification. The mean of the dependent variable is the average in 2004, weighted by the rural population in 2003. *** p<0.01, ** p<0.05, * p<0.10.

region-by-year fixed effects with year fixed effects (column 2), removing city-level controls

(column 3), and dropping weights (column 5). The estimate in column 4 of the specification that drops all controls becomes statistically significant, while the magnitude of the coefficient is similar to that in our baseline model (column 1). This suggests that the omission of variables might overestimate the true effects, and generate an imprecise confidence interval. Appendix Figure A16 plots the dynamic effects of the NCMS on all-cause mortality rate, in which the pattern is consistent with the baseline estimate: the event-study estimates for all period of our working sample lie around the zero line.

The estimates on the all-cause mortality rate shown in Table 12 can mask potential benefits of the NCMS for the treatment of particular diseases. As the program rolls out, it increases coverage for some preventive and highly infectious diseases, such as AIDS/HIV, hepatitis, and catastrophic diseases.[28] Panel A of Table 13 reports the NCMS's effects on incidence rates per 100,000 people across diseases. With a one-percentage-point increase in the NCMS enrollment rate, the incidence rate of infectious diseases is significantly reduced by 0.3 percent (Column 1). Columns 2 to 8 show estimates for the incidence rates of particular infections, such as measles, AIDS/HIV, tuberculosis, hepatitis, dengue fever, and rabies. It appears that, overall, the NCMS decreases the incidence rate for most of these infectious diseases, although the estimates are imprecise due to the small sample size (Columns 7 and 8). Panel B reports the estimates of the NCMS's effects on mortality rates by disease. With each one-percentage-point increase in the NCMS enrollment rate, the NCMS reduces AIDS deaths by 6 percent, with a mean of 0.06 deaths per 100,000 people. The NCMS's effect on the mortality rates of all infectious conditions is about 0.6 percent with no statistical significance (column 1), and is 79 percent for HIV (column), given the low mortality rate of 0.003 per 100,000 people (column 4). The magnitudes of other coefficients are economically small and not statistically significant.

In summary, while the introduction of the NCMS does not reduce the all-cause mortality

[28]Infectious diseases include 57 conditions reported by the Chinese Center for Disease Control and Prevention. Catastrophic diseases include common cancers such as leukemia among children, breast cancer and cervical cancer among women, serious mental illness, and end-stage renal disease, to name a few. These severe diseases put rural residents at high risk of falling into poverty.

Table 13: Effects of the NCMS on the Incidence and the Mortality Rate by Disease

	Panel A. Incidence Rate by Disease							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Infection	Measles	AIDS	HIV	Tuberculosis	Hepatitis	Dengue fever	Rabies
NCMS rate	-136.087*	5.757	-0.340	0.747	-4.046	-24.071	-0.201	-0.038
	(67.689)	(4.066)	(0.410)	(0.807)	(8.325)	(16.956)	(0.349)	(0.120)
R-squared	0.915	0.464	0.887	0.948	0.950	0.932	0.533	0.870
Mean	522.4	5.699	0.259	1.096	76.86	91.51	0.043	0.239
Observations	231	231	230	231	231	231	110	177
	Panel B. Mortality Rate by Disease							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
	Infection	Measles	AIDS	HIV	Tuberculosis	Hepatitis	Rabies	
NCMS rate	-0.454	-0.010	-0.379*	-0.238	0.062	0.007	-0.038	
	(0.439)	(0.011)	(0.199)	(0.277)	(0.041)	(0.033)	(0.120)	
R-squared	0.898	0.557	0.847	0.881	0.882	0.820	0.873	
Mean	0.773	0.006	0.062	0.003	0.104	0.078	0.239	
Observations	231	101	229	197	230	227	177	

Notes: Each cell reports estimates from a separate specification on the dependent variable by disease using the baseline equation (1), with full controls of both time-varying demographic covariates and economic covariates for each province, province fixed effects, and region-by-year fixed effects. The detailed incidence rate and mortality rate by disease data are from the Chinese Center for Disease Control and Prevention. Panel A reports the estimates for the incidence rate per 100,000 people, and Panel B reports the estimates for the mortality rate per 100,000 people. Both dependent variables are without log form. There are not enough observations for the mortality rate of Dengue fever. Standard errors are clustered by province, and are shown in parentheses. The mean of the dependent variable is the average in 2004, weighted by the rural population in 2003. *** p<0.01, ** p<0.05, * p<0.10.

rate, it appears to prevent deaths from some infectious diseases, such as AIDS/HIV. Some of these estimates should be interpreted as suggestive given their lack of precision due to the small sample size. Nevertheless, they imply that the NCMS reduces the incidence rate on infectious diseases and the mortality rate for AIDS.

7 Discussion and Conclusion

This paper studies the effects of the NCMS program on the healthcare utilization, OOP payments, and mortality of rural residents in China. The NCMS is one of the largest

insurance expansion program targeting the rural poor introduced by LMICs. While the NCMS achieves full coverage of the target population through financial subsidies and administrative efforts by the Chinese government, its benefits are limited due to fiscal constraints, which is a common challenge in LMICs. Using a province-year panel dataset covering the eight years after the NCMS expands nationally in 2004, we find that the NCMS is successful overall in the following ways.

First, we observe that the NCMS significantly increases inpatient services utilization, which is consistent with the findings in Wagstaff and Lindelow (2008) and Yi et al. (2009). In addition, we find that the positive effects of the NCMS on inpatient stays come mainly from the services delivered at THCs, CHCs, and county hospitals. Similarly, Wagstaff (2007) reports that the NCMS increases inpatient stays at THCs. Because we are using the aggregate province-year panel data, our estimates of these effects are conservative. In contrast to previous literature, we find that half of the increase in inpatient care use can be attributed to the NCMS's supply-side policy of increasing investments in rural healthcare providers, which are essential to the effectiveness of insurance expansion programs as shown in Kondo and Shigeoka (2013) .

For outpatient services, we find no statistically significant effects, which is consistent with Yip et al. (2008), Lei and Lin (2009), and Babiarz et al. (2012). However, these close-to-null estimates may be attributable to our use of aggregate data at the province level. In particular, our estimates might be imprecise due to larger standard errors in the small samples. To address this issue, we further examine the NCMS's effects on the use of outpatient services by service provider and by department, and find that the NCMS tends to reduce outpatient visits at city hospitals (by a larger but statistically insignificant magnitude), and that the use of outpatient services at general medicine decreases significantly when the NCMS is rolled out, which further supports our finding that the NCMS decreases outpatient visits at city hospitals. In addition, we find that rural residents substitute more expensive inpatient services by visiting more primary care providers at lower costs.

Third, although the NCMS increases healthcare utilization among rural residents in China, it does not increase OOP costs. In addition, we find that the NCMS reduces incidence rates and mortality rates for conditions that are generously covered such as infectious diseases, although the all-cause mortality rate is not affected by the NCMS.

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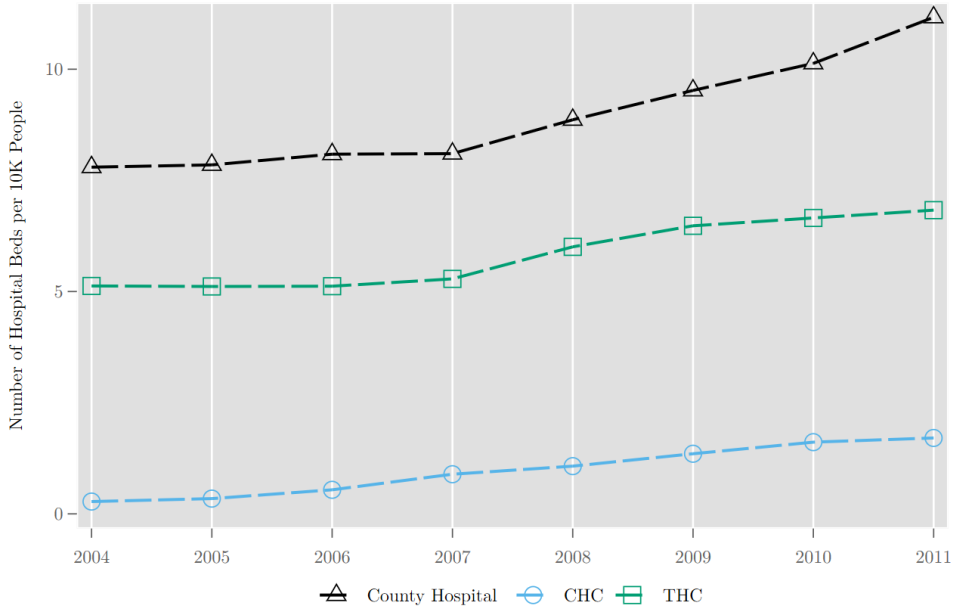


Figure A1: The Number of Hospital Beds Over Time

Notes: The data source is the 2004-2011 CHSY. The y-axis is the number of hospital beds by provider over the 2004-2011 period.

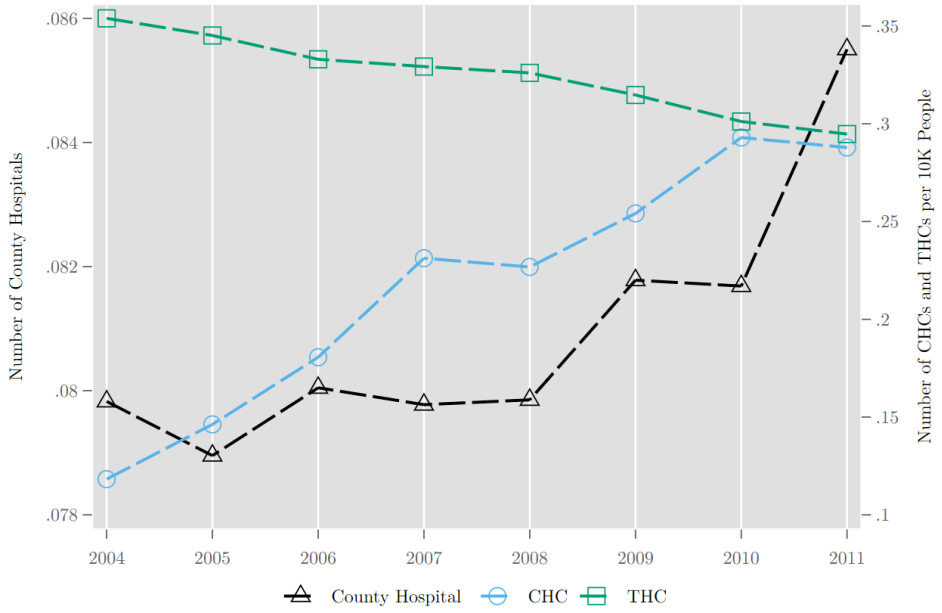
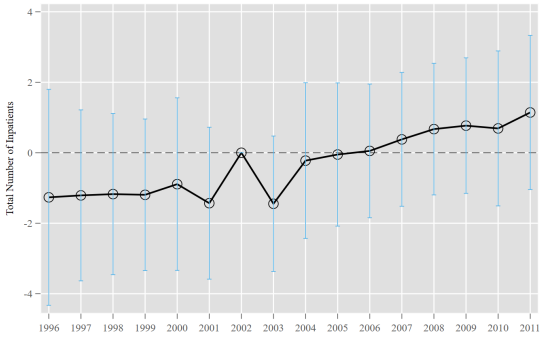


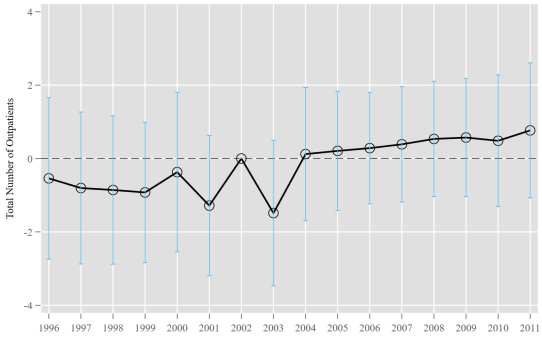
Figure A2: The Number of Institutions Over Time

Notes: The data source is the 2004 to 2011 CHSY. The y-axis is the number of institutions by provider over the 2004-2011 period.

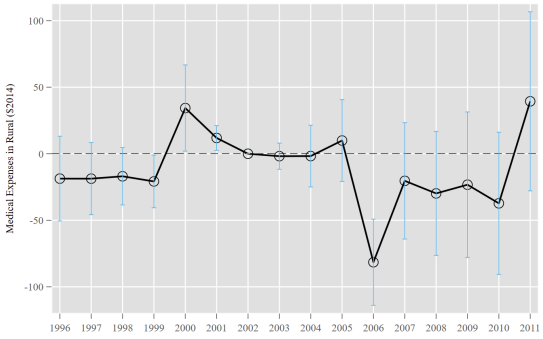
(a) Inpatient, w/o region-by-year FE



(b) Outpatient, w/o region-by-year FE



(c) OOP Expenses, w/o region-by-year FE



(d) Mortality, w/o region-by-year FE

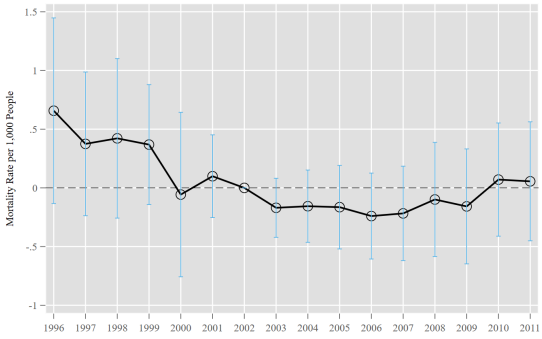


Figure A3: Event-Study Estimates of Total NCMS Enrollment Gain

Notes: The data source are the 1996-2003 CHY and 2004-2011 CHSY and CSY. Each figure plots the baseline event-study estimates in specification (2). The y-axis is the dependent variable in log form for inpatient and outpatient care use. The interval is the 95 percent confidence interval of each estimate.

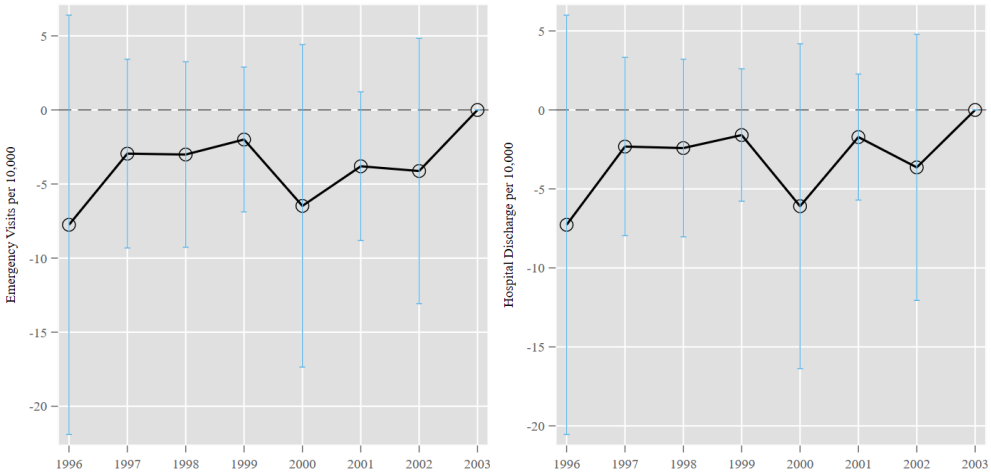


Figure A4: Parallel Trends for the NCMS Effect on Other Healthcare Outcomes

Notes: The data source is the 1996-2003 CHY.. Each figure plots the baseline event-study estimates of the specification (2). The y-axis is the dependent variable in log form. The interval is the 95 percent confidence interval of each estimate.

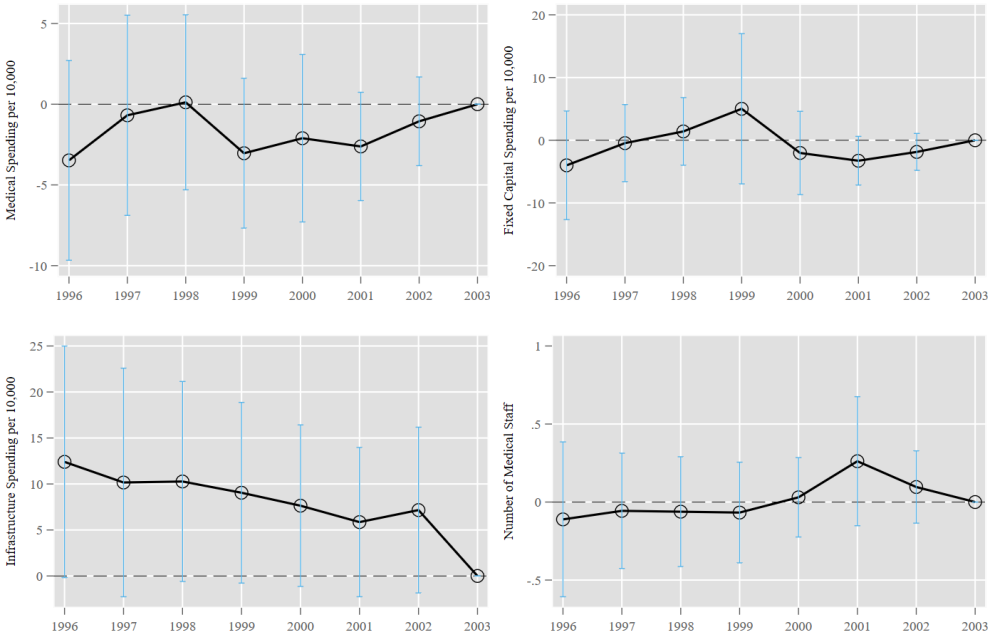
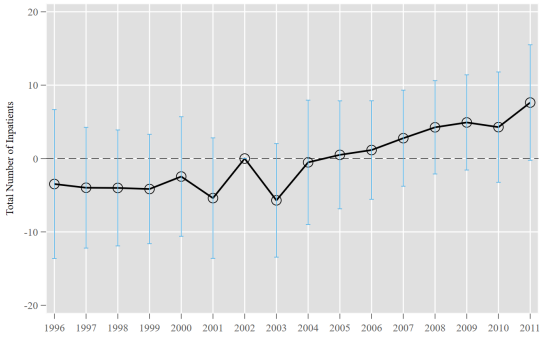


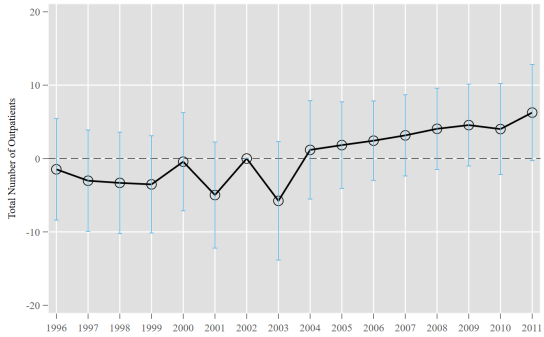
Figure A5: Parallel Trends for the NCMS Effect on Healthcare Spending

Notes: The data source is the 1996-2003 CHY. Each figure plots the baseline event-study estimates in specification (2). The y-axis is the dependent variable in log form. The interval is the 95 percent confidence interval of each estimate.

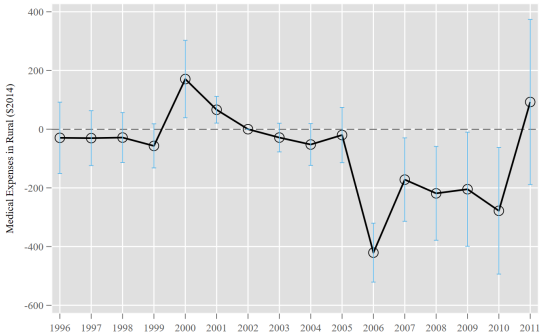
(a) Inpatient, w/o region-by-year FE



(b) Outpatient, w/o region-by-year FE



(c) OOP Expenses, w/o region-by-year FE



(d) Mortality, w/o region-by-year FE

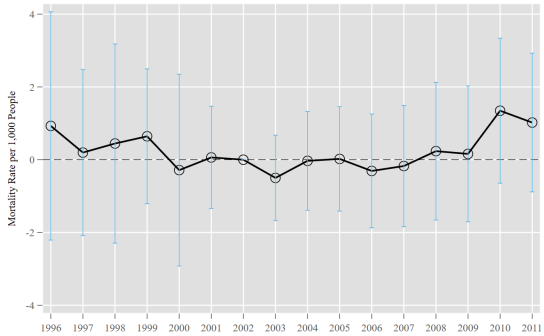


Figure A6: Event-Study Estimates by NCMS Expansion Speed

Notes: The data sources are the 1996-2003 CHY and the 2004-2011 CHSY and CSY. Each figure plots the baseline event-study estimates in specification (2). The y-axis is the dependent variable in log form for inpatient and outpatient care use. The interval is the 95 percent confidence interval of each estimate.

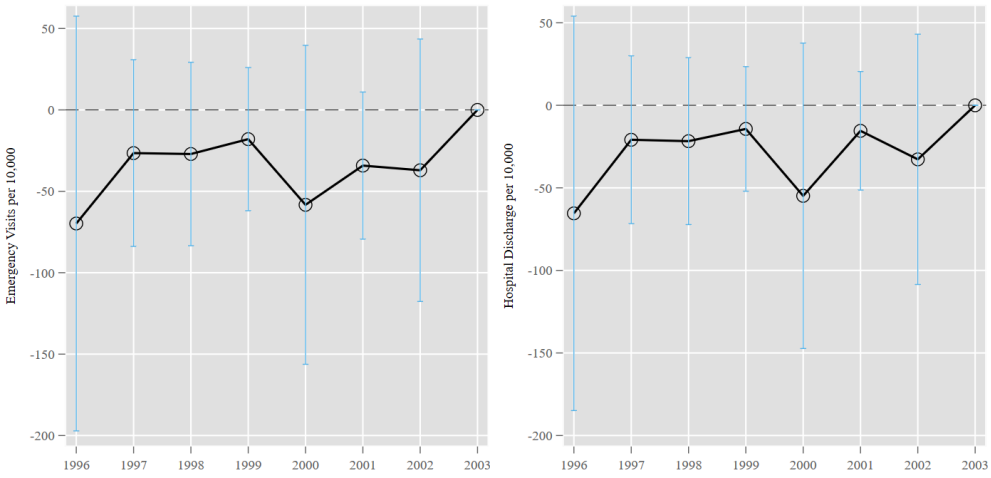


Figure A7: Event-Study Estimates by NCMS Expansion Speed on Other Outcomes

Notes: The data source is the 1996-2003 CHY.. Each figure plots the baseline estimates in the baseline event-study estimates of the specification (2). The y-axis is the dependent variable in log form. The interval is the 95 percent confidence interval of each estimate.

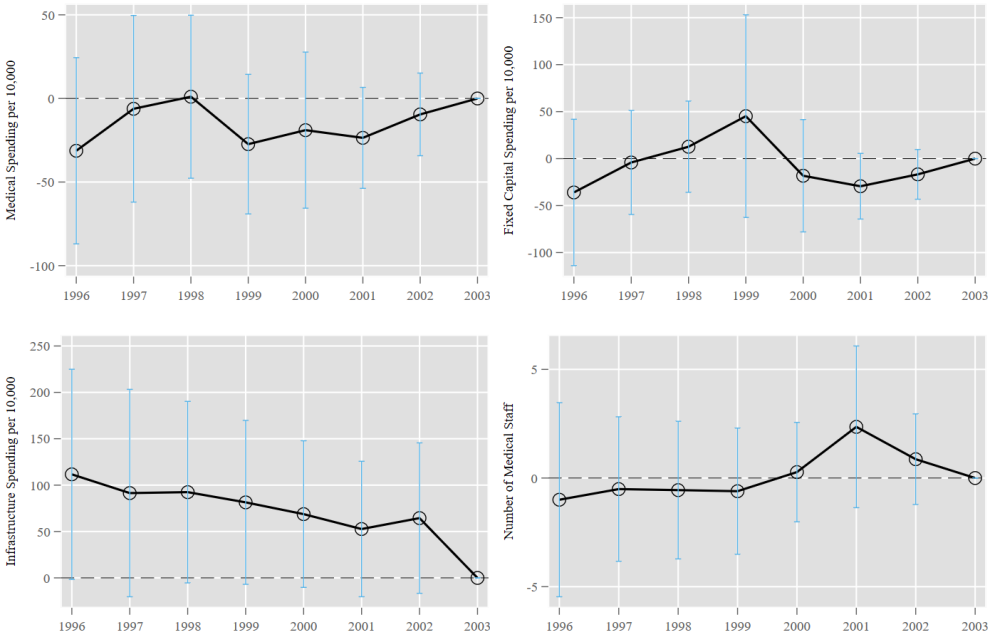


Figure A8: Event-Study Estimates by NCMS Expansion Speed on Healthcare Spending

Notes: The data source is the CHY in 1996-2003. Each figure plots the baseline estimates in the event study of the specification (2). The y-axis is the dependent variable in log form. The interval is the 95% confident interval of each estimate.

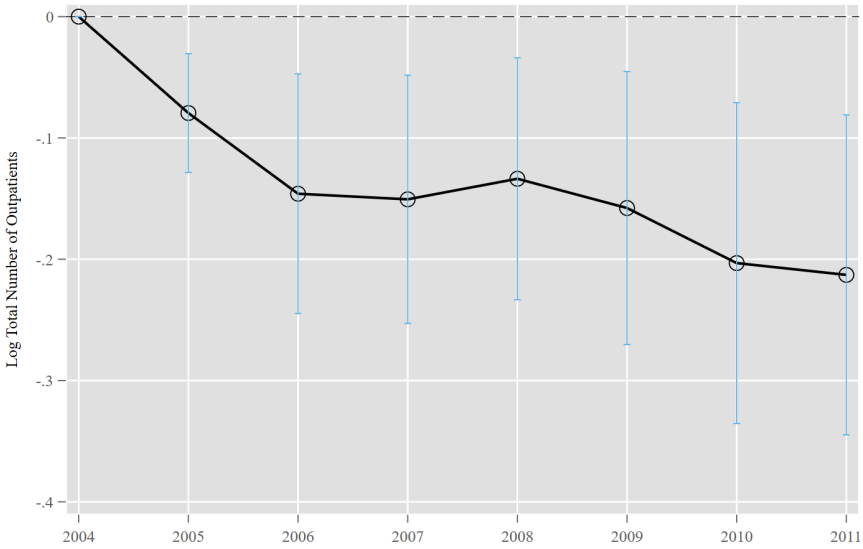
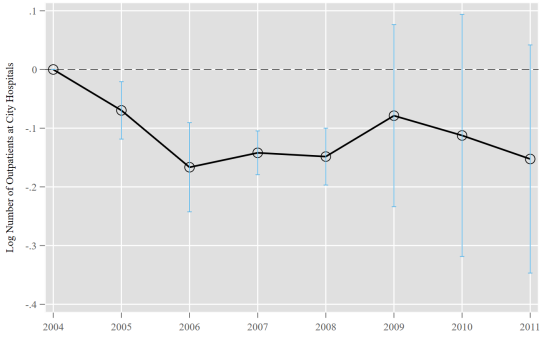


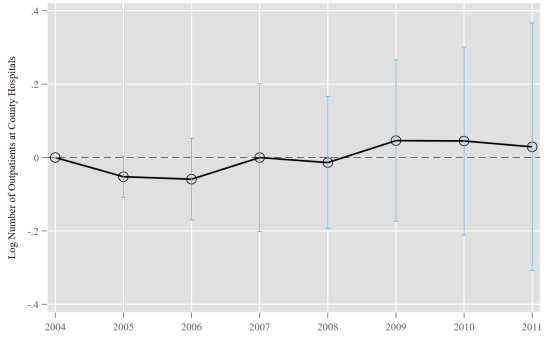
Figure A9: Event-Study Estimates of the NCMS's Effect on Total Outpatient Visits

Notes: The dependent variable is total outpatient visits per 10,000 people. The treatment variable is defined as the differences in the NCMS enrollment rate between 2011 and 2004. The coefficients are weighted event-study estimates from the baseline specification of equation (2). The weights are the rural populations across provinces in 2003. The 95 percent confidence intervals are calculated based on the standard errors clustered by province.

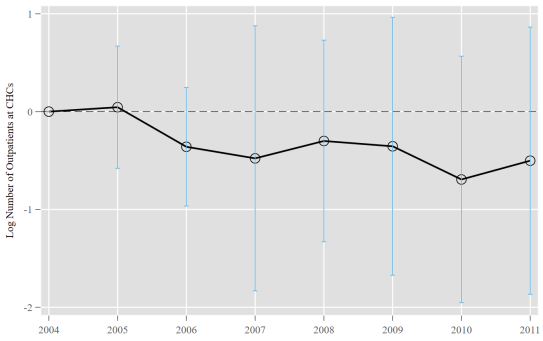
(a) Outpatient Use at City Hospitals



(b) Outpatient Use at County Hospitals



(c) Outpatient Use at CHCs



(d) Outpatient Use at THCs

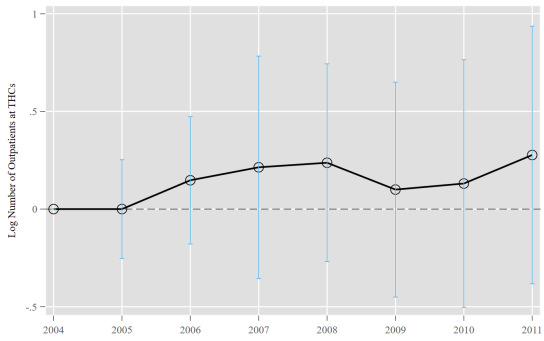


Figure A10: Event-Study Estimates of the NCMS's Effect on Outpatient Visits by Provider

Notes: The dependent variable is outpatient visits per 10,000 people. The treatment variable is defined as the differences in the NCMS enrollment rate between 2011 and 2004. Each figure plots the weighted event-study estimates from the baseline specification of equation (2) at city hospitals, county hospitals, CHCs, and THCs. The weights are the rural populations across provinces in 2003. The 95 percent confidence intervals are calculated based on the standard errors clustered by province.

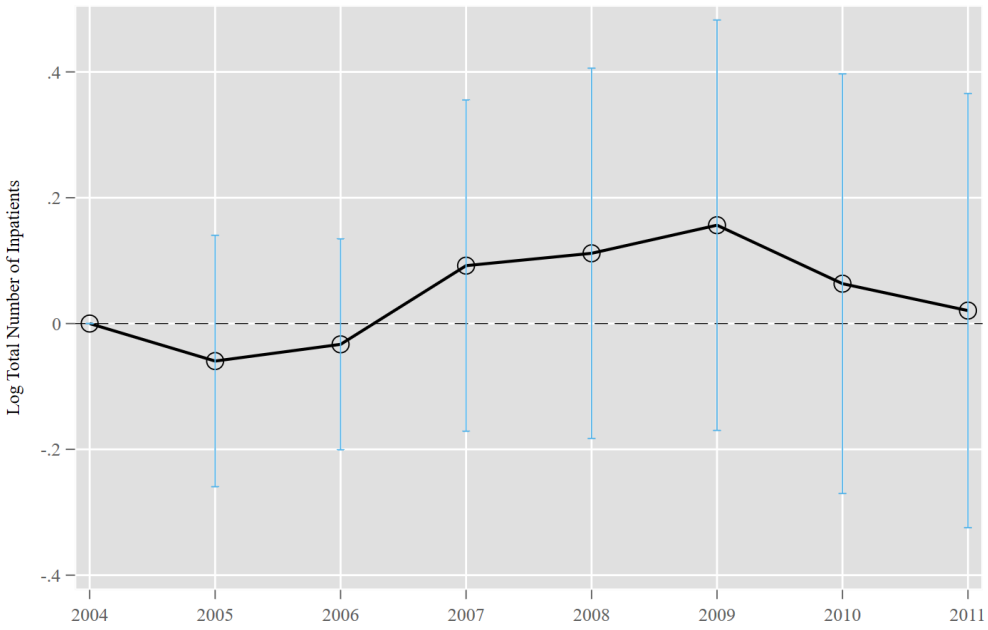
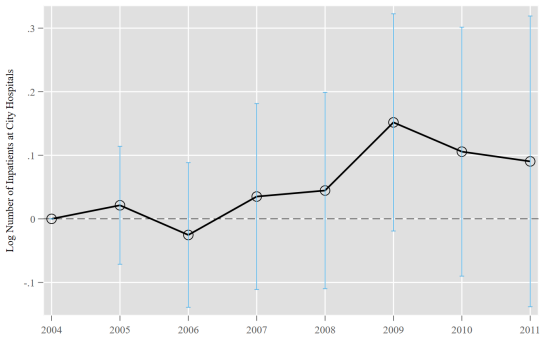


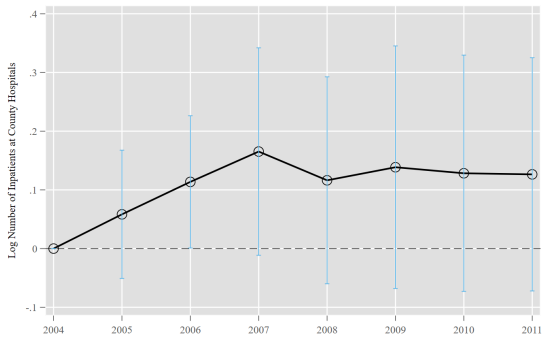
Figure A11: Event-Study Estimates of the NCMS's Effects on Total Inpatient Care Use

Notes: The dependent variable is the inpatient care use per 10,000 people. The treatment variable is defined as the differences in the NCMS enrollment rate between 2011 and 2004. The coefficients are weighted event-study estimates from the baseline specification of equation (2). The weights are the rural population across provinces in 2003. The 95 percent confidence intervals are calculated based on the standard errors clustered by province.

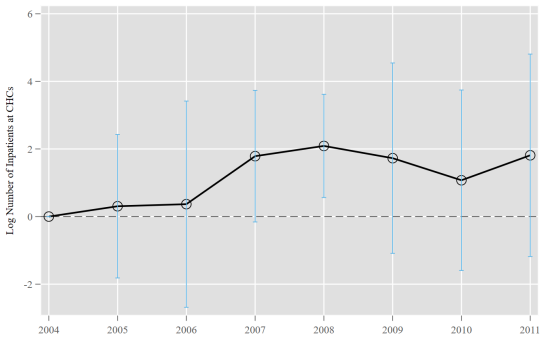
(a) Inpatient Care Use at City Hospitals



(b) Inpatient Care Use at County Hospitals



(c) Inpatient Care Use at CHCs



(d) Inpatient Care Use at THCs

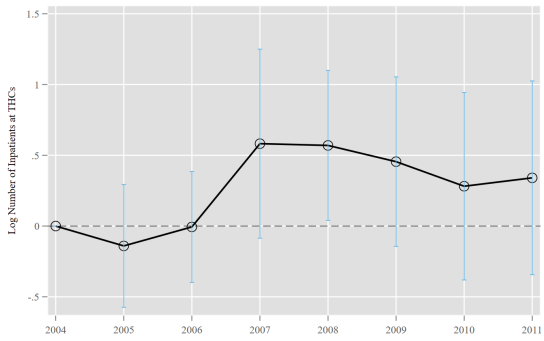


Figure A12: Event-Study Estimates of the NCMS's Effects on Inpatient Care Use by Provider

Notes: The dependent variable is the number of inpatient stays per 10,000 people. The treatment variable is defined as the differences in the NCMS enrollment rate between 2011 and 2004. Each figure plots the weighted event-study estimates from the baseline specification of equation (2) at city hospitals, county hospitals, CHCs, and THCs. The weights are the rural population across provinces in 2003. The 95 percent confidence intervals are calculated based on the standard errors clustered by province.

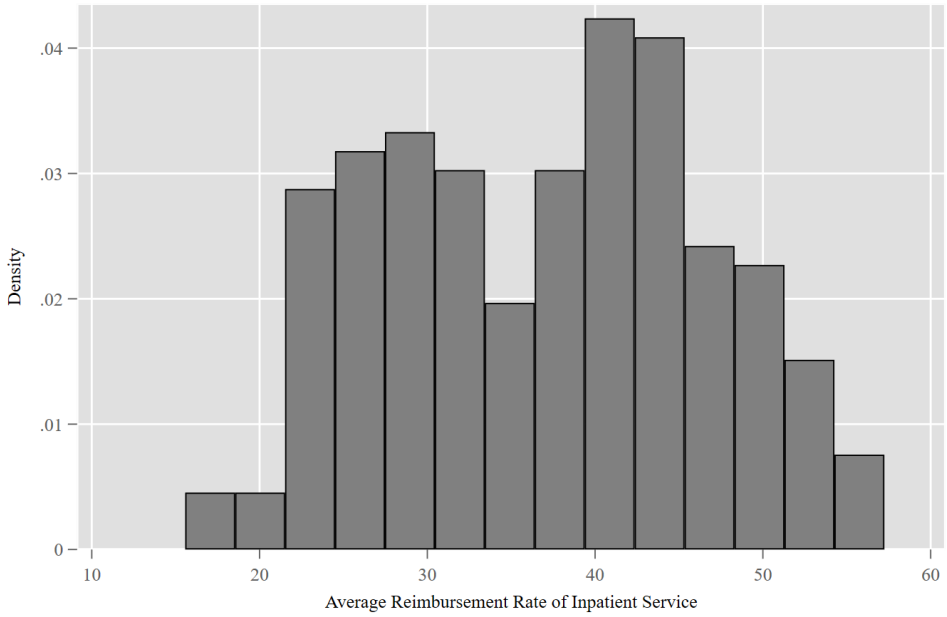


Figure A13: Distribution of the NCMS Reimbursement for Inpatient Service

Notes: The data source is the 2004-2011 CHSY. The y-axis is the density of the average within-province reimbursement rate across the 2004-2011 period.

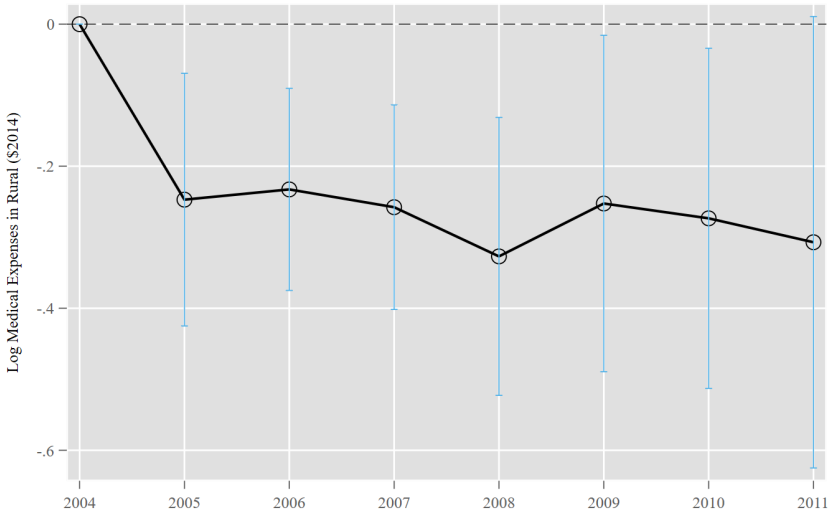


Figure A14: Event-Study Estimates of the NCMS's Effect on Medical Expenses Per Capita

Notes: The dependent variable is medical expenditures per capita for rural residents. The treatment variable is defined as the differences in the NCMS enrollment rate between 2011 and 2004. The coefficients are weighted event-study estimates from the baseline specification of equation (2). The weights are the rural populations across provinces in 2003. The 95 percent confidence intervals are calculated based on the standard errors clustered by province.

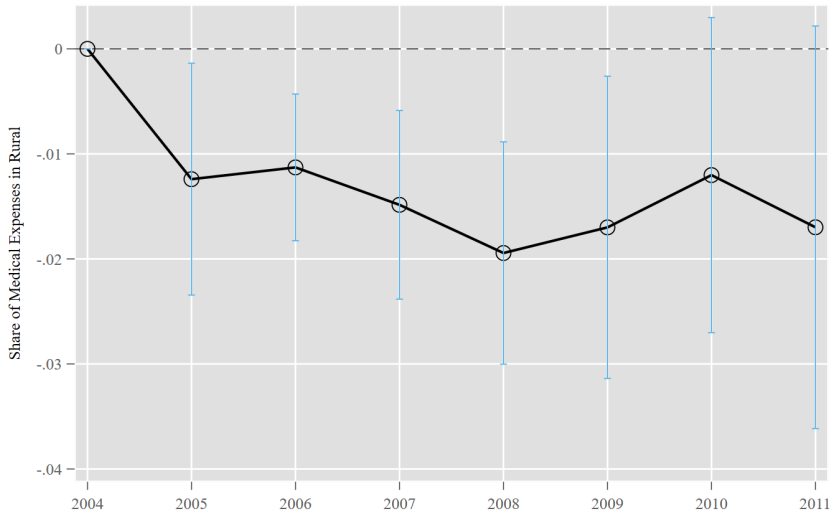


Figure A15: Event-Study Estimates of the NCMS's Effect on Share of Medical Expenses

Notes: The dependent variable is the ratio of medical expenditures to consumption for rural residents. The treatment variable is defined as the differences in the NCMS enrollment rate between 2011 and 2004. The coefficients are weighted event-study estimates from the baseline specification of equation (2). The weights are the rural populations across provinces in 2003. The 95 percent confidence intervals are calculated based on the standard errors clustered by province.

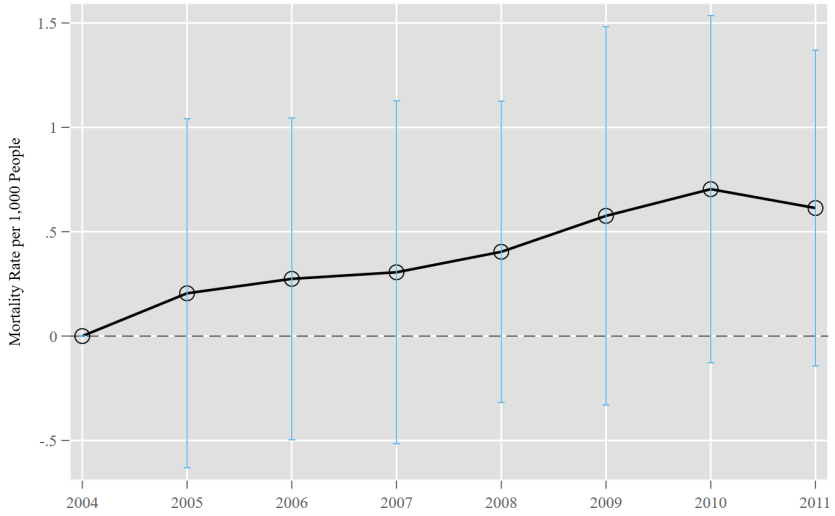


Figure A16: Event-Study Estimates of the NCMS's Effect on All-cause Mortality Rate

Notes: The dependent variable is the mortality rate, deaths per 1,000 people without log form. The treatment variable is defined as the differences in the NCMS enrollment rate between 2011 and 2004. The coefficients are weighted event-study estimates from the baseline specification of equation (2). The weights are the rural populations across provinces in 2003. The 95 percent confidence intervals are calculated based on the standard errors clustered by province.

Table A1: NCMS Implementation Across Provinces

	2002	2003	2004	2005	2006	2007	2008
Beijing	Pilot (13)		Full				
Tianjin			Pilot (4)			Full	
Hebei		Pilot (3)					Full
Shanxi			Pilot (15)				Full
Liaoning			Pilot			Full	
Jilin		Pilot (6)				Full	
Heilongjiang			Pilot (5)				Full
Shanghai		Pilot (10)	Full				
Jiangsu		Pilot (10)		Full			
Zhejiang		Pilot (27)			Full		
Anhui		Pilot (10)					Full
Fujian		Pilot (3)				Full	
Jiangxi		Pilot (7)					Full
Shandong		Pilot (26)				Full	
Henan		Pilot (25)					Full
Hubei		Pilot (8)					Full
Hunan		Pilot (5)					Full
Guangdong	Pilot (4)						Full
Guangxi		Pilot (3)					Full
Hainan		Pilot (3)			Full		
Chongqing		Pilot (6)				Full	
Sichuan		Pilot (5)					Full
Guizhou		Pilot (8)				Full	
Yunnan		Pilot (20)				Full	
Shaanxi			Pilot (3)			Full	
Gansu		Pilot (5)					Full
Qinghai		Pilot (8)		Full			
Ningxia		Pilot (2)					Full
Xinjiang		Pilot (5)					Full

Notes: The data source is the NCMS development report from Chen and Zhang (2013). "Full" indicates that the province has covered all rural residents. The number following "Pilot" refers to the number of counties in the province that participated in the NCMS pilot experiment.

Table A2: Effects of Province-level Economic Conditions on the NCMS Enrollment Rate

	(1)	(2)	(3)	(4)	(5)
Unemployment rate	0.057	0.057	-0.050	-0.407	-0.577
	(0.052)	(0.042)	(0.595)	(0.551)	(0.488)
Unemployment rate^2			0.085	0.147	0.194
			(0.149)	(0.145)	(0.126)
Unemployment rate^3			-0.011	-0.014	-0.018*
			(0.012)	(0.012)	(0.010)
GDP per capita (2014 yuan)				-0.054	0.000
				(0.050)	(0.060)
Average income per capita (2014 yuan)				-1.194**	3.477
				(0.504)	(2.181)
Average income per capita^2					-3.582*
					(1.924)
Average income per capita^3					0.100
					(0.068)
Basic demographic controls		Y	Y	Y	Y
Economic controls				Y	Y
Mean NCMS-rate	0.189	0.189	0.189	0.189	0.189
Observations	231	231	231	231	231
Adjusted R-squared	0.913	0.924	0.927	0.937	0.941

Notes: Each cell reports estimates from a separate specification. The unemployment rate, the demographics, and the economic controls for each province are from the CSY. The NCMS policy information is from the report on the development of the NCMS. The basic demographic controls include population, age structure, education, percentage married and female, and the ratio of dependent persons. The economic controls include the unemployment rate, GDP per capita (2014 yuan), disposable income in rural areas and cities (2014 yuan), and consumption and medical expenses in cities (2014 yuan). GDP per capita, and the average income per capita and its quadratic and cubic form are re-scaled to show non-zero coefficients. All regressions include province and year fixed effects. All statistics are weighted by the rural population in 2003. Standard errors are clustered by province and are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table A3: Effects of Lagged Province-level Economic Conditions on the NCMS Enrollment Rate

	(1)	(2)	(3)	(4)	(5)
Unemployment rate lag 1	-0.007	-0.017	0.277	0.653	0.673
	(0.047)	(0.046)	(0.526)	(0.480)	(0.453)
Unemployment rate lag 1^2			-0.050	-0.142	-0.147
			(0.137)	(0.115)	(0.110)
Unemployment rate lag 1^3			0.002	0.009	0.010
			(0.011)	(0.009)	(0.008)
GDP per capita (2014 yuan)				-0.065*	-0.021
				(0.037)	(0.053)
Average income per capita (2014 yuan)				-1.608***	2.577
				(0.538)	(2.009)
Average income per capita^2					-2.822
					(1.902)
Average income per capita^3					0.066
					(0.072)
Basic demographic controls		Y	Y	Y	Y
Economic controls				Y	Y
Mean NCMS-rate	0.189	0.189	0.189	0.189	0.189
Observations	202	202	202	202	202
Adjusted R-squared	0.908	0.923	0.923	0.939	0.944

Notes: Each cell reports estimates from a separate specification. The unemployment rate, demographics, and economic controls of each province are from the CSY. The NCMS policy is from the report on the NCMS's development. The basic demographic controls include population, age structure, education, percentage of married and female, and ratio of dependent persons. The economic controls include GDP per capita (2014 yuan), disposable income in rural and city (2014 yuan), and consumption and medical expenses in cities (2014 yuan). GDP per capita, and average income per capita and its quadratic and cubic forms are re-scaled to show non-zero coefficients. All regressions include province and year fixed effects. All statistics are weighted by the rural population in 2003. Standard errors are clustered at the province level, and are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table A4: Summary Statistics

	Mean	S.D.	Min.	Max.	N
NCMS Variables					
NCMS enrollment rate	0.70	0.35	0.02	1.27	232
Initial NCMS rate in 2004	0.19	0.24	0.02	0.93	232
NCMS enrollment gains (2004-2011)	0.75	0.25	0.04	1.04	232
Ratio of NCMS beneficiaries to enrollment	1.04	1.55	0.02	13.21	232
Inpatient reimbursement rate	0.37	0.10	0.16	0.57	222
Healthcare Utilization (per 10,000 people)					
Total number of outpatient visits	24150	20474	7558	133000	232
Outpatient visits at city hospitals	10955	14504	1580	79485	232
Outpatient visits at county hospitals	4416	2247	579	16810	232
Outpatient visits at CHCs	3184	7534	56	52484	232
Outpatient visits at THCs	5743	2257	335	15388	226
Total number of inpatient stays	807	274	310	1771	217
Inpatient stays at city hospitals	344	256	80	1565	232
Inpatient stays at county hospitals	248	138	24	1039	232
Inpatient stays at CHCs	10	18	0	111	217
Inpatient stays at THCs	191	112	2	551	226
Medical Expenses and Mortality					
Medical expenses in rural ($2014)	321	193	62	1111	232
Share of medical expenses in rural	0.07	0.02	0.04	0.13	232
Mortality rate per 1,000 People	5.93	0.66	4.21	7.28	232
Incidence rate of infectious diseases per 100,000 people	699	244	265	1604	232
Mortality rate of infectious diseases per 100,000 people	1.56	1.39	0.17	10.37	232
Rural Health Resources (per 10,000 people)					
Beds at county hospitals	9	4	1	30	232
Beds at CHCs	1	2	0	13	232
Beds at THCs	6	2	0	11	232
Number of county hospitals	0.08	0.05	0.01	0.28	232
Number of CHCs	0.22	0.26	0.02	1.36	232
Number of THCs	0.32	0.16	0.00	0.83	232
Demographics					
Population (10,000)	4469	2671	499	10922	232
Married	0.73	0.03	0.64	0.78	232
Female	0.49	0.01	0.46	0.51	232
College degree	0.08	0.05	0.03	0.34	232
High school and above	0.14	0.04	0.06	0.28	232
Aged 65 and above	0.09	0.02	0.05	0.15	232
Aged 15 to 64	0.73	0.04	0.63	0.84	232
Gross dependency ratio	37.09	7.02	19.27	57.58	232
Economic Variables					
Medical expenses in cities (2014 yuan)	856.05	254.61	353.42	1810.81	232
Share of medical expenses in cities (2014 yuan)	0.07	0.01	0.04	0.10	232
Consumption expenses in cities (2014 yuan)	12166	3817	6979	27005	232
GDP per capita (2014 yuan)	27800	17593	5610	91443	232
Income in cities (2014 yuan)	16786	5669	9515	38977	232
Income in rural areas (2014 yuan)	5867	2785	2350	17223	232
Unemployment rate (%)	3.74	0.65	1.30	6.50	231

Table A5: Effects of the NCMS Expansion on Investments in Rural Medical Providers

	(1)	(2)	(3)
	County hospital	CHC	THC
	Panel A. Number of Healthcare Providers		
NCMS rate	0.130	-0.108	0.062
	(0.095)	(0.280)	(0.074)
Mean	0.067	0.105	0.334
Observations	231	231	225
	Panel B. Number of Beds at Hospitals		
NCMS rate	0.029	1.046	0.282**
	(0.043)	(0.941)	(0.109)
Mean	7.335	0.098	5.280
Observations	231	220	225

Notes: Each cell reports estimates from the baseline specification (1), with full controls of both time-varying demographic covariates and economic covariates, province fixed effects, and region by year fixed effects on dependent variables per 10,000 people in logarithm form in each panel. The mean of each dependent variable is the average in 2004 per 10,000 people and is weighted by the rural population in 2003. All estimates are weighted by the rural population in 2003. Standard errors are clustered by province and are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table A6: The NCMS's Effects on Inpatient Care Use Controlling for All Rural Healthcare Resources

	(1) Total	(2) CHC	(3) County hospital	(4) THC
NCMS rate	0.041	1.198***	0.079**	-0.006
	(0.055)	(0.417)	(0.032)	(0.137)
THC beds	0.380***	-1.289	0.070	0.991***
	(0.102)	(0.941)	(0.080)	(0.220)
County hospital beds	0.385**	1.203	0.790***	0.198
	(0.164)	(1.343)	(0.140)	(0.416)
CHC beds	-0.011	1.081***	-0.008	0.005
	(0.009)	(0.137)	(0.005)	(0.018)
Number of THCs	-0.239	1.771*	0.019	0.331
	(0.144)	(0.895)	(0.107)	(0.261)
Number of county hospitals	-0.039	-1.014	-0.027	0.125
	(0.114)	(1.150)	(0.092)	(0.295)
Number of CHCs	0.014	0.123	0.018	0.004
	(0.019)	(0.252)	(0.011)	(0.059)
Mean	479.4	0.995	169.1	127.6

Notes: Each cell reports estimates of the NCMS's effects on inpatient care use after controlling for all of the healthcare resources: hospital beds and number of providers in rural areas using the baseline model 1. The mean of the dependent variable is the average of inpatient care use in 2004 per 10,000 people and weighted by the rural population in 2003. All estimates are weighted by the rural population in 2003. Standard errors are clustered by province and are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table A7: The NCMS's Effects on Healthcare Use with Flexible City Controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
					Panel A. Total Outpatient Service Utilization					
NCMS rate	-0.060	-0.063	-0.075	-0.077	-0.046	-0.074	-0.056	-0.064	-0.078	-0.079
	(0.050)	(0.049)	(0.057)	(0.056)	(0.054)	(0.052)	(0.057)	(0.054)	(0.054)	(0.056)
Mean	15293	15293	15293	15293	15293	15293	15293	15293	15293	15293
Observations	231	231	201	201	231	202	202	231	202	202
					Panel B. Total Inpatient Service Utilization					
NCMS rate	0.114*	0.112	0.128**	0.123**	0.090	0.117*	0.095	0.125*	0.116*	0.125*
	(0.065)	(0.068)	(0.060)	(0.059)	(0.069)	(0.058)	(0.060)	(0.068)	(0.059)	(0.063)
Mean	479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4
Observations	216	216	188	188	216	189	189	216	189	189
Flexible unemployment		Y		Y						
Flexible lag unemployment			Y	Y						
Flexible GDP					Y		Y			
Flexible lag GDP						Y	Y			
Flexible city medical expense								Y		Y
Flexible lag city medical expense									Y	Y

Notes: Each cell reports an estimate of the NCMS's effects on total outpatient visits (Panel A) and total inpatient stays (Panel B) per 10,000 people from different specifications in each column using equation (1). The first column reports the estimates using our baseline model which includes full controls, region-by-year fixed effects, and province fixed effects. Column 2 adds in flexible forms of the unemployment rate including both quadratic and cubic terms. Column 3 adds in flexible forms of the unemployment rate lagged one year for both quadratic and cubic terms. Column 4 adds both flexible controls of the unemployment rate in columns 2 and 3. Columns 5 to 7 test the results using flexible GDP per capita and follow the form as the unemployment rate. Columns 8 to 10 test the results using flexible medical expense of city residents as above. Standard errors are clustered by province and are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table A8: The NCMS's Effects on Healthcare Utilization Without the NRPS

	(1) Total	(2) City hospital	(3) CHC	(4) County hospital	(5) THC
	Panel A. Outpatient Services Utilization				
NCMS rate	-0.000	-0.042	0.281	0.048	0.071
	(0.068)	(0.056)	(0.541)	(0.070)	(0.142)
Mean	15293	5726	602.4	3599	5365
Observations	173	173	173	173	171
	Panel B. Inpatient Services Utilization				
NCMS rate	0.167**	0.023	2.577*	0.110**	0.587**
	(0.079)	(0.047)	(1.295)	(0.046)	(0.221)
Mean	479.4	183.4	0.995	169.1	127.6
Observations	158	173	158	173	171

Notes: Each cell reports estimates from specification (1), with full controls of both time-varying demographic covariates and economic covariates for each province, province fixed effects, and region-by-year fixed effects in the 2004-2009 period. Panels A and B report estimates of the NCMS's effects on outpatient visits and inpatient stays at city hospitals, CHCs, county hospitals, and THCs, respectively. The mean of each dependent variable is the average in 2004 per 10,000 people and is weighted by the rural population in 2003. All estimates are weighted by the rural population in 2003. Standard errors are clustered by province and are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table A9: Robustness of NCMS Results on Healthcare Utilization to Economic Controls

	(1) Baseline	(2)	(3)	(4)	(5)
	Panel A. Total Outpatient Services Utilization				
NCMS rate	-0.060	-0.066	-0.089	-0.076	-0.078
	(0.050)	(0.051)	(0.058)	(0.056)	(0.055)
Mean	15293	15293	15293	15293	15293
Observations	231	231	231	201	201
	Panel B. Total Inpatient Services Utilization				
NCMS rate	0.114*	0.111	0.107	0.116	0.116
	(0.065)	(0.066)	(0.072)	(0.078)	(0.077)
Mean	479.4	479.4	479.4	479.4	479.4
Observations	216	216	216	188	188
GDP trend		Y	Y	Y	Y
Flexible rural income			Y	Y	Y
Flexible unemployment and GDP				Y	Y
Flexible medical expenses in city					Y

Notes: Each cell reports estimates from a separate specification. The unemployment rate, demographics, and economic controls of each province are from the CSY. The NCMS policy is from the report on NCMS's development. Column 1 is the baseline specification (1) with basic demographic and economic controls. The basic demographic controls include population, age structure, education, percentage of married and female, and ratio of dependent persons. The economic controls include the unemployment rate, GDP per capita (2014 yuan), disposable income in rural areas and cities (2014 yuan), consumption and medical expenses in city (2014 yuan). The flexible rural income includes average income per capita, its quadratic, and cubic forms. The flexible unemployment and GDP and medical expenses in cities include both the flexible form and its lagged flexible form. The mean of each dependent variable is the average in 2004 per 10,000 people and weighted by the rural population in 2003. Standard errors are clustered by province, and are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.10.