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The Role of Supply Responses in Public Insurance Expansion: Evidence from China's New Cooperative Medical Scheme

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The Role of Supply Responses in Public Insurance Expansion: Evidence from China's New Cooperative Medical Scheme*

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Abstract

We investigate the effects of a large health insurance in rural China, the New Cooperative Medical Scheme (NCMS), on healthcare utilization and supply-side responses. Exploiting the variation in the NCMS enrollment rate from 2004 to 2011 at the province level, we find that the NCMS is effective in terms of increasing healthcare utilization (particularly inpatient admissions) and improving health outcomes. While the all-cause mortality is not impacted, the NCMS does reduce mortality for some specific diseases, such as AIDS and infectious diseases. Second, we find a supply response to the NCMS expansion: while effects on the number of medical institutions are not significant, the number of hospital beds increases, which suggests that the increased demand from the NCMS induces more healthcare investment on incumbent providers, rather than attracting new entries of medical institutions. Controlling for the supply-side response, we show that the increase in inpatient care use induced by the NCMS is reduced by half. Our results suggest that an effective health insurance expansion in developing countries would provide supply-side supporting policies to meet its increased demand for healthcare use. ©

Keywords: NCMS, Health Insurance, Healthcare Utilization, Supply Response

JEL classification: H51, I12, I13, I18

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1 Introduction

Since the 1990s, developing countries have started to expand health insurance coverage to the low-income uninsured.[1] Unlike in developed countries where the provision of public health insurance effectively improves healthcare use and health outcomes,[2] public insurance programs in developing countries are often found to have limited or null effects.[3] Due to inadequate supply of healthcare resources in developing countries (World Health Organization 2010), insufficient supply-side responses to public insurance programs may be an important reason.

The literature has shown that health insurance expansion in developed countries can generate large supply-side responses to meet an increased healthcare demand.[4] Given the general limited reimbursement provided by public insurance plans in developing countries,[5] whether increasing healthcare supply is an effective strategy to increase healthcare use and promote health of low-income beneficiaries in the developing world is unexplored in the literature. In addition, rare evidence exists on studying to what extent the supply-side responses play a role in the effectiveness of public insurance programs in low- and middle-income countries (LMICs), in which governments are struggling with how to expand these insurance plans (Han 2012).

Our paper tries to fill this gap by exploiting the New Cooperative Medical Scheme (NCMS), a large health insurance expansion to residents in rural China, to answer the following questions: 1) the effects of the program on healthcare use and health outcomes, 2) whether and to what extent healthcare supply responds to the insurance expansion, 3) and to what extent the supply-side responses account for the effectiveness of the NCMS if any.

The reasons we study the NCMS in China are two-folded. First, the NCMS is shown to be

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

[2]Taken the U.S. as an example, its public insurance programs are shown to increase healthcare use, and reduce mortality (Chou et al. 2014; Goodman-Bacon 2018; Swaminathan et al. 2018; Khatana et al. 2019; Borgschulte and Vogler 2020; Goldin et al. 2021; Miller et al. 2021).

[3]For example, health insurance for the poor does not increase healthcare use in Mexico (King et al. 2009), or in Nicaragua (Thornton et al. 2010), or in Georgia (Bauhoff et al. 2011), or in India (Karan et al. 2017). See Acharya et al. (2013) for a comprehensive review.

[4]In particular, Kondo and Shigeoka (2013) find that universal health insurance introduced in 1961 significantly increased the number of hospital beds to meet the increased healthcare needs in Japan. Finkelstein (2007) shows that the healthcare supply shifts in response to the market-wide changes in demand in the United States.

[5]In 2014, on average, 36.26% of medical spending was out of pocket in low- and middle-income countries, 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.

effective in expanding coverage and increasing healthcare use, thereby providing a good setting to study the potential mechanisms of its successes if any. Piloted in 2003, the NCMS expanded coverage rapidly to 640 million rural people (95 percent of the rural population) by 2008. Although the participation is voluntary and requires premium payment, the NCMS achieved near-to-full coverage within five years presumably because local governments have great incentives to promoting enrollment, which is directly linked to the amount of matching fund from the central government.[6] Furthermore, the NCMS successfully translates the expanded coverage into increased healthcare use and financial protection, which is supported by sufficient evidence in the literature.[7]

More importantly, the NCMS reform in China represents a particularly good setting in the developing world where healthcare supply is most likely to respond. Firstly, the demand size of the NCMS is large enough to induce supply-side responses in that the large number of newly covered rural people provides sufficient incentives for medical providers to respond. Secondly, government intervention reinforces medical providers' incentives to increase supply. To alleviate the shortfall in medical resources in rural China, the central government complements the demand-side of the NCMS with the supply-side supporting policy of strengthening the healthcare infrastructure in rural areas. From 2009 to 2011, the central government spent $8.8 billion (RMB59 billion) to develop rural medical institutions, such as increasing the number of hospital beds and purchasing new medical equipment in county hospitals and township health centers (Meng et al. 2019). Moreover, the Chinese government also encourages the entry of private capital into the healthcare industry.

With the good setting of the NCMS, first our paper reevaluates its effectiveness in terms of the extent to which it increases healthcare use and improves health outcomes using the province-level panel data in 2004-2011. The identification relies on the plausibly exogenous temporal and geographical variations in the NCMS enrollment rate in a two-way fixed effect (TWFE) model conditional on socio-economic characteristics of each province. Above all, we confirm that the NCMS increases rural residents' use of inpatient services: a one-percentage-point increase in the enrollment rate increases the inpatient use by 0.1 percent (about 0.5 hospital stays per 10,000

[6] See Section 2 for more details

[7] In particular, studies find that the NCMS increases preventive care use (e.g. physician examinations) (Lei and Lin 2009), increases inpatient stays and outpatient visits (Wagstaff et al. 2009), insures households against health shocks, helps rural residents invest in their children's education (Liu 2016), and reduces OOP expenses slightly (Lei and Lin 2009; Wagstaff et al. 2009; You and Kobayashi 2009; Cheng and Zhang 2012; Cheng et al. 2015) or substantially (Babiarz et al. 2012).

people), despite the limited insurance benefits the NCMS has offered. We do not find evidence for the effectiveness of the NCMS in increasing rural residents' use of outpatient care, presumably because the NCMS's reimbursement rate for outpatient services is too low. In addition, we find that the NCMS improves health outcomes: although the rollout of the NCMS has no effects on the all-cause mortality rates among rural residents, our analysis of mortality rate by disease shows that the NCMS significantly reduces the incidence of infectious diseases and the mortality rate of AIDS. The rich information from the China Health and Nutrition Survey (CHNS) allows us to examine the potential mechanisms, i.e., via increased vaccination rate (influenza), increased use of preventive care services, and more knowledge about healthy diets and healthy living that the NCMS is beneficial to health.[8] Moreover, section A.4 in the Appendix provides evidence confirming the effectiveness of the NCMS in reducing OOP expenses.

To interpret out results as causal, there are several assumptions required to be valid. We first prove the validity of the parallel trend that provinces with earlier adoption and faster expansion of the NCMS show similar pre-trends to other provinces in years absent of the insurance expansion in an event-study design. Second, our outcomes of interest capture the health behaviors of all people in a province, including both urban and rural residents. One might be concerned that the estimates on rural residents could be driven by urban-side confounders. To address this concern, we try several strategies: 1) performing a placebo test by conducting the same regressions on healthcare consumption and total consumption from urban residents, 2) controlling for urban consumption and urban healthcare expenditure in our baseline regression in linear, quadratic, and cubic forms, as well as with flexible lagged economic controls (unemployment rate and GDP per capita), 3) examining the NCMS's effects by urban and rural medical providers in anticipation that the effect of the NCMS is mainly concentrated at rural providers, and 4) re-estimating the effect of the NCMS in healthcare use and health outcomes using the individual-level CHNS data with the province-level enrollment rate as the treatment variable. Reassuringly, our estimates are insensitive to all of these tests. Third, our results might capture effects of other contemporary healthcare reforms in rural areas during the study period 2004-2011, such as the New Rural Pension Scheme (NRPS) providing pension to rural elderly (60+) starting in 2009, and a new round of healthcare-system reform launched in April 2009 increasing investment on rural healthcare infrastructure. To address

[8]See Appendix B for detailed description on CHNS, the estimation model, definition of key variables, and results.

this concern, we control for rural-share-specific linear time trends in the main specification, and do not find significant changes to our estimates. In addition, our estimates are robust to restricting data to years 2004-2009 in which our outcome variables of interest are free from the NRPS and the new medical reform.

In the second part of this paper, we investigate the supply-side responses to large demand shocks by the NCMS on several outcomes that have not been explored extensively in previous studies, such as the number of inpatient beds and medical institutions. We find that the supply-side responses to the insurance differ across the types of healthcare resources. While the NCMS does not increase the number of medical providers in areas with larger demand shocks, the number of beds increase significantly in response to the expansion, particularly at county hospitals and township health centers. The findings suggest that the supply-side responds in the form of larger and better-equipped rather than more medical providers, which could be driven by private behaviors of medical providers as well as by governments, central or local, injecting more healthcare investment into areas with larger NCMS shocks to meet the increasing demand.

To clear concerns that the supply-side responses might be results from other medical reforms in 2009-2011 (Chen et al. 2021), we first present the dynamic effects of the NCMS on healthcare resources and show the increase in hospital beds is mainly concentrated in years before 2009. Second, we estimate to what extent the supply-side responses contribute to the effectiveness of the NCMS. After controlling for hospitals beds, we find that the magnitude of the NCMS's effect on inpatient care use is reduced by 50 percent, which implicates that the improvement in quantity and quality of healthcare providers in rural areas suffices half of the increasing demand.

Our findings contribute to several branches of literature. The first relevant branch of literature comprises studies on the effects of the NCMS. On the one hand, some of these studies find that the NCMS is not effective in terms of increasing outpatient care use (Yip et al. 2008; Lei and Lin 2009; Babiarz et al. 2012).[9] On the other hand, more studies find evidence in support of the effectiveness of the NCMS in terms of increasing healthcare use, providing financial protection, and improving

[9]Lei and Lin (2009) find that the introduction of the NCMS leads to increases the number of general physical examinations, but has little effects on the numbers of inpatient stays or outpatient visits, OOP expenses, or health improvements using the 2000, 2004, and 2006 CHNS data. Yip et al. (2008) conduct a longitudinal survey in 2002 and 2005, and employ a DID method to show that the NCMS does not increase outpatient visits. Babiarz et al. (2012) also estimate a DID model using two waves of survey data for five provinces (Jiangsu, Sichuan, Shaanxi, Jilin, and Hebei) 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.

health outcomes. Wagstaff et al. (2009) use a DID design from the National Health Service Survey (NHSS) for 2003 and 2005 covering 12 provinces and show that the NCMS increases inpatient stays and outpatient visits, particularly at township health centers. Liu (2016) also uses a DID model from the CHNS for 1993 to 2011 showing 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 and lower chances of having high blood pressure with suggestive evidence . 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 a handful of papers that investigate the health effects of the NCMS. Cheng et al. (2015) use a panel data of the Chinese Longitudinal Healthy Longevity Survey with a DID method and find that the insurance significantly improves cognitive functions for rural elderly while has no effects on other health outcomes such as general health status and mortality rate. Lei and Lin (2009) use the CHNS with individual fixed effects and do not find significant health benefits from the NCMS.

Our study contributes to this branch of literature on the effects of the NCMS in the following aspects. First, since the effects of such a large policy change may take time to manifest and differ across geographic areas, it is important to examine the nation-wide and long-term impacts to capture its overall implication. Second, we extend the literature by examining the effect of the NCMS on health outcome – mortality rate, which is rarely studied because of data limitations. Using the province-level mortality data reported in the China Statistical Year Book and Chinese Center for Disease Control and Prevention (CCDC), we are able to examine the NCMS's effects on all-cause mortality as well as mortality by disease. More importantly, we explore the supply-side mechanisms behind its effectiveness, and suggest the importance of supply-side supporting policies in the design and implementation of large-scale insurance programs in LMICs.

Broadly speaking, our study is also related to the branch of literature on the effectiveness of public health insurance. Studies conducted in developed countries have shown that the expansion of health insurance coverage increases healthcare use (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 (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. [10] 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.

However, research on the effects of insurance expansion in developing countries show mixed findings. While studies that examine the impact of the Subsidized Regime in Columbia find that the program increases the use of preventive services and curative care (Trujillo et al. 2005; Gaviria et al. 2006; Giedion et al. 2009; Miller et al. 2013), 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 expenditure 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.[11] Our paper adds evidence on evaluating the effectiveness of public insurance programs and its potential mechanisms that can inform policymakers to better target people in LMICs.

[10] Studies that focus on non-poor populations are papers that examine the impact of health insurance on Medicare beneficiaries (Card et al. 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 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.

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

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, and mortality rate. Section 6 investigates the supply responses and quantifies its importance on the effectiveness of the NCMS insurance expansion. Section **??** discusses and concludes.

2 Institutional Background

2.1 Health Insurance System in China

China's public health insurance system consists of two subsystems: the Urban Employee Basic Medical Scheme (UEBMS) and the Urban and Rural Resident Basic Medical Scheme (URRBMS), covering a total of 1.36 billion (95%) people in 2021. The UEBMS started in 1998, covering employees and retirees in private or state-owned enterprises. The employer and the employee jointly contribute to the financing of the URBMS, with the former paying 6% and the latter paying 2% of the basic salary. The retired employees are typically exempt from paying any premiums. The URRBMS integrated two health insurance systems in 2016, the Urban Resident Basic Medical Scheme (URBMS) and the New Cooperative Medical Scheme (NCMS), and covers urban and rural residents out of the formal labor market such as children, non-working adults, and self-employed individuals. The NCMS and the URBMS was piloted in 2003 and 2007, respectively, and rely heavily on government subsidy for financing. To bridge the gap in patient cost sharing between urban and rural areas, the two systems were integrated into one system so that rural and urban residents can enjoy equal benefits.

2.2 Medicaid Institutions in Rural China

Healthcare services delivery in rural China has been organized in a three-tier public provision system (Wang 2004; Babiarz et al. 2012). Village health clinics are typically the first level of contact, where barefoot doctors provide outpatient services and prescription drugs to patients demanding routine healthcare. Township health centers (THCs) represent the middle tier, and provide more sophisticated 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. The top tier of the rural healthcare system is county hospitals, which provide care of the best quality as compared to THCs and village clinics. 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.[12]

2.3 Supply of Healthcare Resources in China

The supply of healthcare resources in China involves three parties: governments, public providers, and private providers. Governments play a dominant role in determining the healthcare supply and has been a steady financing source to invest in rural healthcare resources. In April 2009, China launched a new round of healthcare-system reform to improve equitable access to medical services for rural residents. Thus, the infrastructure investment on rural healthcare providers, especially the primary care providers in under-served areas, had increased dramatically in 2009-2011.

Public providers have substantial discretion in decision making since 1980s. They regained autonomy to generate, retain, and manage surpluses, while government subsidies account for a small and decreasing share of their revenues (Eggleston et al. 2008). Therefore, public providers have incentives to build infrastructure and purchase medical equipment to meet the increasing demand for healthcare. In addition, private for-profit hospitals have been allowed to operate and private capital has been encouraged in the healthcare section in China since 2000. Subsequently, private medical institutions have grown rapidly in numbers, and play a non-negligible role in outpatient care delivery (Liu et al. 2006).

[12]In addition, some rural patients with chronic or rare diseases may go to city hospitals outside of their home province for treatment. Note that the referral system in China has broken down since the market reform in 1980s, so that patients can self-refer themselves to any providers they can afford.

2.4 The New Cooperative Medical Scheme (NCMS)

The history of the NCMS dates back to the 1990s. While the poor in developed countries mainly live in cities, poor people in China are 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 medical care OOP. To reduce the financial burden associated with healthcare use, the Chinese government initiated the NCMS, one of the largest health insurance programs in history in 2002. 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).[13] In 2003, each provincial government had to choose at least two to three counties for the pilot program based on their financial conditions, the needs of the 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 C1 shows the year when each province fully covered its rural population, and the year 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.[14] As a result, participants paid only around one-fifth of total premiums, with local

[13] 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 C1.

[14] 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.

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.

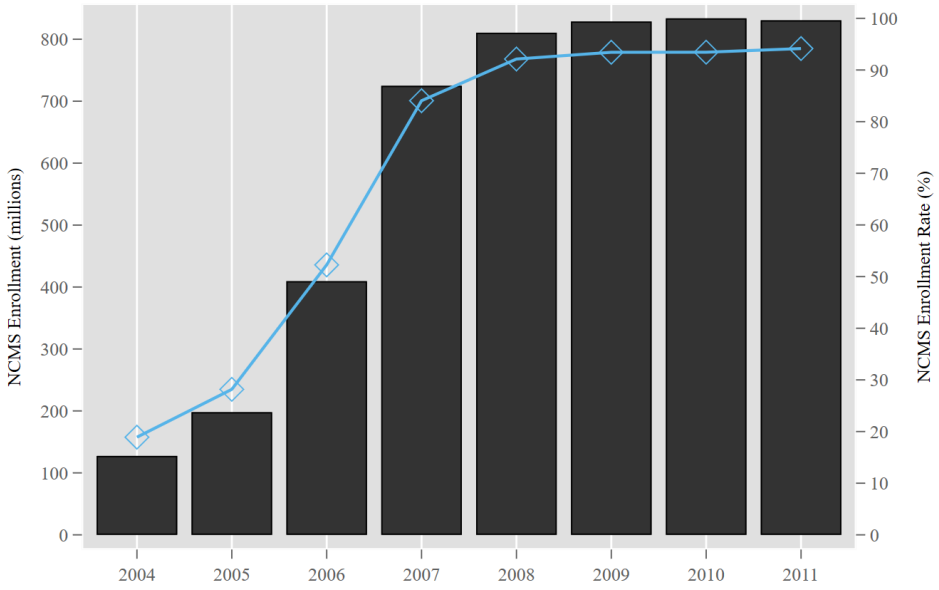


Figure 1: NCMS Enrollment over Time

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 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

C2 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 4.1 and 5.2. 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 C3 shows that the lagged economic conditions are not correlated with the NCMS rollout.

As local governments have discretion in choosing the benefit packages and the administrative arrangements offered in their areas, the deductibles, coinsurance rates, and ceilings of the scheme can vary across provinces (You and Kobayashi 2009). However, the benefit designs of the NCMS have some similar features. First, the NCMS provides more generous benefits for inpatient care than for outpatient care: all providers cover inpatient care, while only a quarter of providers 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.[15]

On reimbursing healthcare providers, the NCMS does not determine provider payment rates. Although local governments have some discretion in setting premium and reimbursement levels, they do not negotiate with healthcare providers. Rather, they set provider payment rate in reference to the payment design of the local public insurance for employees, which is based on the standard set up by the national bureau of health insurance.

Aided by the funding from governments, public providers, and the society, medical resources in rural areas increased in parallel with the introduction of the NCMS. 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 C1). 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 C2). 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

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

and medical expenses in the rural and urban areas of a province, which allows us to estimate the impact of the NCMS on OOP costs.[16] 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.[17] 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 10,000 people) in each province.[18] We collect information on incidence and death rates by infectious 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 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

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

[17] 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.

[18] The original scale in the raw data is deaths per 1,000 people. To keep consistency for all of our outcomes of interest, we re-scale the mortality rate to deaths per 10,000 people.

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.[19] 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.[20] 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 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 supply-side 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

[19]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.

[20]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.

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 10,000 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.[21] The average number of claims filed per rural resident is about one, indicating that an average 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

[21] 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.

to 17,000 yuan (2014 yuan), while the average income in rural areas is around 6,000 yuan (2014 yuan). See Appendix Table C4 for more details.

4 Estimation Model

We use a two-way fixed effect (TWFE) specification with continuous NCMS enrollment rates to estimate the effects of the NCMS on healthcare use, health outcomes, and medical expenses. Exploiting the plausibly exogenous rollout of the health insurance for rural residents, this model utilizes both within- and cross-province variation in the NCMS rollout over time. Specifically, we estimate the following regression:

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

where Y_{pt} denotes the outcomes of interest in province p at year t standardized by per 10,000 people, including healthcare use, rural medical expenses, and mortality rate in logarithm unless otherwise noted.[22] $NCMS_{pt}$ is the continuous NCMS enrollment rate in province p in year t. The parameter of interest, δ, reports the ATT effect of full NCMS expansion on outcomes of interest. We include province fixed effects η_p to control for time-invariant province-specfic unobservables that are correlated with both the NCMS rollout and outcomes of interest, such as government enforcement power,idiosyncratic health behavior and outcomes. The region-by-year fixed effect μ_{rt} allows us to compare provinces within the same region by removing regional common shocks or convergence in outcomes of interest that may be correlated with the NCMS rollout (Stephens Jr and Yang 2014; Goodman-Bacon 2021).[23] X_{pt} is a vector of province-level demographic and economic characteristics, including population, age, education, percentage married and female, and the ratio of dependent persons in a household, as well as the unemployment rate, GDP per capita (2014 yuan), disposable income in rural and urban areas (2014 yuan), and urban consumption and medical expenses (2014 yuan). The outcome variables

[22] We scale the outcome variable by population size to avoid confounding effects from population growth. There are two ways of standardization, by total population or by rural population. We have tried both and find similar results, since our baseline specification controls for total population, and is weighted by rural population.

[23] In China, the 31 provinces are typically divided into five regions according to geographical location and economic conditions: eastern region, northern region, middle region, southern region, and western region. Therefore, provinces within the same region can be regarded similar in terms of geography, government policy, and socio-economic conditions.

of interest do not distinguish rural from urban residents. Therefore, we include urban consumption and medical expenses to remove the confounding effects from healthcare use by urban residents. Our results are robust to controlling for urban medical consumption in flexible forms (See section 5.2). Moreover, we do not find healthcare utilization effect in city hospitals, which suggests our estimates are not likely to be contaminated by the health care use of urban residents. 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.

4.1 Identification Treats

The validity of the identification hinges on the exogeneity of the timing and speed of the NCMS rollout across provinces. It is assumed that absent the NCMS, the average outcomes share similar secular trends in provinces of early expansion with those in provinces of later expansion, and in provinces of faster rollout speed with those in provinces of slower expansion of the NCMS. We test the parallel time trend by conducting an event study model:

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

where $NCMS_p$ denotes province p's NCMS enrollment rate in 2004 when testing for exogeneity of the timing of the NCMS, and is the annual increment of NCMS enrollment rate to achieving full coverage when testing the exogeneity of the speed of the NCMS rollout.[24] 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. All other variables are the same as those in equation (1).

To test for pre-NCMS trends, we obtain the pre-NCMS data for the years 1996-2003 from the CHY and combine it with the post-NCMS outcome data for the years 2004-2011 from the CHSY

[24]To better interpret our results, we re-define the treatment variable to test the timing of the NCMS 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 across provinces. We calculate the expansion speed of province p by dividing the total enrollment gains between 2004 and 2011 by the number of years taken to achieve full expansion.

and CSY.[25] The estimates of interest are the coefficients on the interaction terms between $NCMS_p$ and event-year dummies, θ_y, which capture the differences in outcome Y in year t as compared to 2002 between earlier and later adopters, and between provinces of faster versus slower expansion.

To test the exogeneity of the timing of the NCMS, Figure 2 reports the estimates of our outcomes of interest on the enrollment rate gains in 2004-2011 using specification (2). Estimates prior to 2002 are statistically insignificant, which suggests that the growth rates of healthcare utilization, medical expenses, and health outcomes absent the NCMS are similar for rural residents in earlier- and later-adoption provinces. For years after 2003 when the NCMS started to expand, we observe upward trends in both inpatient and outpatient care use, a downward trend in OOP expenditures before 2008, and a slightly upward trend in mortality rate. Appendix Figure C3 further shows the event-study estimates on other healthcare outcomes for emergency visits and hospital discharges, and Appendix Figure C4 plots the estimates on detailed healthcare spending in 1996-2003. These estimates provide more evidence supporting the parallel trend assumption on the timing of the NCMS.

To test whether the NCMS enrollment expansion speed is exogenous, Figure 3 shows results of our outcomes of interest (i.e., inpatient stays, outpatient visits, OOP expenses, and mortality) on the NCMS's rollout speed. The statistically insignificant estimates before 2002 support the parallel assumption that healthcare utilization, OOP expenses, and health outcomes share similar trends between provinces expanding the NCMS faster and provinces that expand the program at a slower speed. Appendix Figures C5 and C6, 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.

Furthermore, 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 to 2011 on a range

[25] 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.

Figure 2: Event-Study Estimates on NCMS Enrollment Rate Gains in 2004-2011

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 treatment variable is defined as the differences between the NCMS enrollment rate in 2011 and the NCMS enrollment rate in 2004. The y-axis is the dependent variable in log form. The interval is the 95 percent confidence interval of each estimate.

of economic variables in 1996-2004 and healthcare variables in 1996-2003.[26]

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

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 ($H_0 : \beta_1 = 0$). Appendix Table C5 presents the tests of the potential effects of economic conditions and healthcare 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

[26]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.

Figure 3: Event-Study Estimates on 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). We calculate the expansion speed by dividing the total enrollment gains between 2004 and 2011 by the number of years taken to achieve full expansion in each province. The y-axis is the dependent variable in log form. The interval is the 95 percent confidence interval of each estimate.

growth rate). However, the differences in the pre-NCMS economic conditions are mitigated after removing region-by-year variations. More importantly, Panel B of Appendix Table C5 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 Healthcare Use and Mortality

5.1 Main Results

Table 1 shows the results for healthcare use and health outcomes from the estimation Eq. (1) and its alternative specifications. Panels A to C report the effect of the NCMS on inpatient stays, outpatient visits, and all-cause mortality rate, respectively.

Table 1: The NCMS's Effects on Healthcare Use and All-cause Mortality

	(1) Baseline	(2) No Region-Year FE	(3) No Economic Controls	(4) No Controls	(5) Unweighted
			Panel A. Inpatient Stays		
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
Observations	216	216	217	217	216
			Panel B. Outpatient Visits		
NCMS rate	-0.060	-0.053	-0.063	-0.078	-0.025
	(0.050)	(0.041)	(0.050)	(0.047)	(0.054)
Mean	15,293	15,293	15,293	15,293	15,293
Observations	231	231	232	232	231
			Panel C. All-cause Mortality		
NCMS rate	0.039	0.041	0.023	0.048**	0.017
	(0.027)	(0.025)	(0.017)	(0.024)	(0.024)
Mean	4.118	4.118	4.118	4.118	4.118
Observations	231	231	232	232	231

Notes: Each cell reports estimates from a separate specification. The dependent variables are inpatient stays, outpatient visits, and mortality rate per 10,000 people, respectively. 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. 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.

Inpatient Stays: We find that rural residents use more inpatient services after being covered by the NCMS. The baseline estimate in column 1 shows 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 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 of the rural population in 2003.

Outpatient Visits: We do not find a significant effect 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, the baseline estimate in column 1 in Panel B of Table 1 shows 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 our 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.

Mortality: Panel C of Table 1 shows that the NCMS has little effects on the all-cause mortality rate of rural residents. The baseline estimate (column 1) is statistically insignificant and robust to replacing 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.

The estimates on the all-cause mortality rate shown in Panel C of Table 1 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.[27] Panel A of Table 2 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, 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. To explore the potential channels to explain why the NCMS is effective to improve health, Appendix Tables B7-B9 provide preliminary evidence of the NCMS on increasing vaccination rate (with significant on influenza vaccine), increasing use of preventive services, and improving knowledge on healthy living (e.g. eating habits, physical exercises, exposure to electronic

[27] 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 2: 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.

devices, etc.) among rural residents.

Overall, the introduction of the NCMS effectively increases rural patients' use of inpatient service. While failing to reduce the all-cause mortality rate, it reduces the incidence rate on infectious diseases, and prevents deaths from some infectious diseases, such as AIDS/HIV.

5.2 Robustness Checks

Effects from Urban Residents: In this paper, we are interested in estimating the treatment effects of the NCMS on the healthcare utilization of rural residents. Due to data limitations, the outcome variables used in this study measure the behavior from all people but not for rural people, which may confound our estimates with effects from urban residents. To address this concern, we first perform a placebo test by conducting the same regressions on healthcare consumption and

total consumption by urban residents. Appendix Table C7 finds little significant effects of the NCMS for city residents.

Secondly, we control for urban consumption and urban health expenditure in our baseline regression in linear, quadratic, and cubic forms, as well as with flexible lagged controls. All of the results are robust to baseline estimates. Appendix Table C8 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.

Thirdly, we examine the NCMS's effects by urban and rural medical providers. While we find significant effects in healthcare use in rural healthcare providers (county hospitals, township health centers), we find that rural residents' visits to city hospitals are barely affected, which suggests that our estimates mainly capture rural residents' behaviors, rather than reflecting urban residents' health related behaviors.

Table 3: The NCMS's Effects on Healthcare Use by Provider

	(1) City hospital	(2) CHC	(3) County hospital	(4) THC
	Panel A. Inpatient Stays			
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
	Panel B. Outpatient Visits			
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: The dependent variable is inpatient stays per 10,000 people. Regressions are based on the Eq. (1). CHC denotes community health centers, and THC denotes township health centers. County hospitals and THCs mainly serve rural people, while city hospitals and CHCs are mainly used by urban residents. 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.

Lastly, we take advantage of the longitudinal CHNS data that surveys individuals in each province, which merges into our NCMS enrollment rate in years 2004-2011 and re-estimate the

effect of the NCMS on healthcare use and health outcomes. Appendix Table B4 first shows that the NCMS significantly increases health insurance coverage and Appendix Tables B5-B6 obtain similar results and patterns which confirms that our aggregate results are insensitive to any potential measurement errors.

Effects from Contemporaneous Policy: It is possible that our results are driven by other contemporaneous policies targeting rural people. 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. We show that our estimates on increased healthcare utilization are not confounded by the income effect from the NRPS or by the increasing healthcare demand among the older population. First, the analysis of the NRPS by Huang and Zhang (2021) suggests that the NRPS does not have significant effects on 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 C9.[28] The estimates on outpatient visits and inpatient care use are very robust to the main estimates in Tables 1 and 3. 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.

Lastly, to alleviate the concerns that our estimates could reflect the dynamics of other contemporaneous healthcare reforms targeting rural population, we control for rural-share-specific linear time trends. If our estimates are confounded with those policies, they would be changed significantly after controlling this linear time trends. Contrary to the concern, Appendix Table C10 reports little changes to our estimates.[29]

Effects from Economic Trends: Our identification assumption relies on the variation in

[28]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.

[29]We also find no sensitivity of our results to elderly-share-specific linear time trends (age 65) with the idea that the NRPS immediately increases the income of this group. Results are available upon request.

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 C5 show little 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 C11 reports the estimates after including an interaction term between GDP per capita and time trends in our baseline specification (1). In addition, Table C2 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 Supply-side Responses

In this section, we investigate the mechanisms through which the NCMS leads to significant increases in inpatient services use. [30] We emphasize the importance of supply-side responses in explaining the effectiveness of the NCMS. We evaluate two dimensions of healthcare resources 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). Table 4 shows that the NCMS 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

[30] 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. Previously we have confirmed the role of insurance reimbursement benefits in rural patients' healthcare use when exploring the explanations of the heterogeneous effects across providers.

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.

Table 4: Effects of the NCMS Expansion on Investments in Rural Medical Providers

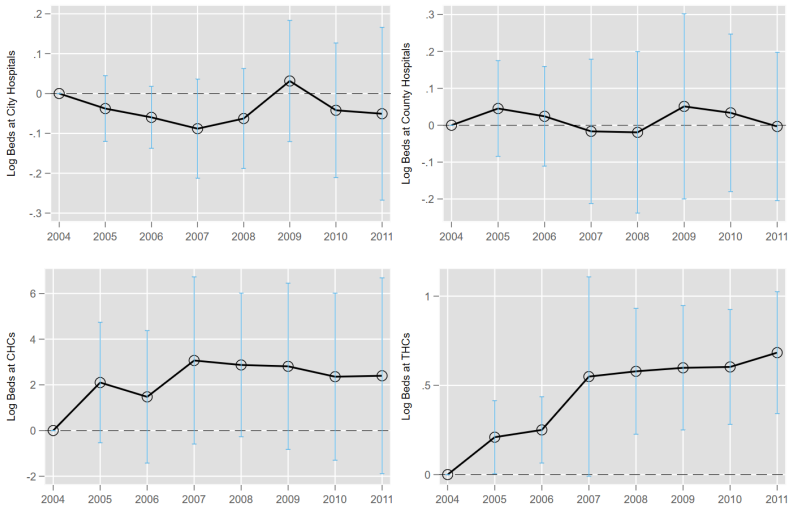
	(1)	(2)	(3)
	County hospital	CHC	THC
	Panel A. Number of Healthcare Providers		
NCMS rate	0.130	-0.108	0.062
	(0.095)	(0.280)	(0.074)
Mean	0.067	0.105	0.334
Observations	231	231	225
	Panel B. Number of Beds at Hospitals		
NCMS rate	0.029	1.046	0.282**
	(0.043)	(0.941)	(0.109)
Mean	7.335	0.098	5.280
Observations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

One may concern that the supply-side responses found above are driven by the independent government support for reinforcing rural healthcare infrastructure, such as the independent new medical reform of 2009, which has substantially increased the total amount of healthcare resources from 2009 to 2018 (Chen et al. 2021). We argue that the evidence we find above suggests that supply-side responses are greater in rural areas with larger NCMS coverage gains. The concern is valid only when the amount of govenment funding is positively correlated with the NCMS enrollment rate, which may not be true since the government determines the funding level based on the general economic conditions but not directly on the NCMS enrollment rate. Second,

we estimate the dynamic effects of the NCMS based on the Eq.(2) where each province is characterized by the total enrollment gain. If the increases in government support since 2009 are driving the supply responses, we would expect a stronger effect after 2009. Figure 4 generally does not support a break in trend at 2009. Rather, the supply-side responses starts in years before 2009, negating the concern that the supply-side responses are from the indeodent new medical reform of 2009.

(a) Number of Beds



(b) Number of Institutions

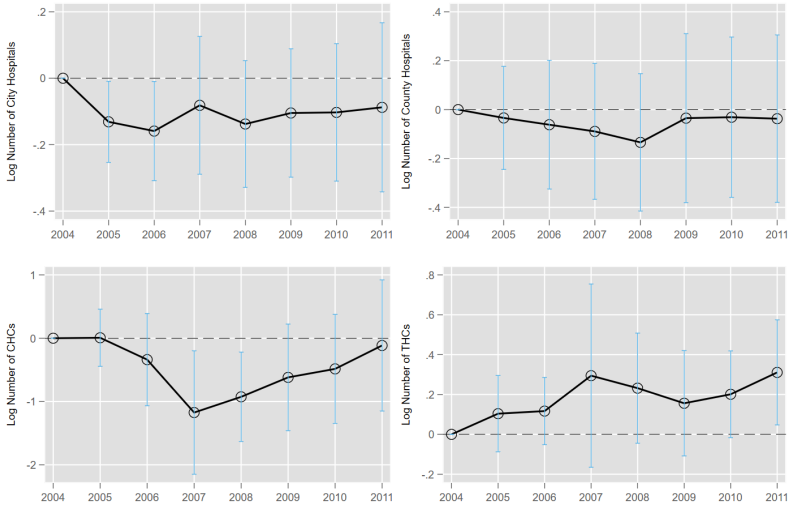


Figure 4: Event-Study Estimates by NCMS Enrollment Gain

Notes: The data source is the 2004-2011 CSY. Each figure plots the 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.

Next, we re-estimate the NCMS's effects on healthcare use after controlling for healthcare resources. Column 1 of Table 5 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 results are in line with our expectations:

Table 5: 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.

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.[31]

Lastly, we describe the NCMS's effects on inpatient care utilization after controlling for rural

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

healthcare resources in Table 6. Panel A shows that controlling for hospitals beds decreases the

Table 6: 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.

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 C6 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 responses 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. Section A.1 in the appendix provide evidence that after 2009 the dynamics of the NCMS's effects on outpatient and inpatient care use, respectively, weaken. Second, section 5 shows that the NCMS produces real health benefits for rural patients by reducing the incidence and mortality rates of infectious diseases and AIDS (Table 2). To conclude, we believe that the supporting policy of increasing rural health investments improves healthcare quality and works with expanded coverage to encourage rural patients' use of healthcare service.

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, as well as explores the role of supply-side responses in explaining the effects if there is any. The NCMS is one of the largest insurance expansion program targeting the rural residents 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 developing countries. 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. Second, although the NCMS increases healthcare utilization among rural residents in China, it does not increase OOP costs. Moreover, 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.

Lastly, we find a supply responses to the NCMS exansion: the number of hospital beds increases following the NCMS, while the number of institutions remain unaffacted, which suggests increased healthcare investment by existing medical institutions. We also quantity the extent to which the supply responses explain the effectiveness of the NCMS. After controlling for healthcare resources, the effect on inpatient care use is reduced by half, suggesting that responses from rural healthcare providers to meet the increased demand are essential to the effectiveness of insurance expansion programs, which is consistent with Kondo and Shigeoka (2013) in the context of developed countries.

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Appendices

A Additional Analysis

A.1 Dynamic Effects of the NCMS

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).

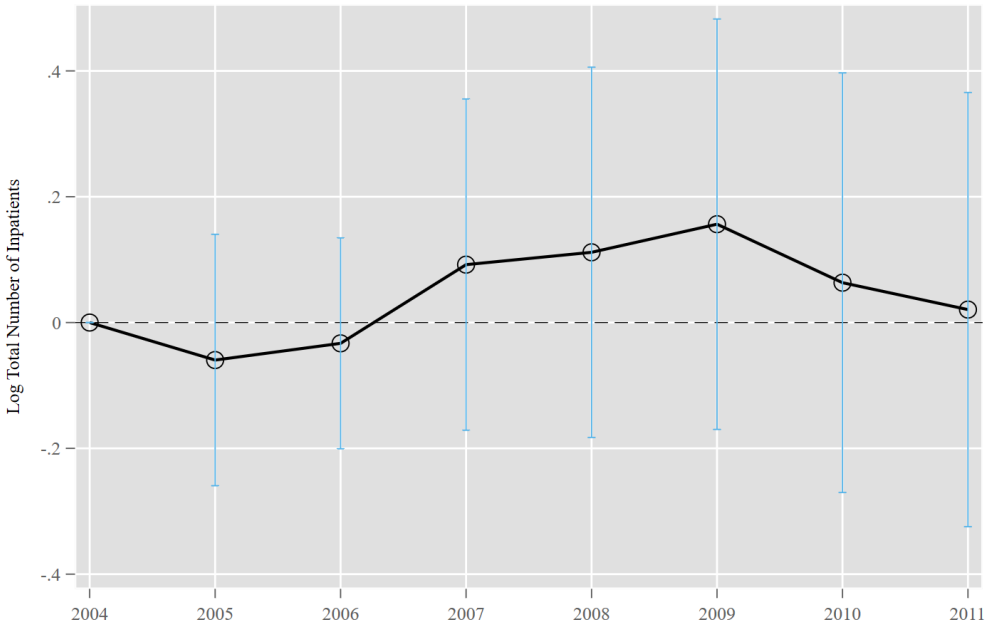
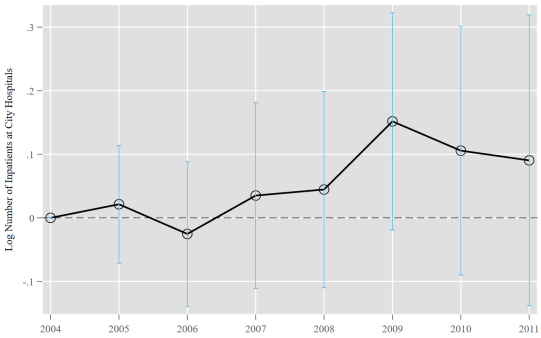


Figure A1: Event-Study Estimates of the NCMS's Effects on Total Inpatient Care Use

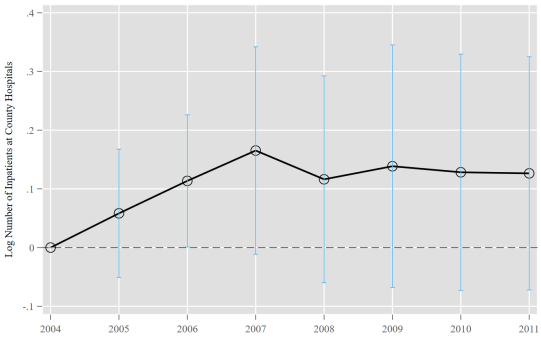
Notes: The dependent variable is the inpatient care use per 10,000 people. The treatment variable is defined as the differences in the NCMS enrollment rate between 2011 and 2004. The coefficients are weighted event-study estimates from the baseline specification of equation (2). The weights are the rural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

Appendix Figures A1 and A2 plot the dynamic effects of the NCMS on inpatient services utilization for inpatient services in total and by provider, respectively. Appendix Figure A1 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

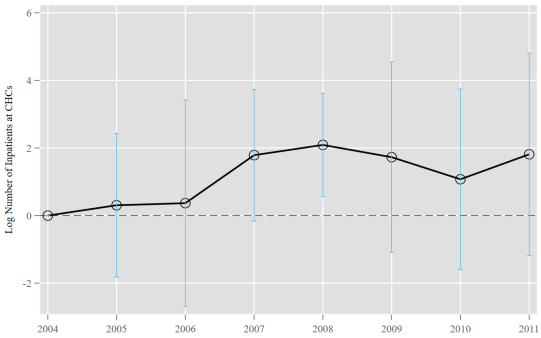
(a) Inpatient Care Use at City Hospitals



(b) Inpatient Care Use at County Hospitals



(c) Inpatient Care Use at CHCs



(d) Inpatient Care Use at THCs

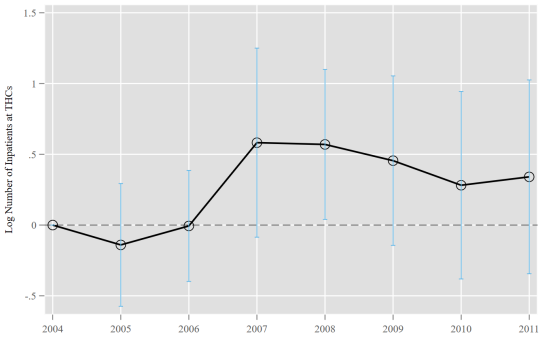


Figure A2: Event-Study Estimates of the NCMS's Effects on Inpatient Care Use by Provider

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.

Appendix Figure A2 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 3 (column 1 of panel A), Appendix Figure A2 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 A1 and A2 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.

Appendix Figure A3 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 A4 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.

A.2 The Heterogeneous Effects on Inpatient Services Use

We analyze the heterogeneous effects of the NCMS on inpatient services use by benefit generosity, level of urbanization, and elderly share. First, we hypothesize that the effects of the NCMS on inpatient care use are weaker 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,[32] and may therefore be less likely to respond to the NCMS. Panel A of Table A1 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

[32]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.

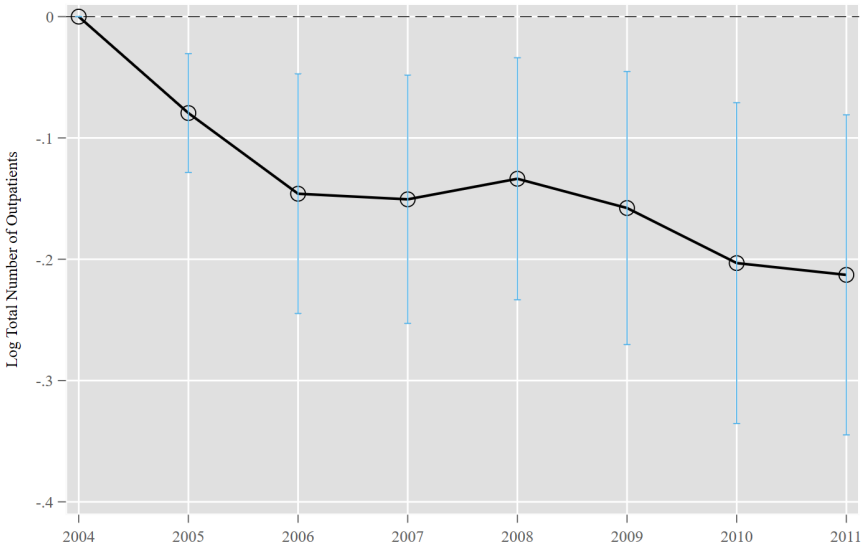


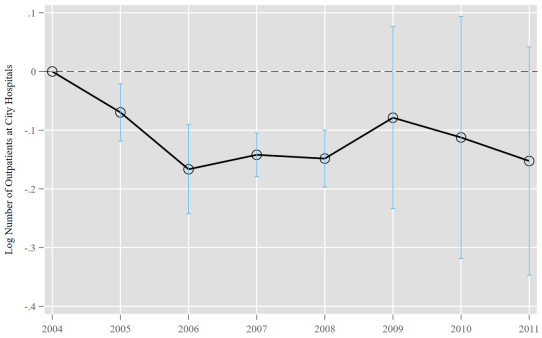
Figure A3: Event-Study Estimates of the NCMS's Effect on Total Outpatient Visits

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.

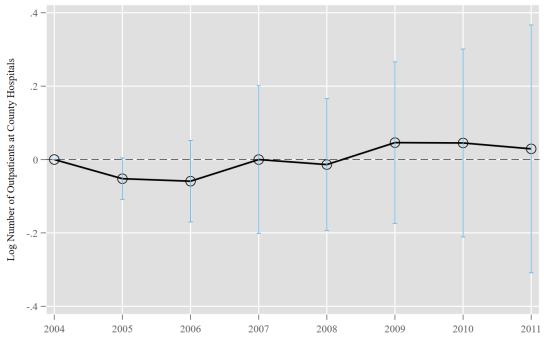
our hypothesis, rural residents in more urbanized provinces are less likely to use inpatient services in general (column 1), particularly at city hospitals and county hospitals.

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 A1 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 C7 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

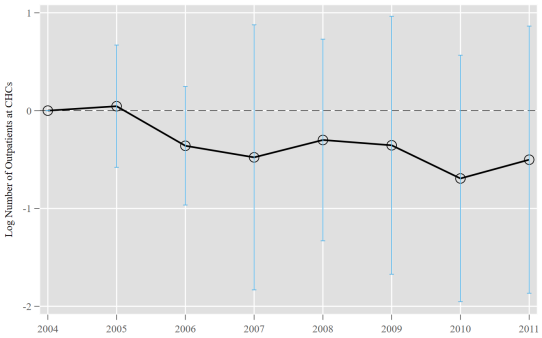
(a) Outpatient Use at City Hospitals



(b) Outpatient Use at County Hospitals



(c) Outpatient Use at CHCs



(d) Outpatient Use at THCs

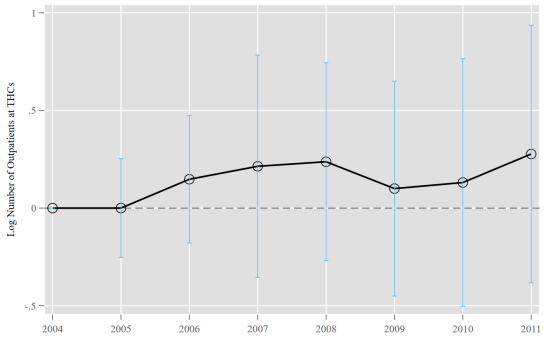


Figure A4: Event-Study Estimates of the NCMS's Effect on Outpatient Visits by Provider

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.

Table A1: 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.

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 A1, 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.

A.3 The Substitution of Outpatient Services

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, we provide evidence that the NCMS does reduce outpatient visits to the more expensive city hospitals. We split hospital outpatient visits by department and examine the heterogeneous effects of the NCMS across outpatient specialties. Appendix Table A2 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 that the NCMS reduces rural residents' incentives to visit more expensive outpatient departments at hospitals, especially the general department.

Second, we show that rural residents substitute outpatient visits to city hospitals for more generously reimbursed outpatient and inpatient care at lower-level medical providers.[33] 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 A3 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

[33]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 A2: 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 A3: 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.

and most noticeable for the emergency department. Similarly, Panel B of Table A3 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 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.

A.4 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. Appendix Table A4 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 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 A5 and A6 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. Overall, the NCMS improves the healthcare utilization of rural

Table A4: 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.

residents without adding to their financial burdens.

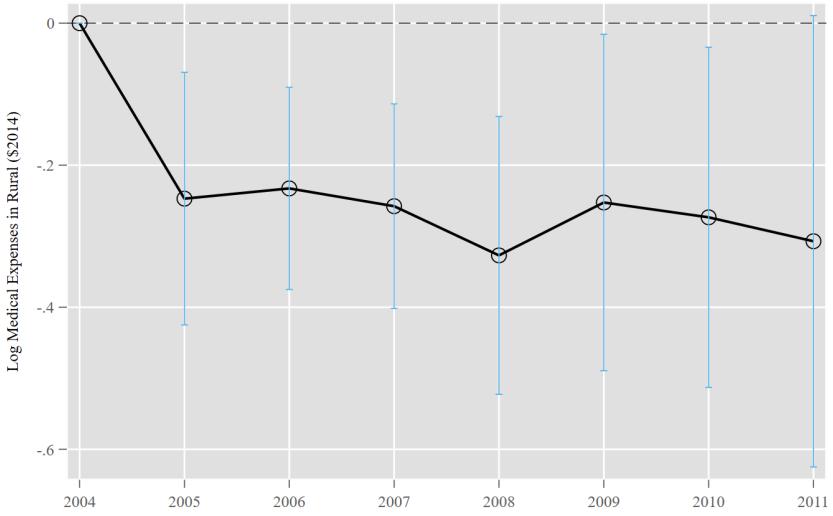


Figure A5: Event-Study Estimates of the NCMS's Effect on Medical Expenses Per Capita

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.

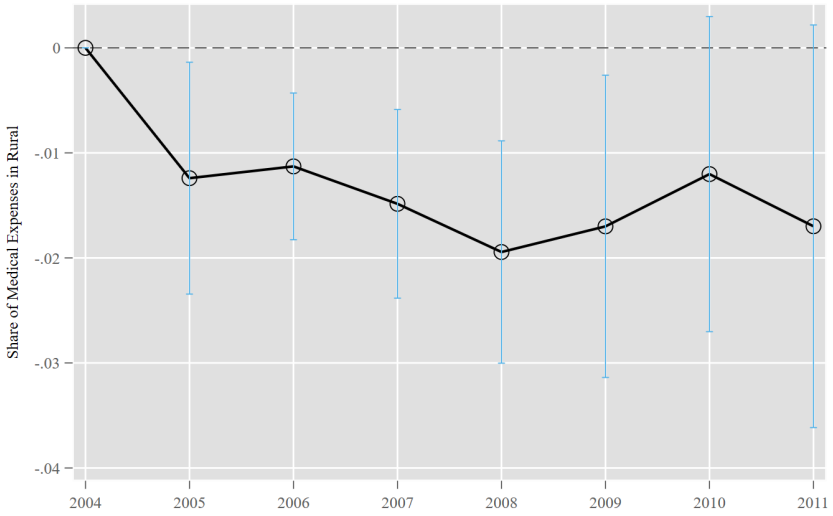


Figure A6: Event-Study Estimates of the NCMS's Effect on Share of Medical Expenses

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.

B CHNS Data Analysis

B.1 Introduction to the China Health and Nutrition Survey

The China Health and Nutrition Survey (CHNS) is a representative longitudinal survey study that collects individual and household data from residents of various provinces in China since 1989. Subsequent waves were conducted in 1991, 1993, 1997, 2000, 2004, 2006, 2009, 2011, and 2015. The CHNS uses a multi-stage random cluster sampling method, which selected a total of 7,200 households and 30,000 individuals with different socio-economic characteristics in 15 provinces and their capitals over a seven-day period. The survey data are collected individually and supplemented by data from clinical examinations and made available for research on the CHNS website in the form of short-term, long-term, and community-level data. The National Institute for Nutrition and Health, China Center for Disease Control and Prevention and the Carolina Population Center at the University of North Carolina are responsible for data collection and processing.[34]

In addition to comprehensive information on dietary habits, body composition, blood pressure, and health history, the CHNS has a variety of health-related variables that allows us to re-evaluate the effects of the NCMS with micro-level data. Specifically, the main variables for our purpose are about medical insurance coverage, healthcare use at medical providers, and health outcomes such as the presence of various illnesses and the extent to which these limited respondents' normal lives. We also take advantage of the CHNS to explore potential channels including vaccination status, utilization of preventive services, and knowledge about healthy diet and habits, through which the NCMS improves health outcomes if any.

To select our working sample, we restrict the data to respondents with rural *hukou* registration status and merge it with our province-level NCMS enrollment rate data in the period 2004-2011.

B.2 Independent Variables

The independent variables are primarily divided into three categories: *demographic characteristics* such as age, sex, marital status, and education; *the urbanization index*, which measures the level of urbanization of the province, and *the total income of the household*, which includes earnings, bonuses from work, and value of gifts transferred. Table B1 summarizes the definitions of each

[34] See https://www.cpc.unc.edu/projects/china for more details.

independent variable used in our estimation model.

Table B1: Independent Variables

Variables	Description
Age	Age of respondents separated into three categories (younger than 18, 18 to 55, and older than 55)
Age squared	Age squared
Sex	1 if male, 0 otherwise
Marital status	1 if never married, 2 if married, 3 if divorced, 4 if widowed, 5 if separated
Highest level of education attained	1 if primary school degree, 2 if lower middle school degree, 3 if upper middle school degree, 4 if technical or vocational degree, 5 if University or college degree, 6 if Master´s degree, 0 if none
Ethnicity	1 if Han, 2 if Mongolian, 3 if Hui, 4 if Tibetian, 5 if Vaguer, 6 if Miao, 7 if Yi, 8 if Zhuang, 9 if Buyi, 10 if Korean, 11 if Man, 12 if Dong, 13 if Yao, 15 if Tujia, 20 if other
Urbanization Index	Urbanization degree, higher the value, more urbanized it is
Household income	Total household income (e.g. salaries, bonus, business income, gifts from family members, etc.)

B.3 Dependent Variables

We take advantage of two sets of dependent variables in the CHNS to evaluate the effectiveness of the NCMS and the potential channels to explain its success if there is any. First, we use detailed health-related variables on *the coverage status of medical insurance* such as any insurance coverage and NCMS coverage, on *healthcare utilization* such as inpatient or outpatient use as well as providers at which the services are received, and *health outcomes* including whether an individual was sick or injured in the past 4 weeks and some indicators of health conditions (e.g. high blood pressure, diabetes, heart disease, etc.). Second, the CHNS asks respondents questions about their *vaccination status*, *utilization of preventive services*, and *knowledge about healthy statements* of agreement or disagreement on health related behaviors (e.g., different diet types, physical activity, etc.) as well as the eating habits which are self-documented with the help of a diary over three consecutive days. We employ these detailed information to explore channels through which the NCMS is effective. Appendix Tables B2-B3 present the definitions of our main outcomes.

Table B2: Dependent Variables

Variables	Description
Panel A: Medical Insurance	
Medical insurance	1 if the individual has a medical insurance, 0 if otherwise
Cooperative medical insurance	1 if the individual has a cooperative medical insurance, 0 if otherwise
Panel B: Healthcare Use	
Inpatient or outpatient care	1 if inpatient care, 0 otherwise
Visited a doctor at a town facility in the last 4 weeks	1 if the individual visited a doctor at a town hospital or at a town family planning service, 0 otherwise
Visited a doctor at a county hospital in the last 4 weeks	1 if the individual visited a doctor at a county hospital or at a county maternal and child hospital, 0 otherwise
Visited a doctor at a city hospital in the last 4 weeks	1 if the individual visited a doctor at a city hospital or at a city maternal and child hospital, 0 otherwise
Panel C: Health Outcomes	
Sick or injured in the past 4 weeks	1 if individual was sick or injured in the past 4 weeks, 0 otherwise
High blood pressure	1 if individual was diagnosed with high blood pressure, 0 otherwise
Diabetes	1 if individual was diagnosed with diabetes, 0 otherwise
Myocardial infarction	1 if individual was diagnosed with myocardial infarction, 0 otherwise
Apoplexy	1 if individual was diagnosed with apoplexy, 0 otherwise
History of bone fracture	1 if the individual has a history of bone fracture, 0 otherwise
Heart disease or chest pain	1 if the individual had a heart disease or chest pain in the last 4 weeks, 0 otherwise

B.4 Estimation Model

We estimate the effects of the NCMS using the TWFE model with province FE and year FE as follows:

$$Y_{ipt} = \beta_0 + \beta_1 NCMS_{ipt} + \beta_2 X_{ipt} + \tau_t + \alpha_p + \epsilon_{ipt} \tag{4}$$

Table B3: Dependent Variables

Variables	Description
Panel A: Vaccination Status	
BCG vaccination	1 if vaccinated against tuberculosis, 0 otherwise
Measles vaccination	1 if vaccinated against measles, 0 otherwise
DPT vaccination	1 if vaccinated against diphtheria, tetanus and pertussis, 0 otherwise
Influenza encephalitis vaccination	1 if vaccinated against influenza encephalitis, 0 otherwise
Encephalitis B vaccination	1 if vaccinated against encephalitis B, 0 otherwise
Hepatitis A vaccination	1 if vaccinated against Hepatitis A, 0 otherwise
Hepatitis B vaccination	1 if vaccinated against Hepatitis B, 0 otherwise
Panel B: Utilization of Preventive Services	
Utilization of a preventive health service at a town facility	1 if an individual received services at a town hospital or at a town family planning service, 0 otherwise
Utilization of a preventive health service at a county hospital	1 if an individual received services at a county hospital or at a county maternal and child hospital, 0 otherwise
Utilization of a preventive health service at a city hospital	1 if an individual received services at a city hospital or at a city maternal and child hospital, 0 otherwise
Diet last year	1 if an individual was on a diet last year, 0 otherwise
Self-assessment of physical activities	1 if an individual thinks that she or he is doing just the right amount of physical activity, 0 otherwise
Panel C: Healthy Knowledge	
Diet with a lot of sugar	1 if an individual agrees that a diet with a lot of sugar is good for one's health, 0 otherwise
Diet with a variety of foods	1 if an individual agrees that a diet with a variety of foods is good for one's health, 0 otherwise
Diet high in fat	1 if an individual agrees that a diet high in fat is good for one's health, 0 otherwise
Diet with a lot of animal products daily	1 if an individual agrees that a diet with a lot of animal products daily is good for one's health, 0 otherwise
Amount of fatty meat and animal fat	1 if an individual agrees that reducing the amount of fatty meat and animal fat is good for one's health, 0 otherwise
Diet with milk and dairy products	1 if an individual agrees that a diet with milk and dairy products is good for one's health, 0 otherwise
Diet with beans	1 if an individual agrees that a diet with beans and bean products is good for one's health, 0 otherwise
Physical activities	1 if an individual agrees that physical activity is good for one's health, 0 otherwise
Heavy body	1 if an individual agrees that the heavier one's body is the healthier, 0 otherwise
Fast food	1 if an individual likes fast food very much, 0 otherwise
Salty snacks	1 if an individual likes salty snacks very much, 0 otherwise
Fruits	1 if an individual likes fruits very much, 0 otherwise
Vegetables	1 if an individual likes vegetables very much, 0 otherwise
Soft drinks and sugared fruit drinks	1 if an individual likes soft drinks and sugared fruit drinks very much, 0 otherwise
Walking and Tai Chi	1 if an individual likes walking and Tai Chi very much, 0 otherwise
Sports	1 if an individual likes sports very much, 0 otherwise
body building	1 if an individual likes body building very much, 0 otherwise
Watching TV	1 if an individual likes watching TV very much, 0 otherwise
Computer/Video games	1 if an individual likes playing computer/video games very much, 0 otherwise

where Y_{ipt} represents different measures of health-related outcomes in Tables B2-B3 for an individual i living in a province p in year t. $NCMS_{ipt}$ is an indicator of whether an individual is enrolled in the NCMS; X_{ipt} includes control variables in Table B1 such as age, age squared gender, education, marital status, ethnicity, urbanization index, and household income. τ_t is year FE that controls for unobservable characteristics that are constant across all provinces. α_p indicates province FE that controls for unobservable characteristics of a province that is constant over time. ϵ_{ipt} is standard errors which are clustered by province.

B.5 Results of the NCMS on Healthcare/Health Outcomes

Tables B4-B6 report estimates of the NCMS on insurance coverage, healthcare use and use by provider, and health outcomes, respectively, using the CHNS in years 2004-2011.

Table B4: Results of the NCMS on Medical Insurance Coverage

Variables	(1) Medical Insurance Coverage	(2) Cooperative Medical Insurance Coverage
NCMS rate	0.879**	0.103*
	(0.301)	(0.054)
Mean	0.627	0.938
Observations	225,830	143,711
R-squared	0.591	0.046

Notes: The sample used is the CHNS individuals who have rural registration status in years 2004-2011. The treatment variable is defined as the NCMS enrollment rate. The coefficients are estimated from the specification of equation (4). The mean row summaries the mean of each dependent variable in each column with detailed definition in Table B2.

Table B5: Results of the NCMS on Healthcare Utilization

Variables	(1) Inpatient Care	(2) Outpatient Care	(3) City Hospital	(4) County Hospital	(5) THC
NCMS rate	0.009*	-0.082	0.058	-0.064	0.176*
	(0.004)	(0.048)	(0.056)	(0.051)	(0.092)
Mean	0,008	0.108	0,089	0.109	0.222
Observations	226,050	226,050	29,094	29,094	29,094
R-squared	0.006	0.038	0.040	0.040	0.031

Notes: The sample used is the CHNS individuals who have rural registration status in years 2004-2011. The treatment variable is defined as the NCMS enrollment rate. The coefficients are estimated from the specification of equation (4). The mean row summaries the mean of each dependent variable in each column with detailed definition in Table B2.

Table B6: Results of the NCMS on Health Outcomes

Variables	(1) Sickness/Illness	(2) Normal Activities	(3) High Blood Pressure	(4) Diabetes	(5) Apoplexy	(6) Myocardial Infarction	(7) Bone Fractures	(8) Heart Disease/Chest Pain
NCMS rate	-0.073	0.056	-0.015	-0.019**	0.003	-0.006	-0.036	0.003
	(0.043)	(1.276)	(0.020)	(0.008)	(0.004)	(0.006)	(0.020)	(0.008)
Mean	0.137	2.839	0,075	0,01	0,009	0,004	0,038	0,009
Observations	225,522	38,016	225,191	225,356	225,471	225,436	225,565	225,345
R-squared	0.045	0.041	0.072	0.013	0.018	0.007	0.016	0.018

Notes: The sample used is the CHNS individuals who have rural registration status in years 2004-2011. The treatment variable is defined as the NCMS enrollment rate. The coefficients are estimated from the specification of equation (4). The mean row summaries the mean of each dependent variable in each column with detailed definition in Table B2.

B.6 Channels of the NCMS on Health Improvement

Tables B7-B9 demonstrate the potential channels such as vaccination status, use of preventive services, and knowledge about healthy statements, through which the NCMS increases healthcare use and health outcomes.

Table B7: Results of the NCMS on Vaccination Status

Variables	(1) BCG	(2) Measles	(3) DPT	(4) Influenza Encephalitis	(5) Encephalitis B	(6) Hepatitis A	(7) Hepatitis B
NCMS rate	0.040	0.294	-0.336	0.505**	0.296	0.169	0.112
	(0.154)	(0.293)	(0.259)	(0.199)	(0.217)	(0.336)	(0.200)
Mean	0.181	0.341	0.264	0.560	0.524	0.217	0.364
Observations	4,775	4,755	4,735	4,811	4,804	4,695	4,755
R-squared	0.047	0.054	0.058	0.157	0.201	0.126	0.131

Notes: The sample used is the CHNS individuals who have rural registration status in years 2004-2011. The treatment variable is defined as the NCMS enrollment rate. The coefficients are estimated from the specification of equation (4). The mean row summaries the mean of each dependent variable in each column with detailed definition in Table B3.

Table B8: Results of the NCMS on Utilization of Preventive Services

Variables	(1) THC	(2) City Hospital	(3) County Hospital	(4) Diet Last Year	(5) Self-assessed Physical Activity
NCMS rate	0.148	-0.016	0.125	-0.096	0.061
	(0.346)	(0.149)	(0.086)	(0.073)	(0.148)
Mean	0.358	0.103	0,098	0,058	0.653
Observations	8,040	8,040	8,040	31,819	28,316
R-squared	0.087	0.096	0.060	0.017	0.023

Notes: The sample used is the CHNS individuals who have rural registration status in years 2004-2011. The treatment variable is defined as the NCMS enrollment rate. The coefficients are estimated from the specification of equation (4). The mean row summaries the mean of each dependent variable in each column with detailed definition in Table B3.

Table B9: Results of the NCMS on Healthy Knowledge

Variables	(1) Sugar	(2) Variety of Foods	(3) Fat	(4) Animal	(5) Meat	(6) Dairy	(7) Beans	(8) Physical	(9) Heavy Body	(10) Fast Food	(11) Snacks	(12) Fruits	(13) Vegetables	(14) Soft Drinks	(15) Tai Chi	(16) Sports	(17) Body Building	(18) TV	(19) Video Games
NCMS rate	0.027	0.106*	-0.016	0.113	0.130**	0.088**	0.064	0.129	-0.013	0.016	-0.111	0.109	0.090	0.131**	0.099*	0.057	0.139***	0.088	-0.100
	(0.032)	(0.059)	(0.060)	(0.070)	(0.050)	(0.031)	(0.056)	(0.077)	(0.020)	(0.056)	(0.063)	(0.147)	(0.147)	(0.053)	(0.049)	(0.046)	(0.034)	(0.090)	(0.057)
Mean	0,071	0.598	0,088	0.264	0.563	0.683	0.692	0.652	0,043	0.106	0.144	0.706	0.777	0.233	0.201	0.122	0.113	0.649	0.132
Observations	212,265	210,869	208,978	215,710	209,906	214,550	215,824	217,083	212,631	130,641	154,130	221,831	223,276	180,332	146,265	134,350	133,288	214,943	124,921
R-squared	0.041	0.457	0.052	0.131	0.391	0.608	0.639	0.539	0.018	0.092	0.081	0.144	0.151	0.070	0.041	0.094	0.033	0.141	0.227

Notes: The sample used is the CHNS individuals who have rural registration status in years 2004-2011. The treatment variable is defined as the NCMS enrollment rate. The coefficients are estimated from the specification of equation (4). The mean row summaries the mean of each dependent variable in each column with detailed definition in Table B3.

C Tables and Figures

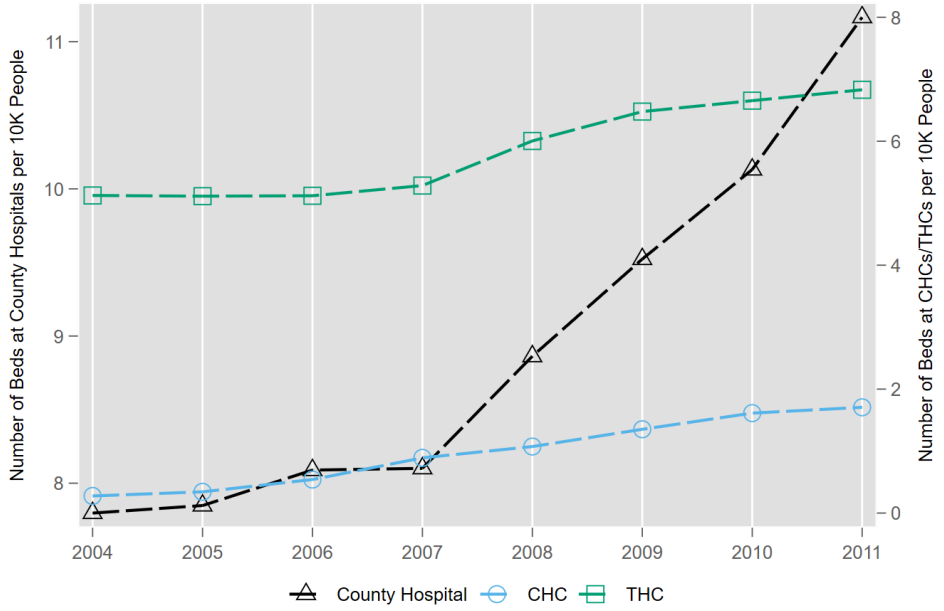


Figure C1: The Number of Hospital Beds Over Time

Notes: The data source is the 2004-2011 CHSY. The y-axis on the left is the number of beds at county hospitals per 10,000 people and the y-axis on the right is the number of beds at CHCs or THCs per 10,000 people over the 2004-2011 period.

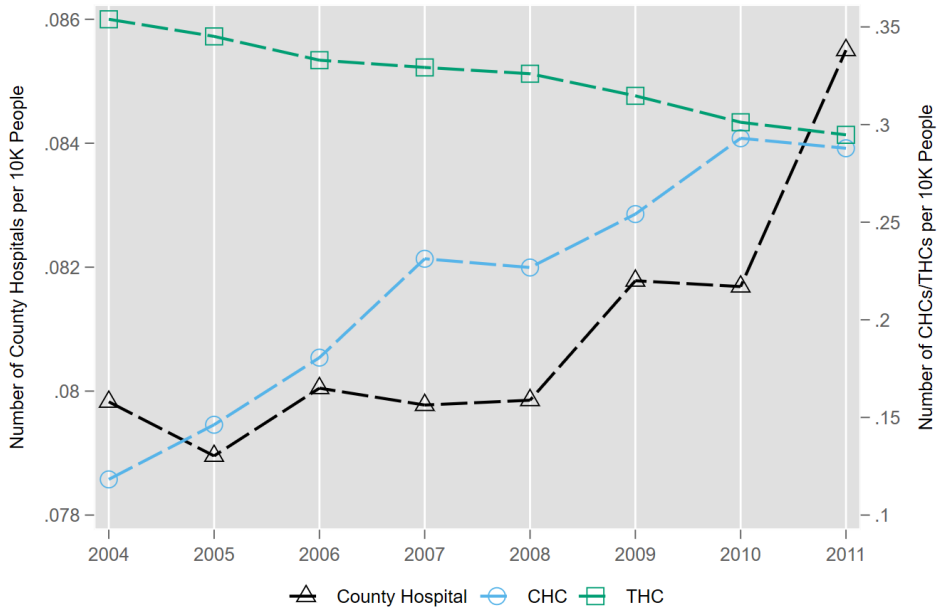


Figure C2: The Number of Medical Institutions Over Time

Notes: The data source is the 2004 to 2011 CHSY. The y-axis on the left is the number of county hospitals per 10,000 people and the y-axis on the right is the number of CHCs or THCs per 10,000 people over the 2004-2011 period.

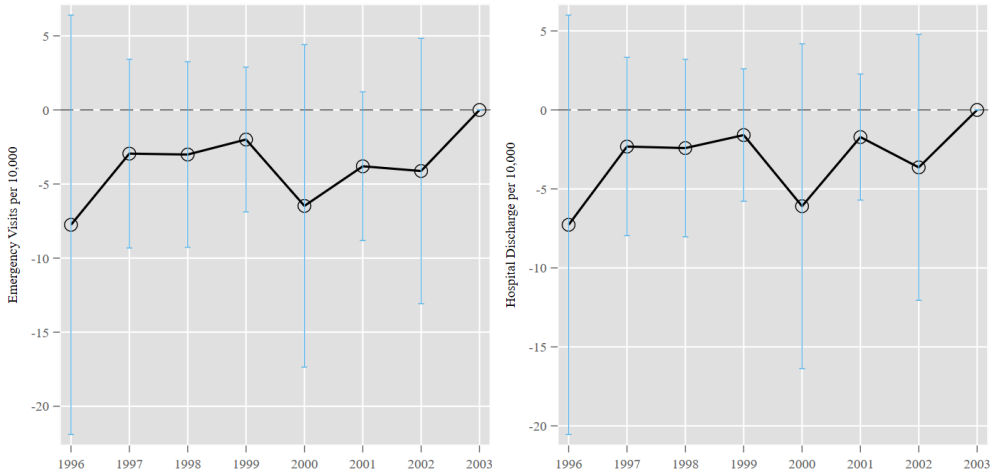


Figure C3: Parallel Trends for the NCMS Effect on Other Healthcare Outcomes

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.

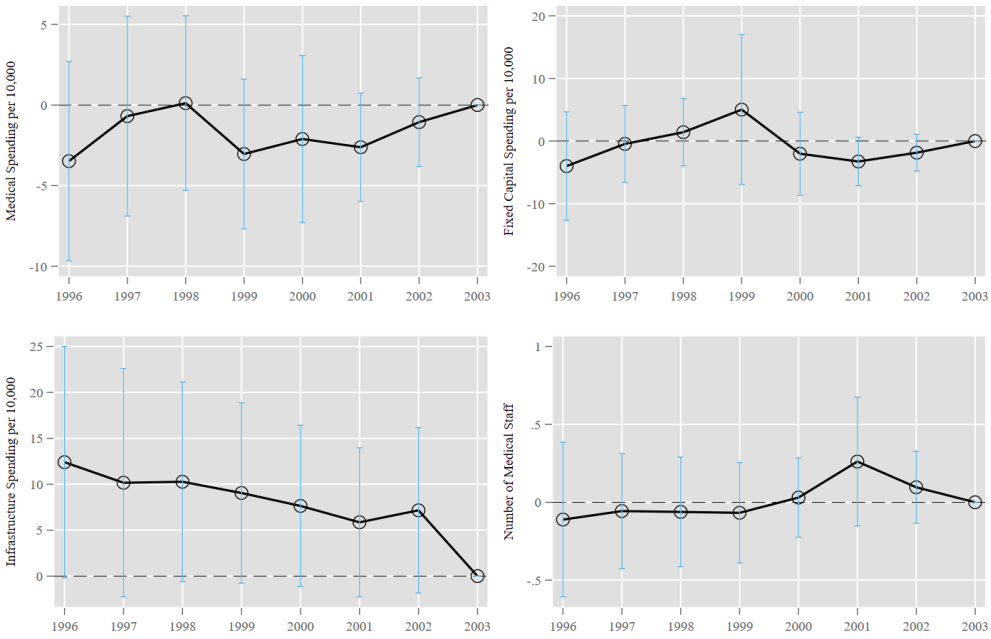


Figure C4: Parallel Trends for the NCMS Effect on Healthcare Spending

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.

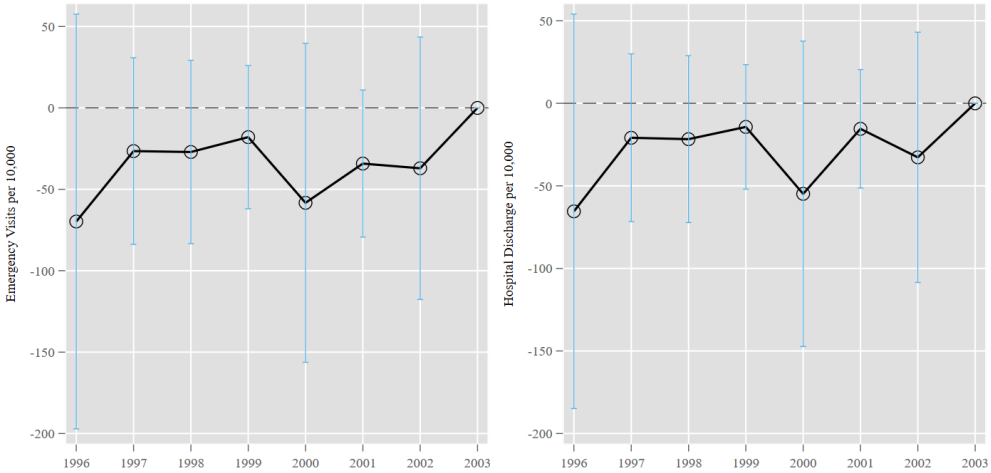


Figure C5: Event-Study Estimates by NCMS Expansion Speed on Other Outcomes

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.

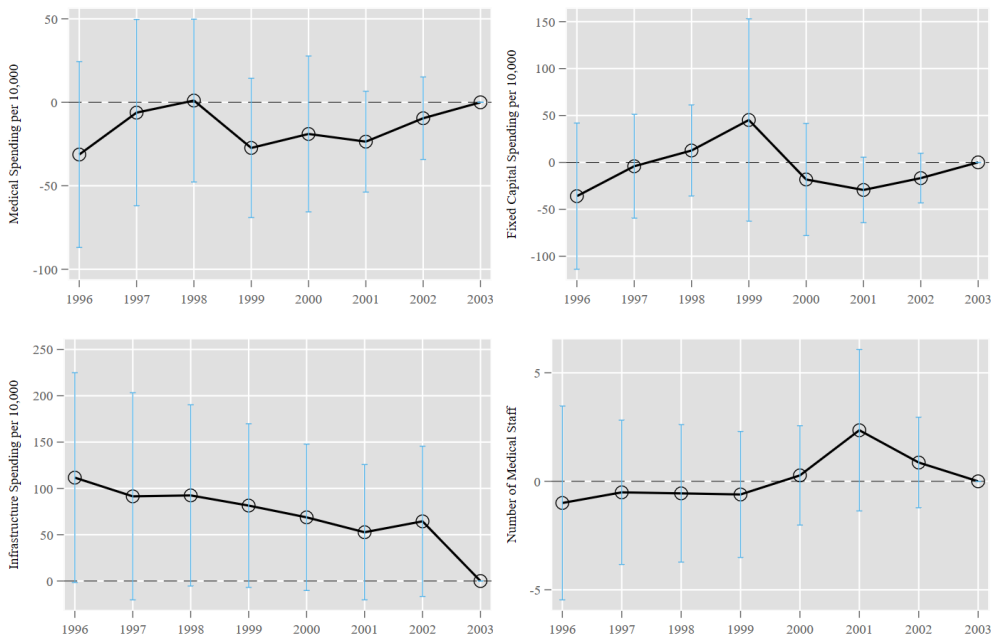


Figure C6: Event-Study Estimates by NCMS Expansion Speed on Healthcare Spending

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.

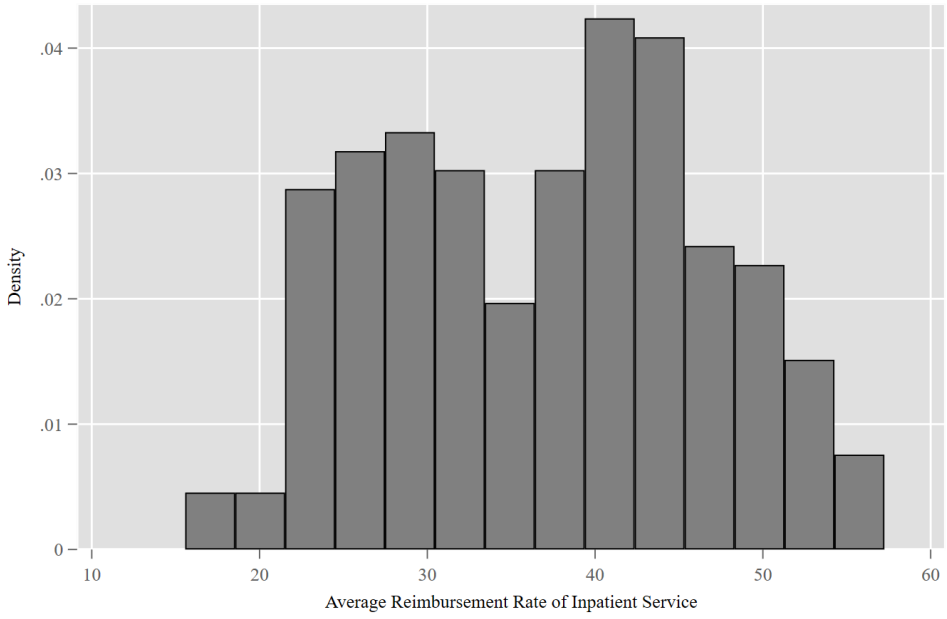


Figure C7: Distribution of the NCMS Reimbursement for Inpatient Service

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.

Table C1: NCMS Implementation Across Provinces

	2002	2003	2004	2005	2006	2007	2008
Beijing	Pilot		Full				
Tianjin			Pilot			Full	
Hebei		Pilot					Full
Shanxi			Pilot				Full
Liaoning			Pilot			Full	
Jilin		Pilot				Full	
Heilongjiang			Pilot				Full
Shanghai		Pilot	Full				
Jiangsu		Pilot		Full			
Zhejiang		Pilot			Full		
Anhui		Pilot					Full
Fujian		Pilot				Full	
Jiangxi		Pilot					Full
Shandong		Pilot				Full	
Henan		Pilot					Full
Hubei		Pilot					Full
Hunan		Pilot					Full
Guangdong	Pilot						Full
Guangxi		Pilot					Full
Hainan		Pilot			Full		
Chongqing		Pilot				Full	
Sichuan		Pilot					Full
Guizhou		Pilot				Full	
Yunnan		Pilot				Full	
Shaanxi			Pilot			Full	
Gansu		Pilot					Full
Qinghai		Pilot		Full			
Ningxia		Pilot					Full
Xinjiang		Pilot					Full

Notes: The data source is the NCMS development report from Chen and Zhang (2013). "Pilot" denotes when each province participated the piloting stage of the NCMS. "Full" indicates that the province fully covered all rural residents.

Table C2: 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 C3: 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 C4: 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 10,000 People	59.3	6.6	42.1	72.8	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 C5: 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.

Table C6: 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 C7: Robustness Checks of the NCMS's Effects on Medical Expenditures in Cities

	(1) Baseline	(2) No Region-Year FE	(3) No Economic Controls	(4) No Controls	(5) Unweighted Baseline
			Panel A. Total Consumption per Capita		
NNCMS rate	450.371	385.529	-278.131	-778.694	446.794
	(501.174)	(458.299)	(551.924)	(687.868)	(418.072)
R-squared	0.994	0.993	0.987	0.985	0.994
Mean	8,816	8,816	8,816	8,816	8,816
			Panel B. Medical Expenditures per Capita		
NCMS rate	109.120	133.045**	95.849	79.109	76.645
	(74.834)	(64.123)	(80.524)	(66.182)	(64.403)
R-squared	0.931	0.918	0.918	0.910	0.945
Mean	641.8	641.8	641.8	641.8	641.8
			Panel C. Ratio of Medical Expenditures to Consumption		
NCMS rate	0.002	0.004	0.003	0.003	0.002
	(0.005)	(0.005)	(0.004)	(0.003)	(0.004)
R-squared	0.907	0.890	0.903	0.898	0.912
Mean	0.0732	0.0732	0.0732	0.0732	0.0732

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), and disposable income in rural and urban areas (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.

Table C8: 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 C9: 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 C10: Robustness Checks of the NCMS's Effects on Healthcare Utilization With the NRPS

	(1) Total	(2) City hospital	(3) CHC	(4) County hospital	(5) THC
	Panel A. Outpatient Services Utilization				
NCMS rate	-0.056	-0.023	-0.085	0.084	0.069
	(0.051)	(0.043)	(0.438)	(0.057)	(0.139)
Mean	15293	5726	602.4	3599	5365
Observations	173	173	173	173	171
	Panel B. Inpatient Services Utilization				
NCMS rate	0.124*	0.040	1.573*	0.123**	0.360*
	(0.066)	(0.035)	(0.855)	(0.048)	(0.184)
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 2004-2011 period as well as rural-share-specific linear trends. 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 C11: 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.