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Assessing the impact of public insurance on healthcare utilization and mortality: A nationwide study in China

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ABSTRACT

We investigate the effects of a significant health insurance expansion in rural China known as the New Cooperative Medical Scheme (NCMS). Our analysis is based on a nationwide dataset spanning from 2004 to 2011. We find that the NCMS effectively increases healthcare utilization, particularly inpatient admissions, and reduces the incidence for infectious diseases. In addition to the increased healthcare utilization, the reduction in the incidence for infectious diseases can be attributed to improved health knowledge and health behavior, both of which are associated with the expansion of insurance coverage. Our findings affirm the importance of insurance coverage in safeguarding low-income individuals from the adverse health consequences linked to infectious diseases.

1. Introduction

Since the 1990s, developing countries have taken significant steps to broaden healthcare coverage for low-income individuals without insurance. To illustrate, in 1993, Colombia initiated the expansion of national insurance programs to encompass low-income residents, followed by similar efforts in Ghana, Vietnam, and China in 2003, Mexico in 2005, Georgia in 2006, and Nicaragua in 2007. Despite the success in extending coverage, the effectiveness of public insurance programs in developing countries is often questioned, primarily due to the perceived limitations of these plans, such as restrictive benefits. For example, in 2014, approximately 36.26 % of medical expenses in low- and middle-income countries were paid out of pocket, in contrast to only 13.63 % in OECD countries.[1]

Indeed, unlike developed countries, public insurance programs in developing nations often exhibit limited effects. For instance, existing studies have demonstrated that public insurance programs in the United States significantly enhanced healthcare utilization and health outcomes for newly covered individuals (Borgschulte & Vogler, 2020; Chou et al., 2014; Goldin et al., 2021; Goodman-Bacon, 2018; Khatana et al., 2019; Miller et al., 2021; Swaminathan et al., 2018). In contrast, expanding health coverage for the low-income uninsured does not lead to increased healthcare utilization in countries such as Mexico (King et al., 2009), Nicaragua (Thornton et al., 2010), Georgia (Bauhoff et al., 2011), or India (Karan et al., 2017).[2]

Starting in 2003, China launched a substantial health insurance expansion program called the New Cooperative Medical Scheme (NCMS), with the goal of providing coverage to approximately 640 million previously uninsured rural residents by 2008. Although a large body of research has investigated the impact of the NCMS on healthcare utilization and health outcomes, the findings often depend on regional data and yield mixed results. In this study, we assess the effectiveness of the NCMS in enhancing healthcare utilization and health outcomes for the targeted rural population across the entire nation, using a comprehensive province-level dataset spanning from 2004 to 2011. This comprehensive data enables us to draw more generalized conclusions by assessing the program's effectiveness on a nationwide scale, as well as allows us to investigate the incidence and mortality associated with

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[1] For more detailed information, consult the WHO Global health expenditure database at https://apps.who.int/nha/databasefor more details.
[2] More details can be referred to the literature discussion paragraph of the Introduction.

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infectious diseases, an understudied yet important topic due to data limitations.

Our analysis relies on the plausibly exogenous temporal and geographical variations in the NCMS enrollment rate within a Two-Way Fixed Effect (TWFE) model, while controlling for the socio-economic characteristics of each province. Our findings indicate that the NCMS effectively increases the number of hospital admissions among rural residents nationwide. Specifically, a one-percentage-point increase in NCMS coverage results in a 0.13 percent increase in hospital admissions, equivalent to approximately 0.6 additional hospital stays per 10,000 people, despite the limited insurance benefits provided by the NCMS. We do not find evidence to support the effectiveness of the NCMS in increasing the overall use of outpatient care among rural residents. However, we observe a noteworthy and statistically significant increase in outpatient visits specifically in county hospitals. This constrained impact on outpatient services utilization is likely attributable to the more restrictive reimbursement rates set by the NCMS for outpatient services.

Furthermore, the increased healthcare utilization has demonstrably led to improved health outcomes. While the introduction of the NCMS does not appear to have a significant impact on all-cause mortality rates among rural residents, our analysis of disease-specific mortality rates reveals a substantial reduction in the overall incidence of infectious diseases, which is a vital health concern in developing countries. Drawing on extensive data from the China Health and Nutrition Survey (CHNS), we identify potential mechanisms contributing to these improved health outcomes, including higher vaccination rates (specifically for influenza) and increased awareness about healthy diets and healthy living. We employ an event study model to validate the common trend assumption that underpins our identification strategy, and our results remain robust across various sensitivity tests.

Our study is closely linked to an extensive body of research investigating the effects of the NCMS on healthcare utilization and health outcomes. Several studies have yielded findings that do not strongly support the effectiveness of the NCMS. For instance, Lei and Lin (2009) reported that, based on the 2000, 2004, and 2006 CHNS data, although the NCMS leads to an increase in the number of general physical examinations, it has little impact on the frequency of inpatient stays, outpatient visits, or health outcomes. Additionally, Yip et al. (2008) found, using surveys from 2002 to 2005 along with a differences-in-differences (DID) approach, that the NCMS does not significantly increase outpatient visits. Meanwhile, Babiarz et al. (2012) conducted an estimation using a DID model with data from two waves of surveys (2005 and 2008) from five provinces in China and found limited evidence that NCMS enrollment increases the likelihood of seeking healthcare when individuals are unwell. Among the papers examining the health effects of the NCMS, Cheng et al. (2015) used panel data from the Chinese Longitudinal Healthy Longevity Survey with a DID approach, revealing that the insurance notably improves cognitive functions among rural elderly individuals but has little effect on other health outcomes, including general health status and mortality rate. Finally, Lei and Lin (2009), using the CHNS data with individual fixed effects, did not identify significant health benefits resulting from the NCMS.

Conversely, other studies provide evidence supporting the effectiveness of the NCMS in increasing healthcare utilization and enhancing health outcomes. For instance, Wagstaff et al. (2009) employed a DID design using data from the National Health Service Survey (NHSS) for 2003 and 2005, covering 12 provinces. Their findings reveal that the NCMS increases the frequency of inpatient stays and outpatient visits, particularly at township health centers. Similarly, Liu (2016) utilized a DID model with data from the CHNS spanning from 1993 to 2011. Their study demonstrates that the NCMS effectively insures households against health-related financial shocks and aids them in investing in their children's education. The most recent research conducted by Huang and Wu (2020) capitalizes on the enhancements in insurance benefits following the integration of rural-urban insurance in 2009. Using a staggered DID design, this study illustrates that the increased reimbursement rates increase the utilization of inpatient care by middle-aged and older residents, and lower their likelihood of having high blood pressure. Furthermore, Gruber et al. (2023), utilizing mortality data for 161 counties from the China Death Surveillance Point Dataset (DSP) spanning from 2004 to 2012, reports that the NCMS has saved approximately 550,000 lives annually during 2004–2007, with even greater life-saving impacts, exceeding one million lives saved each year from 2008 onwards.

Consistent with this line of literature, we provide supportive evidence based on a nationwide dataset for the effectiveness of the NCMS program. In particular, we find that the NCMS effectively increases rural beneficiaries' use of inpatient care, as well as outpatient care in county hospitals. In examining the NCMS' effect on health outcomes, our study finds no significant impacts on all-cause mortality, which contradicts the life-saving effects by Gruber et al. (2023). Nevertheless, our study does support the program's efficacy in reducing the incidence of infectious diseases.

Moreover, our study distinguishes itself from the aforementioned literature by leveraging national data encompassing all provinces in China. This comprehensive approach enables us to assess the program's effectiveness on a nationwide scale. Furthermore, our research concentrates on health outcomes associated with infectious diseases, a relatively understudied area due to data limitations. By utilizing province-level mortality data from the China Statistical Year Book and the Chinese Center for Disease Control and Prevention (CCDC), we are able to investigate the impact of the NCMS on both all-cause mortality and mortality resulting from infectious diseases. Crucially, we delve into various mechanisms underpinning the NCMS's efficacy in combating infectious diseases. Our findings indicate that insurance coverage for rural residents in China promotes vaccination and enhances health knowledge among the less educated individuals in rural communities.

In a broader context, our study is built on studies concerning the effectiveness of public health insurance expansion in both developed and developing countries. Research conducted in developed countries has consistently demonstrated that the expansion of health insurance coverage results in increased healthcare utilization (Finkelstein et al., 2012; Kolstad & Kowalski, 2012; Sommers et al., 2012), protection against catastrophic healthcare expenditures (Finkelstein et al., 2012), and significant reductions in mortality (Borgschulte & Vogler, 2020; Goldin et al., 2021; Goodman-Bacon, 2018; Khatana et al., 2019; Swaminathan et al., 2018). Utilizing Medicaid expansion as a natural experiment, studies in the United States investigate the effects of health insurance on low-income mothers and children (Currie and Gruber, 1996a, 1996b, 2001; Hanratty, 1996; Chou et al., 2014; Goodman-Bacon, 2018), while Finkelstein et al. (2012), Sommers et al. (2012), Borgschulte and Vogler (2020), Goldin et al. (2021), and Miller et al. (2021) focus on impoverished adults. Studies that concentrate on non-impoverished populations explore the impacts of health insurance on Medicare beneficiaries (Card et al., 2009; Chay et al., 2010), patients with specific diseases like end-stage renal disease (Swaminathan et al., 2018) or cardiovascular disease (Khatana et al., 2019), and the general public (Kolstad & Kowalski, 2012).

However, research on the effects of insurance expansion in developing countries yields mixed results. Studies investigating the impact of the Subsidized Regime in Colombia indicate that the program increases the utilization of preventive services and curative care (Gaviria et al., 2006; Giedion et al., 2009; Miller et al., 2013; Trujillo et al., 2005). In contrast, a number of studies examining insurance programs in other developing countries reveal only limited effects. For instance, King et al. (2009) discovered that the Seguro Popular program in Mexico does not result in increased healthcare utilization, while Sosa-Rubí et al. (2009) reported that it does lead to increased use of diabetic care. Other studies find that health insurance for the poor does not lead to increased healthcare utilization in Nicaragua (Thornton et al., 2010), Georgia

(Bauhoff et al., 2011), or India (Karan et al., 2017). Assessments of the impact of the Health Care Funds for the Poor program in Vietnam also produce mixed findings: Wagstaff (2007) observed an increase in inpatient and outpatient care utilization, Axelson et al. (2009) reported a small increase in overall healthcare use, and Wagstaff (2010) found a null effect of this program on healthcare utilization.[3] Our study contributes valuable evidence in evaluating the effectiveness of public insurance programs and their potential mechanisms, which can assist policymakers in better targeting individuals in low- and middle-income countries (LMICs).

This paper proceeds as follows. Section 2 describes the institutional background of the insurance expansion in rural China. Section 3 provides an overview of the data and presents summary statistics. Section 4 explains the empirical model used in the estimation. Section 5 reports the NCMS's effects on healthcare utilization and mortality rates, investigates the potential mechanisms, and presents robustness checks. Section 6 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 UEBMS, 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 were 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. The New Cooperative Medical Scheme (NCMS)

The history of the NCMS dates back to the 1990s. While the low-income individuals in developed countries mainly live in cities, economically disadvantaged people in China are concentrated in rural areas, and especially in mountainous 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 out-of-pocket. To reduce the financial burden associated with healthcare use, the Chinese government initiated the NCMS, one of the largest health insurance programs in history, aiming to fully cover the 640 million otherwise uninsured rural residents of China by 2008.

The NCMS was rolled out on a staggered basis at the county level. In 2003, 300 counties were chosen to pilot the program by each provincial government based on criterias such as financial conditions, healthcare needs and health capacity. As the program was expanded across the country, the number of participating counties was over 600 by 2005 (Liu, 2004). However, there is substantial variation in the progress of the expansion across provinces. As shown in Appendix Table A1, provinces differ in both the year when they participated in the NCMS and the year of full expansion.

The NCMS program has achieved great success in expanding coverage to rural residents. As shown in Fig. 1, the enrollment rate increases rapidly from 18 percent in 2004 to 86 percent in 2007, and to over 95 percent in 2008. Although participation in the NCMS was voluntary, the heavily subsidized premiums in the program offered sufficient incentives to ensure fast and full enrollment. The central government determines the minimum contribution paid by the participants and by the local governments.[4] In practice, participants paid only around one-fifth of total premiums (10 yuan in 2004), with local and central governments subsidizing the rest. Moreover, 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), leading to local governments actively promoting NCMS enrollment. As anecdotal evidence, village leaders often visited the non-participating households in person to assist in enrollment.

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 A2 reports the results using flexible forms of these economic controls. Column 1 estimates a simple relationship between the unemployment rate and the NCMS enrollment rate. Column 2 adds the basic demographic controls for each province, such as population, education, age structure, percentage married and female, and the ratio of dependent persons. Column 3 allows for flexible quadratic and cubic forms of the unemployment rate. Column 4 adds other economic conditions in cities, such as consumption, medical expenses, and the average income in 2014 yuan. Column 5 includes all possible economic controls, and takes flexible forms of the unemployment rate and the average income per capita (2014 yuan) in rural areas. Column 1 estimates that a one-percentage- point increase in the unemployment rate is correlated (without statistical significance) with an approximate 0.06 percentage point increase in the NCMS enrollment rate. The flexible forms in columns 4 and 5 point to a potential relationship between the average income per capita of rural residents and the NCMS enrollment rate. We address the endogeneity concern regarding the NCMS enrollment rate in sections 5.2 and 5.3. 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 and health outcome.

Despite heterogeneities in benefit designs across provinces,[5] the NCMS generally 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). Additionally, 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 Township Health Centers (THCs) and Community Health Centers (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).

[3] For a comprehensive review, refer to Acharya et al. (2013).

[4] 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.

[5] For instance, the NCMS plans in different places can vary in benefits such as deductibles, coinsurance rates, and ceilings (You & Kobayashi, 2009).

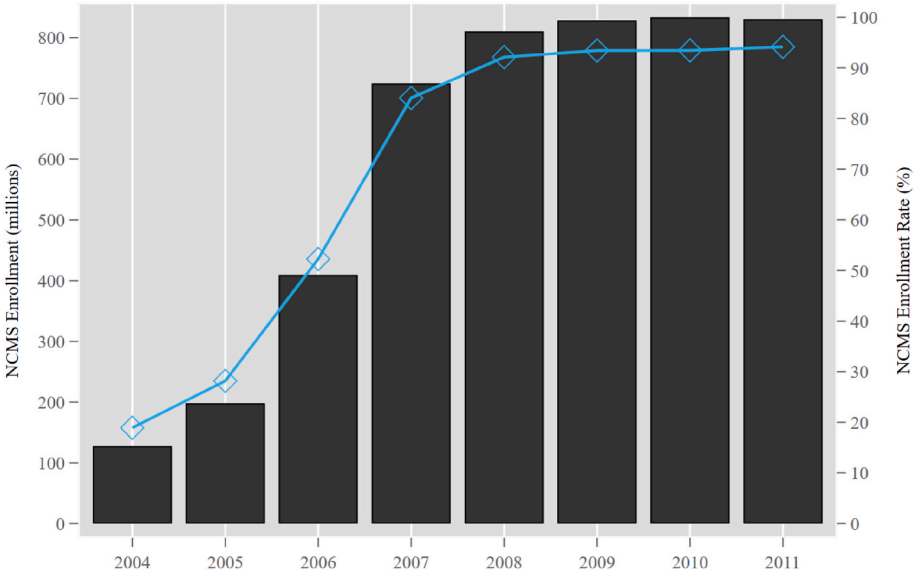

Fig. 1. NCMS Enrollment over Time
Notes: The data source is the NCMS development report by Chen and Zhang (2013). The y-axis on the left is the number of enrollees. The y-axis on the right is the enrollment rate, which is calculated by dividing the rural population by the number of enrollees over the 2004–2011 period.

2.3. Medical providers in rural China

Healthcare services delivery in rural China has been organized in a three-tier public provision system (Babiarz et al., 2012; Wang, 2004). 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 residents within the community 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 nearby city hospitals for better-quality treatment out of their preferences or because their condition cannot be treated at THCs or county hospitals.[6]

3. Data

3.1. Dependent variables

To explore the NCMS's effects, we rely on several data sources for annual information of each province in China. Our healthcare utilization 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 representative health-related information for each province across China.

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 per 10,000 people in each province from 2004 to 2011. In order to investigate the heterogeneous effects of the NCMS on healthcare use across providers at different levels in the three-tier rural medical system, we then categorize outpatient visits and inpatient stays by city hospitals, county hospitals, CHCs, and THCs.

The second set of dependent variables on health outcome is obtained from the annual China Statistical Yearbook (CSY). The CSY provides information on all-cause mortality rate (deaths per 10,000 people) in each province.[7] We also 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. The rates of incidence and mortality associated with infectious diseases from the CCDC is calculated per 100,000 people.

3.2. Independent variables

NCMS Enrollment: Our data on the NCMS policy are derived from the annual CHSY for years 2007–2011 and the report on the NCMS's development by Chen and Zhang (2013) for years 2004–2006. The CHSY reports NCMS enrollment and the report presents information on NCMS enrollment, NCMS beneficiaries, and the program's reimbursements for inpatient care in graphs for each province. 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 the period 2004–2006. For example, the report provides specific NCMS enrollment numbers for Beijing in 2004 and 2006. For the year 2005, the corresponding number is plotted in a

[6] 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.

[7] The original scale in the raw data is deaths per 1000 people. To keep consistency for all of our outcomes of interest, we re-scale the mortality rate to deaths per 10,000 people.

scattered graph. We use the y-scale information and a software tool to proportionately calculate the NCMS enrollment for year 2005.[8] 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.

Control Variables: The data source for province-level controls is the annual China Statistical Yearbook (CSY) for the years 1996–2011. The CSY contains demographic information for each province, including information on the total population, population by rural or urban status, the share of individuals who are married, female, having different levels of education (e.g., high school graduation, college, and above), belonging to different age groups (e.g., aged 14 and above, aged 64 and above), as well as the share dependent people (children and elderly parents) in a household.[9] 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.

3.3. Complementary data

To explore the mechanisms underlying the effectiveness of the NCMS, we use individual-level healthcare use information in the China Health and Nutrition Survey (CHNS). The CHNS is a representative longitudinal survey study that collects individual and household data for residents located in a sample of 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 7200 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. We 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.

We also supplement the main data with additional 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.[10] The variables of interest in the CHY are 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.

3.4. Sample statistics

Starting with an insured rate of 19 percent in 2004, the average NCMS enrollment rate is approximately 75 percent over the 2004–2011 period.[11] In terms of healthcare utilization, 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. 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 accounts for seven percent among total consumption. Average healthcare spending per year in cities is about 856 yuan (2014 yuan), accounting for about seven percent of total consumption, which shares a similar proportion as rural people. The average disposable income in cities is close to 17,000 yuan (2014 yuan), while the average income in rural areas is around 6000 yuan (2014 yuan). See Appendix Table A3 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, and health outcomes. Exploiting the plausibly exogenous rollout of health insurance for rural residents, this model utilizes both within- and cross-province variation in the NCMS enrollment rate over time. Specifically, we estimate the following regression equation:

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

where Y_{pt} denotes the outcomes of interest in province p at year t standardized by per 10,000 people. We take logarithm of the outcome variable unless otherwise noted. $NCMS_{pt}$ denotes the continuous NCMS enrollment rate in province p in year t. The parameter of interest, δ, reports the effect of full NCMS expansion on outcomes of interest. We include province fixed effects η_p to control for time-invariant province-specific 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 (Goodman-Bacon, 2021; Stephens & Yang, 2014).[12] 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). We include urban consumption and medical expenses to remove the confounding effects from healthcare use by urban residents. In section 5.3, we also control for urban medical consumption in flexible forms as robustness checks. ϵ_{pt} denotes the standard error, which is clustered at

[8] 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. Also, we conduct a comparison between the raw data from the report and the data extracted from the software, revealing minimal differences. This finding helps alleviate concerns regarding potential measurement errors in our analysis.

[9] The urban or rural status of an individual is determined by his or her *hukou* status in 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.

[10] 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.

[11] In our data, several provinces have a maximum NCMS enrollment rate exceeding one primarily due to 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.

[12] 31 provinces in China can be categorized into five regions according to geographical location and economic conditions: eastern region, northern region, middle region, southern region, and western region. Provinces in the same region are similar in characteristics such as geography, government policy, and socio-economic conditions.

the province level and bootstrapped 1000 times to account for potential heteroscedasticity (in parentheses).

Our identification strategy assumes that absent the NCMS, healthcare use and health outcomes share similar secular trends between early- and later-adopter provinces, and between fast- and slow-expansion provinces. We test the common trend assumption by estimating an event study model:

$$ln(Y_{pt}) = \alpha_0 + NCMS_p \times \sum_{y=-6}^{9} \vartheta_y \mathbf{1}\{t - 2002 = y\}^{\#} + \eta_p + \mu_{rt} + X_{pt}\ \beta + \epsilon_{pt} \quad (2)$$

where $NCMS_p$ denotes province p's NCMS enrollment rate in 2004 when testing for exogeneity of the timing of the NCMS, and represents the annual increment of NCMS enrollment rate to achieving full coverage when testing the exogeneity of the speed of the NCMS rollout.[13] The event-year dummies $\mathbf{1}\{t - 2002 = y\}$, are equal to one when the year of observations is t = 1996…, 2002, 2003…, 2005…, 2007, …, 2010, 2011, respectively. We use 2002, the year before the NCMS begins, as the reference year. 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 and CSY.[14] 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.

5. Results

In this section, our primary objective is to assess the impacts of the NCMS on healthcare utilization and mortality rates. We begin by quantifying the effects of the NCMS on these two key outcomes. Subsequently, we delve into the underlying mechanisms that might elucidate how the NCMS contributes to the improvement of these outcomes. Furthermore, we present compelling evidence to substantiate our chosen identification strategy and conduct rigorous tests to ensure the robustness and reliability of our main results.

5.1. Effect of NCMS on healthcare use and mortality

Table 1 shows the results for healthcare use and health outcomes from the estimation Equation (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.

Inpatient Stays: We find that once rural residents are enrolled in the NCMS, they tend to utilize inpatient services more frequently. This finding aligns with expectations, as the program offers substantial benefits for hospital stays. 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 0.126 percent (about 0.6 hospital stays per 10,000 people). The larger estimate in column 2, 0.156 percent as compared to the baseline estimate of 0.126 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 3 percentage points. Column 3 provides further evidence that omitting economic controls for urban residents leads to an overestimation of the NCMS's effect by 1.5 percentage points. Column 4 indicates that omitting both demographic controls and economic controls leads to an overestimation by about 6.6 percentage points, which points to the importance of controlling for time-varying demographic and social-economic conditions across provinces and regions. The similar unweighted coefficient 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.

Table 1
The NCMS's effects on healthcare use and all-cause mortality.

(1)		(2)	(3)	(4)
Baseline		No Region-Year FE	No Economic Controls	No Controls
Panel A. Inpatient Stays				
NCMS rate	0.126**	0.156**	0.141***	0.192***
	(0.063)	(0.068)	(0.050)	(0.048)
Mean	479.4	479.4	479.4	479.4
Observations	216	216	217	217
Panel B. Outpatient Visits				
NCMS rate	−0.025	−0.029	−0.054	−0.078
	(0.065)	(0.052)	(0.062)	(0.061)
Mean	15,293	15,293	15,293	15,293
Observations	231	231	232	232
Panel C. All-cause Mortality				
NCMS rate	0.017	0.018	0.017	0.057**
	(0.034)	(0.028)	(0.023)	(0.023)
Mean	4.118	4.118	4.118	4.118
Observations	231	231	232	232

Notes: Each cell reports estimates from a separate specification. The dependent variables are inpatient stays (Panel A), outpatient visits (Panel B), and mortality rate (Panel C) 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 mean of each dependent variable is the average in 2004 per 10,000 people and is weighted by the rural population in 2003. Standard errors are clustered at the province level and bootstrapped 1000 times to account for potential heteroscedasticity (in parentheses). ***p < 0.01, **p < 0.05, *p < 0.10.

Panel A of Table 2 reports the NCMS's effects by urban (city hospital) and rural medical providers (county hospitals, and township health centers). The NCMS significantly increases hospital stays in rural healthcare providers. Notably, rural residents' visits to city hospitals are barely affected, which suggests that our estimates mainly capture the effect of NCMS on rural residents, without any spillover effects to urban residents. Among the rural providers, the hierarchical reimbursement scheme under the NCMS creates larger incentives for rural residents to use inpatient services provided by primary healthcare providers (CHC and THC). Panel A of Table 2 shows that the positive effect of the NCMS on inpatient services utilization is mainly produced by the increased inpatient stays in primary care providers at CHCs and THCs. For an one-percentage-point increase in NCMS coverage rate, the largest effect is at CHCs with a 1.92 percent increase; followed by at THCs, with a 0.532 percent increase. The substantial point estimates regarding inpatient stays in CHCs presented in Panel A of Table 2 can be attributed to the infrequent utilization of CHCs by rural residents for inpatient stays.

[13] The annual increment of NCMS enrollment rate is calculated by dividing the total enrollment gains between 2004 and 2011 by the number of years taken to achieve full expansion.

[14] 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. 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.

Table 2
The NCMS's effects on healthcare use by provider.

	(1)	(2)	(3)	(4)
	City hospital	CHC	County hospital	THC
Panel A. Inpatient Stays				
NCMS rate	0.059	1.920**	0.080	0.532**
	(0.051)	(0.850)	(0.069)	(0.267)
Mean	183.4	0.995	169.1	127.6
Observations	231	216	231	225
Panel B. Outpatient Visits				
NCMS rate	−0.042	0.330	0.075**	0.144
	(0.038)	(0.455)	(0.034)	(0.164)
Mean	5726	602.4	3599	5365
Observations	231	231	231	225

Notes: Each cell reports estimates from a separate specification on inpatient use (Panel A) and outpatient use (Panel B) per 10,000 people by provider 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. 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. Standard errors are clustered at the province level and bootstrapped 1000 times to account for potential heteroscedasticity (in parentheses).
***p < 0.01, **p < 0.05, *p < 0.10.

Consequently, even a small numerical increase in inpatient stays translates into a more pronounced change in percentage points.

Outpatient Visits: We do not find any significant effect in rural residents' overall 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 0.025 percent decrease in outpatient visits among rural residents (approximately 3.82 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.

Panel B of Table 2 reports the heterogeneous effects of the NCMS across providers of different levels: i.e., primary care providers (THCs and CHCs), county hospitals, and city hospitals, ranked from the lowest to the highest in terms of both service price and service quality. We find that the NCMS has smaller effects on outpatient visits at higher-level medical providers: a one-percentage- point increment in the NCMS enrollment rate respectively increases outpatient visits to county hospitals by 0.075 percent (about 2.7 visits per 10,000 people), THCs by 0.144 percent (about 7.7 visits per 10,000 people), and CHCs by 0.33 percent (about 2 visits per 10,000 people), but decreases outpatient visits to city hospitals by 0.042 percent (about 2.4 visits per 10,000 people). The statistical significance is observed solely in the estimate for outpatient utilization at county hospitals. Conversely, the lack of statistical power in other coefficients indicates that the restrictive benefit design for outpatient services fails to provide adequate incentives for rural residents to utilize outpatient services.

All-Cause Mortality: Panel C of Table 1 shows the number of all-cause deaths per 100,000 people associated with insurance coverage for rural residents. The baseline estimate in column 1 is small in size and insignificant (0.0002 deaths per 100,000 people associated with one-percentage-point increase of NCMS coverage relative to the mean of 4.118 deaths per 100,000 people), suggesting that the increased healthcare use from the NCMS coverage seem to have little effects on all-cause mortality. 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 larger and statistically significant, presumably because that the omission of variables might overestimate the true effects.

Cause-Specific Mortality: The estimates on 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 preventive and highly infectious diseases such as AIDS/HIV and hepatitis, along with catastrophic diseases.[15] Our dataset provides comprehensive mortality data related to infectious diseases, which are widely recognized as significant factors affecting health in developing nations. This dataset enables us to investigate the efficacy of public insurance coverage in safeguarding rural residents against infectious diseases.

Panel A of Table 3 reports the NCMS's effects on incidences per 100,000 people across seven common infectious diseases in developing countries. Overall, the NCMS is effective in reducing the total incidence rate for infectious diseases. One-percentage-point increase in the NCMS enrollment rate significantly reduces the incidence of infectious diseases by 1.88 cases per 100,000 people (0.36 percent) (column 1). Columns 2 to 8 present estimates for the respective impacts of the NCMS on the incidence of particular infectious diseases. Although the NCMS demonstrates overall effectiveness in lowering infectious disease incidence, our subsample analysis by infectious disease type fails to substantiate its efficacy in reducing the incidence of specific diseases, namely AIDS, tuberculosis, hepatitis, dengue fever, or rabies. This suggests that the NCMS's efficacy may be evident in other communicable diseases common in rural China but not documented in our data, such as respiratory infections (e.g., Influenza and Pneumonia), vector-borne diseases (e.g., Malaria), schistosomiasis, zoonotic diseases, and hantavirus infections.

Panel B of Table 3 reports the estimates of the NCMS's effects on mortality caused by infectious diseases per 100,000 people. The NCMS exhibits a small and statistically insignificant effect on the mortality rate associated with infectious diseases. Subsample analysis focusing on six common infectious diseases reveals no evidence of effect heterogeneities, providing additional support for the ineffectiveness of the NCMS in reducing mortality related to infectious diseases.

Mechanisms: We have shown that the introduction of the NCMS effectively increases rural patients' use of inpatient service and outpatient services. While failing to reduce the all-cause mortality rate, it decreases the incidence rate of infectious diseases. To explore potential mechanisms, we leverage the extensive data on vaccination records and health-related knowledge sourced from the China Health and Nutrition Survey (CHNS) to demonstrate that the influence of the NCMS extends to encouraging greater rates of vaccination and improved health

[15] 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 3
Effects of the NCMS on the incidence and the mortality rate by disease.

Panel A. Incidence Rate by Infectious Disease								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Infection	Measles	AIDS	HIV	Tuberculosis	Hepatitis	Dengue fever	Rabies
NCMS rate	−187.513**	9.416	0.278	1.390	−4.988	−53.177	−0.051	−0.103
	(87.724)	(6.956)	(0.601)	(1.519)	(9.053)	(35.011)	(0.313)	(0.239)
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 Infectious Disease							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Infection	Measles	AIDS	HIV	Tuberculosis	Hepatitis	Rabies
NCMS rate	0.314	−0.007	−0.065	0.007	0.053	0.074	−0.105
	(0.784)	(0.077)	(0.321)	(0.453)	(0.055)	(0.061)	(0.240)
R-squared	0.898	0.557	0.847	0.881	0.882	0.820	0.873
Mean	1.605	0.006	0.390	0.316	0.231	0.075	0.236
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. Some diseases such as measles have smaller sample sizes due to the absence of data from certain provinces. The detailed incidence rate and mortality rate by disease data are from the Chinese Center for Disease Control and Prevention. AIDS is the late stage of HIV infection that occurs when the body's immune system is badly damaged because of the virus. 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. The mean of the dependent variable is the average in 2004, weighted by the rural population in 2003. Standard errors are clustered at the province level and bootstrapped 1000 times to account for potential heteroscedasticity (in parentheses). ***p < 0.01, **p < 0.05, *p < 0.10.

knowledge among the population. The specific model is as follows:

$$Y_{ipt} = \beta_0 + \beta_1 NCMS_{ipt} + \beta_2 X_{ipt} + \tau_t + \alpha_p + \epsilon_{ipt} \quad (3)$$

where Y_{ipt} represents different measures of health-related outcomes 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 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.

As shown in Appendix Tables A4-A7, the NCMS effectively enhances rural beneficiaries' health awareness and health behavior through increased interactions with healthcare professionals following insurance enrollment. In particular, Appendix Table A4 shows that the NCMS, with robust statistical significance, increases vaccination rates for Influenza Encephalitis, and Encephalitis B.[16] Additionally, Appendix Table A5 reveals that the NCMS contributes to a nuanced improvement in rural beneficiaries' health awareness. This improvement is reflected in their increased inclination to perceive the consumption of proteins (e.g., beans and dairy products) and engagement in physical activities as beneficial to their health, while expressing a disfavor toward eating snacks and excessive video game playing. Moreover, the heightened interaction with healthcare professionals facilitated by the NCMS induces positive changes in the health behavior of rural beneficiaries. This is evidenced by reduced alcohol consumption (Appendix Table A6) and increased consumption of tea and water (Appendix Table A7).

[16] Despite the lack of statistical significance, the estimates for vaccinations such as Measles, Hepatitis A and B are substantial and economically meaningful. For instance, the NCMS coverage increases the probability of rural residents receiving the Hepatitis A vaccination by 16.9 percentage points, roughly a 78 percent increase relative to the average vaccination rate of 0.217. The absence of statistical power might be due to small sample sizes.

5.2. Common trend assumption

To test the exogeneity of the timing of the NCMS, Figure A1 reports the estimates of our outcomes of interest on the enrollment rate gains in 2004–2011 using specification Equation (2). Estimates prior to 2002 are statistically insignificant, which suggests that the growth rates of healthcare utilization 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, and a slightly upward trend in mortality rate.

To test whether the expansion progress of the NCMS program is exogenous, Figure A2 shows results of our outcomes of interest (i.e., inpatient stays, outpatient visits, and mortality) on the NCMS's rollout speed. The statistically insignificant estimates before 2002 support the parallel assumption that healthcare utilization and health outcomes share similar trends between provinces expanding the NCMS faster and provinces that expand the program at a slower speed.

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 of economic variables in 1996–2004 and healthcare variables in 1996–2003.

$$y_{pt} = \alpha + \beta_0 NCMS^{2004} + \beta_1 NCMS^{2004} \times (t - 2004) + \xi_{pt} \quad (4)$$

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 A8 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 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 A8 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.

5.3. Robustness checks

Effects from Urban 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 A9 finds little significant effects of the NCMS for city residents.

Moreover, 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 A10 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.

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 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 to 2009 in which our outcome of interest is free from NRPS in Appendix Table A11.[17] The estimates on outpatient visits and inpatient care use are very robust to the main estimates in Tables 1 and 2 If anything, the magnitudes of the coefficients on total healthcare use and healthcare use at CHCs are larger than those of the baseline estimates. In summary, our baseline estimates are not biased by the contemporaneous rollout of the NRPS policy.

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 A12 reports little changes to our estimates.[18]

Effects from Economic Trends: Our identification assumption relies on the variation in NCMS enrollment within provinces. As discussed in section 2, one potential identification threat is that the NCMS's development might be endogenous to economic conditions, which may, in turn, be correlated with healthcare utilization. The balance tests in Table A8 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 A13 reports the estimates after including an interaction term between GDP per capita and time trends in our baseline specification (1). 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).

Bias from Heterogeneous Treatment Effects: Potential concerns arise regarding estimation bias attributable to heterogeneous and dynamic treatment effects in our model. Given the implementation of the NCMS scheme at varying speeds across provinces, the effect of the NCMS scheme might differ across years. The dynamic effects may stem from the fact that provinces implementing the scheme later learn from the experiences of early-adopters or that the benefits of the NCMS are getting more generous over time. The presence of dynamic treatment effects introduces the possibility of bias in the TWFE estimator with continuous treatment, as suggested by De Chaisemartin and d'Haultfoeuille (2020).

In response to this concern, we assess the magnitude of potential bias by reestimating the effects of the NCMS within a narrower time frame (2004–2009) and comparing these estimates with those derived from the complete sample window (2004–2011). If dynamic treatment effects pose a credible threat to our estimates, discernible differences in estimates across these two time spans are anticipated. Appendix Table A11 presents the re-estimated results using data from 2004 to 2009. The estimates on outpatient visits and inpatient care use are robust to the main estimates in Tables 1 and 2, which suggests that our baseline estimates are not affected by severe bias arising from heterogeneities in treatment effects within our contexts.

6. Conclusion

Using a comprehensive nationwide dataset, we have conducted an extensive analysis to gauge the impact of the NCMS program on healthcare utilization and health outcome among rural residents in China. Our findings reveal the effectiveness of the NCMS in enhancing healthcare utilization, and reducing the prevalence of infectious diseases. Notably, the NCMS has a significant and positive effect on the utilization of inpatient services within the rural population, corroborating findings from prior studies based on regional data (e.g., Wagstaff and Lindelow (2008) and Yi et al. (2009)). Our investigation further uncovers that the pronounced increase in inpatient services primarily stems from care provided at township health centers, community health centers, and county hospitals, aligning with results presented in Wagstaff (2007). For outpatient services, the NCMS coverage induces an increased utilization primarily observed in county hospitals, as opposed to THCs or CHCs, presumably due to the restrictive reimbursement rates for outpatient services. In addition, our analysis highlights the NCMS's role in diminishing the incidence of conditions generously covered by the program, such as infectious diseases.

Furthermore, our research delves deeper into the potential mechanisms underlying the NCMS's effectiveness in curbing the occurrence associated with infectious diseases, which are prevalent health concerns in developing nations. Our findings suggest that extending insurance coverage to rural residents plays a pivotal role in improving health awareness and stimulating health-promoting behaviors, reflected in

[17] 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.

[18] 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.

higher vaccination rates and enhanced understanding of healthy dietary and lifestyle practices. Consequently, this leads to a significant reduction in the prevalence of infectious diseases. Therefore, our study concludes that initiatives aimed at expanding health insurance coverage are essential in the fight against infectious diseases in developing countries. This is achieved through increased healthcare utilization, greater vaccination uptake, and the dissemination of health knowledge.

CRediT authorship contribution statement

Lin Lin: Conceptualization, Data curation, Formal analysis, Methodology, Software, Supervision, Validation, Writing – original draft, Writing – review & editing. **Xianhua Zai:** Conceptualization, Data curation, Formal analysis, Methodology, Resources, Software, Supervision, Visualization, Writing – original draft, Writing – review & editing.

Declaration of Competing interest

The authors declare that they have no relevant or material financial interests that relate to the research described in the paper.

Data availability

Data will be made available on request.

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Appendices.

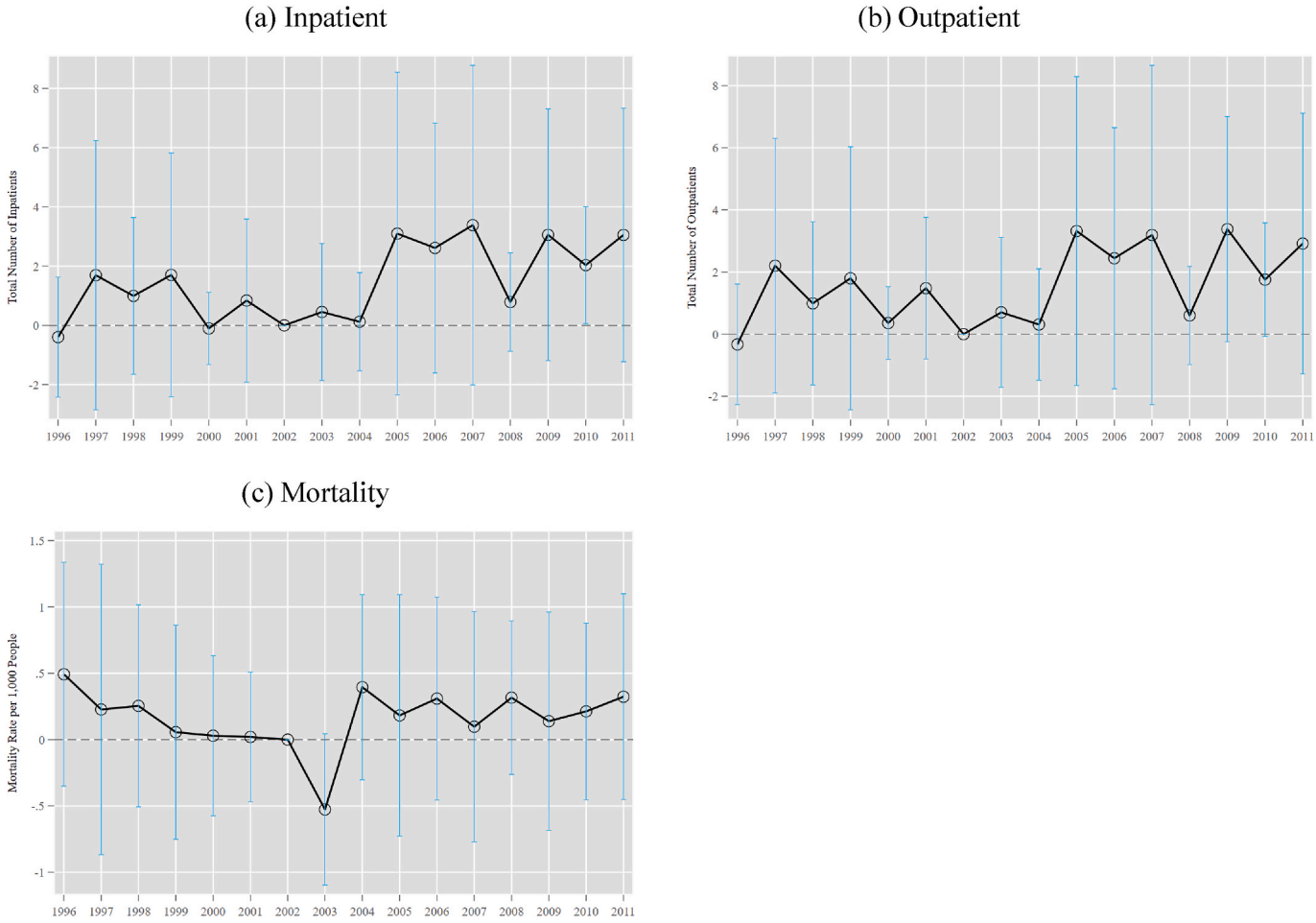

Fig. A1. Event-Study Estimates on NCMS Enrollment Rate Gains in 2004-2011
Notes: The data sources are the 1996–2003 CHY and the 2004–2011 CHSY and CSY. Each figure plots the event-study estimates in specification Equation (2) with the

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.

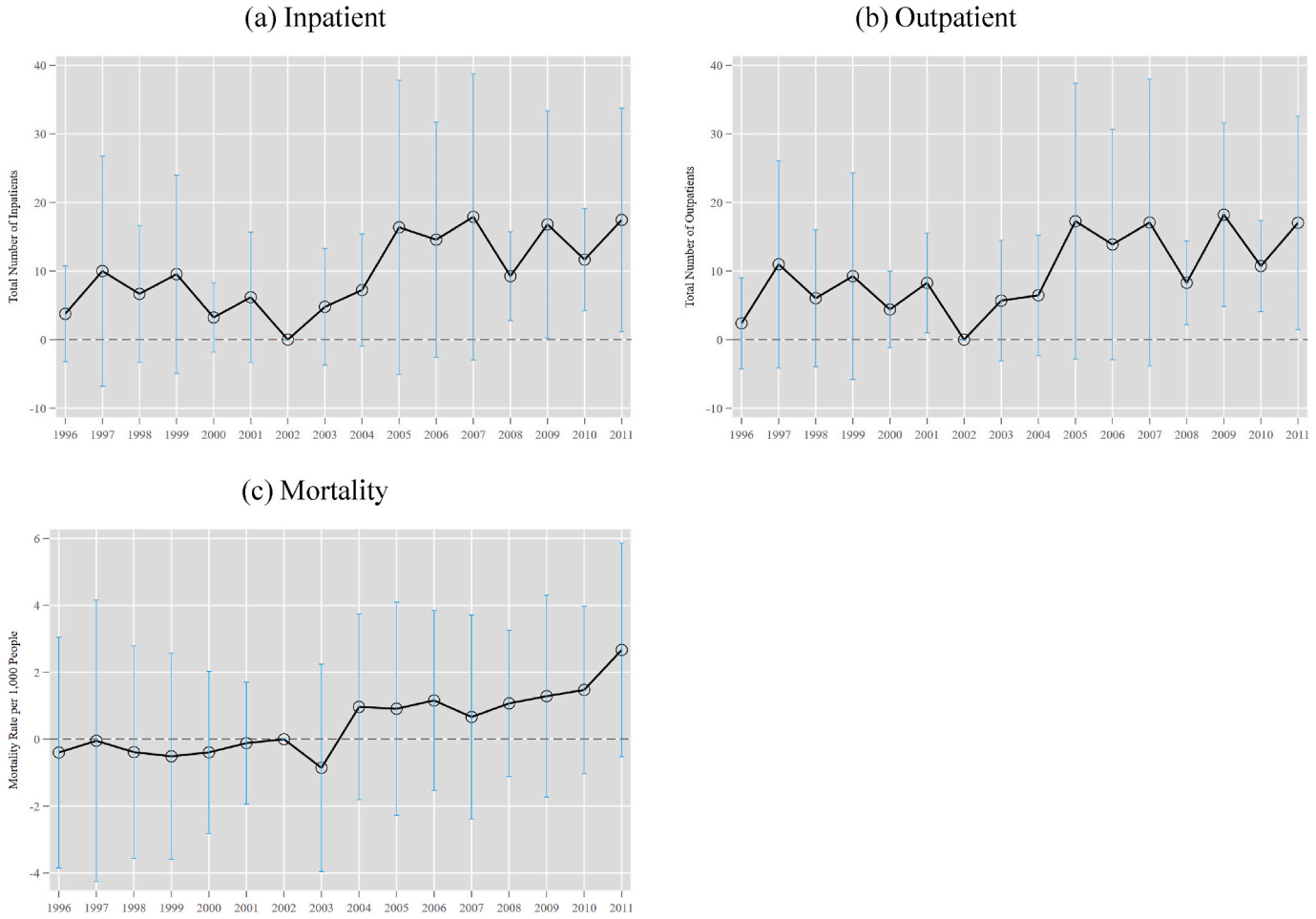

Fig. A2. Event-Study Estimates on NCMS Expansion Speed

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 Equation (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.

Table A1
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	

(*continued on next page*)

Table A1 (*continued*)

	2002	2003	2004	2005	2006	2007	2008
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 A2
Effects of Province-level Economic Conditions on the NCMS Enrollment Rate

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

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

Table A3
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
Mortality					
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
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

(*continued on next page*)

Table A3 (*continued*)

	Mean	S.D.	Min.	Max.	N
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 A4
Results of the NCMS on Vaccination Status

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables	BCG	Measles	DPT	Influenza Encephalitis	Encephalitis B	Hepatitis A	Hepatitis B
NCMS rate	0.040	0.294	−0.336*	0.505***	0.296*	0.169	0.112
	(0.111)	(0.205)	(0.186)	(0.138)	(0.152)	(0.236)	(0.141)
Mean	0.181	0.341	0.264	0.560	0.524	0.217	0.364
Observations	4775	4755	4735	4811	4804	4695	4755
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 (3). Standard errors are clustered at the province level and bootstrapped 1000 times to account for potential heteroscedasticity (in parentheses). ***p < 0.01, **p < 0.05, *p < 0.10.

Table A5
Results of the NCMS on Health Knowledge

Panel A: Whether the following item is good										
Variables	Sugar	Variety of Foods	Fat	Animal	Meat	Dairy	Beans	Physical	Heavy Weight	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
NCMS rate	0.146**	0.095	−0.006	0.125	0.090	0.138*	0.111**	0.198**	−0.030	
	(0.070)	(0.081)	(0.107)	(0.157)	(0.079)	(0.070)	(0.052)	(0.086)	(0.081)	
Mean	2.265	3.532	2.284	2.753	3.433	3.687	3.703	3.635	2.048	
Observations	212,265	210,869	208,978	215,710	209,906	214,550	215,824	217,083	212,631	
R-squared	0.049	0.287	0.059	0.077	0.211	0.427	0.468	0.355	0.029	
Panel B: Whether they like the following										
Variables	Fast Food	Snacks	Fruits	Vegetables	Soft Drinks	Tai Chi	Sports	Body Building	TV	Video Games
NCMS rate	−0.038	−0.354**	0.194	0.126	0.210	−0.011	−0.069	0.113	0.102	−0.360**
	(0.177)	(0.164)	(0.127)	(0.120)	(0.150)	(0.213)	(0.211)	(0.212)	(0.109)	(0.141)
Mean	2.275	2.438	3.677	3.790	2.735	2.600	2.419	2.423	3.578	2.345
Observations	130,641	154,130	221,831	223,276	180,332	146,265	134,350	133,288	214,943	124,921
R-squared	0.131	0.115	0.121	0.132	0.111	0.038	0.109	0.044	0.099	0.236

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. This table provides a comprehensive information in CHNS about diet knowledge, food preferences, and activity preferences. Panel A reports individuals' opinions about dietary choices, with the scale for each variable, ranging from 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree), to 5 (strongly agree). Column 1 of Panel A is about the opinion that eating a lot of sugar is good for one's health; column2, eating a variety of foods is good for one's health; column 3, choosing a diet high in fat is good for one's health; column 4, consuming a lot of animal products daily (fish, poultry, eggs and lean meat) is good for one's health; column 5, reducing the amount of fatty meat and animal fat in the diet is good for one's health; column 6, consuming milk and dairy products is good for one's health; column 7, consuming beans and bean products is good for one's health; column 8, Physical activities are good for one's health; and column 9, the heavier one's body is, the healthier he or she is. Columns 1–5 of Panel B reports individuals' food preferences. The original question is "How much do you like this food", with the scale for each variable ranging from 1 (dislike very much), 2 (dislike), 3 (neutral), and 4 (like), to 5 (like very much). Column 1 explores individuals' preference for fast food items like KFC, pizza, and hamburgers; column 2, salty snacks such as potato chips and pretzels; column 3, fruits; column 4, vegetables; and column 5, soft drinks and sugared fruit drinks. Columns 6–10 of Panel B reports individuals' activity preferences. The original question is "How much do you like to participate in this activity", with the same scale as columns 1–5. Column 6 is about participation in walking or Tai Chi; column 7, sports like ping pong, badminton, tennis, soccer, basketball, and volleyball; column 8, body building; column 9, watching TV; and column 10, playing computer/video games and surfing the internet. The coefficients are estimated from the specification of Equation (3). ***p < 0.01, **p < 0.05, *p < 0.10.

Table A6
Results of the NCMS on Smoking and Drinking

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variables	Cigarettes	Months of Quitting	Alcohol	Frequency	Weekly Beer	Wine	Weekly Wine	Liquor	Soft Drinks	Sugared Drinks
NCMS rate	−1.661	25.784	−0.002	0.123	−1.03	−0.058	−0.014	−0.158***	−0.013	−0.031
	(1.173)	(27.806)	(0.029)	(0.134)	(0.803)	(0.037)	(7.484)	(0.055)	(0.065)	(0.128)
Mean	17.43	56.44	0.328	2.719	3.12	0.0755	10.63	0.79	0.363	0.763
Observations	68,800	6253	241,390	79,061	42,598	78,702	4651	78,910	258,135	92,469
R-squared	0.101	0.096	0.321	0.13	0.044	0.059	0.304	0.158	0.234	0.037

Notes: This table provides estimates of the NCMS on smoking and drinking using CHNS. 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. Column 1 represents the daily quantity of cigarettes smoked by individuals. In column 2, the duration, measured in months, since an individual ceased smoking is documented. Column 3 captures whether an individual consumed beer or any alcoholic beverage that year. The frequency of this consumption is detailed in column 4: 1 - almost every day, 2–3 to 4 times a week, 3 - once or twice a week, 4 - once or twice a month, 5 - no more than once a month. Columns 5 shows the number of bottles of beer one drinks weekly. Column 6 reports whether an individual drinks wine and column 7 shows the number of bottles of wine if drinking weekly. Column 8 denotes whether an individual consumes liquor. Column 9 shows if an individual drank soft drinks or sugared fruit drinks that year. Column 10 investigates any consumption of sugared fruit drinks (including lemonade and juices) that year. The coefficients are estimated from the specification of Equation (3). ***p < 0.01, **p < 0.05, *p < 0.10.

Table A7
Results of the NCMS on Water Consumption

Variables	(1) Tea	(2) Frequency of Tea	(3) Water	(4) Frequency of Water	(5) Daily Cups of Water
NCMS rate	0.155**	−0.349	−0.075	−0.287*	1.598***
	(0.060)	(0.246)	(0.103)	(0.142)	(0.231)
Mean	0.29	1.8	0.884	1.176	3.225
Observations	241,195	69,659	182,824	161,099	154,825
R-squared	0.121	0.073	0.037	0.015	0.065

Notes: This table provides estimates of the NCMS on water consumption using CHNS. 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. Column 1 reports whether an individual normally drinks tea (yes or no). Column 2 specifies the frequency of tea consumption over the preceding 30 days: 1 - almost every day, 2–3 to 4 times a week, 3 - once or twice a week, 4 - once or twice a month, 5 - no more than once a month. Column 3 records the habitual consumption of plain/bottled water among participants (yes or no). Column 4 delineates the frequency of water consumption during the past 30 days. Column 5 quantifies the daily count of cups of plain/bottled water consumed. The coefficients are estimated from the specification of Equation (3). ***p < 0.01, **p < 0.05, *p < 0.10.

Table A8
Balance Test: Relationship Between the NCMS Enrollment Rate in 2004 and the Pre- NCMS Levels and Trends of Socio-economic Characteristics and Healthcare Variables

Dependent Variable	(1)	(2)	(3)	(4)	(5)
		Without Region-Year FE		With Region-Year FE	
	Mean in 1996	Level	Trend	Level	Trend
		($NCMS^{2004}$)	($NCMS^{2004} \times Year$)	($NCMS^{2004}$)	($NCMS^{2004} \times Year$)
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

(continued on next page)

Table A8 (*continued*)

Dependent Variable	(1)	(2)	(3)	(4)	(5)
		Without Region-Year FE		With Region-Year FE	
	Mean in 1996	Level	Trend	Level	Trend
		($NCMS^{2004}$)	($NCMS^{2004} \times Year$)	($NCMS^{2004}$)	($NCMS^{2004} \times Year$)
		(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: $y_{pt} = \alpha + \beta_0 NCMS^{2004} + \beta_1 NCMS^{2004} \times (t - 2004) + \xi_{pt}$. 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 A9
Robustness Checks of the NCMS's Effects on Medical Expenditures in Cities

	(1)	(2)	(3)	(4)
	Baseline	No Region-Year FE	No Economic Controls	No Controls
Panel A. Total Consumption per Capita				
NNCMS rate	446.794	465.191	−31.253	−792.203
	(489.112)	(449.942)	(666.535)	(879.800)
R-squared	0.994	0.993	0.987	0.985
Mean	8816	8816	8816	8816
Panel B. Medical Expenditures per Capita				
NCMS rate	76.645	110.169*	80.925	104.565
	(76.957)	(66.786)	(74.284)	(67.144)
R-squared	0.931	0.918	0.918	0.910
Mean	641.8	641.8	641.8	641.8
Panel C. Ratio of Medical Expenditures to Consumption				
NCMS rate	0.002	0.004	0.003	0.006*
	(0.005)	(0.005)	(0.004)	(0.003)
R-squared	0.907	0.890	0.903	0.898
Mean	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 mean of each dependent variable is the average in 2004, weighted by the rural population in 2003. Standard errors are clustered at the province level and bootstrapped 1000 times to account for potential heteroscedasticity (in parentheses). ***p < 0.01, **p < 0.05, *p < 0.10.

Table A10
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	−0.025	−0.027	0.028	0.025	−0.017	0.032	0.044	−0.021	0.028	0.031
	(0.065)	(0.068)	(0.108)	(0.115)	(0.070)	(0.109)	(0.120)	(0.070)	(0.108)	(0.114)
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	0.126**	0.129*	0.169*	0.176*	0.125*	0.161*	0.156	0.131**	0.171*	0.179*
	(0.063)	(0.068)	(0.090)	(0.100)	(0.066)	(0.094)	(0.100)	(0.065)	(0.092)	(0.097)
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	Y		Y			
Flexible GDP										
Flexible lag GDP						Y	Y	Y		Y
Flexible city medical expense										
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 expenses of city residents as above. Standard errors are clustered at the province level and bootstrapped 1000 times to account for potential heteroscedasticity (in parentheses). ***p < 0.01, **p < 0.05, *p < 0.10.

Table A11
The NCMS's Effects on Healthcare Utilization Without the NRPS

(1)		(2)	(3)	(4)	(5)
Total		City hospital	CHC	County hospital	THC
Panel A. Outpatient Services Utilization					
NCMS rate	0.015	−0.062	0.582	0.008	0.274
	(0.077)	(0.062)	(0.498)	(0.078)	(0.305)
Mean	15293	5726	602.4	3599	5365
Observations	173	173	173	173	171
Panel B. Inpatient Services Utilization					
NCMS rate	0.108	0.054	2.712**	0.038	0.714
	(0.079)	(0.061)	(1.168)	(0.073)	(0.439)
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. Standard errors are clustered at the province level and bootstrapped 1000 times to account for potential heteroscedasticity (in parentheses). ***p < 0.01, **p < 0.05, *p < 0.10.

Table A12
Robustness Checks of the NCMS's Effects on Healthcare Utilization With the NRPS

(1)		(2)	(3)	(4)	(5)
Total		City hospital	CHC	County hospital	THC
Panel A. Outpatient Services Utilization					
NCMS rate	−0.030	−0.050	0.326	0.065	0.132
	(0.065)	(0.061)	(0.513)	(0.071)	(0.237)
Mean	15293	5726	602.4	3599	5365
Observations	173	173	173	173	171
Panel B. Inpatient Services Utilization					
NCMS rate	0.121*	0.050	1.914**	0.066	0.486
	(0.066)	(0.056)	(0.917)	(0.066)	(0.353)
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. Standard errors are clustered at the province level and bootstrapped 1000 times to account for potential heteroscedasticity (in parentheses). ***p < 0.01, **p < 0.05, *p < 0.10.

Table A13
Robustness of NCMS Results on Healthcare Utilization to Economic Controls

	(1)	(2)	(3)	(4)	(5)
	Baseline				
Panel A. Total Outpatient Services Utilization					
NCMS rate	−0.025	−0.029	−0.047	0.003	0.009
	(0.065)	(0.067)	(0.073)	(0.143)	(0.149)
Mean	15293	15293	15293	15293	15293
Observations	231	231	231	201	201
Panel B. Total Inpatient Services Utilization					
NCMS rate	0.126**	0.119*	0.121*	0.161	0.162
	(0.063)	(0.063)	(0.070)	(0.119)	(0.123)
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 at the province level and bootstrapped 1000 times to account for potential heteroscedasticity (in parentheses). ***p < 0.01, **p < 0.05, *p < 0.10.

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