Are People Enrolled in NCMS and CURBMI Susceptible in Catastrophic Health Expenditure? Evidence From China

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Abstract

This study investigated associations between different types of medical insurance and the incidence of catastrophic health expenditure among middle-aged and the aged in China. The data came from the China Health and Retirement Longitudinal Survey implemented in 2013, with 9782 individuals analyzed. Probit regression models and multiple linear regressions were employed to explore the relationship mentioned above and potential mechanisms behind it. It was found that compared with participants in Urban Resident Basic Medical Insurance, individuals participating in New Cooperative Medical Scheme and Coordinating Urban and Rural Basic Medical Insurance was less likely to undergo catastrophic health expenditure ($P < .001$, $P = .008$), especially for low-income and middle-income group. Participants in New Cooperative Medical Scheme and Coordinating Urban and Rural Basic Medical Insurance were more likely to utilize inpatient medical service ($P < .001$, $P = .020$) and choose low-level medical institutions for treatment ($P = .003$, $P = .006$). And individuals participating in New Cooperative Medical Scheme had lower out-of-pocket expenditure ($P = .034$). The study showed the significant difference in the incidence of catastrophic health expenditure among participants in different medical insurances. Efforts should be made to improve the service quality of grassroots medical institutions except for the increase of reimbursement ratio, so that rural residents can enjoy high-quality medical services.

Keywords

insurance, major medical, catastrophic health expenditure, incidence, middle aged, aged, regression analysis, China

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What do we already know about this topic?
Most studies focused on the impact of single medical insurance on the incidence of catastrophic health expenditure (CHE) of residents and did not reach an agreement.
How does your research contribute to the field?
This study contributes to provide evidence of the relationship between different basic medical insurance (Coordinating Urban and Rural Basic Medical Insurance [CURBMI], New Cooperative Medical Scheme [NCMS], Urban Resident Basic Medical Insurance [URBMI]) and the incidence of CHE among the middle-aged and the aged in China.
What are your research's implications toward theory, practice, or policy?
Targeted policies and measures, including hierarchical diagnosis and treatment, telemedicine, are urgently required. So that poor and rural residents can enjoy high-quality medical services.

Introduction

High medical costs have placed a heavy burden on residents, especially in many developing countries. High health expenses force residents to reduce their expenditure in necessities of life.[1] In order to pay for the high medical costs, they even need to borrow money and sell their assets.[2-4] People in extreme poverty may even give up treatment.[5] The high cost of medical care brought about by the disease will result in

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catastrophic health expenditure (CHE) for the family, and it will lead to poverty and the loss of the ability to improve family living standards, and further lead to the loss of individual or family participation in medical security and the enjoyment of basic public health services, causing it to fall into a vicious cycle of disease, poverty, and disease.[6,7] Some studies have calculated the incidence of CHE in China by using different CHE calculation formulas and different micro data sets. For example, a study using National Health Services Survey found that 12.9% households had CHE.[8] Another recent study analyzing the data from 4 rounds of the China Family Panel Studies 2010-2016 concluded that the incidence of CHE decreased from 19.37 to 15.11 between 2010 and 2016.[9] Many countries have regarded health insurance as a means to protect their populations from impoverishment of illness and high medical expenditures.[10-12] To enhance security levels and improve disparities in health and health care, the Chinese government has launched different types of basic health insurance designed for different population groups: Urban Employee Basic Medical Insurance (UEBMI), Urban Resident Basic Medical Insurance (URBMI), and New Cooperative Medical Scheme (NCMS). In order to make the urban and rural residents enjoy fair medical insurance, Coordinating Urban and Rural Basic Medical Insurance (CURBMI) was implemented in 2016 nationwide. According to the *China's medical and health development report 2016*, by the end of 2016, the basic medical insurance system had covered 96.5% of the population in China.

The Current Basic Health Insurance System in China

In December 1998, the State Council issued The Decision on the establishment of the Urban Employee's Basic Medical Insurance System, which marks the establishment of the basic medical insurance system for urban workers. All urban employers, including enterprises (state-owned enterprises, collective enterprises, foreign invested enterprises, private enterprises, etc), organs, institutions, social organizations, private nonenterprise units, and their workers, are required to participate in UEBMI. The UEBMI was financed by a payroll tax of 2% from employees and 6% from employers.[13] About 274 million employees participated in UEBMI in 2013,[14] and the per capita fund of UEBMI was US $424.7.[15] In January 2003, the office of the State Council forwarded the Ministry of health and other departments on *The Establishment of a New Rural Cooperative Medical System*. The NCMS is organized, guided, and supported by the government. It is a voluntary program aiming at improving the health of rural residents and promoting the development of rural economy. The fund of NCMS consisted of premiums of participants (about 20%) and subsidies from central and local governments (about 80%). In 2013, about 802 million rural residents were covered by NCMS, and the per capita funding was US $61.2.[15] In 2007, the State Council issued *The Guidance on The Pilot of*

Basic Medical Insurance for Urban Residents to solve the medical security problems of non-employment urban residents. Students in primary and secondary schools (including vocational high schools, technical secondary schools, and technical school students), children, and other non-employed urban residents who are not covered by the UEBMI can voluntarily participate in the URBMI. The URBMI was financed by premiums from enrollers (30%) and subsidies from central and local governments (70%). Roughly 296 million urban residents were enrolled in URBMI in 2013, and the per capita fund of which was US $66.2. Due to the level of financing of NCMS, the rural population is at a disadvantage compared with the urban population in terms of medical access and compensation.[15] Compared with individuals enrolled in either UEBMI or URBMI, those joining in NCMS had lower reimbursement rates and smaller service coverage.[15]

Coordinating Urban and rural Basic Medical Insurance is designed to deal with the drawbacks of the fragmentation of the medical insurance system, such as system division, management division, and disparities of different medical insurance treatment, which hinders urban and rural residents to enjoy a fair medical service. Before the policy of CURBMI was issued, some provinces and cities and county-level units carried out the pilot of CURBMI. According to the data of China health statistics yearbook, by 2013, Tianjin municipality and Guangdong province had implemented CURBMI. In addition, some counties in Zhejiang and Jiangsu province also implemented CURBMI. In January 2016, the State Council issued the *Instructions on the integration of basic medical insurance system for urban and rural residents* and made clear the concrete implementation plan for the integration of URBMI and NCMS before the end of 2016. Since the funding and reimbursement level of the UEBMI and other types of medical insurance are quite different,[16] the study only analyzed the participants enrolled in CURBMI, URBMI, and NCMS.

Literature Review

Several studies paid attention to the relationship between the health insurance and the incidence of CHE. As a financial sharing mechanism used in medical service, health insurance can effectively alleviate the economic loss caused by medical risk. Some studies have shown that medical insurance can significantly reduce the financial risk of disease and hence reduce the incidence of CHE,[17-22] even in some countries the effects is limited.[23,24] On the other hand, residents may release medical needs and increase the use of medical services, especially medical services of high quality, which causes the increase of health expenditures and probability of experiencing CHE.[4,25]

Researches on the impact of Chinese medical insurance on Residents' CHE mainly focused on NCMS.[26] Some studies found out that participating in NCMS could effectively reduce the incidence of CHE compared to rural residents

who did not have insurance.[27-30] However, contrary conclusions were drawn from other studies. A study from China concluded that NCMS was not effective in increasing financial protection.[31] Another systematic review also showed that there is no clear evidence to support the hypothesis that NCMS decreased the incidence of CHE of rural households.[26] There are also studies comparing the impact of different types of medical insurance on the incidence of CHE for different participants, and the conclusions have not reached an agreement.[16,32] In general, the relationship between different basic medical insurance and the incidence of CHE in China is still unclear.

In this study, we aim to investigate the relationship between different medical insurances (CURBMI, NCMS, URBMI) and the incidence of CHE in different income groups among the middle-aged and the aged in China, and further analyze the mechanisms behind it. This study had some contributions. First, to date, the evidence on the relationship between insurance and CHE mainly focused on the difference of financial risk protection between those without and with medical insurance, or those covered by certain insurance. The study used a nationally representative survey of the middle-aged and the aged in China and examined the associations between different medical insurances and the incidence of CHE. Second, Chinese government has launched the CURBMI in order to extend funding pools and narrow disparities in medical accessibility and benefit packages which existed among different medical insurances. Therefore, CURBMI was also included in the analysis. After the integration of basic medical insurance in urban and rural areas, the degree of financial risk protection among different medical insurances needs to be further examined.

Methods

Data

The data used in this study are from the China Health and Retirement Longitudinal Survey (CHARLS), which aims to collect a set of representative high-quality micro data for individuals aged 45 and above in China.[33] It is used to analyze the problem of aging population and promote the interdisciplinary study of the aging problem. National baseline survey data were launched in 2011 and then the follow-up survey was implemented in 2013 and 2015, respectively. All samples in CHARLS were drawn in 4 stages including county-level sampling, neighborhood-level sampling, household-level sampling, and respondent-level sampling. By using PPS (probabilities proportional to size) sampling, 150 counties were randomly selected in 30 provincial-level administrative units. (The Tibet autonomous region, Taiwan province, and the Hong Kong and Macao special administrative regions are excluded.) At the neighborhood-level sampling stage, 3 administrative villages in rural areas or neighborhoods in urban areas were chosen within each

county-level unit using PPS sampling. At the household-level sampling, 80 households were randomly sampled by using CHARLS-GIS software after verification. Finally, after identifying whether the household had a member meeting the age eligibility requirements, individuals in each sample household will be interviewed.[34]

The survey covers over 10 000 households in 150 county-level units and 450 village level units. In total, 17 000 respondents were asked to participate in the survey. The content of the CHARLS questionnaire includes the Demographic Background, Family Information, Family Transfer, Health Care and Insurance, Health Status and Functioning, Household Income, Work Retirement and Pension, and other information. This study used the cross-sectional data from CHARLS 2013. A total of 18 604 individuals were interviewed in 2013. This study subjects were 12 976 (about 5628 did not answer the question about the household income and expenditure). After drop missing values of key variables including basic information, healthcare and insurance, and health status, 9782 (75.39%) were included in the final analyses.

Variables

Catastrophic health expenditure. Catastrophic health expenditure is the main indicator to measure the risk of family medical expenditure. Generally speaking, a family undergoes CHE if the proportion of its out-of-pocket (OOP) expenditure to the household income or non-food expenditure exceeds a certain threshold value. There are different measuring criterions for CHE. The numerator is usually a family's OOP including all direct and indirect self-paid expenses which is related to health care. The denominator is usually measured in the following 3 categories: (1) capacity to pay (CTP),[35-38] (2) total family income or per capita income,[4,8,19,25,39] and (3) total family expenditure or non-food expenditure.[20,40-43] Given that Chinese residents generally have high saving rate and low consumption tendency, using expenditure as the denominator would overestimate the incidence of CHE. What CTP refers to is the effective income after deducting the necessary living expenses (food expenditure), and it can better reflect the family's affordability for medical expenditure. Therefore, we used the CTP as the denominator to calculate CHE. We calculated the CTP and CHE as follows:

$$CTP_i = Income_i - food_i$$

$$CHE_i = \begin{cases} 1, & if \quad OOP_i / CTP_i \geq 0.4 \\ 0, & if \quad OOP_i / CTP_i < 0.4 \end{cases}$$

Health care utilization. To study potential mechanisms behind the associations of different medical insurances on the incidence of CHE, the specific outcome measures of health care utilization listed were studied. The *inpatient* referred to a dummy variable. When the value of *inpatient* equals to 1, it

means that the individual has used inpatient services during the past year. And when the value of this variable equals to 0, it means that the individual has been diagnosed by a physician to be hospitalized but for some reasons has not used inpatient services during the past year. *oop_inpatient* measures OOP for the most recent hospitalization in the past year. *Num_outpatient* referred to the outpatient times during the last month. Expenditure variables are generally considered to be skewed, and hence *oop_inpatient* was analyzed in the logarithmic scale.

Level of inpatient medical institutions. The level of inpatient medical institutions chosen by patients (*inpatient_level*) was also employed to further analyze the possible causes of associations between different basic medical insurances and incidence of CHE. The *inpatient_level* was an dummy variable. When *inpatient_level* equals to 0, it means that patients chose a medical institution at County/district level. When *inpatient_level* equals to 1, it means that patients chose a medical institution at Regional/city or Provincial/affiliated to a ministry level.

Urban and rural basic medical insurance. The Urban and Rural Basic medical insurance variables are the key variables in our study. URBMI, NCMS, and CURBMI are 3 dummy variables representing individuals enrolled in medical insurance mentioned above.

Covariates. This study added other 4 types of covariates to be confounders in the model. The first type states social demographic characteristics of individuals, including age, gender, education, marital status, and family size. The second category describes the economic conditions measured with nonfarm employment (a dummy variable indicating whether individuals had a non-farm job) and per capita income (logarithmic form). The third type of covariates describes health-related behaviors, including 2 dummy variables, namely smoke and drink. The fourth category describes individual health status, including 2 variables as following. One of them was self-rated health status which are grouped into 5 categories: very good, good, fair, poor, and very poor. And the other was a dummy variable chronic indicating whether the individual has been diagnosed with chronic diseases.

Statistical Analysis

Given that the incidence of CHE is a bivariate variable, a Probit model was used to study the relationship between different medical insurances and the incidence of CHE. The model is specified as follows:

$$probit\left(CHE_i\right) = \beta_0 + \beta_1 CURBMI_i + \beta_2 NCMS_i + \sum_m \alpha_m X_{mi} + \varepsilon_i \quad (1)$$

In equation (1), β_1 and β_2 capture the associations of CURBMI and NCMS and the incidence of CHE, respectively; X represents other covariates; and ε is the error term which is normalized to have mean zero.

In the mechanism analysis, we use different health care utilization variables as outcome variables. Based on the same reason, a Probit model is employed to model *inpatient* on medical insurance and other variables. For other outcomes, multiple linear regressions were applied to identify the relationship between medical insurances and the health care utilization. Also a Probit model was employed to analyze the differences between medical insurances and the level of medical institutions chosen by inpatient patients.

Results

Characteristics of Study Population

Table 1 shows the descriptive statistics of the study sample. The average age was 60.530, and the female sample accounted for 48.05%. Most of the individual's education level was in secondary school and below (72.94%). The non-agricultural workforce accounted for 12.24% of the entire sample, and the mean of logarithmic per capita income was 2.838 ± 8.175. The proportion of smoking and drinking reached 15.56% and 34.19%, respectively. For the individual health status, it can be found that individuals with fair health status accounted for the most (51.68%) of the total sample and the proportion of respondents suffering from chronic diseases in the sample accounted for 68.08%. The number of individuals participating in the NCMS was the largest, accounting for 90.81% of the total sample, and the proportions of individuals participating in URBMI and CURBMI were 6.05% and 3.14%, respectively. Accordingly, the incidence of CHE in the sample accounted for 22.2% as a whole. Residents with URBMI have the highest incidence of CHE (40.54%), while the rural residents with NCMS have the lowest incidence of CHE (22.21%).

The Relationship Between Medical Insurances and Incidence of CHE

As shown in Table 2, compared to residents participating in URBMI, those participating in CURBMI and NCMS had lower incidence of CHE ($P < .001$, $P = .008$). To further examine the relationship among different income levels, the sample was divided according to the percentiles of income. It can be seen that for the low-income group and the middle-income group, the probability of CHE for the participants of NCMS and CURBMI was lower ($P < .05$). For high-income groups, however, there was no significant difference in the incidence of CHE among participants of different medical insurances ($P = .743$, $P = .524$).

Table 1. Description of Variables (N = 9782).

Variable	Total (N = 9782)		URBMI (N = 592, 6.05%)		CURBMI (N = 307, 3.14%)		NCMS (N = 8883, 90.81%)	
	N/mean	%/SD	N/mean	%/SD	N/mean	%/SD	N/mean	%/SD
CHE								
No	7487	76.54	352	59.46	225	73.29	6910	77.79
Yes	2295	23.46	240	40.54	82	26.71	1973	22.21
Pcincome	2.838	8.175	2.871	6.425	3.320	6.734	2.819	8.323
Income-based group								
Quintile 1 (poor)	3294	33.67	282	47.64	119	38.76	2893	32.57
Quintile 2 (middle)	3052	31.20	97	16.39	81	26.38	3051	34.35
Quintile 3 (rich)	3436	35.13	213	35.98	107	34.85	2939	33.09
Age	60.530	9.892	60.515	10.069	61.176	8.981	60.508	9.911
Gender								
Female	5082	51.95	380	64.19	160	52.12	4542	51.13
Male	4700	48.05	212	35.81	147	47.88	4341	48.87
Marital status								
Unmarried	1456	14.88	109	18.41	48	15.64	1299	14.62
Married	8326	85.12	483	81.59	259	84.36	7584	85.38
Educational level								
Elementary school and below	7135	72.94	273	46.11	228	74.27	6634	74.68
Middle school	1923	19.66	190	32.09	55	17.92	1678	18.89
High school and above	724	7.40	129	21.79	24	7.82	571	6.43
Smoke								
No	8260	84.44	526	88.85	264	85.99	7470	84.09
Yes	1522	15.56	66	11.15	43	14.01	1413	15.91
Drink								
No	6438	65.81	419	70.78	197	64.17	5822	65.54
Yes	3344	34.19	173	29.22	110	35.83	3061	34.46
Self-rated health status								
Very good	871	8.90	60	10.14	25	8.14	786	8.85
Good	1327	13.57	95	16.05	47	15.31	1185	13.34
Fair	5055	51.68	307	51.86	164	53.42	4584	51.6
Poor	2005	20.50	109	18.41	59	19.22	1837	20.68
Very poor	524	5.36	21	3.55	12	3.91	491	5.53
Chronic diseases								
Without	3122	31.92	155	26.18	97	31.6	2870	32.31
With	6660	68.08	437	73.82	210	68.4	6013	67.69
Nonfarm work								
Without	8585	87.76	398	67.23	250	81.43	7937	89.35
With	1197	12.24	194	32.77	57	18.57	946	10.65
Family size	3.509	1.811	3.167	1.511	3.765	2.048	3.523	1.818

Note. URBMI = Urban Resident Basic Medical Insurance; CURBMI = Coordinating Urban and Rural Basic Medical Insurance; NCMS = New Cooperative Medical Scheme; CHE = catastrophic health expenditure.

The Robust Check of Results

In order to further verify the robustness of the results, the CHE thresholds were set to 30% and 50%, respectively, and the aforementioned regression was performed again. As shown in Table 3, it can be found that both the coefficient size and its significance are not significantly changed after resetting the CHE threshold value, indicating the robustness of the results.

Potential Mechanism Analysis

Table 4 examined the potential mechanism of the relationship between different medical insurances and the incidence of CHE. Compared with participants of URBMI, individuals participating in NCMS and CURBMI were more likely to utilize inpatient medical services when doctors diagnosed that they needed to be hospitalized during the past year ($P <$ .001, $P =$ .020). Those with NCMS and CURBMI were

Table 2. The Impacts of Different Medical Insurance on the Incidence of CHE Among Different Income Subgroups. .

Variables	Total sample (N = 9782)			Quintile 1 (poor)			Quintile 2 (middle)			Quintile 3 (rich)		
	Coefficient (β_j)	95% Confidence interval	P	Coefficient (β_j)	95% Confidence interval	P	Coefficient (β_j)	95% Confidence interval	P	Coefficient (β_j)	95% Confidence interval	P
Medical insurance												
CURBMI (Ref: URBMI)	−0.256**	(−0.445 to −0.067)	.008	−0.395**	(−0.68 to −0.11)	.007	−0.486*	(−0.914 to −0.057)	.026	0.125	(−0.259 to 0.509)	.524
NCMS (Ref: URBMI)	−0.431***	(−0.556 to −0.307)	<.001	−0.707***	(−0.879 to −0.535)	<.001	−0.500***	(−0.767 to −0.234)	<.001	−0.037	(−0.259 to 0.185)	.743
Per capita income (logarithm)	−0.063***	(−0.08 to −0.046)	<.001	−14.457	(−239.085 to 210.171)	.900	−0.468***	(−0.66 to −0.277)	<.001	−0.052***	(−0.075 to −0.029)	<.001
Age	0.008***	(0.004 to 0.012)	<.001	0.008*	(0.001 to 0.014)	.027	0.012***	(0.006 to 0.018)	<.001	0.003	(−0.004 to 0.009)	.429
Gender (Ref: female)	−0.019	(−0.074 to 0.037)	.513	0.014	(−0.091 to 0.118)	.799	−0.080	(−0.187 to 0.027)	.142	0.061	(−0.07 to 0.191)	.364
Marital status (Ref: unmarried)	−0.026	(−0.112 to 0.06)	.553	−0.344**	(−0.593 to −0.095)	.007	−0.083	(−0.208 to 0.043)	.196	0.090	(−0.061 to 0.242)	.243
Educational level												
Middle school (Ref: elementary school and below)	0.055	(−0.027 to 0.137)	.189	0.084	(−0.045 to 0.214)	.202	0.045	(−0.102 to 0.193)	.547	−0.002	(−0.138 to 0.135)	.982
High school and above (Ref: elementary school and below)	0.177**	(0.063 to 0.291)	.002	0.073	(−0.129 to 0.275)	.476	0.210	(−0.009 to 0.43)	.061	0.213*	(0.018 to 0.408)	.032
Smoke (Ref: No)	−0.077	(−0.163 to 0.008)	.077	−0.038	(−0.181 to 0.106)	.606	−0.078	(−0.218 to 0.063)	.280	−0.133	(−0.298 to 0.033)	.116
Drink (Ref: No)	−0.101**	(−0.169 to −0.033)	.004	−0.059	(−0.182 to 0.065)	.354	−0.153**	(−0.266 to −0.04)	.008	−0.095	(−0.235 to 0.046)	.186
Self-rated health status												
Good (Ref: Very good)	0.094	(−0.028 to 0.217)	.132	0.024	(−0.178 to 0.226)	.814	0.103	(−0.1 to 0.306)	.319	0.206	(−0.053 to 0.466)	.119
Fair (Ref: Very good)	0.194***	(0.084 to 0.304)	<.001	0.166	(−0.018 to 0.349)	.076	0.120	(−0.063 to 0.303)	.197	0.338**	(0.117 to 0.56)	.003
Poor (Ref: Very good)	0.346***	(0.218 to 0.474)	<.001	0.325***	(0.12 to 0.53)	.002	0.207	(−0.006 to 0.421)	.057	0.582***	(0.343 to 0.822)	<.001
Very poor (Ref: Very good)	0.396***	(0.24 to 0.551)	<.001	0.239	(−0.06 to 0.538)	.117	0.179	(−0.088 to 0.446)	.188	0.863***	(0.58 to 1.145)	<.001
Chronic (Ref: without)	0.124***	(0.06 to 0.187)	<.001	0.095	(−0.011 to 0.202)	.079	0.182***	(0.073 to 0.291)	<.001	0.113	(−0.008 to 0.233)	.066
Nonfarm work (Ref: no)	0.300***	(0.204 to 0.396)	<.001	0.243***	(0.102 to 0.385)	<.001	0.719***	(0.52 to 0.918)	<.001	0.066	(−0.116 to 0.249)	.474
Family size	−0.061***	(−0.083 to −0.039)	<.001	−0.093***	(−0.141 to −0.045)	<.001	−0.018	(−0.051 to 0.015)	.289	−0.061***	(−0.092 to −0.03)	<.001
Constant	−0.762***	(−1.088 to −0.437)	<.001	−0.053	(−0.635 to 0.529)	.859	−0.848**	(−1.383 to −0.312)	.002	−1.152***	(−1.73 to −0.573)	<.001

Note. CHE = catastrophic health expenditure; CURBMI = Coordinating Urban and Rural Basic Medical Insurance; URBMI = Urban Resident Basic Medical Insurance; NCMS = New Cooperative Medical Scheme.
*P<0.05. **P<0.01. ***P<0.001.

Table 3. Robust Check.

Threshold value	Variables	Total sample (N = 9782)			Quintile 1 (poor)			Quintile 2 (middle)			Quintile 3 (rich)		
		Coefficient (β_j)	95% Confidence interval	P	Coefficient (β_j)	95% Confidence interval	P	Coefficient (β_j)	95% Confidence interval	P	Coefficient (β_j)	95% Confidence interval	P
30%	Medical insurance												
	CURBMI (Ref: URBMI)	−0.281**	(−0.467 to −0.095)	.003	−0.336*	(−0.617 to −0.055)	.019	−0.555*	(−0.984 to −0.127)	.011	−0.028	(−0.380 to 0.323)	.874
	NCMS (Ref: URBMI)	−0.447***	(−0.569 to −0.325)	<.001	−0.679***	(−0.852 to −0.507)	<.001	−0.540***	(−0.807 to −0.274)	<.001	−0.141	(−0.343 to 0.060)	.169
	Per capita income (logarithm)	−0.054***	(−0.067 to −0.041)	<.001	−11.771	(−232.736 to 209.195)	.917	−0.387***	(−0.578 to −0.197)	<.001	−0.050***	(−0.070 to −0.031)	<.001
50%	Medical insurance												
	CURBMI (Ref: URBMI)	−0.283	(−0.478 to −0.087)	.005	−0.424**	(−0.719 to −0.128)	.005	−0.537*	(−0.963 to −0.112)	.013	0.141	(−0.251 to 0.532)	.482
	NCMS (Ref: URBMI)	−0.441***	(−0.564 to −0.318)	<.001	−0.719***	(−0.889 to −0.549)	<.001	−0.483***	(−0.752 to −0.214)	<.001	−0.049	(−0.272 to 0.174)	.665
	Per capita income (logarithm)	−0.077***	(−0.092 to −0.061)	<.001	−63.603	(−287.653 to 160.448)	.578	−0.516***	(−0.713 to −0.320)	<.001	−0.064***	(−0.086 to −0.043)	<.001

Note. CURBMI = Coordinating Urban and Rural Basic Medical Insurance; URBMI = Urban Resident Basic Medical Insurance; NCMS = New Cooperative Medical Scheme.
*P<0.05. **P<0.01. ***P<0.001.

Table 4. Mechanism Analyses.

Variables	Num_outpatient			Inpatient			inpatient_level			oop_inpatient		
	Coefficient (β_i)	95% Confidence interval	P	Coefficient (β_i)	95% Confidence interval	P	Coefficient (β_i)	95% Confidence interval	P	Coefficient (β_i)	95% Confidence interval	P
Medical insurance												
CURBMI (Ref: URBMI)	0.082	(−0.593 to 0.756)	.812	0.510*	(0.081 to 0.938)	.020	−1.074**	(−1.841 to −0.306)	.006	−0.237	(−0.747 to 0.273)	.362
NCMS (Ref: URBMI)	0.169	(−0.234 to 0.572)	.412	0.502***	(0.201 to 0.803)	<.001	−0.712**	(−1.179 to −0.244)	.003	−0.375*	(−0.722 to −0.028)	.034
Per capita income (logarithm)	0.002	(−0.009 to 0.012)	.763	0.013	(−0.002 to 0.028)	.088	0.009	(−0.002 to 0.019)	.101	−0.004	(−0.016 to 0.008)	.519

Note. CURBMI = Coordinating Urban and Rural Basic Medical Insurance; URBMI = Urban Resident Basic Medical Insurance; NCMS = New Cooperative Medical Scheme.
*$P<0.05$. **$P<0.01$. ***$P<0.001$.

more likely to choose the low level of medical institutions compared with participants in URBMI ($P = .003$, $P = .006$). Individuals participating in NCMS had lower OOP expenditure during the most recent inpatient treatment compared with those in URBMI ($P = .034$). However, there was no significant difference in OOP expenditures between participants with URBMI and CURBMI ($P = .362$). In addition, there was no significant difference in the number of outpatient visits within the past month among participants of different medical insurances ($P = .412$, $P = .812$).

Discussion

This study, based on the national survey data of CHARLS 2013, mainly analyzed the relationship between different medical insurances and the incidence of CHE, and further analyzed potential mechanisms behind it.

The results revealed the relatively lower incidence of CHE among participants with NCMS and CURBMI than those participating in URBMI. On one hand, since the implementation of NCMS in 2003, the inpatient medical service utilization of enrollees in NCMS has increased,[44] and the reimbursement rate has been continuously improved,[45] which reduced the CHEs to a great extent.[28] Those enrolled in CURBMI were previously rural residents with NCMS in our sample. After coordination of URBMI and NCMS, the reimbursement rate and service coverage were also improved for those participated in CURBMI.[15] Therefore, those participants in NCMS and CURBMI had lower incidence of CHE than before. On the other hand, more importantly, access to high-level medical institutions and high-quality medical services would increase the individual health expenditure and hence the incidence of CHE.[4,25] Due to restriction of household income, the access to healthcare, and the consideration of the level of compensation, rural residents in NCMS and CURBMI usually choose institutions with higher reimbursement rates such as township health centers and clinics,[31] which is consistent with the mechanism analysis in our study. Hence, rural residents in NCMS and CURBMI had lower OOP costs than those with URBMI and were less likely to undergo CHE.

In addition, the Chinese government also established the medical assistance scheme in order to protect poor and near-poor households from high medical financial burden.[46] The level of compensation has been improved for reduction of the economic burden and occurrence of CHE among rural residents, especially for the low- and middle-income groups. For high-income group population, on the contrary, there was no significant difference in the relationship between medical insurances and incidence of CHE. Regardless of the type of medical insurance involved, high-income people would choose high-level health institutions to seek high-quality medical services.[47] Our results also showed there was no significant association between outpatient times of last month and participating in NCMS or CURBMI, which is consistent with the conclusion of previous research.[44,48,49]

The implementation of the basic medical security system in China alleviated the problem of *difficulties and high expense in medical care* to some extent, significantly reduced the economic burden of disease and the incidence of CHE. However, due to medical insurance differences, there was obvious difference in the quality of medical services individuals receive. Participants with URBMI were more likely to go to high-level medical institutions to enjoy high-quality medical services, thus facing higher OOP costs and greater possibility of undergoing CHE. Because of income constraints and higher reimbursement rates from lower-level medical institutions, residents of NCMS and CURBMI may limit their own potential medical needs and seek treatment in lower-level medical institutions, which may affect their health status. Therefore, other health financial assistance interventions may also need to be implemented,[50] especially for the vulnerable population. At the same time, measures such as hierarchical diagnosis and treatment, telemedicine shall be promoted to improve the service quality of grass-roots medical institutions, so that rural residents can enjoy high-quality medical services. CURBMI has been implemented nationwide to promote the merger of NCMS and URBMI since 2016, in order to improve the fairness of the medical insurance system. Critical Illness Insurance (CII) has also been implemented since 2012 to reduce the incidence of CHE of residents. The effect of multilevel medical

security system on poverty reduction needs further study in the future.

There are some limitations in our analysis. First, the study was based on the cross-sectional data, so the causal effect of different insurances on the incidence of CHE could not be estimated. Second, some samples may be excluded from the analysis of our study because of extreme poverty. The fixed CHE threshold adopted in the study fails to take into account the extreme-poor groups. Third, our study only focused on the middle-aged and the aged in China. Similar studies among other populations should be considered in the future.

Conclusions

This study revealed the relationship between medical insurances and the incidence of CHE among the middle-aged and the aged in China. Participants with NCMS and CURBMI had lower probability of incidence of CHE compared with those participating in URBMI, especially for low-income and middle-income population group. Those with NCMS and CURBMI were prone to choose low-level medical institutions for treatment and utilize inpatient services. Targeted policies and measures, including hierarchical diagnosis and treatment, telemedicine, are urgently required. So that poor and rural residents can enjoy high-quality medical services.

Author Contributions

H.G. and X.X. designed the study. X.X. and H.Y. led the data analysis and wrote the manuscript. L.B. and D.L. participated in the data analysis. N.C, W.W., and Y.K. participated in the revision of the manuscript. All authors have read and approved the final manuscript.

Ethics Approval and Consent to Participate

Ethical approval for this study was not required because it was based on the publicly available data, CHARLS. The study subjects were not directly approached.

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