

Does the Medical Security System Alleviate the Poverty among Rural Residents with Critical Illness in China? ——Evidence from a Cross Sectional Survey

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ABSTRACT

China has established the Medical Security System (MSS), which consists of New Cooperative Medical Scheme (NCMS), Critical Illness Insurance (CII) and Medical Financial Assistance (MFA), to alleviate poverty in rural areas. This study aims to answer whether the system had a poverty alleviation effect. We conducted a cross-sectional study with a structured questionnaire, 834 valid samples from central and western China were analyzed. The FGT poverty measure was adopted to assess poverty alleviating effect. Binary logistic regression with random effect analysis was used to identify factors associated with Out-of-pocket (OOP) payments-induced poverty. OOP payments pushed 50.5%, 59.5% of non-poor participants into poverty and extreme poverty. MSS protect 9.2%, 10.2% of participants from falling into poverty and extreme poverty and narrow the poverty gap, squared poverty gap by 66%, 85% respectively. Hospital level, household size, age, illness type and income status are associated with OOP payments-induced poverty incidence. It is suggested that OOP payments-induced poverty is serious, the poverty alleviating effect of MSS is limited. The effect on narrowing the poverty gap is greater than that of reducing poverty headcount. CII and MFA are not relatively as effective as NCMS at alleviating poverty. More efforts should be devoted to improving the MSS. Precise guarantees need to be provided for vulnerable rural residents.

Keywords: Poverty, Medical Security System, OOP payments, New Cooperative Medical Scheme, Critical Illness Insurance, Medical Financial Assistance

1. INTRODUCTION

Poverty is a worldwide issue that requires arduous efforts of governments and society to address. Tremendous strides have been made towards reaching the Global Goal of ending poverty entirely by 2030. China has made significant progress in poverty alleviation. Statistics showed that China had made significant progress in poverty alleviation. China has lifted 740 million people in rural areas out of poverty, nearly 19 million each year, contributing heavily to global poverty relief work from 1978 to 2017[1], which means China accomplished one third of the world's poverty alleviation task[2].

Diseases always play an important role in the incidence of poverty[3]. The relationship between poverty and health has been well documented[4, 5]. Of the 55.7 million people living in poverty in rural China as of 2015, about 44 percent were impoverished because of

expenses related to health[6]. Moreover, critical illness always leads to heavier disease burden[7]. Critical illness means high health expenditure, which is often financially devastating for patients and their families. In rural China, the situation is even worse. The economic burden of critical illness has risen to the point where medical expenses cause many households to fall into poverty, and others who have been already in poverty sink deeper[8].

The Chinese government has started to implement a number of policy interventions to tackle health-related poverty. One of the rational choices for poverty reduction strategies is the Medical Security System (MSS). It consists of the New Cooperative Medical Scheme (NCMS), Critical Illness Insurance (CII) program and Medical Financial Assistance (MFA) program. An insured rural resident who incurs high medical cost due to critical illness will first receive reimbursement through NCMS, followed by further reimbursement from CII and MFA.

Health insurance has been verified as an effective way to reduce the economic burden of illness and protect households from impoverishment[9, 10]. NCMS is a basic health insurance scheme designed for rural residents in China which was founded in 2003. The enrollment rate of NCMS gradually increased and has achieved 98.8 % in 2015. To further protect individuals from health expenditure shocks, the State Council of China has set up the CII Program since 2012. The initial objective of CII is to solve the problems of illness-caused poverty. In rural China, an insured resident who has critical illness will first receive reimbursement through URMI, followed by further reimbursement from critical medical insurance[11]. MFA is another important program expected to alleviate the financial burden of poor population and the patients have high costs due to illness, which has been implemented in rural China since 2003. It was proposed to support the participation of rural poor households in NCMS and to give them direct support for receiving medical services with government funding.

Many studies have focused on assessing the effect of these programs independently, especially the NCMS. Wagstaff et al[12] found that the NCMS had no effect on reducing OOP payment. Cheng et al[13] found that the financial protection of NCMS against high health expenditures remained very restricted among the poor in rural China. Fang et al[14] found that CII has limited effect on reducing the incidence of catastrophic health expenditures but its effect varies by city. Zhang et al[15] demonstrated CII can effectively alleviate the incidence and severity of catastrophic health expenditures. Ma et al[16] found that MFA needed to be improved further although it evidences the concern of the government for poor rural people with critical illness.

But there is little literature available on the focus of quantitatively evaluating performance of three programs related to the goal of offering financial protection against poverty at the same time. Few studies clearly answered whether the MSS alleviated poverty among rural residents with critical illness in China. It remains unsubstantiated that to what extent the initial intent of these programs had been obtained. This study aims to explore the impact of critical illness treatment and MSS reimbursement on the health payment-induced poverty. We calculated the effect of the three systems on poverty alleviating, and evaluated relevant factors of poverty due to critical illness after reimbursing by MSS so as to help identify populations that require precision assistance. Our findings may contribute to understanding the comprehensive effect of MSS on poverty and improve related health policy, thereby further alleviating the economic burden of rural residents with critical illnesses.

2. METHODS

2.1. Study Setting

A cross-sectional study using a multi-stage stratified cluster sampling method was implemented in 2017. Considering the availability of data, we selected Hubei Province in the central part and Guizhou Province in the west as the sampling area. Hubei province is in central China with a medium level of economic development. It had a gross domestic product (GDP) per capita of 8,383 USD (Exchange rate in 2016: RMB¥6.6423 to US\$1.00) in 2016, which ranks 11th in China. Guizhou Province is in western China, the GDP per capita was 5,006 USD in 2016, ranks 29th. In these two provinces, we randomly selected two sample counties: Xiantao County in Hubei province and Yuqing County in Guizhou Province. All townships of the county were divided into three categories (good, middle, poor) according to economic development. We extracted 2-5 townships from each group to do the survey.

2.2. Data Collection

This study targeted rural residents that suffered from critical illnesses. The MSS beneficiaries who received inpatient services were searched on the database in 2016. All participants were selected from the sample townships and interviewed individually using a structured questionnaire, which was constructed reference to the National Health Services Survey Questionnaire and China Health and Retirement Longitudinal Study (CHALS) Questionnaire. The questionnaire was composed of three parts: household socioeconomic status, inpatient service utilization and expenses of health care. All completed questionnaires were independently examined to identify and correct errors. A total of 1000 residents were investigated and 834 valid answer sheets were used for analysis after checking on site for completeness and internal logic. Per capita annual income was captured by self-report. The direct hospitalization expenses (HE) and reimbursement information were obtained from NCMS, CII and MFA database for accuracy.

3. MEASUREMENT

3.1. Measuring Poverty

We used two international poverty lines set by the World Bank. The first defined as extreme poverty line is US\$1.90 per day. The second defined as poverty line is US\$3.20 per day. After adjusting for 2011 PPP USD, the extreme poverty line is CNY ¥2503.5 annual; the poverty line is CNY ¥4084.7 annual.

The FGT weighted poverty measure was adopted in this study. The Foster, Greer, and Thorbecke (FGT)

indices are cross-sectional poverty measures[17]. Poverty is defined mathematically as follows:

$$P_{\alpha} = \frac{1}{n} \sum_{i=1}^q \left(\frac{PL - X_i}{PL} \right)^{\alpha} \quad (1)$$

The P-alpha measures in analyzing poverty relate to different dimensions of the indices of poverty. P0, P1 and P2 represent headcount (HC) index, poverty gap (PG) index, squared poverty gap (SPG) index, and are used for incidence, depth of poverty. The HC index shows the proportion of the population that is poor. The PG index represents the aggregate deficit from the poverty line. The SPG index indicates a higher degree of aversion to inequality of poverty across the population[18].

Where n is the number of individuals in the sample, q is the number of individuals below the poverty line. PL is the poverty line, X denotes per capita annual disposable income, i represents individuals. P_{α} indicates the poverty status of rural residents with critical illnesses before paying for HE. In this study, we used per capita annual disposable income instead of per capita consumption expenditure for the availability.

3.2. Measuring Impoverishing Impact of Hospitalization Expenses

Poverty indicators that have included hospitalization expenses are defined as P_{α}^{HE} :

$$P_{\alpha}^{HE} = \frac{1}{n} \sum_{i=1}^q \left[\frac{PL - (X_i - HE_i)}{PL} \right]^{\alpha} \quad (2)$$

where HE is the per capita hospitalization expenses.

The impoverishing effects of HE on poverty is then derived as differences in the poverty measures:

$$P_{\alpha}^{impoverish} = P_{\alpha}^{HE} - P_{\alpha} \quad (3)$$

where P_{α}^{HE} indicates the poverty status of rural residents after HE payments.

3.3. Measuring Poverty Alleviating Impact of Medical Security System

Poverty indicators that have netted out reimbursements of MSS are defined as P_{α}^{MSS} :

$$P_{\alpha}^{MSS} = \frac{1}{n} \sum_{i=1}^q \left[\frac{PL - (X_i - OOP_i)}{PL} \right]^{\alpha} \quad (4)$$

P_{α}^{MSS} indicates the poverty status of rural residents after MSS reimbursement. The poverty alleviating effects

of medical security system is derived as differences before MSS reimbursements and after MSS reimbursements in the poverty measures.

$$P_{\alpha}^{alleviate} = P_{\alpha}^{MSS} - P_{\alpha}^{HE} \quad (5)$$

Similarly, $P_{\alpha}^{MSS} - P_{\alpha}$ indicates the impoverishing impact of OOP payments.

Poverty analyses were carried out using Povcal software developed by the World Bank.

4. DATA ANALYSIS

General characteristics, including gender, age, marriage status, household size, education level, employment status, and length of stay (LOS), inpatient frequencies were examined using descriptive statistics. Given the skewed distribution of the cost data, median, 25th percentile (P25), 75th percentile (P75) of HE, OOP payments and reimbursements were reported. Per capita annual income were described by quartiles as poorest group, poor group, middle group, wealth group, wealthiest group. Illness type was determined by the patient's primary diagnostic ICD10 code in the visit record. HE, OOP payments and reimbursement of NCMS, CII and MFA were also calculated. The results were reported in US dollars. Indirect medical costs were not included in this study. STATA 12.0 was used to conduct the quantitative data analysis.

We modeled associations between selected characteristics and whether falling into poverty and extreme poverty due to critical illnesses treatment after reimbursed by MSS using binary logistic regression. Random effect analysis upon counties was included in regression that would have taken the correlated nature of samples measured from the same county into consideration. $P < 0.05$ was considered to be statistically significant.

5. RESULTS

5.1. Characteristic of Participants

Table 1 presents the general characteristics of individuals involved in the study. In total, 834 rural residents with critical illness were evaluated, 439 were male and 395 were female. Only 9.1% of them got high school education and above. The majority of residents were married (78.8%), endured chronic illness (77.5%) and in the station of unemployment (72.1%). 74.3% of them sought inpatient services out county.

Table 1. General characteristics of participants.

	Number(n=834)	Percent(%)
Region		
Xiantao	434	52.0

Yuqing	400	48.0
Gender		
Male	439	52.6
Female	395	47.4
Marriage		
Married	657	78.8
Unmarried	106	12.7
Other	71	8.5
Education level		
None	192	23.0
Primary	309	37.1
Secondary	257	30.8
High school	61	7.3
Undergraduate and above	15	1.8
Employment		
Currently working	233	27.9
Not employed	601	72.1
Hospital		
In county	214	25.7
Out county	620	74.3
Illness		
Acute	188	22.5
Chronic	646	77.5
Per capita annual income		
Quantile 1	166	19.9
Quantile 2	167	20.0
Quantile 3	166	19.9
Quantile 4	168	20.1
Quantile 5	167	20.0
	Mean	SE
Length of stay(LOS)	49	2.25
Inpatient frequency	5	0.24
Age	50	0.64
Household size	3.78	0.06

5.2. Hospitalization Expenses (HE), Out-of-Pocket (OOP) Payments And Reimbursements

Table 2 presents estimates of HE and OOP spending reimbursements. Residents spent a median of US\$8285.49 (IQR US\$5214.88–US\$13091.67) on direct medical costs relevant to critical illnesses treatment during their hospital stay. The median OOP payments are

US\$3169.88 (IQR US\$1983.17–US\$4993.45). NCMS (US\$4133.0, IQR US\$2633.9–US\$ 6705.6) compensated more than CII (US\$538.8, IQR US\$199.2–US\$1300.6) and MFA (US\$648.9, IQR US\$283.6–US\$1055.4) for patients. As figure 1 shows, the OOP payments accounts for 41.91% of HE. The average total reimbursements ratio of MSS for all participants is 58.09%. NCMS covers 33.14% of HE, followed by CII (15.61%) and MFA (9.34%).

Table 2. Hospitalization expenses (HE), Out-of-Pocket (OOP) payments and reimbursements. (\$[†])

	HE	OOP	NCMS	CII	MFA
Median	8285.49	3169.88	4133.00	538.80	648.90
p25	5214.88	1983.17	2633.90	199.20	283.60
p75	13091.67	4993.45	6705.60	1300.60	1055.40

[†] Exchange rate in 2016: CNY¥6.6423 to US\$1.00.

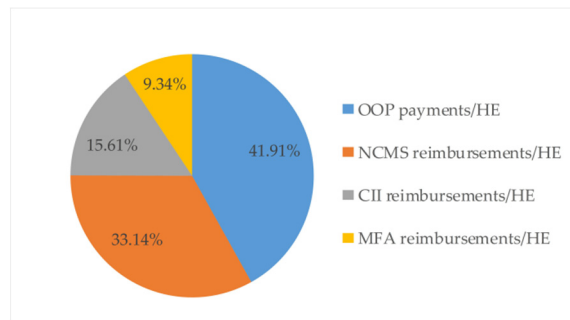


Figure 1. Proportions of Out-of-pocket payments and reimbursement ratio of Medical Security System in hospitalization expenses.

5.3. Impoverishing impact of HE, OOP and Poverty Alleviating Impact of MSS

Table 3 demonstrates the results of impoverishing impact of HE, OOP and poverty alleviating impact of MSS using the poverty measures. After incurring HE, the percentage of people who become poor increased drastically. Poverty headcount increased from 0.375 to 0.972, extreme poverty headcount increased from 0.269 to 0.966, which suggested the HE pushed 59.7% of non-poor residents with critical illnesses into the poor at the poverty line and 69.7% at the extreme poverty line.

Table 3. Impoverishing impact of Hospitalization expenses (HE), Out-of-Pocket (OOP) payments and poverty alleviating impact of Medical Security System (MSS).

	Poverty line			Extreme Poverty line		
	HC	PG	SPG	HC	PG	SPG
Before HE payments(1)	0.375	0.210	0.150	0.269	0.140	0.100
After HE payments(2)	0.972	15.610	372.630	0.966	24.830	960.210
After NCMS (3)	0.928	7.280	97.080	0.918	11.370	243.760
After NCMS+CII (4)	0.905	5.670	57.900	0.894	8.750	142.760
After NCMS+CII+MFA (5)	0.880	5.480	54.970	0.864	8.440	135.360
HE impoverish difference						
Absolute (2) – (1)	0.597	15.400	372.480	0.697	24.690	960.110
Relative [(2) – (1)]/(1)	1.592	73.333	2483.200	2.591	176.357	9601.100
OOP impoverish difference						
Absolute (5) – (1)	0.505	5.270	54.820	0.595	8.300	135.260
Relative [(5) – (1)]/(1)	1.347	25.095	365.467	2.212	59.286	1352.600
MSS poverty alleviate difference						
Absolute (5) – (2)	-0.092	-10.130	-317.660	-0.102	-16.390	-824.850
Relative [(5) – (2)]/(2)	-0.095	-0.649	-0.852	-0.106	-0.660	-0.859
NCMS poverty alleviate difference						
Absolute (3) – (2)	-0.044	-8.330	-275.550	-0.048	-13.460	-716.450
Relative[(3) – (2)]/(2)	-0.045	-0.534	-0.739	-0.050	-0.542	-0.746
CII poverty alleviate difference						
Absolute (4) – (3)	-0.023	-1.610	-39.180	-0.024	-2.620	-101.000
Relative[(4) – (3)]/(2)	-0.024	-0.103	-0.105	-0.025	-0.106	-0.105
MFA poverty alleviate difference						
Absolute (5) – (4)	-0.025	-0.190	-2.930	-0.030	-0.310	-7.400
Relative[(5) – (4)]/(2)	-0.026	-0.012	-0.008	-0.031	-0.012	-0.008

It is also found that OOP payments pushed 50.5%, 59.5% of non-poor residents with critical illnesses into the poor at the poverty and extreme poverty line. Relatively, these translate into 134.7% and 221.2% increment in poverty and extreme poverty headcounts respectively. As shown in Table 3, with OOP payments, the estimated PG and SPG at poverty line rose by 5.27, 54.82 respectively. There are greater gaps at extreme poverty line, the estimated PG and SPG rose by 8.3, 135.26. Relatively, the raise of estimated PG in extreme poor population (59.286) is 2.362 times more than that in poor population (25.095), the raise of estimated SPG in extreme poor population (1352.6) is 3.701 times more than that in poor population (365.467).

After MSS reimbursements, the poverty headcount, poverty gap and squared poverty gap are all decreased. Poverty headcount decreased from 0.972 to 0.880, extreme poverty headcount decreased from 0.966 to 0.864, which indicates the MSS protects 9.2% of rural residents with critical illness from falling into poverty at the poverty line and 10.2% at the extreme poverty line. As for the depth of poverty, the estimated PG and SPG dropped from 15.61 to 5.48, 372.63 to 54.97 at the poverty line, dropped from 24.83 to 8.44, 960.21 to 135.36 at the extreme poverty line. In relative terms, the MSS narrowed the PG and SPG by 64.9% and 85.2% at the poverty line, 66.0% and 85.9% at the extreme poverty line respectively. We may conclude that the effect of MSS in narrowing the poverty gap is greater than that of reducing the headcount of poverty.

While comparing the three programs of MSS, CII and MFA is not relatively effective as NCMS at alleviating poverty by headcount, poverty gap and squared poverty gap. In relative terms, NCMS reduced the headcount of poverty and extreme poverty for 4.5% and 5%, followed by MFA (2.6%, 3.1%), the least was CII (2.4%, 2.5%). CII narrowed the PG of poverty and extreme poverty to 10.3%, 10.6%, greater than MFA (1.2%, 1.2%), but less than NCMS (53.4%, 54.2%).

5.4. Determinants of OOP Payments-induced Poverty Incidence After MSS Reimbursements.

Table 4 shows factors associated with OOP payments-induced poverty incidence after MSS reimbursements. It clearly shows that hospital level was associated with poverty and extreme poverty incidence ($P < 0.001$), patients seeking health care out county were at higher risk of falling into poverty. The household size and age of participants are also relevant to the poverty and extreme poverty incidence ($P < 0.01$). Compared with the poorest income group, the wealth of residents is associated with poverty and extreme poverty incidence ($P < 0.05$). Moreover, rural residents with acute illness are more likely to experience extreme poverty compared with those suffering from chronic illness ($P < 0.05$). While gender, marriage, education level, employment status, LOS and inpatient frequency are irrelevant to health payment-induced poverty incidence after MSS reimbursements.

Table 4. The binary logistic linear regression of poverty and extreme poverty with random effect analysis upon area.

	Poverty		Extreme poverty	
	Coef.	SE	Coef.	SE
Gender(Male as reference)				
Female	-0.114	0.241	-0.116	0.228
Marriage(Married as reference)				
Unmarried	0.700	0.495	0.783	0.474
Other	-0.363	0.391	-0.202	0.387
Education level(None as reference)				
Primary	-0.167	0.336	-0.091	0.310
Secondary	-0.275	0.361	-0.055	0.339
High school	-0.467	0.465	-0.511	0.430
Undergraduate and above	-1.064	0.708	-1.204	0.655
Employment(Currently working as reference)				
Not employed	0.177	0.251	0.069	0.242
Hospital(In county as reference)				
Out county	0.992***	0.248	0.954***	0.238
Illness(Acute as reference)				
Chronic	-0.430	0.292	-0.592*	0.287
Income(Poorest group as reference)				

Quantile 2	0.661	0.347	0.443	0.331
Quantile 3	0.019	0.311	-0.132	0.304
Quantile 4	0.921*	0.361	0.745*	0.347
Quantile 5	0.901*	0.362	0.552*	0.334
length of stay(LOS)	0.001	0.003	0.002	0.003
Inpatient frequency	0.006	0.027	-0.001	0.026
Age	0.030**	0.010	0.031**	0.009
Household size	0.223**	0.076	0.175**	0.071
Cons_	-2.882	2.455	-1.599	2.360

* P<0.05, ** P<0.01, *** P<0.001

Figure 2 compares the poverty incidence at two poverty lines by hospital level. The poverty incidence is decreasing as covered by more programs of MSS, not only for residents seeking inpatient services in county, but also out county. The extreme poverty and poverty incidence of residents seeking inpatient services in county dropped by 14.49%, 14.02% after triple guarantee of MSS, more than those out county (8.71%, 7.58%).



Figure 2. Poverty incidence by hospital level at the extreme poverty line (left) and the poverty line (right).

Figure 3 compares the poverty incidence at two poverty lines by economic status. The poverty incidence is decreasing as covered by more programs of MSS for participants from all economic groups. Wealth group has the largest proportion of health payment-induced poverty incidence (98.81% at the extreme poverty line, 99.40% at the poverty line), followed by wealthiest group (98.20% at the extreme poverty line, 98.70% at the poverty line), poor group (96.60% at the extreme poverty line, 97.6% at the poverty line), middle group (95.18% at the extreme poverty line, 95.78% at the poverty line), whereas poorest group has the smallest proportion of health payment-induced poverty incidence (93.37% at the extreme poverty line, 94.58% at the poverty line).

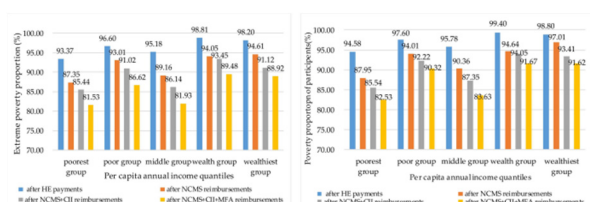


Figure 3. Poverty incidence by economic status at the extreme poverty line (left) and the poverty line (right).

After triple guarantee of MSS, wealth group and wealthiest group still have a larger proportion of health payment-induced poverty incidence. But the poverty incidence of residents in the middle economic group dropped most by 13.25% at the extreme poverty line, 12.15% at the poverty line, followed by the poorest group (11.84% at the extreme poverty line, 12.05% at the poverty line), whereas the wealthiest group dropped the least (9.28% at the extreme poverty line, 7.19% at the poverty line). In other words, a higher percentage of participants in the middle economic group and poorest group are protected from being pushed below the poverty line by MSS compared to other groups.

6. DISCUSSION

In this study, we have assessed the impact on poverty of HE, OOP and MSS based on the share of medical expenses reimbursed and the FGT indices. We demonstrate general increases in poverty that result from paying HE and decreases in poverty that result from MSS reimbursement. We have a brief comparison of poverty alleviating impact among NCMs, CII and MFA.

The results suggest that the OOP induced-poverty is very serious although MSS indeed helps to alleviate the poverty among rural residents with critical illness in China in terms of incidence and depth. Critical illnesses still impose really heavy financial burden on those sufferings despite with MSS. We find that the OOP payments pushed more than half of non-poor residents with critical illnesses into the poor at the poverty and extreme poverty line. This is higher than previous researches. A study of 11 Asian countries survey using urban and rural household survey data (2000) showed that the healthcare OOP payments raised the poverty headcount by 2.6 % at the poverty line of US\$1.08 per day and 1.8% at the poverty line of US\$2.15 per day[19]. Yip et al[20] used household survey data (2006) and found that 7.31% of individuals were impoverished due to medical expenses under the poverty line of US\$1.08 per day. Another study using the data of the China Fourth National Health Service Survey (2008) showed that after OOP payments, 7.5% of non-poor households became poor at the poverty line of US\$ 449.40 per year[21]. One

reason for the difference is that compared with the normal population, the rural residents with critical illness are more vulnerable economically and have higher OOP payments. This indicates more attention should be given to them on the precision poverty alleviation.

According to our findings, the poverty alleviation effect of MSS is somewhat limited, only 9.2% of rural residents with critical illness from falling into poverty at the poverty line and 10.2% at the extreme poverty line. And the effect of MSS in narrowing the poverty gap is greater than that of reducing the headcount of poverty. Among the three programs of MSS, NCMS is more effective than CII and MFA at alleviating poverty. The findings are in line with study in rural Shandong, China, where Sun et al[22] collected primary data from a household survey and reported that after NCMS reimbursements, the health payment-induced poverty gap of households dropped at the Chinese national poverty line of 668 Yuan per capita, but financial protection from the NCMS was limited. Studies assessed the effect of CII, MFA also support our findings. Zhao et al[23] found the CII is only partially effective in protecting households from CHE when considering the total medical expenses. Zhu[24] reported that MFA helps to reduce the impact of disease on the economies of poor families, and prevents the poor afflicted with serious illnesses from being marginalized whereas the financial assistance is often insignificant in relation to medical expenses. But it is in contrast to a fieldwork study in the Inner Mongolia Autonomous Region, People's Republic of China conducted by Sagli et al[25], which showed that NCMS does not prevent poor and disabled households from sinking deeper into poverty when using healthcare services as healthcare expenses increase.

Several factors may explain the modest relief for poverty provided by the MSS. First of all, the reimbursement ratio of MSS is still insufficient although China has made remarkable progress in anti-poverty work and improved the medical security system gradually. As this paper shows, the reimbursement rate accounts for 58.09% of total HE. When compared with the large amount of HE for critical illnesses treatments, the amounts of subsidies from CII and MFA are relatively small, which accounts for 15.61% and 9.34% respectively. The effect of subsidies on financial protection is greatly undermined, which may greatly impede the impact of financial protection against impoverishment. Secondly, there is still much space to improve the benefit package design of MSS. For example, the compensation of NCMS for inpatient care is not adjusted to a rural county's level of economic development or per capita GDP[26]. The deductible of CII was RMB 12,000 in Xiantao and RMB 8,000 in Yuqing[27]. However, many poor residents can't even pay for the threshold and give up medical services due to difficulty paying medical bills[28]. MFA covers the cost of limited kinds of critical illnesses and the threshold and ceiling of compensation are restricted by

the local governments' fiscal capacity[29]. In addition, direct non-medical costs such as transportation and indirect costs such as work loss, which were not included in this study, were not covered by MSS. However, previous evidence denotes that these costs are considerable[30,31]. This implies that the harsh economic effects of critical illness would be worse if taking direct non-medical and indirect costs into consideration.

Further, this paper evaluated the determinants of OOP payments-induced poverty after MSS reimbursements. Our study found that age and household size are relevant factors. The older patients are more likely to incur complications and increase economic burden. Residents with large households may have complicated family structure with more children or elders[32] that would reduce per capita annual income. These could be the potential reasons why older and larger household sizes are the risk factors of health payment-induced poverty. The results also demonstrate that wealth and wealthiest group are more likely to suffer from OOP payments-induced poverty after MSS reimbursements compared with lowest-income residents. This makes sense as many residents in the poorest quintile already live below the poverty line and lots of them will choose not to seek care when they get ill, rather than become impoverished[10]. Besides, this could be partially explained by the reason that the wealthier group tend to bypass primary health care services and seek more expensive upper health care services with self-referral in general and direct costs are usually higher[33].

Rural residents with critical illnesses that sought inpatient services out county account for 74.5%, and it is significantly associated with the incidence of the OOP payments-induced poverty. The extreme poverty and poverty incidence of residents seeking inpatient services in county dropped more than those out county after triple guarantee of MSS. This can be explained by several reasons. For one thing, according to the reimbursement policies of MSS, the reimbursement proportions for medical services out county medical treatment of NCMS is lower than that in county, as for CII and MFA. The reimbursement proportions for medical services out county medical treatment in accordance with that in county. Moreover, patients seeking services out county have large amounts of non-reimbursable expenses. For another, patients with critical illness usually cannot obtain effective treatment in local hospitals and instead have to seek services far from their homes[34]. Besides, the allocation of healthcare resources in China is uneven[35]. This situation will further aggravate patients' economic burden and make them more likely to fall into poverty. Our study also proved this. Further efforts are needed to alleviate the financial burden of certain disadvantaged groups with these features.

It is also found that rural residents with acute illness are more likely to fall into extreme poverty compared with those suffering from chronic illness. In general, the therapeutic effect of acute illness is more significant than chronic illness, thus patients probably are willing to get treatments even with high financial burden.

Therefore, in accordance with the findings of the study, we emphasize some potential policy implications. Precise guarantee needs to be provided for vulnerable rural residents with critical illness. Further efforts should be devoted to keep trying to extend MSS fund investment channel and increasing the reimbursement ratio continuously. To explore appropriate cooperation mechanisms for these programs and set up one-stop service platform to solve the inconveniences of procedure. What's more, make policies to reduce the burden of direct non-medical costs and indirect costs especially among the poor and vulnerable residents. Including more illness into the beneficial categories according to the local situation. The poverty alleviating effect of MSS can only be improved if accompanied by efforts at investing in health and strengthening primary health care, which in line with the international trend towards poverty alleviation[36]. A more effective referral system at the primary health care level is necessary. It would not only reduce the risk of impoverishment due to OOP payments incidence, but it would also lead to better efficiency and outcomes of the health sector.

This study reinforces evidence about the impoverishment of HE, OOP due to critical illnesses treatments, and the poverty alleviating impact of MSS. The paper revealed some problems and challenges MSS faces in providing an effective social protection system for the rural population. However, there exist several limitations. It was a cross-sectional study, thus the causal relationship between the determinants and level of impoverishment and poverty alleviating effect could not be firmly identified. Per capita annual income was self-reported, therefore there may have been over-reporting or under-reporting for participants' recall bias or their unwillingness to tell the truth. There are policy differences among provinces or cities during the implementation of MSS, future relevant studies in other provinces are needed.

7. CONCLUSIONS

Critical illnesses place really heavy financial burden on rural residents and the OOP payments-induced poverty is serious as the poverty alleviating effect of MSS is limited. The limited effect especially in that the effect of reducing the poverty headcount is not good as narrowing the poverty gap, CII and MFA is less effective than NCMS. Critical illness patients with features of older, larger household size, acute disease and seeking inpatient services out county are sensitive to the OOP payments-induced poverty after MSS reimbursements.

Governments should raise awareness of the relatively affluent residents' risk of falling into poverty caused by OOP payments. Hence, precise guarantee needs to be provided for the vulnerable rural residents with critical illness. The MSS can be improved by increasing the reimbursement ratio, optimizing the benefit package design, exploring appropriate cooperation mechanisms for MSS programs and strengthening primary health care.

AUTHORS' CONTRIBUTIONS

Conceived and designed the experiments: L.L. Collected materials and data: J.J. Analyzed the data: L.L. L.C. Wrote the paper: L.L, J.J. Reviewed the overall manuscript: L.L, J.J, L.C.

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REFERENCES

- [1] 40 years on: Achievements in poverty relief - Chinadaily.com.cn.
<http://www.chinadaily.com.cn/a/201809/26/WS5baab6eca310c4cc775e80ca.html>.
- [2] Report: 10 Mln people out of poverty in China in 2016 -- China Development Gateway.
http://en.chinagate.cn/fupin/2017-01/16/content_40120106.htm.
- [3] Waitzkin H. Report of the WHO Commission on Macroeconomics and Health: a summary and critique. *Lancet*. 2003;361(9356):523-526. doi:10.1016/S0140-6736(03)12491-9
- [4] DAC Network on Poverty Reduction, ed. Poverty and Health. Paris : Geneva: OECD ; World Health Organization; 2003.
- [5] Morrisson C. Health, Education and Poverty Reduction. OECD Publishing; 2002. <https://EconPapers.repec.org/RePEc:oec:devaab:19-en>.
- [6] Liu YL, Rao KQ, Hsiao WC. Medical expenditure and rural impoverishment in China. *Journal of Health Population and Nutrition*. 2003;21(3):216-222.
- [7] Adhikari NKJ, Fowler RA, Bhagwanjee S, Rubinfeld GD. Critical Care 1 Critical care and the global burden of critical illness in adults. *Lancet*. 2010;376(9749):1339-1346. doi:10.1016/S0140-6736(10)60446-1
- [8] 2020 health plan to ease burden on people in poverty

- China - Chinadaily.com.cn.
http://www.chinadaily.com.cn/china/2016-06/22/content_25797364.htm.
- [9] Kawabata K, Xu K, Carrin G. Preventing impoverishment through protection against catastrophic health expenditure. *Bulletin of the World Health Organization*. 2002;80(8):612-612.
- [10] Somkotra T, Lagrada LP. Payments for health care and its effect on catastrophe and impoverishment: Experience from the transition to Universal Coverage in Thailand. *Social Science & Medicine*. 2008;67(12):2027-2035. doi:10.1016/j.socscimed.2008.09.047
- [11] General Office of the State Council. Guiding Opinions on Carrying out Critical Disease Insurance Work for Urban and Rural Residents. http://www.gov.cn/zhengce/content/2015-08/02/content_10041.htm. Published 2015.
- [12] Wagstaff A, Lindelow M, Jun G, Ling X, Juncheng Q. Extending health insurance to the rural population: An impact evaluation of China's new cooperative medical scheme. *Journal of Health Economics*. 2009;28(1):1-19. doi:10.1016/j.jhealeco.2008.10.007
- [13] Cheng L, Liu H, Zhang Y, Shen K, Zeng Y. The Impact of Health Insurance on Health Outcomes and Spending of the Elderly: Evidence from China's New Cooperative Medical Scheme. *Health Economics*. 2015;24(6):672-691. doi:10.1002/hec.3053
- [14] Fang P, Pan Z, Zhang X, Bai X, Gong Y, Yin X. The effect of critical illness insurance in China: *Medicine*. 2018;97(27):e11362. doi:10.1097/MD.00000000000011362
- [15] Zhang Y, Vanneste J, Xu J, Liu X. Critical Illness Insurance to alleviate catastrophic health expenditures: new evidence from China. *International journal of health economics and management*. September 2018. doi:10.1007/s10754-018-9252-1
- [16] Ma Y, Xiong X, Li J, Zhang J. The Impact of Different Types of Health Insurance on the Hospitalization Services Utilization of Patients with Hemorrhagic Stroke in China. *Value in Health*. 2015;18(3):A150-A150. doi:10.1016/j.jval.2015.03.873
- [17] Foster J, Greer J, Thorbecke E. A Class of Decomposable Poverty Measures. *Econometrica*. 1984;52(3):761-766.
- [18] Ozturk GB. Anti-Poverty Effects of In-Kind Transfers Among Divorced or Separated Women in the United States. *Poverty & Public Policy*. 2018;10(1):57-80. doi:10.1002/pop4.203
- [19] van Doorslaer E, O'Donnell O, Rannan-Eliya RP, et al. Effect of payments for health care on poverty estimates in 11 countries in Asia: an analysis of household survey data. *Lancet*. 2006;368(9544):1357-1364. doi:10.1016/S0140-6736(06)69560-3
- [20] Yip W, Hsiao WC. Non-evidence-based policy: How effective is China's new cooperative medical scheme in reducing medical impoverishment? *Social Science & Medicine*. 2009;68(2):201-209. doi:10.1016/j.socscimed.2008.09.066
- [21] Li Y, Wu Q, Xu L, et al. Factors affecting catastrophic health expenditure and impoverishment from medical expenses in China: policy implications of universal health insurance. *Bulletin of the World Health Organization*. 2012;90(9):664-671. doi:10.2471/BLT.12.102178
- [22] Sun X, Sleight AC, Carmichael GA, Jackson S. Health payment-induced poverty under China's New Cooperative Medical Scheme in rural Shandong. *Health Policy and Planning*. 2010;25(5):419-426. doi:10.1093/heapol/czq010
- [23] Zhao S, Zhang X, Dai W, Ding Y, Chen J, Fang P. Effect of the catastrophic medical insurance on household catastrophic health expenditure: evidence from China. *Gaceta Sanitaria*. January 2019. doi:10.1016/j.gaceta.2018.10.005
- [24] Zhu L. Effects of rural medical financial assistance in China. *China & World Economy*. 2007;15(2):16-28. doi:10.1111/j.1749-124X.2007.00059.x
- [25] Sagli G, Zhang J, Ingstad B, Fjeld HE. Poverty and disabled households in the People's Republic of China: experiences with a new rural health insurance scheme. *Disability & Society*. 2013;28(2):218-231. doi:10.1080/09687599.2012.699281
- [26] Dong H, Duan S, Bogg L, et al. The impact of expanded health system reform on governmental contributions and individual copayments in the new Chinese rural cooperative medical system. *International Journal of Health Planning and Management*. 2016;31(1):36-48. doi:10.1002/hpm.2259
- [27] Jiang J, Chen S, Xin Y, et al. Does the critical illness insurance reduce patients' financial burden and benefit the poor more: a comprehensive evaluation in rural area of China. *Journal of medical economics*. 2019:1-1. doi:10.1080/13696998.2019.1581620
- [28] Baughman KR, Burke RC, Hewit MS, Sudano JJ,

- Meeker J, Hull SK. Associations between Difficulty Paying Medical Bills and Forgone Medical and Prescription Drug Care. *Population Health Management*. 2015;18(5):358-366. doi:10.1089/pop.2014.0128
- [29] Liu K, Yang J, Lu C. Is the medical financial assistance program an effective supplement to social health insurance for low-income households in China? A cross-sectional study. *International Journal for Equity in Health*. 2017;16(1). doi:10.1186/s12939-017-0638-3
- [30] Su TT, Sanon M, Flessa S. Assessment of indirect cost-of-illness in a subsistence farming society by using different valuation methods. *Health Policy*. 2007;83(2-3):353-362. doi:10.1016/j.healthpol.2007.02.005
- [31] Logminiene Z, Norkus A, Valius L. [Direct and indirect diabetes costs in the world]. *Medicina (Kaunas, Lithuania)*. 2004;40(1):16-26.
- [32] Lan X, Zhou Z, Si Y, et al. Assessing the effects of the percentage of chronic disease in households on health payment-induced poverty in Shaanxi Province, China. *Bmc Health Services Research*. 2018;18:871. doi:10.1186/s12913-018-3698-1
- [33] Dorjdagva J, Batbaatar E, Svensson M, Dorjsuren B, Kauhanen J. Catastrophic health expenditure and impoverishment in Mongolia. *International Journal for Equity in Health*. 2016;15:105. doi:10.1186/s12939-016-0395-8
- [34] Guo MT, Qun-Hong WU, Ye LI. Analysis of the Changing Tendency of Inpatient Reimbursement, Copayment Rate and Impoverishment from Medical Expenses of the Patient with Medical Insurance. *Chinese Hospital Management*. 2014.
- [35] Nan Z. Analyzing the equity of health resources allocation in China based on Theil Index. *Chinese Health Service Management*. 2014.
- [36] The World Health Report 1999: Making a difference. *Physiotherapy*. 1999;85(6):337. doi:10.1016/S0031-9406(05)67141-6