Measuring and decomposing the effort regarding the equity of inpatient benefits based on the adjustment of the new cooperative medical scheme in western rural China

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Background: The ultimate objective of rural health reform and development is to establish a mature healthcare service system that adapts to the socialist market economy and the developmental level of the Chinese economy and meets the health demands of the people. Reform of the payment system is one of the key elements. This article explores the effect of the system and the causes of benefit inequity, provides an objective evaluation of policy implementation and offers data support for policy adjustment.

Methods: A two-stage stratified random sampling data collection method comprising a survey in 2009 (the sample size was 3832 families) and a follow-up survey in 2015 (the sample size was 3992 families) was used. Qualitative data are presented as rates or ratios and the χ^2 test was used for descriptive statistics. Quantitative data were analysed using a t test. A generalized linear model (GLM) with gamma distribution of the log connection function was adopted to analyse the factors of the compensation benefit inequity. The degree of the compensation benefit inequity contribution was analysed using the concentration index (CI) decomposition method and the Oaxaca decomposition method.

Results: Reimbursement refers to the reimbursement expense received by inpatients from the New Cooperative Medical System (NCMS). In the GLM, there were some positive factors for reimbursement in the NCMS, including economic level, level of health facility and deductibles. The CI decomposition analysis results show that the main factors that increased the compensation benefit inequity were economic levels and deductibles over the past 2 y. However, inpatient days (2009) and the actual reimbursement ratio (2015) decreased the inequity. The Oaxaca decomposition analysis results suggest that changes in compensation benefit inequity between 2009 and 2015 were more attributable to changes in economic status and variables related to policy compensation than to demographic variables.

Conclusions: This study showed that inequity decreased from 2009 to 2015, which could be the result of adjustment of the compensation policy. However, we should remain vigilant lest the gap between the rich and the poor leads to an increase in inequity.

Keywords: beneficial degree of equity, CI decomposition, new rural cooperative medical scheme, reimbursement for expenses

Introduction

In China, approximately 50.32% of the population, nearly 67 million people, are classified as rural residents (by the existing 'household registration' system).[1] The extent of rural development is an important indicator of economic prosperity in China.[2] Meanwhile, a key question remains about obstacles to develop-ment in rural areas. Following economic reforms, medical expenditure has been a major financial burden for a number of rural households in China.[3–5] Because residents of the country are characterized as not having a high degree of universal health knowledge, they have a weaker elasticity for assuming economic risk. Therefore, building a social security system that allows residents to effectively avoid medical risks and reduces the economic

burden of disease is an urgent governmental issue that needs to be addressed. Some studies indicate that health insurance may reduce the financial burden faced by patients in accessing health services, which in turn enhances access to health services.[6] Since 2000, numerous developing countries worldwide have sought to establish universal health insurance schemes.[7] The New Cooperative Medical Scheme (NCMS) was implemented by the Chinese government in 2003; this policy, through helping each other and jointly protecting against disease risk, reduces the burden of disease and reduces the phenomena of 'the sick poor' and 'poverty due to illness'.[8] The NCMS is a medical insurance funding system that is to be funded, distributed and used to resolve issues related to preventing and curing disease among residents; it is based on state and government financial assistance combined with individual payments and the collective support of farmers.

During the first decade of policy implementation, coverage by the NCMS reached >98%[9] and the annual benefit distribution increased yearly. From 2008 to 2017, financial subsidies at all NCMS levels improved from 120 yuan (approximately US$18.80) to 450 yuan (approximately US$70.50) per person per year and the health level of rural residents in China significantly improved as well. The health level of residents was most fundamentally improved through the implementation of basic public health projects, which significantly improved the ability to avoid disease risk. However, this came at the cost of excessive growth of government health expenditures, frequent waste of medical resources and increasingly apparent defects in the payment system.

A number of efforts have been undertaken by the government of China, such as adjusting the payment system, regulating the scope of medical payments, optimizing the reimbursement ratio and simplifying payment methods. Ningxia Province, located in the western region of China, implemented a remarkable project for reforming the payment system—'innovating the paying system, improving healthy efficiency'—which was carried out jointly by Harvard University, Oxford University and the Health and Family Planning Commission in Ningxia. This project mainly focused on reforming the payment system: changing it gradually from a 'post-payment system', which was mainly based on payments for medical treatment items, to a 'total prepaid hospitalization system', paid according to the number of patients. The specific approach was that, according to the number of insured persons, the average annual hospitalization, the average cost of hospitalization, the service capacity by disease type and the consideration of inflation-related factors among the county hospitals in various regions, the total budget of each county hospital was estimated by experts and local health insurance centres. In addition, 70% of the total budget was paid quarterly in advance. The remaining 30% of the funds were cleared according to an annual performance appraisal. (1) For county hospitals that reached the established service volume, the balance was retained. (2) For county hospitals that failed to meet the established service volume, the corresponding proportion of funds was deducted and the hospitals were required to bear expenses beyond the budget themselves. (3) Compensation and reward were given to those county hospitals that attracted patients from outside the county or added extrabudgetary service beyond the established service volume. (4) No compensation was granted to those who overspent due to other unreasonable factors. On

the one hand, for the supplier, economic incentives are used in hospitals, especially in county-level hospitals, to encourage patients to remain at the grassroots level for treatment to reduce the burden on higher medical institutions and adjust the rational distribution of medical resources. On the other hand, for the buyer, hospitalization expenses can be reimbursed directly, without prepayment of all expenses before reimbursement to the medical insurance centre, which increases the convenience of reimbursement. Meanwhile, the government of China has continually adjusted the deductibles, the reimbursement ratio (the increase in the reimbursement ratio for referral patients was higher than that for non-referral patients) and the capping line, and has implemented 'a system of three gears' policy. According to their health requirements and economic level, residents can independently choose their insurance package and receive the corresponding reimbursement benefits, within the same health insurance policy, which increases the amount of reimbursement for patients and the flexibility of insurance options. A series of policies has been implemented that not only alleviates hospitalization costs but also intensifies the effect of the 'porter' in county-level hospitals.[10] The policy reform promotes the use of primary medical technology and is based on convenience, so the health needs of rural residents are ensured to the maximum extent.

Some scholars have engaged in considerable research exploring policy reforms and improving residents' health levels. Shaohua et al.,[11] in a case analysis of the payment system of package intervention, pointed out that the policy effect is remarkable for controlling the risk of the medical insurance fund, improving the actual compensation rate for residents and addressing the actual interests of insured residents after implementation of the system in the Jimo District of Qingdao and Funan County of Anhui Province. In addition, Na et al.[12] used panel data analysis to determine that increased health service utilization can promote an increase in average hospitalization expenses. Jianmin et al.[13] used the concentration index (CI) to analyse the benefits of compensation for the NCMS and found them to be fairer. However, Feng[14] got the opposite results, believing that there was vertical inequity in the benefits of the compensation. In previous studies, researchers mostly used general methods to evaluate the current situation of policy implementation.[15,16] Some methods such as propensity score matching (PSM), the difference in differences method (DID), logistics and so on were used by others to study the factors affecting the impact of policy implementation.[17,18] There were few articles using the method of CI decomposition to analyse the impacts of key variables of the NCMS for equity of compensation benefits and using the Oaxaca decomposition method to evaluate health policy. Using these two methods, this article aims to explore the effect of the system and the causes of benefit inequity to objectively evaluate policy implementation and provide data support for policy adjustment.

Materials and methods

Data collection

Data were obtained mainly from the National Natural Science Foundation of China. Our research was approved by the Ethics Review Committee of Ningxia Medical University. Our question-

naire was designed and tested by experts at Harvard University and our research group. The investigation team from the School of Public Health and Management at Ningxia Medical University was assisted by the local health administration department in conducting onsite investigations.

Survey methods and sample

Inhabitants of the project counties (Yanchi and Haiyuan) who had been living there for >6 months were selected as respondents. Data collection followed a two-stage stratified random sampling method. All the villages in the two project counties were divided into three economic levels. At each level, sample villages were selected according to a 40% proportion. There were 76 villages, and 40 villages were selected from Haiyuan County and Yanchi County. Then, using the household head roster, 33 households in each village were selected by systematic sampling. All members of the sample households were surveyed and served as the sample population. The survey conducted in the baseline year (2009) included 3832 families (16 865 people). In the follow-up year (2015), families that were lost to relocation or could not be reached were replaced in the sample with a similarly structured family. The survey conducted in 2015 included 3992 families (15 234 people).

To define the household economic status, we measured the household income and consumption expenditure per capita to divide the study sample into five groups of equal size, from the lowest 20% to the highest 20%.

Statistical analysis method

EpiData 3.02 (EpiData Association, Odense, Denmark) was used to input the data and the data were analysed using Excel (Microsoft, Redmond, WA, USA) and Stata 12.0 (StataCorp, College Station, TX, USA). Qualitative data were analysed using a χ^2 test and presented as rates or ratios, and quantitative data were analysed using a t test. A GLM with gamma distribution of the log connection function was adopted to analyse the influencing factors. The degree of inequity contribution was analysed using the CI decomposition method and the Oaxaca decomposition method. The significance level was 0.05.

Model

GLM

The GLM has been presented by Nelder and Wedderburn[19] and McCullagh and Nelder[20] as an extension of the traditional linear model. Their model extends the dependent variable with the normal hypothesis in the traditional linear model to the exponential distribution and lets the total mean of the dependent variable depend on the linear predictive value through a non-linear connectivity function. There are three components in a GLM[21]: the linear component, a monotonic function that is related to the linear predictor and the independent response variables, each of which has a probability distribution from an exponential family.

The GLM is defined as follows:

$$\mu_i = E\left(Y_i = g^{-1}\left(\sum_j X_{ij}\beta_j + \xi_j\right)\right),$$
$$Var(Y_i) = \frac{\varphi V(\mu_i)}{\varpi_i}$$

where Y_i is a dependent variable vector; $g_{(x)}$ is a connection function, in which X_{ij}, β_i, ξ_i are the explanatory variable matrix, the parameter vector to be estimated and the error term vector, respectively; and $V_{(x)}$ is a variance function, in which φ is the dispersion parameter and ω_i is weight. There are four variables— Y_i, X_{ij}, ω_i and ξ_i—depending on the processing of data. Then $V_{(x)}$ and $g_{(x)}$ are based on a pre-set model. Because reimbursement comprised non-normal continuous data and not all factors were linearly additive,[22] this survey analysed the factors influencing reimbursement expenses using the GLM.

CI

The CI is a common index that is used to measure equity in health services.[23] The CI is defined as twice the area between the concentration curve and the line of equity (the 45-degree line).[24] The value of the CI is between −1 and 1.[25] The greater the absolute value is, the less fair the health services are.

The CI formula is as follows:

$$C = \frac{2}{\mu}\,cov\,(h, r),$$

where r is the rank of socio-economic status, h is the reimbursement, μ is the mean and cov is the weighted covariance. Socio-economic status was determined by the households' per capita consumption expenditure and was divided into five economic groupings.

CI decomposition method

The method was proposed by Wagstaff et al.[26] and Zahra et al.[27] to decompose CI into its determinant variables to explain how much they contribute to inequity in regard to the benefits of hospitalization.

First, the following linear regression model was used:

$$Y = \alpha + \sum_k \beta_k X_{ki} + \varepsilon_i,$$

where Y is the variable of the health services benefit, β_k is the independent variable and ε is the error term.

The CI decomposition formula is as follows:

$$C = \sum_k \left(\frac{\beta_k \overline{X_k}}{\mu}\right) C_k + \frac{GC_\varepsilon}{\mu},$$

where $\overline{X}, \beta, C_k, \frac{\beta_k \overline{X_k} C_k}{\mu}$ are the mean of the K factor, regression coefficient, CI and contribution, respectively, and GC_ε is the error term of the CI.

In our analysis, the reimbursement for expenses (the hospitalization benefit) was decomposed as a dependent variable. We measured the level of importance regarding the inequity of the NCMS compensation benefits based on the contribution of different variables. If the contribution value is positive, and is the only factor, people with high economic levels exceed people with low economic levels in receiving compensation benefits (i.e, there are unfair compensation benefits for people with a high economic level). If the contribution value is negative, it indicates the opposite results.

Oaxaca decomposition method[28,29]

The Oaxaca decomposition method was used to determine how much the changes in inequity are attributable to changes in inequalities in the determinants and was measured in regard to the longitudinal inequity changes of the compensation benefits. We denoted two-sided changes, which were the CI of a variable and the elasticity.

The formula can be presented as

$$\Delta C = \sum_k \eta_{kt}\left(C_{kt} - C_{kt-1}\right) + \sum_k C_{kt-1}\left(\eta_{kt} - \eta_{kt-1}\right) + \Delta\left(\frac{GC_{\varepsilon t}}{\mu_t}\right),$$

where η represents the elasticity of X_k relative to Y in time variation and ΔC is the change in compensation benefits between the two years. The Oaxaca decomposition assessed the extent to which the changes in compensation benefits were due to changes in inequity in the determinants rather than changes in elasticity.[30]

Description of the relevant variables

Relevant variables include the following:

- Hospitalization rate was the number of inpatients/total number of surveys.
- Reimbursement expense is the reimbursement expense of the NCMS.
- Degree of benefits is the total reimbursement cost/total number of reimbursers.
- Actual reimbursement ratio is the reimbursement expenses of the NCMS/total hospitalization expenses.
- Deductibles are the starting point for calculating the compensation fee received from the NCMS fund by the residents.
- Capping line is the upper limit of medical expenses reimbursed by the NCMS fund.

Results

Descriptive analysis of the sample

In 2009, a total of 16 865 people were surveyed, including 16 399 non-hospitalized people and 1142 inpatients who participated in the NCMS, with a 6.96% hospitalization rate. In 2015, a total of 15 234 people were surveyed, including 14 818 non-hospitalized people and 1524 inpatients who participated in the NCMS, with a 10.28% hospitalization rate. Table 1 shows the summary statis-tics for the inpatients who participated in the NCMS and the differences between the different groups over the 2 y period. In the 2 y comparison, there were differences in age, ethnicity, marital status, main occupation, chronic disease, self-reported health status and level of health facility (Table 1).

Analysis of factors influencing reimbursement expenses

Table 2 reports the results of the GLM analysis of the various factors influencing NCMS reimbursement for inpatients in the sample counties. Some factors had a statistically significant association with reimbursement expenses, including economic level, gender, ethnicity, chronic disease, family scale, inpatient days, level of health facility, actual reimbursement ratio and deductibles (χ^2 test, $p<0.05$). Among these factors, there were positive correlations between economic level, gender, inpatient days, level of health facility, actual reimbursement ratio, deductibles and reimbursement expenses. All other factors had a negative correlation.

Factors contributing to equity

The CIs for the degree of benefits were 0.0659 and 0.0348 for the years 2009 and 2015, respectively. Table 3 shows decomposition of the degree of benefits based on the CI decomposition, indicating the effects of different factors on the total degree of beneficial inequalities.

The decomposition analysis demonstrated that the income status variable was the largest contributor to compensation benefit inequities in 2009 and 2015. Household income contributed as much as 57.58% and 118.61% per year to the inequity in reimbursement expenses. Moreover, all of the contributions were positive, increasing the inequity in favour of higher-income groups. All of the income elasticities were positive, indicating that income had a positive influence on the degree of benefits.

Among the contributions related to the policy in 2009, there was a higher contribution to the inequity of the degree of benefits from the actual reimbursement ratio and deductibles, which contributed −12.75% and 18.18%, respectively. The inpatient days contributed −15.59%, which was negative for elasticity, the same direction as the actual reimbursement ratio. In addition, for the inequity of the degree of benefits in 2015, they contributed 19.09%, −9.75% and 7.71% for the deductibles, the capping line and the insurance package, respectively. Among them, the deductibles and insurance package revealed positive values for elasticity, but the capping line showed the opposite. In addition, age and inpatient days contributed −12.92% and 7.78%, respectively (Table 3).

Longitudinal change in equity

From 2009 to 2015, the change in the CI was −0.031. Table 4 shows that some factors, i.e. household income, age, inpatient days, actual reimbursement ratio and deductibles, had a greater contribution to the degree of benefits: −11.04%, 14.66%, −41.87%, −27.41% and 17.16%, respectively. Among these factors, the change in CI contributed more than the change in elasticities to the change in inequity (Table 4).

Table 1. Descriptive analysis of inpatients who participated in the NCMS in the sample counties

Characteristics	2009	2015	p-Value
Age (years), mean±standard deviation	42.26±21.19	50.82±20.08	0.000
Gender, n			
Male	482	642	0.967
Female	660	882	
Ethnicity, n			
Hui	522	773	0.010
Han and other	620	751	
Marital status, n			
Married	925	1350	0.000
Other	217	174	
Main occupation, n			
Farmer	703	1000	0.031
Other	439	524	
Level of education, n			
Illiterate	543	713	0.200
Primary school	367	534	
Junior high school	199	227	
Senior high school and above	33	50	
Chronic disease, n			
Yes	498	826	0.000
No	644	698	
Self-reported health status, n			
Extremely good	13	41	0.000
Good	194	387	
Fine	501	399	
Poor	394	577	
Very poor	40	120	
Inpatient days, mean±standard deviation	13.42±15.96	14.07±14.489	0.272
Level of health facility, n			
Township health centre	289	492	0.000
County hospital	594	677	
Above county hospital	206	313	
Other	53	42	

Discussion

The aim of the NCMS is to protect patients against catastrophic health expenditures, based on the rationale that most households are generally able to afford expenses resulting from minor illness.[31] During policy adjustment, the actual reimbursement ratio, deductibles and capping line significantly increased. The hospitalization rate was 6.96% among the inpatients participating in the NCMS in 2009, while in 2015 the rate was 10.28%. In addition to an increase in hospitalization rates, there were also significant differences in the analysed variables, except for gender, level of education and inpatient days.

In the GLM, our study provided evidence for the effect of the NCMS on the degree of compensation benefits. Among the variables related to hospitalization compensation, inpatient days, level of health facility, actual reimbursement ratio and deductibles were all positively correlated influencing factors.[32] This finding indicates that increasing inpatient days, selecting a higher-level health facility and enhancing the reimbursement ratio and deductible can all lead to increased compensation for expenses, reflecting the remarkable effect of constantly adjusting the NCMS. However, consistent with several previous studies,[33] we should guard against the waste of medical resources caused by excessive medical treatment. The selection of a higher-level health facility results in a higher level of reimbursement. Contrary to the original intention of the policy, the reimbursement ratio decreased step-by-step with increasing levels of medical institutions. The cause of this phenomenon may be that inpatients with a serious illness usually need to visit a higher-level health facility and therefore receive a higher reimbursement for expenses as a result of higher total hospital expenses, even though they have a lower reimbursement ratio. The increased reimbursement ratio can effectively ensure that poor inpatients have access to much-needed medical services. Furthermore, appropriately raising deductibles ensures the security and high efficiency of health insurance funds.

Table 2. Results of the GLM analysis for inpatients who participated in the NCMS in the sample counties

Variable	β	Standard error	Wald χ^2	p-Value
Intercept	4.350	0.2630	273.702	0.000
Economic level				
II	0.053	0.0976	0.299	0.584
III	0.283	0.0948	8.923	0.003
IV	0.481	0.0918	27.422	0.000
V	0.547	0.0961	32.383	0.000
Age	−0.003	0.0023	1.818	0.178
Gender				
Male	0.117	0.0589	3.920	0.048
Ethnicity				
Hui	−0.175	0.0597	8.577	0.003
Marital status				
Married	0.099	0.1286	0.592	0.442
Main occupation				
Farmer	0.039	0.0631	0.390	0.532
Level of education				
Primary school	−0.195	0.0662	8.702	0.003
Junior high school	−0.109	0.0917	1.414	0.234
Senior high school and above	0.164	0.1682	0.951	0.330
Chronic disease				
Yes	−0.125	0.0626	3.967	0.046
Self-reported health status				
Good	0.063	0.1748	0.130	0.719
Fine	0.117	0.1759	0.442	0.506
Poor	0.175	0.1751	0.993	0.319
Very poor	0.465	0.1970	5.575	0.018
Family scale	0.052	0.0152	11.674	0.001
Inpatient days	0.030	0.0028	115.396	0.000
Level of health facility				
County hospital	0.722	0.0656	121.005	0.000
Above county hospital	0.360	0.1137	10.031	0.002
Other	0.479	0.2056	5.421	0.020
Actual reimbursement ratio	3.116	0.1377	512.004	0.000
Deductibles	0.002	0.0002	96.310	0.000
Insurance package				
Package 2	0.088	0.1436	0.377	0.539
Package 3	0.290	0.1952	2.202	0.138

In addition, economic level is a positive factor that cannot be underestimated. The rich receive more compensation from the NCMS than the poor.[34] The economic level determines residents' purchasing power. The rich can choose more and better medical resources than the poor,[35,36] indicating a greater possibility that expenditure on inpatient health care and the absolute values of reimbursement will be greater in richer groups under the current policy arrangements.[37,38] Finally, economic level is related to gender, chronic disease, family scale, etc. in the benefit compensation level.

Shi et al.[39] note that equity is the core of primary healthcare. The research used the CI decomposition method to compare the equity of the degree of compensation benefits and found that the related variables (such as the actual reimbursement ratio, inpatient days, etc.) had a greater contribution to policy compensation.[40] The contribution rates of inpatient days and the actual reimbursement ratio to equity were 15.59% and 12.75%, respectively, with a negative contribution in 2009, reflecting that the inequity of the degree of benefits was reduced in favour of the richer group. These two variables played an important role in the inequity of the degree of compensation benefits. Some studies also showed that the NCMS had a certain role in alleviating inequity and can effectively avoid the trap of disease poverty for rural residents.[41] Meanwhile the actual reimbursement ratio is an important policy variable of the NCMS. Therefore we had reason to think that our results were similar to those of previous studies. An appropriate reimbursement ratio would effectively help reduce the economic burden of disease for poor inpatients.

Table 3. Decomposing the equity regarding the degree of benefits for inpatients during the period of adjustment of the NCMS

Variable	2009			2015		
	Elasticity	Contribution	Contribution rate (%)	Elasticity	Contribution	Contribution rate (%)
Economic level	0.238804	0.037967	57.58	0.237151	0.041393	118.61
Age	0.014541	0.000039	0.06	0.754006	−0.004510	−12.92
Gender				0.000000	0.000000	0.00
Male	0.006536	0.000025	0.04	0.005501	−0.000033	−0.09
Ethnicity				0.000000	0.000000	0.00
Hui	0.012897	−0.000749	−1.14	−0.033111	0.002028	5.81
Marital status				0.000000	0.000000	0.00
Married	0.006132	0.000043	0.07	0.007360	−0.000005	−0.01
Main occupation				0.000000	0.000000	0.00
Farmer	0.000212	0.000001	0.00	−0.000195	−0.000002	−0.01
Level of education				0.000000	0.000000	0.00
Primary school	−0.003096	−0.000067	−0.10	−0.003223	−0.000062	−0.18
Junior high school	−0.000360	−0.000019	−0.03	−0.000309	−0.000017	−0.05
Senior high school and above	−0.001074	−0.000119	−0.18	0.000362	0.000033	0.09
Chronic disease				0.000000	0.000000	0.00
Yes	−0.006002	−0.000059	−0.09	−0.046641	0.000588	1.68
Self-reported health status				0.000000	0.000000	0.00
Good	0.001403	0.000052	0.08	−0.001356	−0.000005	−0.01
Fine	0.001962	−0.000031	−0.05	−0.000233	0.000000	0.00
Poor	0.017094	0.000045	0.07	0.033816	−0.000454	−1.30
Very poor	0.001168	−0.000066	−0.10	0.003343	0.000126	0.36
Family scale	0.052386	−0.001768	−2.68	0.017407	−0.000653	−1.87
Inpatient days	0.415580	−0.010281	−15.59	0.459258	0.002716	7.78
Level of health facility				0.000000	0.000000	0.00
County hospital	0.013959	−0.000129	−0.20	0.035349	−0.000545	−1.56
Above county hospital	0.044071	0.002440	3.70	0.008110	0.000343	0.98
Other	0.000319	0.000010	0.02	0.002107	0.000026	0.07
Actual reimbursement ratio	0.156203	−0.008407	−12.75	0.202482	0.000100	0.29
Deductibles	0.874648	0.011987	18.18	0.731493	0.006661	19.09
Capping line	–	–	–	−0.471680	−0.003401	−9.75
Insurance package						
Package 2	–	–	–	0.000486	0.000052	0.15
Package 3	–	–	–	0.005730	0.002640	7.56

In addition, the contribution rates of deductibles were 18.18% in 2009 and 19.09% in 2015, and the contribution was positive for both years, indicating that the inequity of the degree of benefits was increased in favour of the richer group. Some research has shown that not setting deductibles can increase the benefit level, but it also reduces the security of the fund.[42] In contrast, setting deductibles can effectively ensure smooth implementation of the policy and the safe use of funds, but doing so produces a 'threshold' effect for the poor group, limiting their access to more compensation. Importantly, the economic level made the greatest positive contribution to inequity—57.58% in 2009 and 118.61% in 2015—indicating that most of the pro-rich inequalities were accounted for by income. One study showed that a disproportionate hospitalization rate was more likely for people with higher incomes.[43] The inequity of economic level is a root cause of the utilization of medical resources in the hospital.[8] The Gini coefficient in China exceeds international standards (0.4).[44] The excessive gap between the rich and the poor leads to an imbalance in health service benefits, increasing the incidence of inequity. In addition to these common findings, the factors of age and the insurance package also played a part in the inequity of the degree of compensation benefits in 2015.

The change in inequity in the degree of compensation benefits showed improvement from 2009 to 2015. The results of the Oaxaca decomposition showed that the actual reimbursement ratio and deductibles played a positive role in the equity

Table 4. Vertical comparison of the change in the equity of the degree of benefits from 2009 to 2015

Variable	$\Delta C\eta$	$\Delta\eta C$	Total change (contribution)	Total contribution (%)
Economic level	0.003688	−0.000263	0.003426	−11.04
Age	−0.006509	0.001960	−0.004549	14.66
Gender	0.000000	0.000000	0.000000	0.00
Male	−0.000054	−0.000004	−0.000058	0.19
Ethnicity	0.000000	0.000000	0.000000	0.00
Hui	0.000104	0.002673	0.002777	−8.95
Marital status	0.000000	0.000000	0.000000	0.00
Married	−0.000056	0.000009	−0.000048	0.15
Main occupation	0.000000	0.000000	0.000000	0.00
Farmer	−0.000001	−0.000002	−0.000003	0.01
Level of education	0.000000	0.000000	0.000000	0.00
Primary school	0.000008	−0.000003	0.000005	−0.02
Junior high school	−0.000001	0.000003	0.000002	−0.01
Senior high school and above	−0.000007	0.000159	0.000152	−0.49
Chronic disease	0.000000	0.000000	0.000000	0.00
Yes	0.001043	−0.000397	0.000646	−2.08
Self-reported health status	0.000000	0.000000	0.000000	0.00
Good	0.000046	−0.000103	−0.000057	0.18
Fine	−0.000003	0.000035	0.000031	−0.10
Poor	−0.000544	0.000044	−0.000499	1.61
Very poor	0.000315	−0.000123	0.000192	−0.62
Family scale	−0.000066	0.001180	0.001115	−3.59
Inpatient days	0.014077	−0.001081	0.012997	−41.87
Level of health facility	0.000000	0.000000	0.000000	0.00
County hospital	−0.000218	−0.000197	−0.000416	1.34
Above county hospital	−0.000106	−0.001991	−0.002097	6.76
Other	−0.000040	0.000056	0.000016	−0.05
Actual reimbursement ratio	−0.010998	0.002491	−0.008508	27.41
Deductibles	−0.003363	−0.001962	−0.005325	17.16
Capping line	–	–	–	–

of the NCMS changes, with contribution rates of 27.41% and 17.16%, respectively. These contributions mainly resulted from a change in the CI over the study years and from changes in a consistent direction between the contributions and ΔCI. We found that the inequity in the degree of compensation benefits effectively improved with policy adjustment. There is some evidence showing that health payments can induce poverty, and thus households could have more illness.[45,46] Medical expenses could create a vicious cycle between illness and poverty.[2] Moreover, some studies have indicated that one benefit of increasing reimbursement is to reduce catastrophic household health payments among poor inpatients.[30] That is, with policy implementation, the problem can be effectively improved by constant adjustment of the reimbursement ratio. In addition, age was a positive factor for change inequity. However, the contribution of inpatient days had an opposite effect on the change in inequity (41.87%) that was mainly attributable to the change in CI, which aggravated the inequity. Unreasonable extensions of the length of the hospital stay lead to the irrational use of resources. This phenomenon tended to occur mostly among richer inpatients,

and it greatly reduced the equity of compensation benefits, which is consistent with several previous studies.[37] Finally, the gap in economic levels was not responsive to the equity adjustment. We should pay more attention to the inequity arising from the disparity in economic levels. In addition to constantly adjusting the compensation policy to increase the compensation benefit, especially for the poor, the key to reducing the incidence and inequity in catastrophic healthcare expenditures in China lies in reducing poverty, decreasing the gap between the poor and rich and continuing to improve the medical aid system, which can play a key role in providing extra financial assistance to the poorest residents.[47] These recommendations are consistent with findings of other studies.[48,49]

As a basic medical security policy for rural residents, the NCMS in China has achieved remarkable results. But many objective factors will make implementation of the policy face practical problems, especially with China's large population. We should constantly update and improve payment policies based on the experiences of developed countries such as the USA, UK and Germany, and strive to ensure basic health services for residents.

Conclusions

Our study indicated that inequity decreased from 2009 to 2015, possibly as a result of adjustment of the compensation policy. With this adjustment, an increasing number of low-income people received medical aid, which may reduce their medical economic burden and increase their level of health. However, we should remain vigilant lest the gap between the rich and the poor leads to an increase in inequity.

Limitations

In this study, the materials we consulted have some limitations. Our understanding of health policies in other countries is not very deep. We should continue to expand our reading to develop a deep understanding of different health policies. In addition, this study evaluated the effect of policy implementation among sample counties in Ningxia. There is still no evidence for wider promotion, which would require a more extensive and comprehensive investigation and analysis. More in-depth research needs to be conducted in the future.

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