Inequity under Equality: Research on the Benefits Equity of Chinese Basic Medical Insurance

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Abstract

Background: Insisting on equity is one of the basic principles behind deepening health care reform. China's new rural cooperative medical insurance (NRCMI) and urban residents' basic medical insurance (URBMI) are both “equalized” in fundraising and reimbursement. This paper studies the benefits of equity under such "equalized" system designation.

Methods: The data analysed in this paper are from China Family Panel Studies (CFPS) from 2014 to 2016, implemented by the Institute of Social Science Survey at Peking University. A two-part model and a binary choice model are used in the empirical test.

Results: An empirical test found that high-income people benefit more from basic medical insurance than low-income people. Mechanism analysis found that high-income people have higher medical insurance applicability and can utilize better health care. Since low-income people are unhealthier, an inequity in benefits will exacerbate health inequity. We also found that the benefits equity of URBMI is better than that of NRCMI.

Conclusions: The government needs to pay more attention to the issue of medical insurance inequity. We can consider allowing for different income groups to pay different premiums according to their medical expenses or allowing for different income groups to apply different reimbursement policies.

Keywords: medical insurance; benefits equity; different income groups; China

Background

Since the 1990s, addressing the issue of health inequities and improving the health of vulnerable groups have been the core goals of health care reform in many countries [1]. Governments continue to ameliorate the medical insurance system and increase the supply of medical services to improve the coverage of and accessibility to medical insurance of vulnerable groups and reduce their personal burdens related to medical services groups [2]. However, a study by the World Bank [3] found that increased health insurance coverage does not promote health equity, as it is not poor individuals who benefit more from health insurance. Based on transnational data, Davoodi et al. [4] and Wagstaff et al.
reached similar conclusions. Similar to most other countries, the Chinese government has attached great importance to health insurance reform in the past decade and aims to improve the fairness of medical insurance and accessibility to medical services. The realization of residents' health equality will be an important goal of health care reform [6,7].

At present, China has implemented urban residents' basic medical insurance (URBMI) and new rural cooperative medical insurance (NRCMI) for urban and rural residents. These two medical insurance systems are “equalized” in fundraising and reimbursement. Specifically, in the same arrangement area, each insured person pays the same premium on average and has the same reimbursement proportion. The design of URBMI and NRCMI is aimed at guaranteeing that all insured individuals have "equal opportunity" [8]. However, equal opportunity does not mean “equal results”. According to the system design, individuals with higher health care utilization can have more reimbursement, and such differences in health care utilization will lead to differences in the associated benefits [9]. The goal of basic medical insurance is to ensure that every citizen has access to medical services, with a focus on providing low-income people with better health care [10]. Then, while reducing the financial burden of medical care for all people, whether basic medical insurance can provide more benefits to low-income people has become an important issue that deserves attention.

From the perspective of social equity and justice [11,12], vulnerable groups should be the focus of social medical insurance [13]. This focus should be not only the basic principle of China's health care system reform but also the correct value orientation of China's social security system. Therefore, assessing the fairness of the actual benefits of the insured population at different income levels will help policy makers ameliorate medical insurance policies [14]. The Chinese government has continuously increased its financial subsidy in basic medical insurance to increase benefits and promote social equity [15]. In 2018, the financial subsidy standards for URBMI and NRCMI were raised to 490 yuan per person per year. However, if the basic medical insurance system cannot effectively provide more benefits to low-income people, then the corresponding financial subsidy will play a role in further promoting the inequity of health care utilization.

Equity is an important indicator for evaluating the effectiveness of health care reform [16]. According
to the World Health Organization's ranking of health care system financing equity and distribution justice to its member states, China ranks fourth from the bottom [17]. After decades of health care system reform, especially the “healthy China” strategy proposed by the Chinese government, how has the equity of the basic medical insurance system benefitted? Mathematical methods and representative data are needed for evaluation. Based on this question, this paper uses China Family Panel Studies (CFPS) data from 2014 to 2016, implemented by the Institute of Social Science Survey at Peking University. A total of 46,166 samples were analysed with a two-part model and binary choice model in this paper. Does the “equal opportunity” designation of the medical insurance system achieve equal benefits for participants with different incomes? If not equal, do low-income people benefit less than high-income people? At the same time, we examined whether there is a difference in the benefits equity between URBMI and NRCMI.

**Literature Review**

Many scholars have studied the equity of medical insurance and public health services. Doorslaer et al. [18] compared the correlation between income and health inequity in nine developed countries and found that the correlation between the income and health of American and British residents is stronger than that of other developed countries, showing higher health inequity. Pannarunothai and Mills [19] studied health care utilization and medical insurance equity for urban residents in Thailand. The study showed that there was no significant difference in hospitalization rates among different income groups but that the minimum income group had the lowest reimbursement rate. Gwatkin et al. [20] discussed how to promote the equity of the health care system and believed that direct compensation for poor or vulnerable people is an effective approach. Chu et al. [21] evaluated the implementation effect of National Health Insurance (NHI) in Taiwan, China, by comparing out-of-pocket payments before (1994) and after (1996) the implementation of the insurance system. They found that NHI narrowed the gap in the out-of-pocket payments of families with different economic conditions and promoted health care equity. Castro-Leal et al. [22] examined the status of fiscal subsidies to public health in seven African countries and found that these subsidies benefit rich people more than poor people.

Since the 1990s, with the improvement of China's medical system and the increase in the supply of
medical services, many scholars have analysed the equity of public health services in China. Most of the early literature focussed on the macro or meso level. For example, by studying the medical financing mechanism of rural areas, Ping [23] pointed out that poorer farmers had more financial burden than their richer counterparts. According to Wang et al's [24] research based on national health service survey data, China's market-oriented medical reform has caused inequity in its health care service utilization. With regional statistical data, Wei & He [25] pointed out that such inequity is not only between but also within urban and rural areas. Feng & Chen [26] pointed out that the main beneficiaries of public medical services are residents in high-income areas.

In recent years, research using household survey data has become mainstream. Compared with the macro- or meso-level data, basic medical insurance benefits and socioeconomic characteristics can be directly observed through household survey data. With information on medical insurance participants and public medical service beneficiaries, some scholars have concluded that China's basic medical insurance is inequitable among individuals with different incomes. For example, Xie E [27] and Qi & Li [28], based on the China Health and Nutrition Survey (CHNS) data, found that China's basic medical insurance benefits and public health service utilization are obviously pro-rich [29]. Zhou et al. [30] found that income is the main determinant of inpatient service utilization based on China's 2003 and 2008 National Health Service Survey (NHSS) data. Based on data from household surveys in 10 western provinces in China conducted in 2005, Liu et al. [31] drew similar conclusions. In addition, out-of-pocket payments are also obviously not conducive to poor people. According to Doorslaer et al. [32], based on household survey data of 14 Asian countries and regions, out-of-pocket payments are heavily biased towards poor people, which increases poverty rates and aggravates poverty depth in China. Wang [33] found that inequity still exists in rural areas after the integration of urban and rural medical insurance and that there is still a gap between the actual and expected goal of URBMI.

More specifically, some scholars have focused their research on the equity of NRCMI and URBMI. For example, Li [34] analysed whether NRCMI can alleviate inequity and found that the design of a rural cooperative medical insurance financing system has not achieved vertical equity. Shen et al. [35] judged the equity of NRCMI and found individual payments with great inequity. Wong et al. [36] used Wuhan
City as an example to discuss the reform of China's urban medical system; the reform is believed to have certain effects, but it cannot benefit vulnerable people much. Zhou et al. [9] conducted a study of urban residents in China and found that the level of medical insurance compensation for low-income people was significantly lower than that for high-income people.

In summary, regarding equity in the health care system, great efforts have been made by previous studies. Compared with these previous studies, we tested whether URBMI and NRCMI, which are equalized in the design of fundraising and reimbursement, can benefit the insured equally and if these two systems are equitable themselves. We also used two-part models to reduce the estimated bias caused by the endogeneity and sample selection that may exist in the model, ensuring the accuracy of the results.

**Methods**

**Data source**

This paper analysed data from CFPS from the Peking University Open Research database. Compared to other micro databases, CFPS has more comprehensive information on health care utilization. The survey was conducted in 19,986 households in 986 villages/communities of 162 districts/counties in 25 provinces/cities/autonomous regions across the country, and all economically linked family members in these households were targeted. The 2010 baseline survey included a total of 14,960 households with 57,155 baseline respondents, including 33,600 adults aged 16 years and older and 8,990 children aged 15 years and younger. Panel surveys were conducted in 2012, 2014 and 2016. Among these surveys, the 2012 panel survey successfully accessed 42,970 individuals in 12,725 households; the second panel survey in 2014 successfully accessed 45,738 individuals in 14,237 households; and the third panel survey in 2016 successfully accessed 41,761 individuals in 14,810 households.

Since we focused on the issue of the equity of basic medical insurance benefits after the “new health care reform” in China, data from the latest survey years, 2014 and 2016, are merged into pooled cross-sectional data to conduct an empirical analysis. A total of 87,499 insured samples are included in the original data, and after deleting the samples missing key variables, a total of 46,166 samples are analysed in the study; among these samples, 3,810 respondents experienced hospitalization. In addition, the paper also studied the health status of the insured population (including the incidence of hospitalization, the
incidence of chronic diseases and self-reported health (SRH), and health care utilization.

Variables

1. Dependent variable. First, we use hospitalization expense reimbursement to analyse medical insurance benefits. Hospitalization expense reimbursement is a continuous variable and has been logarithmic prior to analysis in the model.

Next, we analyse whether the difference in benefits is due to differences in the health of different income groups. In this paper, sick in the last 2 weeks, sick in the last half year and SRH are the three proxy variables of health status. Among them, if the respondent becomes sickness in the last 2 weeks or half year, the value is 1; otherwise, it is 0. The SRH data were processed in this study. If the answer for "What is your health status?" is "Fair, good, excellent or perfect", then the value is 0; if the answer is "Bad", then the value is 1.

Finally, after excluding or controlling the effects of health status, we examine the causes of inequity in medical insurance benefits. In the model, we will analyse the variables of “medical insurance applicability”, “total hospitalization expense” and "medical institution choice". Among them, “medical insurance applicability” is determined by the following question: "After medical treatment, whether it is because of the payment line, location restriction, the coverage of medical insurance reimbursement, etc., will your medical insurance pay for your medical expenses?"; if the answer is yes, the value is 0, and otherwise, it is 0. "Medical institution choice" is determined by the following question: “What kind of medical institution do you usually choose when you are sick?”; if the respondent chooses a general hospital or specialist hospital, then the value is with 1, and if the respondent chooses a community health service centre, township hospital or clinic, then the value is 0.

2. Independent variable. The independent variable of this paper is family income. Referring to the study of Wagstaff [16], we divide household income from low to high into five groups. The number of samples in each group is the same, and the assignments are 1, 2, 3, 4 and 5.

3. Control variables. To accurately estimate the equity of medical insurance benefits, we added the individual and family characteristic variables of the insured group into the regression analysis. These variables mainly include gender (dummy variable: male = 1, female = 0), age (continuous variable), age
squared, marital status (dummy variable: married = 1, unmarried = 0), schooling years (continuous variable), and family size (continuous variables). STATA 15 was mainly used in the analysis in this paper. The specific definitions of all the variables are shown in Table 1.

| Variable                                | Definition                                                                 | URBMI Mean or Proportion | NRCMI Mean or Proportion |
|-----------------------------------------|---------------------------------------------------------------------------|--------------------------|--------------------------|
| **Medical insurance benefits variables** | Hospitalization choice Dummy variable: 0=no, 1=yes                          | 0= 87.38%, 1= 12.62%     | 0= 88.32%, 1= 11.68%     |
|                                         | Hospitalization expense reimbursement Continuous variable: hospitalization expense reimbursement (CNY) | mean= 11,295.78          | mean= 6,227.138          |
| **Health status variables**             | Sick in the last 2 weeks Dummy variable: 0=no, 1=yes                       | 0= 71.19%, 1= 28.81%     | 0= 70.64%, 1= 29.36%     |
|                                         | Sick in the last half year Dummy variable: 0=no, 1=yes                      | 0= 80.45%, 1= 19.55%     | 0= 83.83%, 1= 16.17%     |
|                                         | SRH Dummy variable: 0=good, 1=bad                                           | 0=85.96%, 1= 14.04%      | 0=83.56%, 1= 16.44%      |
| **Mechanism variables**                 | Medical insurance applicability Dummy variable: 0=no, 1=yes                | 0= 30.25%, 1=69.75%      | 0= 40.18%, 1= 59.82%     |
|                                         | Total hospitalization expenses Hospitalization expense (CNY)               | mean=11,882.75           | mean= 17,272.32          |
|                                         | Medical institution choice Dummy variable: 1 =general hospital or specialist hospital, 0 = community health service centre, township hospital or clinic | 0=38.51, 1=61.49%        | 0=71.00%, 1=29.00%       |
| **Independent variable**                | Household income Dummy variable: from the lowest income to the highest income, all samples were divided into five groups of equal amounts, and each group was assigned a value of 1, 2, 3, 4, or 5 | 1=9.88%, 2=9.18%, 3=18.71%, 4=28.24%, 5=33.98% | 1=24.78%, 2=15.35%, 3=23.96%, 4=22.75%, 5=13.17% |
| **Control variable**                    | Age Continuous variable: age of respondents (years)                         | mean=46.15               | mean=46.30               |
|                                         | Age squared Continuous variable: age squared of respondents (years squared)  | mean=2,407.28            | mean=2,458.69            |
|                                         | Gender Dummy variable: 0=female; 1=male                                       | 0=55.74%, 1 = 44.26%     | 0 = 50.94%, 1 = 49.06%   |
|                                         | Marital status Dummy variable: 0= unmarried; 1=married                        | 0= 27.16%, 1= 72.84%     | 0= 19.33%, 1= 80.67%     |
|                                         | Schooling years Continuous variable: 0 =illiterate, 6 =primary school, 9 =middle school, 12 =high school, 15 =college, 16 =undergraduate, 19 =postgraduate | mean= 8.50               | mean= 5.53               |
|                                         | Family size Continuous variable: family population (person)                  | mean= 3.81               | mean= 4.51               |
**Model construction**

1. Two-part model. When analysing the differences in the medical insurance benefits of different income groups, if there are too many respondents without any medical insurance reimbursement, the assumption of a random error normal distribution cannot be achieved, which leads to biased estimation. A two-part model was proposed by Duan et al. [37] to solve this problem, and it mainly included a selection model and outcome model. In this study, the probit model is used as the selection model:

\[
pr(\text{Reimburse}_m = 1|\text{Income}, X) = \theta(\alpha_0 + \sum_{n=1}^{5} \alpha_n \times \text{Income}_{mn} + X_m \kappa + e_m)
\]

(1)

where \(\theta(\cdot)\) is the standard normal cumulative distribution function; \(\text{Reimburse}_m\) refers to the dichotomous variable of whether the medical insurance reimbursement amount is over 0. If the medical insurance reimbursement amount of hospitalization expenses is over 0, then the value is 1; otherwise, it is 0; \(\text{Income}_{mn}\) is the income of respondent \(m\) in group \(n\), where \(n\) is a value of 1, 2, 3, 4, or 5; \(X_m\) is a series of control variables; and \(e_m\) is a random disturbance.

The general linear model (GLM) is used as an outcome model to estimate non-zero medical insurance reimbursement:

\[
\log(\text{Reimburse}_m) = \alpha_0 + \sum_{n=1}^{5} \alpha_n \times \text{Income}_{mn} + \beta_m \kappa + e_i
\]

(2)

All of the respondents’ medical insurance reimbursement analysed in this model is over 0. Assume that the random disturbance \(e_m\) and \(e_i\) of equations (1) and (2) are not related; that is, the medical insurance reimbursement amount of 0 and over 0 are independent of each other. \(\beta_m\) is a series of control variables that may affect medical insurance reimbursement, and \(e_i\) is the residual term.

2. Binary choice model. The binary choice model is used to estimate the binary discrete dependent variable. The model is used in this paper to analyse the influencing factors of health status, hospitalization choice and medical insurance applicability. The regression equation of hospitalization choice is the same as equation (1) and will not be described here. The probit models for health status and medical insurance applicability are set as follows:
\[ pr(\text{Health}_m = 1 | \text{Income}, X) = \theta(\alpha_0 + \sum_{n=1}^{5} \phi_n \ast \text{Income}_{mn} + X_m \kappa + \chi_m) \] (3)

\[ pr(\text{Reimburse}_j = 1 | \text{Income}, X) = \theta(\alpha_0 + \sum_{n=1}^{5} \phi_n \ast \text{Income}_{mn} + X_m \kappa + \sigma_m) \] (4)

Similarly, \( \theta(\cdot) \) is a standard normal distribution function, assuming that the random perturbation terms \( \chi_m \) and \( \sigma_m \) follow a standard normal distribution, where \( \text{Health}_m \) denotes the dummy variable “sick in the last 2 weeks”, “sick in the last half year”, and “SRH”. \( \text{Reimburse}_j \) refers to medical insurance applicability, and the control variable \( X_m \) is the same as in equation (1).

**Results**

**Descriptive analysis**

Table 2 shows that there is a significant difference in medical service utilization among different income groups. First, in terms of respondents with URBMI, total hospitalization expenses and income are positively correlated, with respondents in the lowest-income group having an average hospitalization expense of 14,188.38 CNY/year and those in the highest-income group having 22,722.83 CNY/year. The same conclusion is drawn for NRCMI, with the lowest-income group having 10,335.58 CNY/year and the highest-income group having 12,637.06 CNY/year. Second, medical insurance reimbursement is positively correlated with both income and total hospitalization expenses. The reason for this may be that the group with higher income utilizes more and higher-quality health care. Third, in both the samples of URBMI and NRCMI, the medical insurance applicability of the lower-income group is worse, which may increase the inequity of medical insurance benefits.

| Quintile   | URBMI | NRCMI |
|------------|-------|-------|
|            | Total hospitalization expenses (CNY) | Hospitalization expense reimbursement (CNY) | Medical insurance applicability | Total hospitalization expenses (CNY) | Hospitalization expense reimbursement (CNY) | Medical insurance applicability |
| Poorest    | 14,188.38 | 6,005.48 | 0.63 | 10,335.58 | 4,613.19 | 0.59 |
| (15,231.84) | (5,710.46) | (0.48) | (23,549.75) | (9,336.36) | (0.49) |
| 2nd        | 14,618.51 | 5,625.16 | 0.67 | 11,467.72 | 4,570.25 | 0.60 |
| (17,658.92) | (9,493.36) | (0.47) | (19,925.77) | (14,682.43) | (0.49) |
If the positive correlations among medical insurance reimbursement, health care utilization and income are because people with higher incomes are unhealthier, then the conclusion that there is inequity in medical insurance benefits cannot be drawn. Table 3 shows the health status of the insured populations at different income levels; sick in the last 2 weeks, sick in the last half year and SRH are used to measure health status. In the sample of respondents with URBMI, from the lowest-income group to the highest-income group, the 2-week sickness rate dropped from 24% to 19%, and the half-year sickness rate dropped from 43% to 26%. The proportion of people with bad SRH dropped from 26% to 10%. In the sample of respondents with NRCMI, from the lowest-income group to the highest-income group, the 2-week sickness rate dropped from 20% to 13%, and the half-year sickness rate dropped from 36% to 25%. The proportion of people with bad SRH dropped from 25% to 10%. People with higher incomes are healthier than their lower-income counterparts. Therefore, the assumption that high-income people receive more medical services due to poor health is not established. Of course, to scientifically verify this conclusion, an empirical test is still needed.

Table 3 Health status of insured individuals

| Quintile | URBMI | NRCMI | P value (between the poorest group and the richest group) |
|----------|-------|-------|---------------------------------------------------|
|          | Sick in the last two weeks | Sick in the last half year | SRH | Sick in the last two weeks | Sick in the last half year | SRH |
| Poorest | 0.24 (0.42) | 0.43 (0.50) | 0.26 (0.44) | 0.20 (0.40) | 0.36 (0.48) | 0.25 (0.43) |
| 2nd     | 0.23 (0.42) | 0.30 (0.46) | 0.22 (0.42) | 0.18 (0.38) | 0.30 (0.46) | 0.19 (0.39) |
| 3rd     | 0.19 (0.39) | 0.31 (0.46) | 0.17 (0.37) | 0.16 (0.37) | 0.28 (0.45) | 0.15 (0.36) |
| 4th     | 0.19 (0.39) | 0.26 (0.46) | 0.11 (0.37) | 0.13 (0.37) | 0.25 (0.45) | 0.11 (0.36) |

Note: ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively.
**Empirical test**

1. Test of the equity of medical insurance benefits

Table 4 reports the differences in medical insurance reimbursement for different income groups. Among respondents with URBMI, we found that compared with the lowest-income group, the second- and third-lowest-income groups have no significant difference; however, the reimbursement of the fourth-lowest-income group and the highest group are approximately 8.95% and 12.7% higher than that of the lowest group, respectively. Among respondents with NRCMI, the reimbursement of the second-, third-, and fourth-lowest-income groups and the highest-income group were approximately 3.12%, 3.77%, 5.87% and 5.98% higher than that of the lowest-income group, respectively. At the same time, we compared the differences between URBMI and NRCMI and found that the benefits equity of URBMI is better than that of NRCMI. The reason for this may be that the income gap in rural areas is relatively wider than that in urban areas.

| Variable | URBMI | NRCMI |
|----------|-------|-------|
|          | Selection model (probit) | Outcome model (GLM) | Selection model (probit) | Outcome model (GLM) |
| Reference group: Poorest | | | | |
| 2nd | 0.0917 (0.280) | 0.0122 (0.039) | 0.075 (0.073) | 0.0312 (0.015) |
| 3rd | 0.102 (0.282) | 0.0164 (0.036) | 0.024 (0.079) | 0.0377 (0.012) |
| 4th | 0.561* (0.295) | 0.0895** (0.035) | 0.079 (0.070) | 0.0587*** (0.011) |
| Richest | 0.658** (0.286) | 0.127*** (0.036) | 0.128* (0.073) | 0.0598*** (0.012) |
| Control variable | YES | YES | YES | YES |
| Constant | 1.456* (0.775) | 0.446*** (0.102) | 0.309 (0.247) | 0.366*** (0.039) |
| Observations | 498 | 498 | 3,312 | 3,312 |

Note: ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively.
Note: Control variables include respondents’ age, age squared, gender, schooling years, marital status and family size; ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively.

The descriptive analysis has already found that the reason that higher-income people can reimburse more from their medical insurance is not because people in this group is unhealthier, and the probit model will be used to ensure the robustness of the conclusion in this section (see Table 5).

Table 5 The impact of income on health

| Variable                      | URBMI |     |     | NRCMI |     |     |
|-------------------------------|-------|-----|-----|-------|-----|-----|
|                               | Sick in the last two weeks | Sick in the last half year | SRH | Sick in the last two weeks | Sick in the last half year | SRH |
| Reference group: Poorest      |       |     |     |       |     |     |
| 2nd                           | -0.291*** | -0.115 | -0.0415 | -0.106*** | 0.0125 | -0.113*** |
|                               | (0.085) | (0.094) | (0.093) | (0.021) | (0.024) | (0.024) |
| 3rd                           | -0.274*** | -0.109 | -0.307*** | -0.116*** | 0.00871 | -0.210*** |
|                               | (0.072) | (0.082) | (0.082) | (0.019) | (0.022) | (0.022) |
| 4th                           | -0.381*** | -0.0105 | -0.503*** | -0.165*** | -0.0765*** | -0.340*** |
|                               | (0.069) | (0.078) | (0.080) | (0.024) | (0.023) | (0.024) |
| Richest                       | -0.388*** | -0.0291 | -0.515*** | -0.167*** | -0.110*** | -0.459*** |
| Control variables             |       |     |     |       |     |     |
|                               | YES | YES | YES | YES | YES | YES |
| Constant                      | -0.542*** | -2.104*** | -2.433*** | -1.006*** | -2.711*** | -2.825*** |
|                               | (0.165) | (0.204) | (0.241) | (0.060) | (0.081) | (0.088) |
| Observations                  | 4,914 | 4,914 | 4,914 | 41,346 | 41,342 | 41,348 |

Note: Control variables include respondents’ age, age squared, gender, schooling years, marital status and family size; ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively.

Table 5 shows that among respondents with URBMI, the incidence of being sick in the last two weeks is significantly negatively correlated with income, but there is no significant correlation between the incidence of being sick in the last half year and income. Compared with the lowest-income group, the highest-income group and the 4th-lowest income group have better health. Among respondents with NRCMI, the incidence of being sick in the last two weeks or half year and SRH were all significantly correlated with income. There is a significant positive correlation between income and health. In fact, according to the definition of equity, respondents with poorer health deserve more medical insurance compensation; therefore, the results have shown that equalized fundraising and reimbursement cannot guarantee the equity of medical insurance benefits and may even deepen health inequity.

Among respondents with URBMI, the lowest-income group is significantly different from the second-lowest-income group in medical institution choice, but among respondents with NRCMI, this difference is not significant, indicating that more urban residents than rural residents can utilize more expensive
and better health care, which leads to more inequitable benefits among respondents with NRCMI.

**Mechanisms**

This part analyses the potential mechanism of inequity in basic medical insurance benefits from three aspects, and the regression results are shown in Table 6. The highest-income group and 4th-lowest-income group tended to be hospitalized in general or specialist hospitals compared with other income groups, and their total hospitalization expenses were significantly higher than those of the other groups, indicating differences in health care utilization. In addition, from the perspective of medical insurance applicability, respondents with higher income are more applicable to medical insurance; although the low-income group is covered by a medical insurance system, they are more likely to receive no reimbursement for their expenses. The reason for this may be that their total expenses do not reach the minimum level required.

| Variable          | Total hospitalization expenses | Medical institution choice | Medical insurance applicability | Total hospitalization expenses | Medical institution choice | Medical insurance applicability |
|-------------------|--------------------------------|-----------------------------|---------------------------------|--------------------------------|-----------------------------|---------------------------------|
| Reference group:  |                                |                             |                                 |                                |                             |                                 |
| Poorest           |                                |                             |                                 |                                |                             |                                 |
| 2nd               | 0.118                          | 0.312***                    | 0.115***                        | 0.0764                         | 0.0272                      | 0.063***                        |
| (0.180)           | (0.083)                        | (0.015)                     | (0.059)                         | (0.022)                        | (0.016)                     |
| 3rd               | 0.195                          | 0.230***                    | 0.112***                        | 0.0583                         | 0.0948***                   | 0.081***                        |
| (0.181)           | (0.071)                        | (0.012)                     | (0.053)                         | (0.020)                        | (0.015)                     |
| 4th               | 0.486***                       | 0.267***                    | 0.227***                        | 0.194***                       | 0.182***                    | 0.0718***                       |
| (0.180)           | (0.067)                        | (0.015)                     | (0.059)                         | (0.020)                        | (0.016)                     |
| Richest           | 0.495***                       | 0.421***                    | 0.399***                        | 0.213***                       | 0.359***                    | 0.126***                        |
| (0.181)           | (0.068)                        | (0.012)                     | (0.071)                         | (0.023)                        | (0.016)                     |
| Control variables |                                |                             |                                 |                                |                             |                                 |
| Constant          | 8.099***                       | -0.112                      | -0.335                          | 8.181***                       | -0.363***                   | 0.407**                         |
| (0.509)           | (0.157)                        | (0.530)                     | (0.193)                         | (0.057)                        | (0.185)                     |
| Observations      | 618                            | 4,910                       | 618                             | 4,858                          | 41,256                      | 4,858                           |

**Note**: Control variables include respondents’ age, age squared, gender, schooling years, marital status and family size; ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively.

**Discussion**

In 2009, the “Health Care Reform” programme proposed the goal of “total coverage of urban and rural residents with the basic medical insurance system in 2011”. The Chinese government has invested 850 billion CNY over three years to expand medical insurance coverage and improve reimbursement
standards. The investment in URBMI and NRCMI accounts for almost 50% of the central government's medical expenditure. However, in the midst of the renewed appeal for equity in reform, we cannot ignore the deep inequities that have been brought about by health care reform, such as the inequity in medical insurance benefits and health care utilization due to income.

This paper analyses the issue of benefits equity in Chinese basic medical insurance. If people with different incomes pay the same premiums to the insurance fund and have the same medical needs, but they obtain different insurance benefits because of the difference in their total medical expenses, then it can be considered that residents' medical insurance benefits are unfair. We used CFPS data in 2014 and 2016 and found that the reimbursement for high-income people was significantly higher than that for low-income people. At the same time, low-income people are unhealthier and need more health care and reimbursement; that is, high-income people receive higher reimbursement than their premium contribution, while low-income people are reimbursed less. The amount of hospitalization reimbursement in China is calculated according to the total hospitalization expenses. Large general or specialist hospitals have better medical services and charge higher medical expenses, which may help those individuals who obtain care in such locations to easily reach the minimum deduction required for reimbursement. Therefore, the differences in health care utilization and medical insurance applicability are the main cause of inequity in medical insurance benefits.

At the same time, although URBMI and NRCMI are "equalized" in fundraising and reimbursement, NRCMI is less equitable than URBMI in benefits. China has a typical urban-rural dual structure, and the income gaps in urban and rural areas are also different. Some scholars have pointed out that the income gap between individuals with the highest income and those with the lowest income in rural areas is much higher than that in urban areas [38], which means that residents of the highest-income group in rural areas are more likely to utilize better health care resources and that residents in the lowest-income group are less likely to utilize health care. Thus, NRCMI is more inequitable than URBMI.

Yip, an expert in China's health care reform, believes that the greatest challenge facing China's health care reform is increasing the efficiency of financial input [39]. To achieve the "equity" goal, financial input should bring about better policy outcomes, including improving the equity of medical insurance,
the health of residents, the quality of health care services, and patient satisfaction and reducing the financial burden on patients. However, even under the equalization medical insurance system, the equalized medical insurance provided by the government still causes inequity in benefits; that is, low-income people “subsidize” high-income people through their premiums.

Looking back at the reform of China's health system, it has undergone a process from loss of equity to reshaping equity through equalized designation. In this process, the transformation from policy formulation to policy implementation urgently needs to be realized. Therefore, the equity issue that China's medical reform truly needs to solve is the allocation of a portion of the medical services that the rich people over-occupy to the poor. Only in this way can we solve the problem of inequity in public medical services.

Conclusion

With 2014-2016 CFPS data, this paper found that medical insurance reimbursements for high-income people are higher than those for low-income people, which is more significant in the NRCMI group than in the URBMI group. The study found that differences in health status are not the reason for inequity in medical insurance benefits; in contrast, lower-income people have worse health. This paper further reveals the mechanism and finds that health care utilization and medical insurance reimbursement are the main causes of benefits inequity.

This study has important policy implications. In the designation of the medical insurance system, we can consider allowing for different income groups to pay different premiums according to their medical expenses or allowing for different income groups to apply different reimbursement policies. At the same time, broadening and opening up new funding channels and providing more medical assistance for low-income people will help us avoid difficult situations caused by high medical expenditures [40]. It is also possible to consider increasing the reimbursement rate of primary medical institutions so that low-income people who seek medical care in such medical institutions will benefit more than if they sought help in other types of institutions.

Abbreviations

NRCMI: New Rural Cooperative Medical Insurance
URBMI: Urban Residents’ Basic Medical Insurance
CFPS: China Family Panel Studies
SRH: Self-rated health
CNY: Chinese Yuan

Declarations

Ethics approval and consent to participate
The study was exempt from human subjects’ approval (non-identifiable data; not human subjects).

Consent for publication
Not applicable.

Availability of data and materials
The datasets used during the current study are not publicly available, but CFPS datasets can be applied in Peking University Open Research dataverse: https://opendata.pku.edu.cn/dataverse/CFPS.

Competing interests
The authors declare that they have no competing interests.

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Authors’ contributions
LYW and DL designed the study. LYW conducted the primary statistical analysis. DL and LYW wrote the initial drafts of the manuscript. LYW and DL read, revised and approved the final manuscript.

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