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ARTICLE



# Revisiting income-related health inequality in China: changes before and after the 2009 healthcare reform

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## ABSTRACT

In 2009, the Chinese government launched a systemic healthcare reform. Despite the massive investment in the health sector, little is known about how health inequality across economic classes has changed after the reform. Using data from the China Health and Nutrition Survey (CHNS), this study traces the income-related health inequality (IRHI) before and after the reform with the corrected concentration index (CCI). Furthermore, the inequality change is decomposed into income and non-income factors.

## KEYWORDS

Health; inequality; healthcare reform; concentration index

## JEL CODES

D30; D63; I18

## I. Introduction

Health inequality is of great political importance all around the world. Since the 1990s, China has made substantial investments in the health system, but these investments did not curb the health gap between the rich and the poor. Prior to 2009, health and healthcare utilization were skewed among the rich (Yang and Kanavos 2012; Guo et al. 2020); income-related health inequality (IRHI) was even rising in China (Baeten, Van Ourti, and van Doorslaer 2013). In April 2009, the State Council of China initiated a new healthcare reform aiming to make health services more accessible and affordable. However, there has not been a study comparing income-related inequality in health before and after the reform thus far. This paper compares income-related health inequality before and after 2009, shedding light on the evolution of health inequality in the era of healthcare reform.

## II. Data and methods

### Data

The China Health and Nutrition Survey (CHNS) is employed as it is the only known database that started collecting microdata in China before 2009. This study makes use of data from 2006, 2009, 2011, and 2015. The sample consists of people 18 and older from nine provinces: Liaoning, Heilongjiang,

Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi, and Guizhou. Although self-assessed health (SAH) is a popular health indicator, it is not a viable option for this research. CHNS surveyed SAH in 2006 and 2015, but the evaluation scheme used to quantify SAH increased from four to five categories. Therefore, this variable is not suitable for comparison. Alternatively, this study defines a health variable, 'Healthy', as having a value of 1 if the respondent reported illness during the past four weeks and 0 otherwise. Factors that may affect health used in this study are income, health insurance status, urban residence, years of education, marital status (= 1 partnered, 0 otherwise), age, gender, and province dummies. Table A.1 displays descriptive statistics of the main variables considered.

### Corrected concentration index (CCI)

Income-related health inequality (IRHI) is measured using the corrected concentration index (CCI) (Erreygers 2009), which is a well-known technique to evaluate socioeconomic inequality with binary health measures. Given a population of  $n$  individuals, CCI can be expressed as

$$CCI(h) = \frac{8}{n^2(h^{max} - h^{min})} \sum_{i=1}^n z_i h_i = \frac{8}{n^2} \sum_{i=1}^n z_i h_i \quad (1)$$

where  $h$  is the health variable, and  $h^{min}$  and  $h^{max}$  designate the lower and upper bounds of the health variable.  $z_i$  is a weight determined by the income rank of individual  $i$ . A positive (negative) sign of  $z$  means the individual's income ranking is higher (lower) than  $\frac{n+1}{2}$ , that is relatively richer (poorer), and an individual with the median income has a zero weight ( $z = 0$ ). A positive (negative) CCI indicates that people at a higher income level are more likely to enjoy better (worse) health.

### Decomposition

Previous research has shown that linear and non-linear regressions yield similar equity analysis results (Yang and Kanavos 2012). For the convenience of coefficient interpretation, this paper adopts a linear probability model (LPM). Consider the following specification:

$$h = \alpha + \sum_k \beta_k x_k + \varepsilon \quad (2)$$

where  $x_1, x_2, \dots, x_k$  stand for the explanatory variables,  $\varepsilon$  is the error term. Erreygers (2009) has shown that CCI can be decomposed as:

$$CCI = 4 * \sum_{i=1}^n \hat{\beta} * GCI_k + 4GCI(\varepsilon) \quad (3)$$

where  $\hat{\beta}$  is the estimated coefficient from equation (2);  $GCI$  is the generalized concentration index.  $4 * \hat{\beta} * GCI_k$  provides the absolute contribution of the determinant  $x_k$ ; the absolute contribution in percent of the overall CCI is the relative contribution. The last component represents the unexplained part after decomposing the CCI.

Additionally, we take an Oaxaca approach to decompose the change in inequality. Define  $\eta_k = \frac{\beta_k \bar{x}_k}{h}$  as the elasticity of  $x_k$  on health, and we have:

$$\Delta CCI = \sum_k \eta_{k,2015} * \Delta CCI_k + \sum_k CCI_{k,2006} * \Delta \eta_k + 4\Delta GCI(\varepsilon) \quad (4)$$

**Table 1.** Corrected concentration indices.

	2006	2009	2011	2015
CCI	0.020**	0.024***	0.062***	0.014*
Observation	9,507	9,831	9,401	9,365

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

### III. Results

Table 1 shows that IRHI the rich had a lower risk of suffering from illness between 2006 and 2015. IRHI did not significantly change from 2006 to 2009, but exhibited a temporary jump in 2009. However, comparing 2015 to 2006, the pro-rich inequality fell to a lower level.

#### Decompose inequality

This section discusses the inequality decomposition results. A positive (negative) percentage indicates that if health inequality is affected by that factor alone, the rich would be more (less) likely to have better health.

Figure 1 plots how income and other factors contributed to inequality over time. Perhaps because the new healthcare reform officially landed in the middle of 2009, the configuration of 2009 is markedly different. Another thing that stands out right away is that the relative contribution of income declined substantially.

Since we are interested in comparing inequality before and after the 2009 reform, the following analysis focuses on 2006 and 2015. The decomposition results for 2009 and 2011 are shown in Table A.2. According to Table 2, inequality can be primarily attributed to income, education, and age. However, income accounted for the largest proportion of CCI in 2006, whereas it fell to the third place in 2015, with age climbing to the top. Having health insurance and being an urban resident reduced health disparities. Nevertheless, their protective effects substantially diminished: being insured lowered inequality by 52.839% in 2006, but only 0.2% in 2015. Similarly, the relative contribution of urban residence shifted from -76.501% to -23.378%. Being a man and being married were two factors associated with greater health risks, but their proportions did not change much.

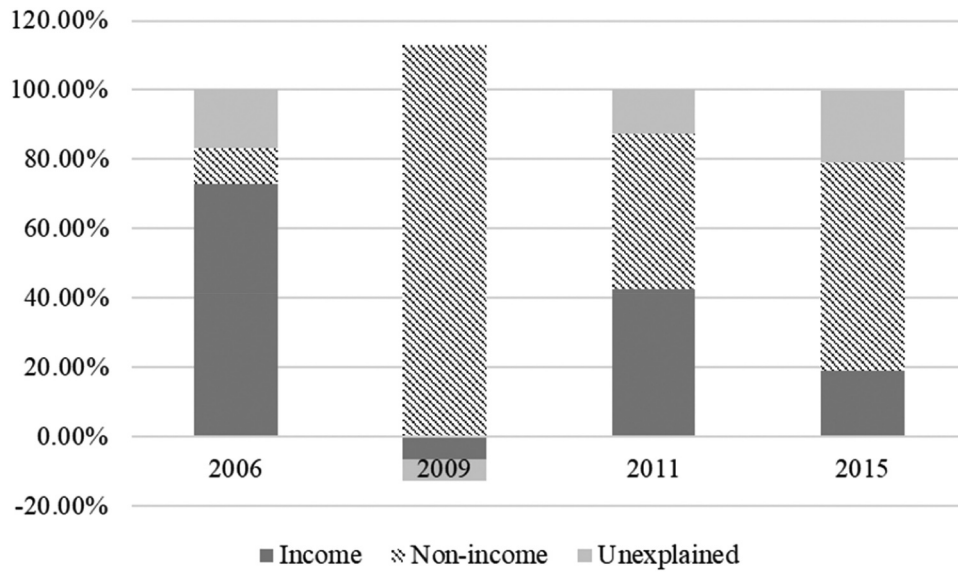


Figure 1. Decomposing health inequality.

Table 2. Decomposing CCI.

	2006			2015		
	$\beta$	GCI	%	$\beta$	GCI	%
Income	0.007*	0.539	72.810	0.001	0.634	18.991
Health insurance	-0.038***	0.069	-52.839	0.026	0.000	-0.200
Urban residence	-0.037***	0.101	-76.501	-0.010	0.077	-23.378
Married	0.045***	0.012	11.166	0.028***	0.012	9.953
Education	0.001***	1.857	54.973	0.001**	1.398	46.663
Male	0.013*	0.011	3.003	0.018**	0.006	3.212
Age	-0.004***	-0.678	50.042	-0.003***	-0.648	60.065
Province	Yes		20.586	Yes		-36.200
FE						
Residual		0.001	16.760		0.001	20.892
Total	9,507		100	9,365		100

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

### Decompose the change in inequality

An essential ingredient to understanding the change in inequality is identifying what can be attributed to different factors. In Table 3, a positive (negative) percentage means that the variation of that factor helps to reduce (raise) the pro-rich inequality.

Three main insights emerge from Table 3. First, income had a beneficial impact on decreasing inequality. Although the rich are more likely to be healthy, the income elasticity of health declined, indicating that health was less dependent on income. Second, province dummies considerably contributed to the reduction in inequality, but the underlying heterogeneities across provinces need more investigation. Third, urban residence and health insurance were inversely correlated with inequality reduction, whereas they were shown to reduce inequality in Table 2. This is because the absolute value of these two factors' pro-poor absolute contributions ( $4 * \hat{\beta} * GCI_k$ ) decreased.

### IV. Discussion

We show that the pro-rich health inequality persisted over time, even after health insurance coverage nearly reached 100% following the reform; however, health

Table 3. Decomposing change in CCI.

	$\Delta\eta * CI_{2006}$	$\Delta CI * \eta_{2015}$	Change in absolute contribution	%
Income	-0.011	0.000	-0.012	198.844
Health insurance	0.025	-0.014	0.011	-176.111
Urban residence	0.011	0.001	0.012	-200.906
Marital status	-0.001	0.000	-0.001	14.006
Education	-0.002	-0.003	-0.005	74.435
Male	0.000	0.000	0.000	2.512
Age	-0.001	-0.001	-0.002	26.569
Province FE	-0.008	-0.001	-0.009	153.569
Residual		0.000	0.000	7.082
Total			-0.006	100

was less dependent on income. Meanwhile, the rising relative contribution of age implies that ageing posed a greater threat to health equality.

Our health measurement relies on illness reports, which may prompt consideration of illness awareness. Additionally, illness awareness deserves further discussion because it directly influences people's health behaviours and, therefore, health. Indeed, illness awareness may be a mechanism behind income-related health inequality. According to our results, two points are worth highlighting.

First, health insurance may promote illness awareness. In 2006, the rich were more likely to have health insurance ( $GCI_{insurance,2006} > 0$ ), and insured people were more likely to report illness ( $\beta_{insurance,2006} = -0.038 ***$ ). One explanation is that insured people could afford more preventive care, hence having a higher probability of being aware of illness than the uninsured. However, when almost everyone had health insurance, the gap in illness awareness narrowed. This may be why the impact of insurance on inequality dropped to  $-0.2\%$  in 2015.

Second, urban residents earned more money and had access to more health services; hence they may be more aware of the illness. This argument is consistent with the finding that hypertension detection (Li et al. 2017) and awareness of diabetes (Lai et al. 2019) were lower among rural adults. Considering this, it is not surprising that 'urban residence' negatively contributed to inequality (Table 2).

CHNS asked respondents to choose from 'self-care; saw the local health worker; saw a doctor; did not pay

attention' when they felt ill. According to Figure 2, when feeling ill, 9.57% of rural residents paid no attention, compared to 8.89% of urban residents; the share of uninsured people who paid no attention (11.49%) is greater than that of insured people (8.83%). In summary, uninsured people and rural residents were more likely to be negligent. Hence, it is reasonable to presume that they were less conscious of illness, supporting our previous argument.

For robustness, this study assesses inequality in illness severity. If respondents reported illness, CHNS asked them to rate the severity, with a higher score indicating a better condition. In addition to the concentration index, the Cowell-Flachaire index (Cowell and Flachaire 2017) is computed using the Stata program *inequord* (Jenkins 2020) to access pure inequality. Table A.3 presents the results. In line with the main findings, the outcomes indicate that health inequality decreased after the reform but still exists.

There are certain limitations in this study that point to a path for future research. To begin, this study does not identify a causal effect of healthcare reform. Administrative-level data would be necessary to identify causal effects since multiple health policies were implemented almost concurrently, but with regional variations. Nevertheless, our finding is consistent with the recent research indicating that universal health insurance alone cannot eliminate health disparities (Costa-Font, Cowell, and Saenz de Miera 2021). Next, a cross-province comparison could be conducted in the future to explore the provincial heterogeneity in depth.

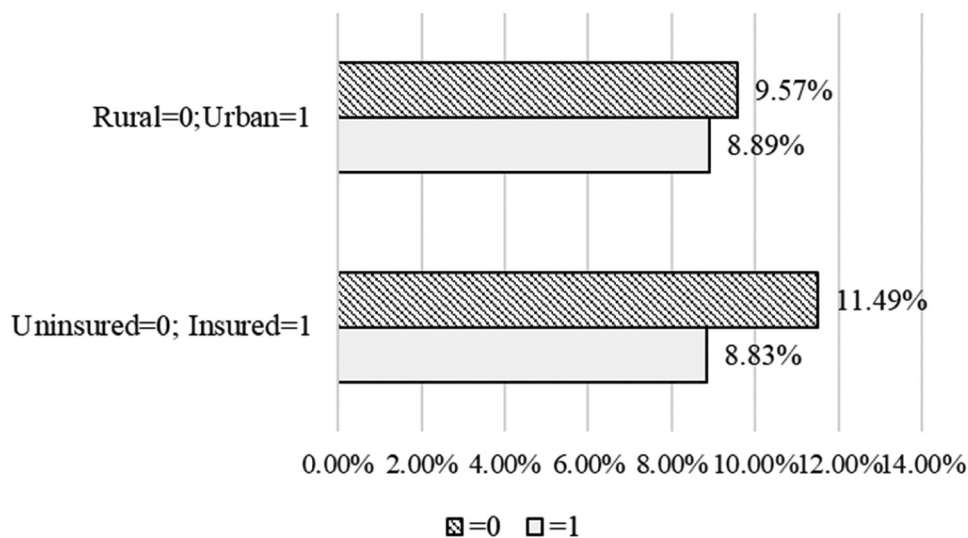


Figure 2. % of people paid no attention when feeling ill.

Thirdly, if data is available, health inequality can be evaluated along other dimensions.

## V. Conclusions

This is one of the first studies to compare income-related health inequality in China before and after the 2009 healthcare reform. We show that the pro-rich inequality persisted, but health was less dependent on income. The decomposition analysis offers valuable insights into the health system. First, universal health insurance is not a panacea for reducing inequality. Second, health insurance and urban residence may affect inequality through illness awareness. Last but not least, the ageing population exerts growing pressure on health equality.

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