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RESEARCH ARTICLE

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Income-Related Inequalities of Health and Health Care Utilization

Abstract By utilizing the China Health and Nutrition Survey (CHNS) data, this paper examines the extent of deviations in terms of horizontal equity in the field of China's health and medical community, i.e., that those in equal demand ought to be treated equally, and computes the contribution of income in health inequality and utilization inequality of health care. The main conclusions are: There is pro-rich inequality in health and utilization of health care; income contribution to inequality of health care utilization accounts for 0.13–0.2; insurance also enlarges the inequality of health care utilization; health inequality in rural area is larger than that of in urban area; and both rural and urban health inequality are increasing. From 1991 to 2006, income changes in urban districts and rural area account for 7.08% and 13.38% respectively of raising inequality of rural and urban health.

Keywords health inequality, inequality in health care utilization, income, concentration index, Oaxaca decomposition

JEL Classification I10, I18

1 Introduction

Equity has long been considered as an important goal in the health sector. Mooney (1986) argues that health equality should be considered prior to other targets, even in the trade-off between equity and efficiency. In fact, to some extent, there exists health inequality and inequality in health care utilization, accessibility of medical services and health financing in different countries and

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regions. Inequality between the rich and the poor is especially serious. The poor tend to suffer higher rates of mortality and morbidity than the better-off. They often access to less medical services, despite in higher level demand. Moreover, the poor often spend more on health care as a large share of their income than the better-off, trapping them in the vicious circle of poverty and disease.

The inequality between the poor and the rich is not a reflection of their different preferences, but the constraint conditions, i.e., lower income, less access to health insurance and living conditions that are more likely to encourage the spread of disease (Le Grand, 1987a; Alleyne, 2000; Evans, 2001). The research of Sen (2002) argues that inequalities in health are more worrisome than inequalities in many other spheres. Because health and health care are important to people's capability of function—their abilities to flourish as human beings.

Equities of health and health care utilization include horizontal equity and vertical equity, and the former is widely applied in health economics. Horizontal equity means that equal demand ought to be treated equally; the demands of health care are related with age, health condition, but not with income, region and race. Inversely, horizontal inequity is defined as equal demands are not treated equally and the utilization of medical care is influenced by non-demand variables (Stephen, 2005).

In the study of health economy, the common indexes and methods used to measure the equalities of health care are different, e.g., Gini coefficient, diversity index, concentration index and Atkinson index. Empirical studies on health inequality can be classified into two kinds: cross-regional comparison and time-series comparison, e.g., Illsley (1987) employs the Gini coefficient from 1921 to 1983 in England and Wales to compare the average age at death; Le Grand (1987b) uses Gini coefficient, absolute Gini coefficient and Atkinson index to compare the average age at death of 32 developed countries; Van Doorslaer (1997) analyzes health inequality by means of individual health in 9 countries and the test of dominant concentration index indicates that health care is in favor of the high-income group; Propper (1992) estimates the health inequality in Briton by using the concentration index in the year of 1974, 1982, 1985 and 1987, and he utilizes four indexes to measure health: with or without acute disease, with or without activity-unrestraint chronic disease, with or without activity-restraint chronic disease and individual's subjective health condition. Their conclusion shows that except for the index of activity-unrestraint chronic disease in 1985 and 1987, all the other indexes demonstrate pro-rich health inequality. Wagstaff (2003) employs decomposition method of concentration index to study the health inequality of Vietnam in 1993 and 1998, attempting to find the origin of inequality.

The empirical literature on inequality of the health care utilization mainly focuses on the application of the indirect standardization and direct

standardization methods. The standardization here means eliminating the correlation between non-income factors and income factors. Dusheiko (2001) compares the influences of the indirect standardization and direct standardization method on the estimation of inequality, and argues that compared with the direct standardization inequality index, indirect standardization inequality index underestimates the partial concentration index largely. Lairson (1995) analyzes inequality of health care utilization in Australia in 1990 by using the method of direct standardization. The conclusion is that under the given necessary condition, the rich enjoys more inpatient service than the poor. Direct standardization method demands grouped data and indirect standardization method could use both grouped data and individual data, thus there are more literatures using indirect standardization method (van Doorslae, 2000; 2004; 2008).

The important researches on income-related inequalities of health and health care utilization of China include: Utilizing subjective health data, Liu (2003) estimates four districts (counties) in Shanghai and concludes that, in sample regions, there exists income-related inequality of health; Hu (2005) uses the subjective health data from the third national health services survey and the income data to calculate the health concentration index in some sample counties in China, and argues that according to the international comparison, the health inequality in China is at a relatively high level, and according to the regional comparison within China, there are many differences among different regions.

All these literatures enrich the research on health inequality. The existing literature, however, either decomposes and analyzes the cross section or focuses on the decomposition analysis of the changes, but seldom takes the discussion of health equity and equity of health care utilization into one analytical framework. This paper uses the data of the China Health and Nutrition Surveys (CHNS), and attempts to decompose and analyze the equity of health care utilization, health equity and its change grouped by year and by urban-rural areas.

2 Method, Data and Variables

2.1 Estimation Method: The Estimation and Decomposition of Inequality

We use the method of O'Donnell (2008), Van Doorslaer (2003) and Wagstaff (2002) to estimate individual demand on health care utilization. The method is as follows:

$$y_i = \alpha + \beta \ln income_i + \sum_k \gamma_k x_{ki} + \sum_p \delta_p z_{pi} + \varepsilon_i \quad (1)$$

where y_i denotes the dependent variable (medical care use of individual i in a given period). There are three explanatory variables: $\ln income_i$ stands for the household income of individual i; x_k stands for a set of k necessary indicator

variables including demographic and morbidity variables; z_p stands for p unnecessary variables. α, β, γ_k and δ_p are parameters to be estimated. ε_i is an error term.

Eq. (1) can be used to estimate the expected demand, $\hat{y}_i^x$ is the expected value of the utilization of health care based on an individual's demand characteristics. The expected demand value can be computed with x_k 's actual value. $\ln income_i$ of the sample means value of z_p and the expected parameters of Eq. (1). That is:

$$\hat{y}_i^x = \hat{\alpha} + \hat{\beta} \ln income^m + \sum_k \hat{\gamma}_k x_{ki} + \sum_p \hat{\delta}_p z_p^m \tag{2}$$

Estimates of the (indirectly) standardized-demand utilization $\hat{y}_i^{IS}$ can be obtained with the difference between the actual and *x*-expected utilization adding to the sample mean y^m.

$$\hat{y}_i^{IS} = y_i - \hat{y}_i^x + y^m \tag{3}$$

Though the method above can measure the health care utilization of different income levels, it cannot decompose the inequality. Wagstaff (1991a, 1991b, 2003) uses concentration index (*CI*) to measure and decompose inequality in health care utilization and health inequality. *CI* is between –1 and 1; positive sign (negative sign) stands for pro-rich (pro-poor); and 0 means absolute equality.

$$CI = \frac{2}{y^m} \sum_{i=1}^{n} w_i (y_i - y^m)(R_i - R^m) = \frac{2}{y^m} \mathrm{cov}_w (y_i, R_i) \tag{4}$$

y^m is the weighted sample mean; R_i ($R_i = \sum_{j=1}^{i-1} w_j + \frac{1}{2} w_i$, w_i denotes the sampling weight of the i^{th} individual) is the fractional rank in the income distribution of sample *i*; R^m is the mean of weighted fractional rank (weighted by body weight); cov_w denotes the weighted covariance (weighted by body weight).

For testing the standard deviation of the concentration index,[1] Kakwani (1997) applies the following regression model to estimate.

$$\frac{2\sigma_R^2}{y^m} y_i = \alpha_1 + \beta_1 R_i + \varepsilon_{1,i} \tag{5}$$

σ_R^2 is the variance of R_i; and regression coefficient is *CI*.

The decomposition of health care utilization and health concentration index is as follows:

$$CI = \eta_r CI_{\ln income} + \sum_k \eta_k CI_{x,k} + \sum_p \eta_p CI_{z,p} + GCI_\varepsilon \tag{6}$$

$CI_{\ln income}$, $CI_{x,k}$ and $CI_{z,p}$ stand for concentration index of income, demand and non-demand respectively; η_k stands for *k* factors' elasticity of

[1] Concentration index can also be estimated by Rao's (1965) nonlinear delta method.

demand,[2] $\eta_k = \frac{\gamma_k x_k^m}{y^m}$; x_k^m and y^m are the mean of x_k and y respectively. This method of decomposition is based on linear regression, thus it is not the most appropriate method for calculating the dependent variable and the binary dependent variable. But using the methods of the two-part model (TPM) and the truncated negative binomial model, the decomposition and application of health care in some countries done by Van Doorslaer (2000; 2004) and Wagstaff (2000) have demonstrated that the measurement of horizontal inequity differs less between OLS and based TPM. This paper use OLS method for simplicity.

We compute an *HI* in health care use by subtracting the necessary inequality from total inequality:

$$HI = CI - \sum_k \eta_k CI_{x,k} \tag{7}$$

HI measures income-related inequity in health care utilization after standardizing for demand differences. It is between –2 and 2. Positive sign (negative sign) stands for pro-rich (pro-poor). 0 means absolute equality (Jui-fen, 2007).

This paper uses the method of Oaxaca (1973) to decompose the changes of the concentration index. The formula is as follows:

$$\Delta CI = \sum_k \eta_{kt}(CI_{kt} - CI_{kt-1}) + \sum_k CI_{kt-1}(\eta_{kt} - \eta_{kt-1}) + \Delta(GCI_{\varepsilon t} / \mu_t) \tag{8}$$

2.2 Data

This paper uses the data of China Health and Nutrition Surveys (CHNS). The survey covers urban and rural area in 9 provinces or autonomous regions (Liaoning, Heilongjiang, Shandong, Jiangsu, Henan, Hubei, Hunan, Guangxi and Guizhou) and applies multi-stage stratified random sampling method. Since 1989, this survey has been done for 7 times (in 1989, 1991, 1993, 1997, 2000, 2004 and 2006). The data include health care utilization, medical insurance and individual health information, and a considerable part of the data is from the same respondents in different years. Due to the comparatively large differences of the health care utilization and health features between the adult and the minor, all the respondents' ages are larger than 18 in this survey.

2.3 Variables

2.3.1 Health Care Utilization

Generally, foreign scholars choose frequency to see a doctor, times of emergency

[2] Individual health can be considered as the demand for health.

treatment and time in hospital during a certain period time as the criteria for health care utilization (Van Doorslaer, 2008). Due to the limitation of information; we can only use one of the questions in the survey, the time in hospital in the past four weeks as the criteria to measure the utilization of medical service. In addition, as the survey in 1989, 1991 and 1993 do not involve this question, we cut out these years.

2.3.2 Health

Indicators available for health equity analysis can be categorized under medical, body functional and subjective standards (Wagstaff, 1991a). Medical standard means the presence of some acute and chronic diseases that result from health deficiency. Body functional indicators define health-related deficiencies in performing normal functions. According to a subjective model, health is defined in relation to the individual's overall perception of his or her health or the changes therein, possibly by comparing with other people of a similar age, e.g., self-assessed health is: (1) very good, (2) good, (3) so-so, and (4) poor.

Dichotomizing the multiple-category responses and measuring health as the percentage of individuals with characteristics, this practice avoids the imposition of some scale that is assumed to indicate how much health is enjoyed in one category compared with another for an individual. But it obviously results in a loss of information and requires the introduction of an arbitrary cutoff point (Wagstaff, 1994). Several index-scoring algorithms have been developed for a number of generic health profiles, such as SF-36 index (Brazier, 1998), the Euroqol-5D index (Busschbachet, 1999) and HUI index (Feeny, 2002). This paper uses the method of Quality of Well-being Scale (QWB), which is established by Kaplan and Anderson (1988). QWB not only bases on objective index such as individual's health condition, but also reflects the subjective judgment of the health status by oneself. QWB is estabilished on professional knowledge of economics, psychology, medicine and public hygiene. There are three steps: First, dividing daily activities into three types by function: mobility, physical activity and social activity. According to the related studies, especially those studies in medicine, three indexes are created by combining the diseases and disabilities with one's capacity to be engaged in these three activities. They can reflect the objective situations of health condition. Zhao (2005) concludes the corresponding variables of objective situations appeared in the survey of CHNS in detail; second, according to the subjective statement of individual's symptom, an index is constructed to reflect the subjective judgment of the health condition (symptom/condition index). Different weights are given to objective condition and subjective judgment; third, integrating the above 3 objective indicators and 1 subjective index to create a unified index to measure health. QWB is between 0

and 1. 1 indicates the healthiest and 0 means death. The survey in 1989 does not involve adults' health condition, thus the analysis of health inequality does not include the data of this year.

2.3.3 Income

The analytical unit of this paper is individual; however, the survey of CHNS for income is family unit. Accordingly, this paper substitutes per capita household income for personal income, but does not apply equal scale method that considers household economies of scale. The per capita household income in this paper is the sum of every family member's wages, bonuses, subsidies and farm income divided by the number of family members.

2.3.4 Other Explanatory Variables

The other explanatory variables include gender, age, educational background, working state, occupation, region, health insurance and household characteristics. Before 2004, the types of medical insurance in CHNS included public medical care, labor health insurance, insurance owned by family members, cooperative medical care, coordinating medical, maternal and child health insurance and equivalent premium income (EPI) insurance. Labor health insurance and insurance enjoyed by family members are merged into medical insurance for urban workers in 2006. Except that, the types of medical insurance are almost the same for each year. This paper sums all kinds of medical insurance. 1 means that individual enjoys one or more than one type of medical insurance and 0 means that individual does not enjoy any kind of medical insurance. The definitions of variables are showed in Table 1.

Table 1 The Defimition of Variables

Variable	Mark	Definition
QWB	Health	Health index
Ln(*income*)	logarithm	Per capita household income (include wages, bonuses, subsidies and farm income)
gender	Gender	1=male; 2=female (the same as CHNS)
Age	Age	Four age groups: age 18–30; age 30–44; age 44–66; age 60+
Sah	self-assessed health	sah1=very good; sah2=good; sah3=fair; sah4=poor
Edu	Education	The highest education level. Edu2=primary school and junior high school; edu3=senior high school; edu4=secondary technical school and vocational school; edu5=college and university; edu6=master and above

(*To be continued*)

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Variable	Mark	Definition
Work	Employment status	1=employment; 0=unemployment
occup	Occupation	1=non-peasant and fishermen; 0=else
region	Region	1=west region; 0=else (Liaoning, Shandong, Jiangsu)
urban	Urban and rural	1=urban; 2=else (the same as CHNS)
Insu	Medical insurance	1= one or more than one type of medical insurance; 0=else
hhsize	Household scale	Number of family members
drwater	Tap water	1=with tap water in house or yard; 0=else
Sani	Sanitary status	0=without or few excrement surrounds the house; 1=else
hosplong	Distance to hospital	Time for going to hospital (minutes for one way)

Due to the dual-character in Chinese economy and society, the living environment, medical conditions and cultural value of urban residents are quite different from those of rural residents. This paper estimates urban and rural area respectively when analyzing health. However, for the reason of shortening the length, the utilizations of health care in urban area and rural area are analyzed together. The health analysis in urban and rural area is in Table 2.

3 Empirical Results

3.1 Income-Related Inequality of Health Care Utilization

3.1.1 Distribution of Health Care Utilization

Table 3 includes actual hospital utilization, concentration index of demands-standardized use and horizontal inequality index according to income quintile group.

If the condition for horizontal equality of the health care utilization is met, the distributions of health care utilization for every income quintile group should be the same, i.e., under the same demands, the health care used by different income level should be the same. However, Table 4 illustrates that for both actual and demand standardized use, the coefficients of the concentration index and horizontal inequality are positive. This fact proves that the health care utilization is pro-rich: The richer, the more health care they enjoy, and income and health care utilization are positively related. Except for the actual utilization and demand standardized use in 1997 and the actual utilization in 2006, the inequality between actual utilization and demand standardized use are obvious.

Table 2 Sample Mean in Health Analysis

	1991		1993		1997		2000		2004		2006	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
QWB	0.950	0.950	0.930	0.930	0.900	0.910	0.880	0.900	0.870	0.890	0.860	0.870
Ln(*income*)	7.030	6.410	7.150	6.520	7.840	7.140	7.980	7.530	8.420	7.790	8.400	7.660
gender	1.510	1.490	1.510	1.490	1.510	1.500	1.510	1.500	1.510	1.500	1.520	1.520
age30–44	0.290	0.280	0.320	0.290	0.310	0.280	0.250	0.230	0.230	0.220	0.210	0.180
age44–60	0.160	0.160	0.170	0.160	0.190	0.190	0.210	0.180	0.240	0.210	0.220	0.160
age60+	0.320	0.320	0.320	0.350	0.290	0.280	0.410	0.470	0.410	0.480	0.490	0.600
edu2	0.290	0.28	0.300	0.300	0.280	0.310	0.290	0.350	0.290	0.330	0.270	0.320
edu3	0.140	0.090	0.160	0.100	0.160	0.110	0.170	0.110	0.150	0.110	0.160	0.110
edu4	0.040	0.010	0.050	0.010	0.070	0.020	0.090	0.030	0.100	0.040	0.110	0.050
edu5	0.050	0.007	0.050	0.010	0.070	0.010	0.100	0.020	0.100	0.020	0.130	0.020
edu6	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.001	0.000
work	0.740	0.830	0.720	0.820	0.680	0.800	0.590	0.760	0.470	0.660	0.470	0.640
occup	0.770	0.440	0.780	0.450	0.800	0.550	0.830	0.590	0.920	0.760	0.930	0.800
hhsize	4.150	4.380	4.010	4.400	4.180	4.610	3.980	4.420	3.890	4.330	4.320	5.270
region	0.700	0.650	0.680	0.660	0.760	0.760	0.680	0.680	0.680	0.690	0.700	0.690
drwater	0.930	0.440	0.900	0.500	0.910	0.560	0.890	0.600	0.920	0.640	0.930	0.680
sani	0.040	0.290	0.120	0.260	0.110	0.230	0.100	0.160	0.040	0.130	0.040	0.130
hosplong	11.400	11.240	10.900	5.970	11.800	10.300	11.750	8.270	11.400	10.300	11.350	10.370
N	4803	7500	3066	7451	3848	8435	4402	9858	4307	9548	4803	12007

Table 3 Hospital Utilization of Each Income quintile Group

Year	Hospital utilization	Income quintile group					Total	*CI*/*HI*	*t*-statistic
		1 (the poorest)	2	3	4	5 (the richest)			
1997	Actual use	0.023	0.137	0.144	0.903	0.223	0.286	0.263	1.320
	Demand standardized use	0.035	0.118	0.092	0.926	0.255	0.271	0.331	1.580
2000	Actual use	0.022	0.064	0.074	0.118	0.144	0.084	0.300	2.330
	Demand standardized use	0.001	0.052	0.070	0.114	0.175	0.083	0.423	2.660
2004	Actual use	0.049	0.096	0.139	0.097	0.137	0.103	0.161	2.050
	Demand standardized use	0.029	0.092	0.145	0.100	0.149	0.103	0.223	2.850
2006	Actual utilization	0.058	0.062	0.072	0.126	0.083	0.080	0.116	1.290
	Demand standardized use	0.028	0.054	0.074	0.139	0.104	0.080	0.244	2.720

Table 4 Decomposition of Health Care Utilization

Variable	1997				2000				2004					2006			
	CI	Regr-ession coeffi-cient	*t*-stat-istic	Contr-ibution	*CI*	Regr-ession coeff-icient	*t*-stati-stic	Contr-ibution	Mean	*CI*	Regr-ession coeff-icient	*t*-stat-istic	Contr-ibution	*CI*	Regr-ession coeff-icient	*t*-stati-stic	Contr-ibution
Actual utilization	0.263				0.300					0.161				0.116			
Expected utilization	–0.068				–0.124					–0.06				–0.128			
Ln(*income*)	0.090	0.089	0.940	0.208	0.080	0.022	0.960	0.164	8.114	0.081	0.021	1.540	0.134	0.083	0.018	1.610	0.154
gender	0.000	0.030	0.140	0.000	–0.001	0.024	0.500	–0.000	1.519	–0.00	0.005	0.190	–0.020	–0.006	–0.028	–1.100	0.003
age30–44	0.023	0.064	0.230	0.002	0.015	0.022	0.290	0.001	0.302	0.014	0.020	0.410	0.001	0.063	0.032	0.690	0.008
age45–59	0.021	0.154	0.490	0.003	0.028	0.083	1.070	0.008	0.338	–0.01	–0.052	–1.000	0.003	0.014	0.051	1.060	0.003
age60+	–0.07	–0.448	–1.100	0.019	–0.051	–0.053	–0.600	0.006	0.242	0.021	0.005	0.090	0.000	–0.126	0.067	1.270	–0.028
sah2	–0.00	0.025	0.080	–0.00	0.010	0.014	0.190	0.000	0.452	0.014	0.023	0.540	0.001	0.028	0.014	0.350	0.002
sah3	–0.03	0.544	1.490	–0.01	–0.027	0.112	1.420	–0.010	0.333	–0.02	0.071	1.520	–0.006	–0.055	0.071	1.640	–0.016
sah4	–0.11	3.555	5.950	–0.08	–0.115	1.058	8.660	–0.130	0.076	–0.10	0.759	11.500	–0.061	–0.190	0.513	8.710	–0.100
edu2	0.047	–0.202	–0.700	–0.01	–0.007	0.045	0.720	–0.000	0.314	–0.02	–0.001	–0.000	0.000	0.009	0.005	0.160	0.000
edu3	0.172	–0.084	–0.200	–0.01	0.161	0.178	2.090	0.047	0.130	0.150	–0.045	–0.900	–0.009	0.174	0.035	0.800	0.010
edu4	0.300	–0.117	–0.200	–0.01	0.294	–0.063	–0.500	–0.010	0.066	0.394	–0.154	–2.400	–0.039	0.365	–0.000	–0.000	–.003
edu5	0.436	0.877	1.400	0.045	0.446	0.365	2.920	0.100	0.052	0.568	–0.047	–0.700	–0.013	0.538	–0.030	–0.500	–0.014

(*To be continued*)

(*Continued*)

Variable	1997				2000				2004					2006			
	CI	Regr-ession coeffic-ient	*t*-stat-istic	Contr-ibution	*CI*	Regr-ession coeff-icient	*t*-stati-stic	Contr-ibution	Mean	*CI*	Regr-ession coeff-icient	*t*-stat-istic	Contr-ibution	*CI*	Regr-ession coeff-icient	*t*-stati-stic	Contr-ibution
edu6	0.233	–0.341	–0.100	–0.00	0.336	–0.070	–0.100	–0.000	0.020	0.786	–0.227	–0.200	–.000	0.755	4.500	9.200	0.028
work	–0.00	–0.659	–2.200	0.012	–0.007	–0.083	–1.200	0.005	0.602	–0.01	–0.047	–1.200	0.004	0.028	–0.028	–0.800	–0.006
occup	0.204	0.068	0.250	0.029	0.169	–0.048	–0.700	–0.060	0.731	–0.00	–0.010	–0.200	–0.049	0.105	–0.004	–0.100	–0.004
region	–0.04	0.224	0.870	–0.03	–0.085	0.053	1.010	–0.040	0.668	–0.10	0.065	2.070	–0.042	–0.074	0.025	0.910	–0.016
urban	–0.04	0.054	0.230	–0.02	–0.036	–0.044	–0.800	0.031	1.649	–0.04	–0.080	–2.500	0.062	–0.049	–0.005	–0.200	0.006
insu	0.271	0.251	0.930	0.063	0.373	0.136	2.060	0.131	0.276	0.362	0.163	4.530	0.157	0.121	0.057	2.130	0.043
N	8 895				8 116					9 266				9 232			

Note: The omitted groups of age, subjective health and education are 18–30 years old, healthy and primary school respectively. For shortening the length, the constants are omitted. The concentration index of actual utilization is the same as in Table 4; concentration index of expected utilization is the sum of coefficients of each demand variable (involve gender, age and subjective health).

For actual utilization of 2000, the highest income quintile is 5.5 times bigger than the poorest income quintile and the concentration index is significantly not zero. For demand standardized use, the highest income quintile is 174 times bigger than the poorest income quintile and the horizontal inequality index is significantly not zero neither. After 2000, the health care utilization gap between the rich and the poor has been decreasing, but still larger.

Without considering individual's living standard, if everybody enjoys the same health care utilization, then the concentration curve will overlap with the 45° equity line, which illustrates that the health care utilization is under equity status. When the poor (the rich) enjoys more health care, the concentration curve will be above (under) the equity line. The concentration curves of actual hospital utilization in the year of 2000 and 2004 were strictly under the 45° line, which indicated the health care utilizations in these years were pro-rich, i.e., the rich enjoyed more health care utilization. The *t*-statistic of the actual hospital utilization in 2000 and 2004 are also significant. In 1997 and 2006, the concentration curves of health care utilization are not strictly close to the equity line, but sway around the line. And the *t*-statistic of actual hospital utilization is not significant.[3]

3.1.2 Decomposition of the Health Care Utilization

The analysis above shows the differences of hospital utilization among different income quintile. In this section, we turn to analyze the causes of these differences. The decomposed results based on OLS are showed in Table 4. Classified by income, this table shows the extents of all the variables' contribution to the total inequality in hospital utilization. For explaining and decomposing the results, we take the year 2004's data including mean, concentration index, regression coefficient and contribution for instance (means analysis in other years are omitted). Every variable depends on three factors: first, the importance of the variable indicated by its mean value; second, the distribution of the variable of different income groups indicated by its concentration index; third, the marginal effect of hospital utilization indicated by regression coefficient. Take self-assessed health for example, averagely 7.6% of the respondents are under "poor" status; the larger the negative concentration index is, the more likely the "poor" status occurs in low-income groups. The regression coefficient, 0.7592, stands for the average increased days staying in hospital for the unhealthy individuals when compared with the healthy ones. The contribution of the variable—"poor" health condition—can be computed by use of Eq. (6) with these three factors. Table 5 illustrates that the contribution of the health condition,

[3] For shortening the length, the concentration curve is not drawn in the paper.

"so-so" and "poor," are generally negative, due to the negative concentration index. Negative contribution rate implies this contribution may lower the inequality of the days in hospital for the rich. Because the model is linear, one can sum the subjective health contribution rate to get the contribution of subjective health to the inequality of hospital utilization. This value in 2004 is 0.0656, which indicates that the distribution of subjective health is in equal status (concentration index equals 0), and will decrease hospital utilization inequality by 0.0656. The computations and explanations of other variables' contributions are generally the same.

In short, negative contribution rate can decrease inequality, while positive contribution rate may increase inequality. The more unequal the income distribution is (measured by concentration index of logarithmic income), the larger the marginal hospital utilization and income's positive contributions are. In each year, the inequality in income distribution causes pro-rich inequality in days of staying in hospital. The contribution of income to hospital utilization inequality decreased from 0.208 in 1997 to 0.164 in 2000 and 0.134 in 2004. In 2006, this contribution rate increased to 0.154. All these indicate that income plays an important role in health care utilization.

Demand variables' (gender, age and subjective health) total contribution rate is negative in each year. This is good news for the poor because it implies that demand-orientated resource distribution of health care can decrease income-related inequality in health care utilization. Otherwise, when demand is not the main factor of health care utilization, income-related inequality in health care utilization will increase.

Education and employment status are important socio-economic variables related to health and income. Compared with primary school (omitted group), the higher the education level is, the more the individual earns (*CI* is positive). If the marginal effect of health care utilization (the regression coefficient) is positive, education might have positive pro-rich contribution rate. Summing the contribution rates of education above primary school level (except for 2004), the contribution rate of education to the inequality of health care utilization in other years are all positive. Though the employment status reflects the differences of the accessibility of health care and the different time values, it is not the direct factor on health care utilization. It can be one part of the demand variables, e.g., compared with their healthy peers, the disabled are less healthy, earn less and have more demand on health care. The contribution of unemployment for them is generally negative in 2006. Compared with unemployment (omitted group), people who have jobs are richer (*CI* is positive), but the health care utilization is lower than the unemployment (the regression coefficient is negative). Thus the factor of employment status is pro-poor in 2006. Although it is pro-rich in other years, the contribution rate of employment status is quite low, only about 0.01.

The differences of health care utilization among regions or between urban and rural areas contribute to the income-related inequality of health care utilization only when the income levels in these areas are different. In fact, the differences between urban and rural areas are a reflection of the differences of the individual's socio-economic conditions. Compared with the urban, rural area is poorer (*CI* is negative); the accessibility of health care is worse; the health care utilization is less (regression coefficient is negative), thus the health care utilization is pro-rich. Except for 1997, the income-related inequality of health care utilization between urban and rural area is positively pro-rich. Compared with the east region of China (omitted group), the west region of China is poorer (*CI* is negative). Because the average year health care utilizations in west region are higher than that in the east (regression coefficients are positive and he causes might be that the time value in the west is lower or the lower health level tends to enjoy more health care), the contribution of regions to the income-related inequality of health care utilization is pro-poorly negative.

In most years, the contributions of occupation to the inequality of health care utilization are negatively pro-poor. Compared with farmer, non-farmer are richer (*CI* is positive). Health care utilization is relatively low due to the low time value. The contribution of occupation is only 0.004 in 2006.

Whether one owns health insurance may also influences health care utilization. Jones (2000) argues that in the model of health care utilization, health insurance may be not completely exogenous under the health care system of voluntary medical insurance. Under the medical insurance system in China, medical insurance for urban workers is compulsory, while cooperative medical care and commercial medical insurance are voluntary. In all the years in survey, the proportions of voluntarily medical insured are not so high and the emphasis of this paper is the application of the decomposition of concentration index, thus we use the same method to estimate "marginal effect" and "contribution," which may affects the accuracy of the results. The results indicate that compared with without medical insurance (omitted group), individuals who have medical insurance are richer (*CI* is positive); the health care they enjoy are more (the regression coefficient is positive); and the contribution of medical insurance to the income-related inequality of health care utilization is positive, i.e. pro-rich. Except for 2007, the *t*-statistics are significantly in almost other years. The contribution rates in 2000 and 2004 are 0.131 and 0.157 respectively, both larger than 0.1.

3.2 Income-Related Inequality of Health

3.2.1 Distribution of Health

The health-indexes corresponding with income quintile are showed in Table 5. In

1991, the health conditions of the richest quintile and the poorest quintile were nearly the same. After 1997, the gap of health conditions between the high income and the low income began to expand and the health of the poorest individual was 95.6% of the richest individual in 1997. In 2000 and 2004, the proportion was near 95% and decreased to 89.7% in 2006. From 1997, the health index of every quintile tended to decrease. Health index of the poorest decreased from 0.954 to 0.797, and for the richest, the index was from 0.952 to 0.888.

Table 5 Health Indexes Correspond by Quintile

Quintile	1991	1993	1997	2000	2004	2006
1 (poorest)	0.954	0.935	0.880	0.863	0.847	0.797
2	0.953	0.936	0.900	0.891	0.874	0.846
3	0.955	0.939	0.910	0.910	0.891	0.878
4	0.953	0.936	0.913	0.900	0.889	0.878
5 (richest)	0.952	0.935	0.920	0.907	0.869	0.888

The comparison between urban and rural health indexes has three features. First, the difference of health index between the richest and the poorest in rural area is larger than that in city. From 1997, when the gap of health began to emerge in urban area and rural area for all quintile, to the year of 2006, this feature was obvious almost every year, e.g., in 2006, the health index of the richest in rural area was 0.903, and for the poorest, the number was 0.791 (the difference was 0.112). In the same year, this difference in urban area was only 0.042. Second, the health index of relatively high income in rural area was larger than that in urban area. The health index of the forth and the fifth quintile in rural area were higher than their counterparts in urban area in each year. Third, the health index of both urban and rural area decreased from 1997.

Form the health concentration curve, in 1991 the health concentration curves of urban and rural area were almost overlapped the equity line, which indicated that in the early 1990s, the extent of health equity was relatively high. In 2006, in both urban and rural area, the health concentration curves were under the equity line, which illustrated the pro-rich inequality of health in China and the rich were healthier. In 2006, health concentration curve was under the curves of other years, which indicated in recent years, the inequality of health in China has been enlarging.[4]

3.2.2 Decomposition of Health Inequality

We use the equations above to calculate the concentration indexes which

[4] For shortening the length, the concentration curve is not drawn in the paper.

influence health indexes in urban area and rural area, and calculate the contribution rate of each variable to health inequality based on regression (see Table 6, Table 7 and Table 8).

From the concentration indexes in Table 6, except 1991 in rural area and 2004 in urban area, the concentration indexes of health indexes are positive every year, which indicate that the health in urban area and rural are all pro-rich. In most years, the concentration indexes of health indexes in rural area are larger than that in city, which implies that the pro-rich extent of health is higher in rural area. And in 2006, the concentration indexes of health in urban area and rural were all larger than that in 1991, which indicated the health inequality enlarged in both urban and rural.

The same as health care utilization, if the concentration index of a variable smaller than zero means that compared with omitted group, the income is lower; conversely, if the concentration index is positive, the meaning is opposite. The variables of which the concentration indexes are negative each year imply that both in urban area and rural the low income group include female, west region, large family, bad sanitation condition, etc. Correspondingly, the concentration indexes are positive for the high income group, which include high level of education, non-peasant and with tap water in house or yard.

The concentration index of income (logarithm) can reflect the inequality in income distribution. The concentration index of income in rural area steadily decreased from 1991 to 2004, and began to increase in 2006. The inequality of income tended to aggravate in rural area. For each year in survey, the concentration indexes of income in rural area are larger than that in city, which indicates that the extent of income inequality in rural area is larger than that in city.

In rural area, the variables of which the concentration index decreased year by year were with tap water and occupation, which might due to the water improvement project and urbanization in recent years. The reducing of the positive concentration index is in favor of poverty group.

The explanation of the regression results of urban and rural area should be careful, because the analysis of the decomposition of health inequality are more like the description, but not regression analysis in strictly causal sense, and with the directly estimated features of the outcome indicators of health systems. The health regression in urban area and rural areas implies the relationship between health and other factors like income, employment status, etc. The relationship may be reversely causality, e.g., health may have positive influence on income (income as dependent variable). The test of causality of variables should apply panel data. This paper focuses on the application of decomposition method, thus the explanation of the results should be considered more as the explanation of the relation ship between income and health.

Table 6 Variables' Concentration Indexes Related to Health

	1991		1993		1997		2000		2004		2006	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
QWB	0.001	–0.001	0.000	0.000	0.009	0.011	0.008	0.011	–0.005	0.011	0.100	0.026
Ln (*income*)	0.067	0.112	0.079	0.108	0.066	0.102	0.073	0.087	0.0763	0.083	0.076	0.093
gender	–0.004	–0.003	–0.001	–0.003	–0.002	–0.002	–0.003	–0.000	–0.001	–0.002	–0.004	–0.005
age30–44	–0.008	–0.055	–0.046	–0.028	0.047	0.038	0.038	0.061	–0.018	0.122	0.062	0.240
age44–60	0.181	0.030	0.107	0.048	0.105	0.042	0.079	0.042	0.073	0.023	0.115	0.112
age60+	–0.091	0.028	0.033	0.016	–0.132	–0.110	–0.073	–0.045	–0.033	–0.069	–0.092	–0.123
edu2	–0.008	0.089	–0.031	0.093	0.004	0.080	–0.049	0.027	–0.062	0.015	–0.068	0.060
edu3	0.088	0.194	0.069	0.157	0.091	0.197	0.096	0.164	0.042	0.198	0.055	0.216
edu4	0.182	0.345	0.094	0.135	0.173	0.355	0.197	0.294	0.248	0.439	0.199	0.426
edu5	0.173	0.569	0.236	0.383	0.308	0.478	0.364	0.448	0.416	0.589	0.399	0.521
edu6	0.454	–0.785	0.380	0.794	0.540	–0.018	0.215	0.755	0.701	0.879	0.803	0.622
work	0.006	–0.036	0.006	–0.016	0.026	–0.006	0.005	0.007	–0.011	0.022	0.051	0.062
occup	0.095	0.318	0.063	0.227	0.075	0.162	0.071	0.112	0.044	0.046	0.023	0.009
hhsize	–0.036	–0.045	–0.038	–0.043	–0.053	–0.036	–0.062	–0.029	–0.080	–0.043	–0.095	–0.074
region	–0.086	–0.073	–0.033	–0.043	–0.060	–0.040	–0.086	–0.081	–0.143	–0.082	–0.084	–0.075
drwater	0.046	0.262	0.023	0.155	0.025	0.117	0.046	0.079	0.035	0.079	0.029	0.045
sani	–0.174	–0.187	–0.188	–0.127	–0.235	–0.147	–0.244	–0.142	–0.392	–0.288	–0.354	–0.236
hosplong	–0.021	–0.079	–0.067	–0.016	–0.027	–0.023	0.049	–0.026	0.062	–0.032	0.101	–0.026

Table 7 Regression and Decomposition of Health Conditions in the Urban Area (*QWB* as dependent variable)

	1991			1993			1997			2000			2004			2006		
	Coeff-icient	*t*-statistic	Contri-bution (%)	Coeff-icient	*t*-statistic	Contr-ibut-ion (%)	Coeff-icient	*t*-statistic	Contr-ibution (%)	Coeff-icient	*t*-statistic	Contr-ibution (%)	Coeff-icient	*t*-statistic	Contr-ibution (%)	Coeff-icient	*t*-statistic	Contr-ibution (%)
Ln (income)	0.002	1.060	124.580	0.001	0.530	654.000	0.007	2.260	47.090	0.013	3.940	113.320	0.003	0.760	–42.300	0.011	2.990	78.390
gender	0.056	20.700	–54.910	0.050	12.200	–97.200	0.045	7.940	–1.580	0.037	5.970	–2.210	0.027	3.930	1.110	0.044	6.350	–3.360
age30-44	–0.003	–0.800	0.960	–0.014	–2.500	226.800	–0.018	–2.30	–3.230	–0.008	–0.900	–1.150	–0.020	–1.800	–2.120	–0.011	–0.880	–1.610
age44-60	–0.002	–0.500	–9.920	–0.032	–4.700	–654.000	–0.038	–4.220	–9.510	–0.041	–4.200	–10.460	–0.050	–4.400	22.700	–0.047	–3.870	–13.800
age60+	–0.011	–2.200	53.480	–0.108	–13.000	1288.000	–0.236	–22.200	113.500	–0.215	–18.000	98.300	–0.250	–19.000	–86.500	–0.257	–19.000	136.500
edu2	0.007	1.920	–2.640	0.001	0.160	–9.060	0.016	2.100	0.199	0.030	3.550	–6.610	0.035	3.840	16.390	0.061	6.350	–13.400
edu3	0.004	0.960	8.740	0.005	0.730	60.700	0.024	2.630	4.550	0.037	3.570	9.390	0.039	3.520	–6.390	0.067	5.890	6.810
edu4	0.009	1.510	14.050	0.017	1.730	99.580	0.026	2.220	4.180	0.055	4.520	15.030	0.049	3.910	–32.300	0.077	6.060	19.210
edu5	0.014	2.430	22.180	0.022	2.190	281.400	0.030	2.420	7.760	0.055	4.590	30.440	0.044	3.390	–49.500	0.082	6.560	51.260
edu6	0.038	1.560	6.690	0.014	0.350	16.260	–0.013	–0.080	0.025	0.059	0.820	0.510	0.071	0.380	0.360	0.031	0.330	0.340
work	0.011	2.870	7.760	0.019	3.360	94.290	0.004	0.580	0.920	0.012	1.520	0.580	0.016	1.960	2.030	0.017	1.960	4.790
occup	0.003	0.820	38.980	–0.00	–0.400	130.100	–0.021	–2.480	–15.800	–0.039	–3.900	–35.690	–0.054	–4.000	54.720	–0.049	–3.460	–12.200
hhsize	0.002	1.870	–39.590	0.003	1.730	–442.000	0.002	0.860	–4.440	–0.002	–0.600	5.490	–0.004	–1.500	–28.600	0.004	1.880	–20.500
region	0.003	1.060	–29.010	0.003	0.600	–68.400	–0.009	–1.240	4.840	–0.002	–0.300	1.990	0.001	0.090	1.570	–0.015	–2.020	10.210
drwater	–0.008	–1.900	–54.710	–0.009	–1.300	–225.000	0.029	2.700	8.150	–0.005	–0.400	–3.160	0.021	1.600	–17.300	0.019	1.200	6.240
sani	–0.002	–0.500	8.980	–0.006	–0.800	144.900	–0.026	–2.370	8.710	0.005	0.430	–2.010	0.004	0.200	1.700	–0.024	–1.250	4.630
hosplong	0.000	0.690	–2.290	–0.000	–1.400	94.130	–0.100	–1.390	0.510	0.000	0.280	0.310	–0.000	–2.300	7.250	–0.000	–0.980	–1.440

Table 8 Regression and Decomposition of Health Conditions in the Rural Area (*QWB* as dependent variable)

	1991			1993			1997			2000			2004			2006		
	Coeff-icient	*t*-statistic	Contr-ibution (%)	Coeff-icient	*t*-statistic	Contri-bution (%)	Coeffic-ient	*t*-statistic	Contr-ibu-tion(%)	Coeff-icient	*t*-statistic	Contri-bution (%)	Coeff-icient	*t*-statistic	Contrib-ution (%)	Coeff-icient	*t*-statistic	Contri-bution (%)
Ln (*income*)	0.000	0.080	–5.980	0.001	0.630	342.200	0.007	4.130	48.170	0.007	3.570	44.540	0.005	2.480	36.360	0.004	2.150	14.050
gender	0.060	29.100	30.310	0.052	19.900	–173.000	0.043	11.340	–1.350	0.032	7.580	–0.220	0.044	9.440	–1.320	0.037	7.840	–1.220
age30–44	–0.014	–5.600	–26.980	–0.011	–3.200	60.680	–0.022	–4.530	–2.410	–0.015	–2.500	–2.100	–0.015	–2.000	–4.510	–0.005	–0.640	–1.080
age44–60	–0.016	–5.200	9.330	–0.038	–9.500	–208.000	–0.048	–8.660	–3.850	–0.037	–5.600	–2.770	–0.039	–4.900	–2.070	–0.038	–4.240	–3.210
age60+	–0.017	–4.400	18.920	–0.117	–25.000	–466.000	–0.259	–38.100	83.630	–0.240	–30.000	51.250	–0.27	–30.000	96.830	–0.280	–28.700	92.550
edu2	0.001	0.400	–3.160	0.002	0.610	40.370	0.010	2.220	2.670	0.019	3.670	1.830	0.035	6.190	1.860	0.044	7.560	3.870
edu3	0.005	1.210	–9.540	0.005	1.120	58.800	0.017	2.590	3.720	0.027	3.610	5.300	0.034	4.290	8.380	0.047	5.890	5.390
edu4	–0.019	–2.200	10.690	–0.004	–0.400	–6.330	0.023	2.090	2.360	0.033	2.710	3.640	0.035	2.970	6.740	0.057	5.070	5.610
edu5	0.024	2.090	–11.530	0.031	2.140	60.370	0.022	1.390	2.350	0.036	2.350	3.710	0.026	1.570	3.150	0.048	3.390	3.260
edu6			0.000			0.000	0.096	0.690	0.000	0.097	0.650	0.080	0.374	2.190	0.540	0.143	1.140	0.120
work	0.013	3.710	45.840	0.026	6.550	–230.000	0.036	6.410	–1.750	0.037	5.820	1.980	0.047	7.500	7.410	0.031	4.440	5.440
occup	–0.001	–0.400	18.010	–0.004	–1.200	–277.000	–0.012	–2.410	–10.400	–0.016	–0.700	–10.730	–0.011	–1.900	–4.100	–0.024	–3.630	–0.790
hhsize	0.001	1.490	22.850	0.000	0.480	–50.300	0.001	1.100	–2.100	–.000	–0.100	0.120	0.001	0.850	–2.470	0.004	7.560	–7.720
region	0.010	4.530	57.200	–0.004	–1.600	88.850	–0.004	–0.850	1.150	–0.007	–1.600	3.880	0.013	2.620	–7.850	–0.003	–0.580	0.660
drwater	0.001	0.560	–17.610	–0.001	–0.500	–73.100	0.011	2.800	7.470	0.000	0.080	0.167	0.004	0.830	2.130	–0.001	–0.120	–0.080
sani	–0.002	–1.000	–15.460	–0.006	–2.000	149.600	–0.016	–3.190	5.480	–0.004	–0.100	0.960	–0.009	–1.300	3.910	–0.019	–2.540	2.640
hosplong	0.000	0.520	2.940	–0.000	–0.500	2.080	–0.002	–2.170	0.480	–0.000	–1.400	0.340	–.0000	–0.600	0.220	0.000	0.390	–0.060

In Table 7, the influences of income to health were all positive and in 1997, 2000 and 2006, the statistical significances were very high. For gender, female were healthier than male, and *t*-statistics were very significantly high each year. The older the man was, the unhealthier he was. As getting old, health as a kind of human capital, its depreciation rate would increase gradually.

The regression coefficients of relatively high education level in almost all the years are positive (except that the coefficient of master in 1997 is negative). The higher the education level is, the healthier the people are, and the more health people demand. This may be the fact that people who have higher education levels pay more attention to the human resource value of health. Certainly, under some conditions, high levels of education tend to cause greater psychological stress, thus influence the health index. The fact that the coefficients of the highest level of education are not significantly positive or even negative in some years proves the foregoing surmise. Compared with the unemployed, people who had jobs are healthier. Non-peasant in most of the years is not healthier than peasant. Family number, living in east or west region, sanitation condition, water condition and the distance to hospitals do not have specific influences to health.

Table 8 indicates that the health regression coefficients in rural area were almost the same as in the urban. In all the years in survey, the influences of individual income to health were positive in rural area. From 1997, this kind of positive affection was significant. In rural area, female were healthier than male, and the *t*-statistics were all larger than 7, which implied that regression coefficient of gender was very significant. The older people were, the unhealthier they were. In most of the years, the higher the education level was, the larger the health index was. Non-peasant in most of the years was not healthier than peasant. Compared with the unemployment, people who had jobs were healthier. Family scale, living in east or west region, sanitation condition, water condition and the distance to hospitals did not have specific influences to health.

In most of the years, income factor in urban area has the greatest contribution to health inequality and the contribution of income to the pro-rich health inequality is positive, which enforces health inequality. In 1991, 1993 and 2000, this contribution to heath inequality even exceeds 100%. Because the concentration indexes of employment are pro-rich (*CI* is positive), thus the employment status has positive contribution to pro-rich health inequality each year. People who have jobs are healthier than the unemployment, and the former's health level (demand of health) is higher (regression coefficient is positive). The positive contribution of the employment status to health inequality also enforces the pro-rich health inequality.

Except the year 1991, the contributions of rural income to health inequality are all positive, which enforces the pro-rich health inequality. The contribution of rural income to health inequality tended to decrease, and the contribution rate

reduced from 342.2% in 1993 to 14.05% in 2006.

3.2.3 Decomposition of Changes of Health Inequality

The health concentration index in urban area increased from 0.00065 in 1991 to 0.1004 in 2006; in rural area, it increased from –0.00088 to 0.0259. During the expanding process of health inequality in both urban and rural area, what kind of role does the relevant determinants and elasticity of demand play? We apply Eq. (8) to decompose the changes of health inequality in urban and rural areas. The results are showed in Table 9.

Table 9 Decomposition of Changes in Health Inequality: Oaxaca Method (1991–2006)

	Urban				Rural			
	$\Delta C\eta$	$\Delta \eta C$	Total	%	$\Delta C\eta$	$\Delta \eta C$	Total	%
Ln (*income*)	0.001	0.006	0.007	7.077	–0.000	0.004	0.004	13.382
gender	–0.002	0.000	0.000	0.023	–0.000	0.000	–6.200	–0.231
age30–44	–0.000	1.410	–0.000	–0.167	–0.000	–0.000	–0.001	–1.937
age44–60	0.001	–0.002	–0.001	–1.322	–0.000	–0.000	–0.001	–2.797
age60+	5.000	0.013	0.013	13.395	0.029	–0.005	0.024	89.852
edu2	–0.001	–0.000	–0.001	–1.327	–0.000	0.001	0.001	3.636
edu3	–0.000	0.001	0.001	0.628	0.000	0.001	0.001	4.905
edu4	0.000	0.002	0.002	1.842	0.000	0.001	0.002	5.781
edu5	0.003	0.002	0.005	5.016	–7.770	0.001	0.001	2.773
edu6	1.000	–2.400	–8.950	–8.970	0.000	–4.060	3.220	0.120
work	0.000	2.580	4.310	4.320	0.002	–0.000	0.002	6.900
occup	0.004	–0.005	–0.001	–1.486	0.007	–0.007	–4.700	–0.177
hhsize	–0.013	–0.007	–0.020	–20.375	–0.001	–0.001	–0.002	–6.712
region	–0.000	0.001	0.001	1.218	5.420	6.710	6.760	2.530
drwater	–0.000	0.001	0.001	0.987	0.000	–0.000	–0.000	–0.660
sani	0.000	0.000	0.000	0.408	0.000	0.000	0.001	2.052
hosplong	–0.000	4.530	–0.000	–0.131	0.000	–2.890	7.900	2.950

The results in Table 9 show us that during the expanding process of health inequality in the urban area, changes in income inequality and income demand elasticity are mutually reinforced, for the $\Delta C\eta$ and $\Delta \eta C$ are both positive. In addition, we find that in the income changes, $\Delta C\eta$ is much bigger than $\Delta \eta C$, so the main cause for the expanded health inequality is the expanding income inequality, but not the increased income demand elasticity. From 1991 to 2006,

the average contribution rate of the income changes to the health inequality in the urban area is 7.08%. Factors like the variation of aging population, high level education and so on also have positive contribution to the expanding of health inequality in the urban; while changes of family scale and middle-aged population play an inhibitory role to the rising of health inequality.

In the rural area, reversely, we find that during the process of the enlarging health inequality affected by income, changes of income inequality and income demand elasticity mutually offset. The main cause is the increased income demand elasticity, not the income inequality. From 1991 to 2006, the average contribution rate of income changes to the health inequality was 13.38% in the rural area. Similar to the urban area, factors like the change of aging population; employment status and so on also have positive contribution to the increased health inequality in the rural area; furthermore, changes of family scale and middle-aged population also play an inhibitory role to the increased health inequality.

4 Conclusion

This paper uses the data of CHNS to test the horizontal equity of medical treatment and public health territory in China, and precisely to test if same demands are treated equally and the deviation from that target. The paper also calculates the contribution of income to the health inequality and inequality of health care utilization. Considering the differences of the determinants of health care utilization and health, this paper distinguishes among income, demand (gender, age and health condition) and non-demand variables (education, occupation, region, etc.). The results of the decomposition of concentration indexes based on regression show that: First, there is pro-rich health inequality and inequality of health care utilization in China. People with higher income are healthier and enjoyed more health care than those who have lower income. The contribution of income to the inequality of health care utilization is between 0.13 and 0.2. Income is not the only cause of the inequality of health care utilization; factors like medical insurance also enlarge it. Second, in most years of the survey, the concentration indexes of health in the rural area are larger than that in city, which implies that the extent of health inequality in rural area is more serious than that in the urban, i.e., the extent of pro-rich in rural area is higher. And in 2006, the concentration indexes of health in the urban and rural areas were both larger than that in 1991, which indicated the deepened inequity in the urban and rural area. Third, during the process of the exacerbation of health inequality, the contribution rates of the income changes to the increasing of health inequality are 7.08% and 13.38% respectively for the urban and rural area. During this process in the urban, the main reason is the income inequality, while in the rural; the

rising of the income elasticity of demand plays the more important role. The corresponding policy implications are: For solving the problem of income-related inequality and health care utilization in China, the key point is to increase the income of people whose socio-economic status are relatively low, and then to improve their accessibility of health and health care, at the same time, expanding the coverage of medical insurance to absorb the vulnerable groups into the health care security net.

Compared with international empirical studies on health equity, in this paper there are still some problems of the calculation of the concentration index to investigate: Because the total household expenditure is not available in CHNS, it is difficult to estimate the disposable income. In this paper, I use total income to calculate concentration index, while internationally, disposable income is widely used, and thus the accuracy of the concentration index in this paper may be affected. Household income usually does not distribute equally among every family member, the method of substituting per capita household income for individual income may also lead to errors. For the weighing of income ranking, this paper uses the method of weighting by individual weight. However, which is more accurate to the estimate of inequality, weighted by weight or by height? All these demand further research.

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