

Fairness evaluation for the elder population in China

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Research article

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Abstract

Background: Population aging and the increasing burden of non-communicable diseases are increasingly a strain on health systems. The World Health Organization (WHO) uses fairness of health financing as one of the criteria for assessing health system performance. The Chinese government has undertaken a series of health reforms to reduce the pace of disease transition towards non-communicable diseases (NCDs), as well as protecting people from catastrophic health expenditures. The aim of this study was to assess the fairness of health financing among the elderly with different health conditions in China.

Methods: The data source was the WHO Study on global AGEing and adult health (SAGE) Wave 1, a national weighted data collected from adults older than 50 years. In this study, 10099 respondents were included for analysis. Chi-square and partial proportional odds model test were applied to assess the distribution of socioeconomic and health behavior factors among different chronic conditions. Fairness of health financing analysis was used to evaluate how the burden of health financing is distributed according to the household ability to pay (ATP). Dominance tests were applied for comparing different ways of health financing among health conditions.

Results: More than half of the elderly had at least one chronic condition, and around 20% people suffered from multi-morbidity. Several socioeconomic as well as health behavior factors were found associated with developing NCDs. Out-of-pocket payment dominated other health finance sources in all three chronic conditions with a regressive pattern. Even though mandatory insurance had covered more than 70% of the elder population in China, due to the relative lower proportion reimbursement for chronic diseases, people still had to pay a lot for seeking healthcare.

Conclusion: When reimbursement for chronic diseases is relatively low, high mandatory insurance coverage does not ensure fairness of health financing. The Chinese health system should be developed further in order to meet the needs of elderly with different chronic conditions.

Background

Aging is a natural process, while population aging is a process which refers to the proportion of the elderly in a population increases all the time(1). Thanks to the relative stable politic environment and fast economic growth in China, the life expectancy has been increased strikingly in the past three decades, from 63.9 years in 1975 to about 76.5 years in 2017(2). The percentage of population with 65 plus years had reached to 7.7% by 2005, which had been ascribed as an “aged society” (3). Since aging population have higher risks in developing chronic diseases and some other co-morbidities, interventions as well as efficient healthcare delivery specifically for the elderly are getting more concerns(4)(5).

Nowadays, China is undergoing fast industrialization and urbanization. Due to the fast socioeconomic and demographic transition, non-communicable diseases (NCDs) have become the main causes for death and disability in China(6). Non-communicable diseases (NCDs), which also called chronic diseases,

is a type of disease which tend to be in a long duration and are the results of combined genetic, lifestyle or environmental factors(7). Cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes are known as the common NCDs(8). NCDs increase dramatically in Chinese society, which is estimated above 260 million and has already put a big pressure in the field of public health(8)(9). As the prevalence of chronic diseases increases with age, multi-morbidity, which is defined as an individual suffers any two or more chronic or acute diseases, has become more common with the elderly(10). Multi-morbidity has brought several challenges to the health system, as its more complex diagnosis, clinical treatment, limited beds for overnight stays and polypharmacy prescription(11).

Chinese healthcare system had several transitions since 1949. The most well-known phrase was between 1949-1965, in which the national health advanced dramatically. By conducting a centralized three-tier delivery system, nearly the whole Chinese population were covered by a low and affordable health cost(12). However, since the 1977, along with the reform and opening-up policy, the health inequality was getting obvious. Due to lack of a well-developed health system, larger proportion of Chinese population could not afford to health care, catastrophic expenditure on healthcare occurred a lot(13). It arouse much concern to tackle with the insufficient health system in China(12). Starting from 1990's, the government has taken some measures to rein the accelerating healthcare costs, such as built-up the urban employee-based basic medical insurance scheme (UEBMI) for urban employees(13). During the post-SARS period in 2003, New Cooperative Medical System(NCMS) has been developed in response to the deterioration in access to the health service in rural areas and attempted to reduce the inequity between urban and rural areas(14). Later in 2007, urban resident-based basic medical insurance scheme (URBMI) has been launched for people living in urban areas without having UEBMI like students, children and the elderly without pensions(12)(15). Since then, a multi-level health care financing system has built up gradually for urban and rural population, attempting for healthcare funding equitable distributed(12)(13)(16).

Along with the healthcare reforms for achieving universal health coverage in China, fairness in health system financing has become a major concern for policy-makers as one of the three intrinsic goals in health system performance provided by WHO framework(16)(17).Health system financing mainly addresses two challenges(18), one is about financial risk pooling, the other is to ensure richer people could contribute more than the poor in terms of health financing(18). Fairer financing has been regarded as higher level of health and equality in health distribution(18). Within a fairer health system financing, poorer people could get access to the prompt and efficient medical treatment especially under the change of disease spectrum, where NCDs make poorer people in more vulnerable situation for more health expenses(12). In China, it mainly has four channels for healthcare financing: government-raised revenue; public health insurance; private health insurance as well as out-of-pocket payment(OOP)(16)(17). Government-raised financing draws revenues from general taxes for health system, which is a stable and important channel of getting fund for health resources in China(16). Public health insurances are constituted of UEBMI, URBMI and NCMS three types, but the service packages are varied from each other(17). Private health insurance is still at initial stage comparing to many OECD countries, which accounts for only around 3% of the whole healthcare financing amount in China(16). OOP is to purchase health services directly from healthcare providers, which is more likely to generate catastrophic

expenditure(18). Based on the four channels above, it has turned an urgent need to examine whether the health reforms have achieved goals in promoting universal coverage of health service as well as fairness financing(18)(19).

Though fairness of health financing has been assessed in many countries, seldom researches looked on whether it was fair for the elderly with different chronic conditions in respect of health financing. The main objectives of this study were: Described distribution of chronic conditions among various socioeconomic status and risk factors and fairness analysis of Chinese healthcare financing system among the elderly with different chronic conditions. Through this study, it would be clear about the situation of NCDs among the elderly, and whether the health financing system was fair to the elderly with chronic conditions in China.

Methods

Due to technological limitations, the Methods section is only available as a download in the supplementary files section.

Results

Population health

Table 1 described the distribution of socioeconomic and behavior risk factors among the elder population in China and survey sampling weights were employed during the analysis. Among these population, 49.86% did not have any chronic diseases, 29.79% had single NCD morbidity and 20.35% were in multi-morbidity status.

By applying chi-square test, sex, age, marriage status, residence, education, wealth, insurance coverage, BMI, smoking, alcohol consumption and physical activities were found statistically significant difference with the selected eight chronic diseases. For further comparing the effect of factors on developing chronic diseases, partial proportional odds model had been applied. Through adjusting to the model, it was found only factors of female, older age, the second and fourth-level wealth, overweight played as risk factors whereas rural residence and high-intensive exercise were found as protective factors, in which, the odds for females were 1.29 times higher than the odds for males, and older ages increased the likelihood of being chronic conditions. The ratio of odds (OR) for normal, overweight and obesity to underweight were 1.85, 2.69 and 2.81, respectively. It was found the odds of second and fourth-level wealth were 1.25 and 1.34 times greater than the baseline, while the rest classes had no significant differences. It was noteworthy that the fourth-level of wealth group did not present statistical differences when multi-morbidity group compared to the non-NCDs and single morbidity group. Under the module of physical activities, the OR for high-intensive exercises to lower intensity was 0.73 and it further decreased as an increased number of chronic diseases.

Fairness in healthcare financing

Table 3 reported the distribution of household assets and health care payments by wealth quintile. In all three health status groups, the concentration indices were all positive. This indicated that the rich contributed more in terms of healthcare payments than the poor. The Gini coefficient and CI values were the highest in the non-chronic disease group, and were lower as higher number of chronic conditions. An exception was OOP payment, for which the CI was the lowest in the group with a single chronic condition. CI values for voluntary health insurance were consistently higher than for other types of healthcare payment. This suggested that voluntary health insurance was more unequally distributed. Comparing to other healthcare payments, OOP payment distributed proportionally to the household wealth.

The results of the dominance tests between concentration curves for the different sources of health financing were presented in Table 4. OOP payment dominated the other three health payments regardless of the number of chronic conditions.

The CI value was limited in that it only indicated whether healthcare payments were equally distributed with respect to household wealth. To further evaluate the fairness of health financing, Kakwani Indexes were calculated with considering the ATP in a household. (Values were represented in table 3). The KI values for general tax, mandatory health insurance, and voluntary health insurance payments were all positive across different health status, with only one exception. These positive values indicate that general tax, and both types of health insurance were all progressive ways of financing. Furthermore, KI values were always higher in the voluntary health insurance group. While KIs in OOP groups were always in negative regardless of health conditions. The lowest KI in OOP classification was -0.23, which was in single morbidity group and the highest KI was in multi-morbidity group with value of -0.11.

It could be seen from figure 3 that OOP payment was in a regressive spending, for the curves always lied inside of Lorenz curves, indicating OOP payment was beyond people's ability to pay. In multi-morbidity group, the distance was shortest between OOP and ATP curves, while presented the longest in single morbidity group, stating people with single NCD morbidity suffered a most unfair financing distribution with OOP payment. General tax curve had intersected with ATP in non-chronic diseases group at nearly 60% cumulative wealth sharing, while almost overlapped with ATPs in the other two groups. Mandatory health insurance curves coincided with ATPs mostly in all three groups, showing it was a progressive spending in most cases. Voluntary health insurance payment was below ATP in non-NCD and single morbidity groups, while intersected with ATP in multi-morbidity group, stating elder population from 28% to 70% cumulative proportions of wealth level in the group, could not afford for the voluntary insurance.

Discussion

This study used data from WHO SAGE WAVE1 (2007-2010) to evaluate the fairness of health financing for the elderly with chronic conditions in China. More than half of the elderly had some chronic conditions, and 20.35% had multi-morbidity; these results fall within the prevalence range reported by researchers(29)(30). Socioeconomic and several health risk factors were found to play an important role

in developing chronic diseases. Previous studies found the rise of NCDs in most developing countries were probably linked to the urbanization(31). Due to profound changes in exercise and diet, the risk of having diabetes and cardiovascular diseases attendant increase(31). People living in rural areas were less likely to develop chronic conditions owing to a better natural environment, healthier lifestyle and less densely population comparing to the urban people(31)(32). However, the finding might also arise because the presence of chronic conditions in this study was self-reported. Due to inequalities in the allocation of health resources, access to prompt and effective healthcare is not as good in rural areas, and chronic conditions may not be diagnosed properly(29)(33). There may similarly be a bias towards under-reporting in a poorer population for lack of accurate diagnosis(34).

Healthcare financing mainly consisted of four types, of which out-of-pocket payment stood out in this study. OOP payment was found to be the most regressive type regardless of health status, even though OOP spending decreased from 57.7% in 2002 to 34.8% in 2011 under health reforms(35)(36). In the single morbidity group, the Kakwani Index had the smallest value (-0.23) value comparing to the rest two groups, which indicated poorer people spent more for their healthcare treatment according to the ATP sharing.

Mandatory health insurance covered more than 70% of elder population in the study. However, the services for treating chronic diseases included in the insurance package were limited, especially in NCMS and URBMI(37), people still need to pay a lot for healthcare expenditure through Out-Of-Pocket, which might account for the KI was lowest in disease group.

In the multi-morbidity group, tax payment was also somewhat regressive. In other words, tax posed a financial burden on the poor with multi-morbidity. A common finding in both high and middle income countries is that tax revenue is a progressive form of healthcare financing(38). In contrast to most high-income countries, indirect taxes such as value-added tax, sales tax, and excise taxes (e.g. on alcohol and tobacco) constitute the majority of total tax revenue in China (52% in 2010) (16). In this study, tobacco and alcohol consumption were taken as risk factors for having chronic conditions. Thus, higher consumption on tobacco and alcohol could partly explained why people in multi-morbidity status were in a regressive system for tax payment. Regarding this, redistribute of income wealth through tax payment, reforms are called to ensure the equity.

We also found the different values of redistribution for household insurance in three groups. Although both mandatory and voluntary health insurance were all in a progressive pattern in three groups, they did not contribute proportionally comparing to the according ATP sharing. As mandatory health insurance was consisted of UEBMI, URBMI and NCMS types, and the way of financing for different types varied from each other, people could face the health payment beyond their ATP(17)(37). UEBMI-covered population were requested to pay a certain proportion of their salary as premiums (17)(39), while it was a fixed number for premium of URBMI and NCMS from the insured health payment, without considering so much about the ability to pay in most of cases(40)(41). It explained partly that in all three groups, mandatory insurance curve was always higher than ATP sharing at the beginning. As a typical pre-paid

payment for healthcare financing, national health insurance should play an important role in preventing people from catastrophic and impoverishing in health expenditures(16)(17). To achieve this objective, Chinese government should take measures to ensure the public health insurance could be afforded in any income groups according to their ability to pay.

Even though the value of voluntary health insurance was positive (0.01) in multi-morbidity, the curve fluctuated the most in this group, and the negative effect could be offset due to the crossed over curves(27), which could find at the third picture in figure 3, the curve of voluntary insurance was inside of ATP sharing at middle class households. Not like most OECD countries, voluntary health insurance only takes smaller proportion under health financing in China(38). We found the voluntary health insurance covered around 10% of elder population, and the proportion of insured was much smaller comparing to the mandatory health insurance. Since the service benefits insured by URBMI and NCMS were limited for both outpatient and inpatient care, people still had to pay more than half of whole expenses when seeking healthcare(6)(17)(42), which increased the demand for voluntary insurance specifically for the elderly. Previous studies also showed that the commercial insurance was highly associated with socio-economic status as well as personal knowledge on insurance purchase(16)(17). People with chronic conditions were more likely to consume voluntary health insurance for reducing out-of-pocket health expenses. As premiums of private insurance were more related to personal risk factors rather than income, it is very likely to exceed people's ATP(43). These might explain why the commercial insurance was in regressive pattern among the middle-class in multi-morbidity group. Heterogeneity of health risks as well as asymmetric information between insurers and insureds could cause problems since people in higher risks of developing diseases might pay more than lower risks(44)(45)(46). Likewise, moral hazard could also occur when policyholders were lack of honesty(47). Due to the imperfect rules of private health insurance, it still has long way to go for a fairness financing system.

Our studies had several limitations. First of all, since the updated data has not been released from WHO, the data for analysis here was 10 years ago. However, because Chinese health system has experience a lot during these years, the findings could be varied from updated setting. Secondly, SAGE only took arthritis, stroke, angina, diabetes, chronic lung disease, asthma, hypertension, cataracts, oral health as chronic conditions. More chronic conditions such as cancers or cardiovascular diseases could be included in future questionnaire design for a comprehensive comparison between non-NCDs and NCDs groups. Another weakness was since the questionnaires do not classify the mandatory health insurance into UEBMI, URBMI and NCMS, fairness of the compulsory insurance could not be looked in detail. Future analysis should be carried on this study.

Conclusions

This study used the data from WHO SAGE WAVE1 (2007-2010) for evaluation the fairness of health financing system for the elderly with chronic conditions in China. More than half of the elderly had some chronic conditions, and 20.35% had multi-morbidity. Different socioeconomic status as well as risk factors accounted for reasons in developing the chronic conditions. Out of pocket payment was in

regressive pattern among different chronic conditions, and KI value was lowest in single morbidity group. Even though mandatory insurance covered more than 70% of the elderly, but due to the relative lower proportion reimbursement for chronic diseases as well as fragmented public health insurances, people still have to pay a lot for seeking care and the poorer suffered more from the increased health expenses. A health system which allows majority of people could afford for health service is still a big challenge in China especially under population aging and epidemiological transition background. Because of the inconvenience and disparity schemes across regions, Chinese government has to take steps in merging those three insurances. Health system should be developed in order to meet the needs of elderly with different chronic conditions as well as achieve the universal health coverage.

Declarations

Ethics approval and consent to participate

The WHO-SAGE study was approved by the Ethics Review Committee, World Health Organization, Geneva, Switzerland and the individual ethics committees in each of the SAGE countries. Written consent was obtained from all respondents before the interviews were initiated. Confidential records of participants are maintained by SAGE country teams.

Consent for publication

The data were provided after completion of User's agreement available through the WHO SAGE website. The manuscript does not contain individual personal data, therefore statement of consent is not applicable.

Available of data and materials

The anonymized datasets are in the public domain:

<http://apps.who.int/healthinfo/systems/surveydata/index.php/catalog/central> SAGE is committed to the public release of study instruments, protocols and meta- and micro-data: access is provided upon completion of the Users Agreement available through WHO's SAGE website:

www.who.int/healthinfo/systems/sage and the WHO archive using the National Data Archive application (<http://apps.who.int/healthinfo/systems/surveydata>). The questionnaires and other materials can be found at: <http://www.who.int/healthinfo/sage/cohorts/en/index2.html>. SAGE is committed to the public release of study instruments, protocols and meta- and micro-data: access is provided upon completion of the Users Agreement available through WHO's SAGE website (www.who.int/healthinfo/systems/sage).

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

GW made a substantial contribution to the conception of the study, analyzed the data, wrote the first draft and reviewed the literature. QS helped in developing and finalizing the draft. All authors read and approved the final draft.

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Tables

Table1 Characteristics of respondents stratified by NCDs, adults aged 50+ China (2007-2010), SAGE Wave1

Characteristics	China (n=11654)			P-value
	No CD n=4880	Single morbidity n=2962	Multi- morbidity n=2257	
Overall rates	49.86%	29.79%	20.35%	
Sex				P=0.00**
male	2461 (54.48)	1361 (28.94)	939 (16.58)	
Female	2419 (45.23)	1601 (30.65)	1318 (24.12)	
Age				P=0.00**
50-59	2704 (60.76)	1270 (28.98)	509 (10.27)	
60-69	1338 (44.89)	950 (31.08)	763 (24.04)	
70-79	671 (34.27)	612 (30.08)	781 (35.65)	
80+	167 (33.97)	130 (27.76)	204 (38.27)	
Marital status				P=0.00**
unmarried	47 (54.86)	20 (25.91)	14 (19.23)	
married/cohabit	4189 (50.94)	2489 (29.93)	1779 (19.13)	
widow/separate	644 (42.62)	453 (29.22)	464 (28.16)	
Residence				P=0.00**
urban	1671 (39.75)	1321 (30.50)	1404 (29.75)	
rural	3209 (56.27)	1641 (29.35)	853 (14.38)	

Education				P=0.00**
			632	
no education	1194 (46.76)	754 (29.92)	(23.32)	
			784	
less & primary school	2006 (52.40)	1133 (29.55)	(18.06)	
	1549 (50.44)	948 (29.59)	714	
secondary & high school			(19.97)	
			127	
college & university	131 (35.59)	127 (33.75)	(30.66)	
Wealth				P=0.00**
			339	
1 poorest	1437 (58.69)	652 (27.47)	(13.84)	
			421	
2	1134 (52.45)	675 (30.58)	(16.97)	
			517	
3	941 (48.96)	609 (29.44)	(21.60)	
			508	
4	702 (40.20)	553 (32.78)	(27.02)	
			472	
5 richest	667 (43.48)	472 (29.42)	(27.10)	
Household insurance				P =
			334	0.04*
None of insurance	555 (46.41)	359 (28.20)	(25.39)	
Mandatory insurance			1748	
	3846 (49.94)	2303 (29.72)	(20.34)	
			101	
Voluntary insurance	253 (51.67)	152 (29.96)	(18.37)	
Both of insurance	226 (52.50)	148 (33.08)	74 (14.41)	
Body Mass Index				P=0.00**

underweight	266 (55.13)	131 (28.77)	83 (16.10)	
			1224	
normal	3314 (54.70)	1734 (27.63)	(17.67)	
			744	
overweight	1147 (42.93)	914 (33.41)	(23.66)	
			206	
obese	153 (29.68)	183 (35.07)	(35.25)	
Smoking				P=0.00**
			1611	
Non-smoker	3052 (46.12)	1981 (30.74)	(23.14)	
			647	
Smoker	1828 (56.13)	980 (28.21)	(15.66)	
Alcohol drinking				P=0.00**
			1661	
No	3246 (47.61)	2047 (30.26)	(22.13)	
			596	
Yes	1634 (54.13)	915 (28.90)	(16.97)	
Fruit/veg intake				P=0.71
			362	
Inadequate	735 (49.80)	443 (28.98)	(21.22)	
			1895	
adequate	4145 (49.86)	2519 (29.91)	(20.23)	
Physical activity				P=0.00**
			859	
Low	1388 (42.79)	945 (30.69)	(26.52)	
			726	
Moderate	1175 (44.25)	802 (30.44)	(25.31)	
			672	
High	2317 (57.03)	1215 (28.92)	(14.04)	

Actual numbers of observations; Proportions in brackets sum across rows and include survey sampling weights. Person χ^2 tests were undertaken for comparisons. *P-value < 0.05;**P-value < 0.01

Table2 Results of multiple partial proportional odds model, adults 50+ years China (2007-2010), SAGE Wave1

Comparisons

Co-variable(s)	No CD vs. (Single morbidity & Multi-morbidity)			No CD & Single morbidity vs. (Multi-morbidity)		
	OR ₁	95%CI	P-value	OR ₂	95%CI	P-value
Sex						
Male	1	Reference	–	1	Reference	–
Female**	1.29	(1.13,1.48)	0.00	1.29	(1.13,1.48)	0.00
Age						
50-59	1	Reference	–	1	Reference	–
60-69**	1.85	(1.65,2.08)	0.00	2.64	(2.21,3.15)	0.00
70-79**	2.69	(2.29,3.17)	0.00	4.09	(3.47,4.83)	0.00
80+**	2.81	(2.13,3.72)	0.00	4.86	(3.50,6.74)	0.00
Marital status						
Unmarried	1	Reference	–	1	Reference	–
Married/cohabit	0.85	(0.46,1.56)	0.59	0.85	(0.46,1.56)	0.59
Widow/separate	0.81	(0.44,1.52)	0.51	0.81	(0.44,1.52)	0.51
Residence						
City	1	Reference	–	1	Reference	–
Rural**	0.63	(0.51,0.78)	0.00	0.49	(0.40,0.60)	0.00
Education						

No education	1	Reference	_	1	Reference	_
Less & primary school	0.99	(0.87,1.13)	0.96	0.99	(0.87,1.13)	0.96
Secondary & high school	1.02	(0.87,1.20)	0.76	1.02	(0.87,1.20)	0.76
College & university	1.03	(0.84,1.27)	0.76	1.03	(0.84,1.27)	0.76
Wealth						
1 Poorest	1	Reference	_		Reference	_
2**	1.25	(1.08,1.44)	0.00	1.25	(1.08,1.44)	0.00
3	1.21	(0.98,1.50)	0.07	1.21	(0.98,1.50)	0.07
4*	1.34	(1.03,1.75)	0.03	1.14	(0.87,1.48)	0.30
5 Richest	1.04	(0.81,1.34)	0.67	1.04	(0.81,1.34)	0.67
Household insurance						
None insurance	1	Reference	_	1	Reference	_
Mandatory insurance	1.12	(0.97,1.29)	0.11	1.12	(0.97,1.29)	0.11
Voluntary insurance	0.96	(0.75,1.23)	0.77	0.96	(0.75,1.23)	0.77
Both of insurance	0.98	(0.74,1.30)	0.88	0.98	(0.74,1.30)	0.88
BMI						
Underweight	1	Reference	_	1	Reference	_

Normal*	1.23	(1.02,1.49)	0.03	1.23	(1.02,1.49)	0.03
Overweight**	1.81	(1.51,2.18)	0.00	1.81	(1.51,2.18)	0.00
Obesity**	3.17	(2.53,3.97)	0.00	3.17	(2.53,3.97)	0.00
Smoking						
Non-smoker	1	Reference	–	1	Reference	–
Smoker	0.92	(0.81,1.05)	0.21	0.92	(0.81,1.05)	0.21
Alcohol consumption						
No	1	Reference	–	1	Reference	–
Yes	1.09	(0.97,1.22)	0.13	1.09	(0.97,1.22)	0.13
Fruit/vegetables intake						
Inadequate	1	Reference	–	1	Reference	–
Adequate	1.02	(0.90,1.16)	0.78	1.02	(0.90,1.16)	0.78
Physical activities						
Low	1	Reference	–	1	Reference	–
Moderate	0.95	(0.80,1.12)	0.54	0.95	(0.80,1.12)	0.54
High**	0.73	(0.65,0.82)	0.00	0.64	(0.54,0.76)	0.00

Note: Survey sampling weights applied; OR=odds ratio; 95%CI=95% confidence Interval; *p-value < 0.05;

**p-value < 0.01

Table3 Distribution of household assets and health care payments by wealth quintiles, concentration index (CI), and Kakwani index

Classification of health status	Household wealth quintiles	Ability to pay(ATP)	general tax	mandatory health insurance	voluntary health insurance	OOP
No CD	Q1	5.00%	1.05%	10.30%	1.20%	11.64%
	Poorest					
	Q2	15.98%	13.07%	13.09%	10.29%	16.79%
	Q3	19.75%	21.41%	13.49%	12.49%	19.39%
	Q4	24.00%	27.69%	22.83%	22.81%	22.53%
	Q5	35.28%	36.77%	40.29%	53.21%	29.65%
	Richest					
	Gini/CI	0.37	0.46	0.43	0.49	0.25
	P-value	-	0.00**	0.00**	0.00**	0.00**
	Kakwani index	-	0.09	0.06	0.12	-0.12
	P-value	0.00**	0.48	0.49	0.32	0.01**
Single morbidity	Q1	3.45%	2.33%	6.48%	1.23%	13.50%
	Poorest					
	Q2	13.37%	14.70%	11.49%	14.14%	15.49%
	Q3	18.06%	17.17%	16.95%	15.56%	20.38%
	Q4	28.17%	31.19%	23.37%	33.80%	22.49%
	Q5	36.96%	34.55%	41.71%	35.28%	28.15%
	Richest					
	Gini/CI	0.33	0.41	0.40	0.41	0.09
	P-value	-	0.00**	0.00**	0.00**	0.03*
	Kakwani index	-	0.08	0.07	0.08	-0.23
	P-value	0.00**	0.54	0.63	0.41	0.00**
Multi-morbidity	Q1	2.33%	0.17%	4.26%	0.48%	4.36%
	Poorest					
	Q2	9.31%	4.82%	10.02%	12.64%	11.19%

Q3	17.35%	12.25%	10.94%	14.27%	21.24%
Q4	29.56%	25.41%	37.35%	29.39%	27.54%
Q5	41.45%	57.34%	37.43%	43.23%	35.67%
Richest					
Gini/CI	0.28	0.28	0.32	0.30	0.17
P-value	-	0.01**	0.00**	0.36	0.00**
Kakwani	-	-0.01	0.03	0.01	-0.11
index					
P-value	0.00**	0.92	0.72	0.98	0.00**

*p-value < 0.05;**p-value < 0.01

Table 4 Tests of dominance between concentration curves for different sources of health finance

Classification of health status	Sources of health financing	General tax	Mandatory health insurance	Voluntary health insurance	OOP
No CD	General tax		D	D	D
	Mandatory health insurance			None	D
	Voluntary health insurance				D
Single morbidity	General tax		D	D	D
	Mandatory health insurance			None	D
	Voluntary health insurance				D
Multi-morbidity	General tax		D	D	D
	Mandatory health insurance			None	D
	Voluntary health insurance				D
	OOP				

Note: D indicated that concentration curve of row source was dominated by the column source; None indicated failed to reject the null hypothesis that curves were indistinguishable at the 5 percent significance level.

Figures

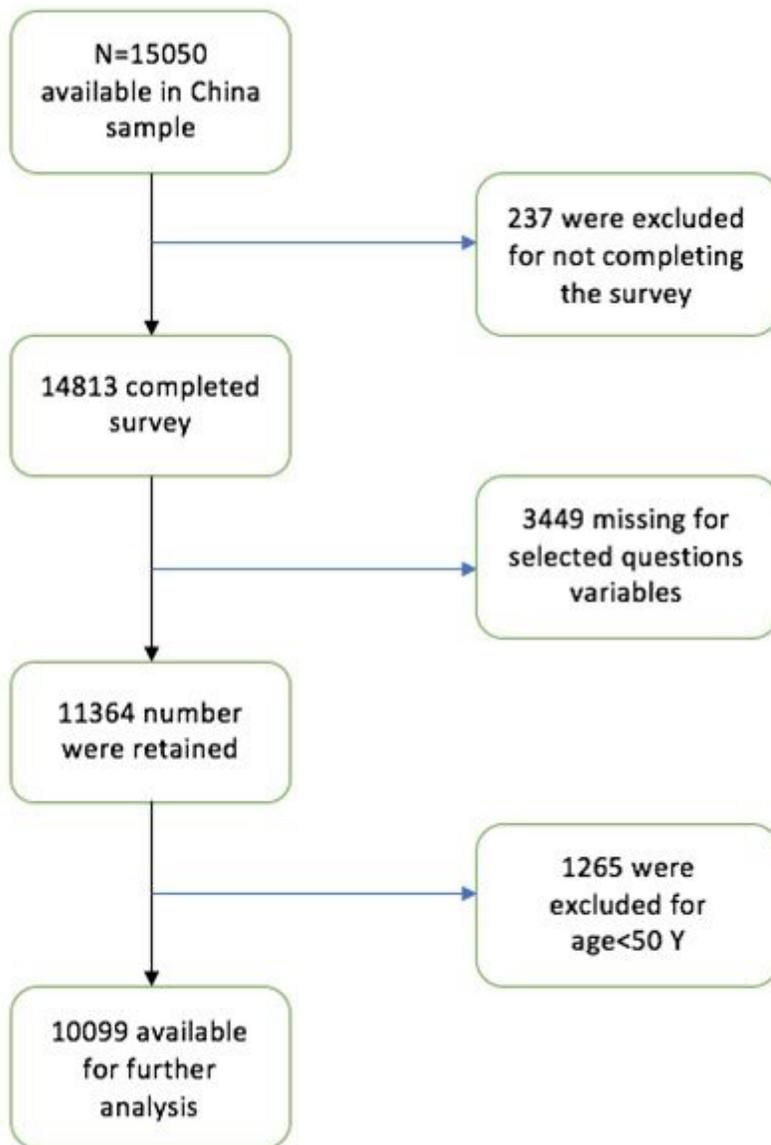


Figure 1

Derivation of study sample from SAGE WAVE1 Chinese population

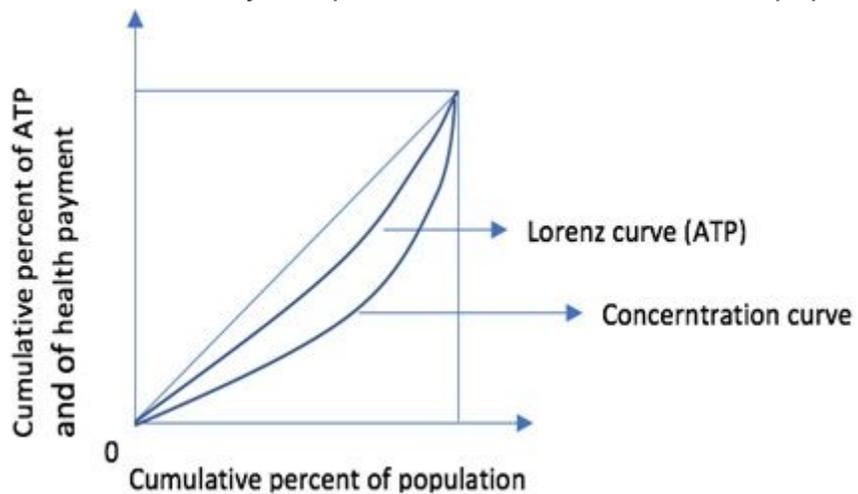


Figure 2

Conceptual cumulative concentration curve for healthcare payment and household wealth

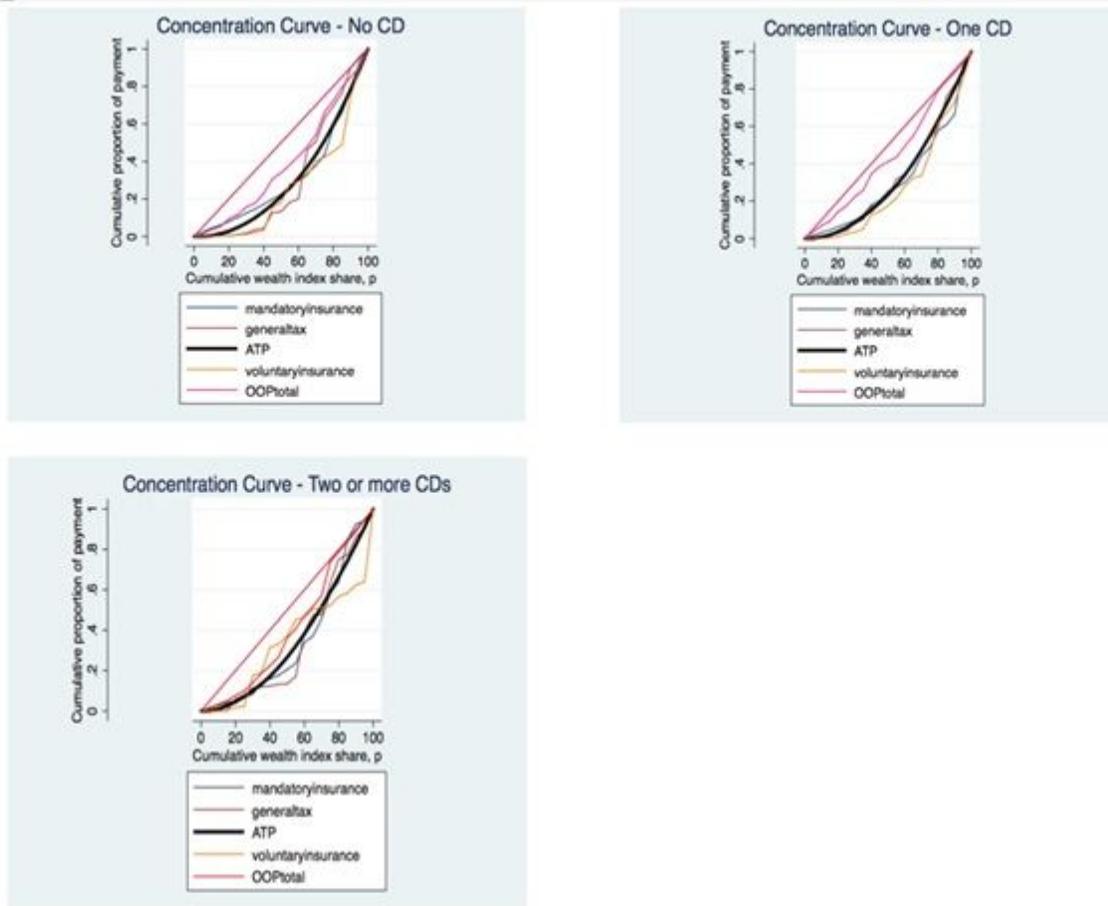


Figure 3

Concentration curve of healthcare payments and Lorenz curve sorted by health status

Supplementary Files

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