

BMJ Open Comparing income-related inequality on health service utilisation between older rural-to-urban migrant workers and older rural residents in China: a cross-sectional study

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ABSTRACT

Objectives This study quantifies income-related inequalities in health service utilisation of older rural-to-urban migrant workers, by comparison with older rural residents, and identify with factors giving rise to the inequalities.

Setting Nationally representative survey conducted in 29 provinces, municipalities and autonomous regions of China.

Participants 952 older rural-to-urban migrant workers and 2676 older rural residents were identified for further analysis.

Main outcome measures The probability of 2 weeks outpatient utilisation and inpatient utilisation.

Design Coarsened exact matching was used to control the confounding factors between older rural-to-urban migrant workers and their rural counterparts. Concentration index was used to depict the inequality in health service utilisation, and it can be decomposed proportionally into contributions.

Results The concentration indices of 2 weeks outpatient utilisation of two groups were -0.2061 (95% CI: 0.0193 to 0.1364) and -0.2041 (95% CI: 0.0594 to 0.1469), respectively. The concentration indices of inpatient of two groups were -0.0024 (95% CI: -0.0047 to 0.0639) and -0.1412 (95% CI: 0.0235 to 0.1125), respectively. The contributors of the inequality of 2 weeks outpatient utilisation of two groups were poor self-assessed health (SAH) status and richest group. The contributors of the inequality of inpatient utilisation of the rural elderly were poor SAH, fair SAH and sense of happiness. The horizontal inequality indices for 2 weeks outpatient of two groups were 0.1321 and $-0.0.992$, respectively. The horizontal inequality indices for the inpatient of two groups were -0.0032 and -0.0396 , respectively.

Conclusions The results illustrated the existence of a socioeconomic gradient in health service utilisation between older rural-to-urban migrant workers and older rural residents. Our studies provided evidences to take full account of the health service needs, contributing to more reliable understandings of inequalities in the health service utilisation. The results may be referential to identify policy priorities conducive to the health policy reform in the process of active ageing in China.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ Our study revealed the facets and causes by decomposing inequalities between the two groups into determinants at multiple levels by concentration index and its decomposition.
- ⇒ Commenced coarsened exact matching was adopted to better yield estimates of the causal effect between the comparison groups.
- ⇒ However, the cross-sectional study precluded formal conclusions on cause-effect relationship.
- ⇒ More determinants to measure comprehensive dimensions should be included to illustrate more relationships in our further study.

BACKGROUND

Rural-to-urban migrant workers are a concomitant of reform and opening in China, a main force during the process of Chinese urbanisation development. With the change of population age structure, the proportion of rural-to-urban migrant over the age of 50 is increasing, which shows that older rural-to-urban migrant workers have gradually become an important force in the construction of urbanisation. A number of rural-to-urban migrant workers have entered the old age and are shaping the population composition called older rural-to-urban migrant workers (age 50 and above).¹⁻⁴ According to the National Bureau of Statistics,^{1 5} older rural-to-urban migrant workers accounted for 14.3% of rural-to-urban migrant workers in 2011, and the proportion had risen to 27.3% by 2021. Notably, the widespread public concern about the vulnerable group is of great significance, and older rural-to-urban migrant workers cannot be ignored in the healthy and sustainable development in mainland China. The obstacle of systems, the physical function degradation caused by age growth, the lack of social capital and the

great intensity of work brought challenges to their health service utilisation. With the further intensification of population ageing, older rural-to-urban migrant workers, as a phenomenon of labour structure ageing, deserved more and more attention. Clarifying the health services utilisation for older rural-to-urban migrant workers is expected to not only benefit their medical security rights and interests to a certain extent, but also the practical significance for deepening the health system reform and realising the strategic goal of 'healthy China'. Nevertheless, their health service utilisation has not received adequate attention.

Widespread evidence consistently pointed towards the existence of inequalities in health service utilisation between immigrants and non-immigrants. For example, immigrants were more particularly vulnerable to equal opportunity in specialised health service than the native population in Spain.⁶ African immigrant women who faced more unique barriers to access healthcare, had lower likelihood of regular healthcare than African-American women.⁷ Widespread evidences have documented that the current situation of health service utilisation of Chinese rural-to-urban migrant workers, and influencing factors were education, income, medical scheme, age and education attainment.^{8–10} However, the growth of age and the decline of physical function exacerbated the health vulnerability of Chinese older rural-to-urban migrant workers, and many conclusions may not be completely applicable to older rural-to-urban migrant workers. The right evidence should be targeted in studies with respect to their health service utilisation. However, few empirical studies^{11 12} have specially focused on their current situation and determinants in their health service utilisation.

Although urban–rural dual structure in China have remarkably improved, Chinese household registration system (Hukou) still made a clear difference in the access to government-provided public health services and welfare programmes between urban and rural areas. Due to a set of regulations of Hukou, the migration of older rural-to-urban migrant workers resulted in problems caused by marginality in economic status, and off-site medical settlement, which has brought great challenges to their health service utilisation in the cities where they lived. Therefore, an in-depth comparative study in the health service utilisation between older rural-to-urban migrant workers and older rural residents would provide evidence to the heterogeneity in the formulation of health policies.

The WHO stated that equity was a goal that health systems should ensure responsiveness to population needs from healthcare services, and called for reducing existing barriers to healthcare.¹³ Healthy China 2030 programme clearly proposed to reduce group differences in the utilisation of basic public health services. According to Roemer *et al.*,¹⁴ the equality outcome cannot hold individuals responsible for imprudent actions, reducing the values of the outcomes they enjoy. Indeed, some inequalities are not under individual or public authorities control and

cannot be 'avoided' by public policy interventions in the health service utilisation. Consistent with Roemer, more studies should be concluded on reasonable inequalities, and clarify reasonable factors and unreasonable factors. While there is general recognition of the disadvantaged position of older rural-to-urban migrant workers, the extent of inequality in health service utilisation, particularly the reasonable inequality, has not been widely studied. Measuring and comparing reasonable inequalities in health service utilisation are a concern for Chinese policy on the equalisation of basic public services. Many potential confounding factors may cause biases of selection effect, it is necessary to accurately compare reasonable inequalities in health service utilisation between older rural-to-urban migrant workers and older rural residents in appropriate methods.

Our study aimed to reveal the facets and causes by decomposing inequalities in health service utilisation by concentration index (CI) and its decomposition, and to compare with inequalities of older rural-to-urban migrant workers and older rural residents after commenced coarsened exact matching (CEM), with a focus on whether inequalities in health service utilisation differ systematically according to socioeconomic variables. Our findings would enhance the extant literature on the older rural-to-urban migrant workers and served as useful references for the health policy reform in the process of active ageing in China.

METHODS

Patient and public involvement

No patient involved.

Data

The dataset in our study is from two parts. First, we used a nationally cross-sectional data from China Labor-Force Dynamic Survey in 2016 (CLDS 2016) carried out by the Center for Social Survey at Sun Yat-sen University.¹⁵ CLDS 2016 provided a wide range of information including labour migration, work, health status, health service utilisation and other information from three terms of individual labour force, family and community. To ensure sample representativeness, respondents were chosen randomly by probability proportional to size in 401 village-level units covering 29 provinces, municipalities and autonomous regions in China (except Hong Kong, Macao, Taiwan, Tibet and Hainan). CLDS in 2016 successfully interviewed about 21 086 participants in about 14 226 households, reflecting the China's working-age population (aged 15–64) collectively. Second, to capture differences in public service capacity of different cities, we adopted the data in the official Chinese Urban Statistical Yearbook to construct indicators. There may be a reverse causal relationship between resource allocation in Chinese cities and the status of migration for older rural-to-urban migrant workers. Taking previous studies^{4 16} for reference, we lagged the data of public

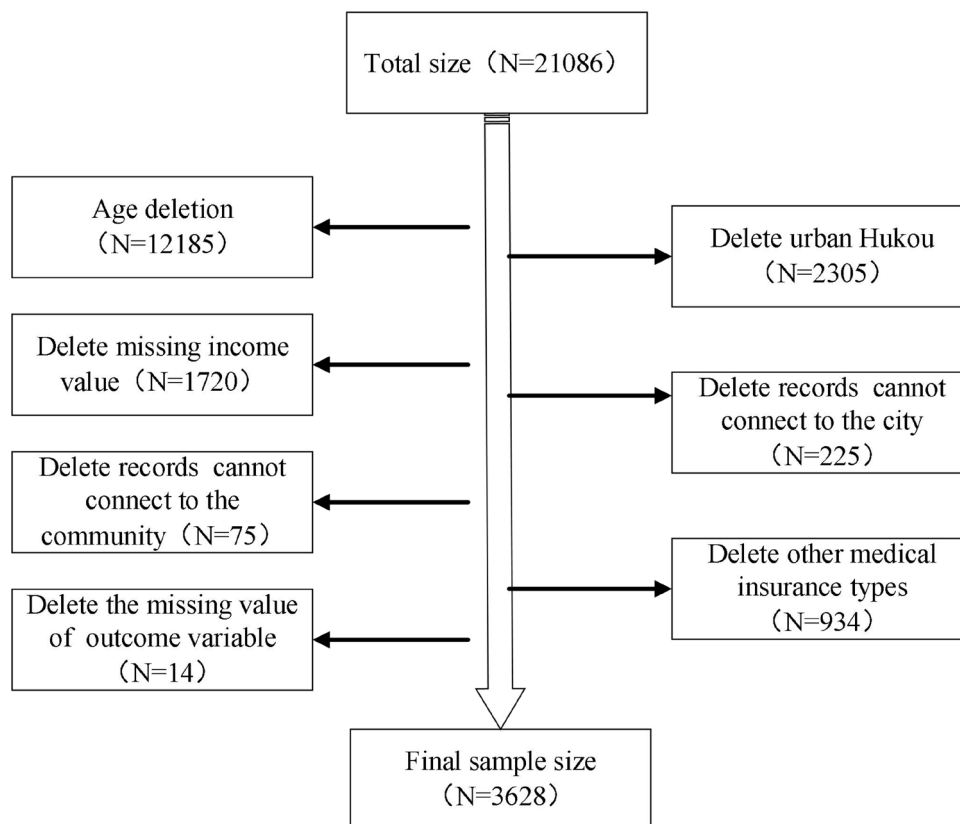


Figure 1 Flowchart on the sample selecting process of this study.

service capacity of different cities and other urban characteristics by 1 year to reduce the endogeneity caused by the possible existence of reverse causality. Therefore, we obtained the indicators in Chinese Urban Statistical Yearbook released by the Chinese government that are reliable in 2016 for measuring the public service capacity at various levels in 2015. In our study, the urban service quality index is designed based on the exploratory factor analysis method. In order to accurately compare the differences in the health service utilisation between older rural-to-urban migrant workers and older rural residents, the cities that older rural-to-urban migrant workers were relocated were selected. The reimbursement of the basic medical insurance for urban workers and the one for urban residents made a real difference on our result, therefore, we deleted the samples of these two medical insurances. Respondents with missing key variables (the probability 2 weeks outpatient, the probability of inpatient and income) were excluded from the study, and total of 3628 samples were included. Since the size of missing value was <5% of the total size, we used the average value to fill in. The flowchart on the sample selecting process of this study is shown in [figure 1](#).

Inclusion and exclusion criteria

Older rural-to-urban migrant workers referred to those who live in cities have engaged in non-agricultural work for more than 6 months, have rural Hukou (Chinese household registration system) and aged 50–65.^{4 9} For comparison, older rural residents in the standard study

are those who worked in agriculture, have rural Hukou, live in rural areas, have rural household registration and aged 50–65. A total of 952 older rural-to-urban migrant workers and 2676 older rural residents were identified for further analysis after data cleaning.

Measurement

When analysing equity in health service utilisation at the individual level, different measures have been used in the equality in health service utilisation, ranging from 2 weeks outpatient utilisation, inpatient utilisation, hospitalisation days, the average annual number of patients received by each outpatient doctor and the utilisation rate of hospital beds.^{17 18} Given the availability in socioeconomic surveys of CLDS 2016, our study measured the health service utilisation by 2 weeks outpatient utilisation and inpatient utilisation. There are two questions in CLDS 2016 were used (originally in Chinese) to get the information about health service utilisation:

Question 1: Have you visited the clinic at least one time within 2 weeks?

Question 2: Have you been admitted to a hospital during the past 12 months when you were sick or injured?

In this study, they were dichotomised into binary variables of health service utilisation, namely the probability of 2 weeks outpatient and the probability of inpatient, with the value 1 if the respondent answered ‘yes’ and 0 if ‘no’.

Predictors

Our study applied the lasted Andersen model to explore possible factors that can explain the health service utilisation of older rural-to-urban migrant workers and older rural residents. Followed by prior empirical investigations, we selected predictors from four dimensions based on lasted Andersen model and the model for vulnerable populations.¹⁹ Multiple interactions of four dimensions also be mentioned in the Andersen model,²⁰ but our study only paid close attention to how different variables affect the health service utilisation, that is how health service utilisation is determined by four dynamics: contextual characteristic, individual characteristics, health behaviour and health outcome.

Individual characteristics considered in the study were age group (50–60, 61 and above), gender (man, woman) and living arrangement (living with spouse, living without spouse), educational attainment (below primary school, primary school, middle school and above), political affiliation (the party members, the masses), type of industry (manufacturing and construction, wholesale, retail trade and catering, transportation and other non-agricultural sectors), working hours (moderate labour, excessive labour), the New cooperative medical scheme (NCMS) (yes, no), basic endowment scheme (yes, no), income quantiles (poorest, poorer, middle, richer, richest), self-assessed health (SAH) status (good, fair, poor), number of friends (≤ 5 , 6–10, ≥ 11). In China, NRCM is designed for rural residents. What needed to be clear is that the variable of SAH referred to the demand variable, which is the perception in individual characteristics before receiving health services according to his/her judgement and values, rather than the individual's perception in health outcome after receiving health services.^{19 21} The differentiation standard is 'before and after'.

Health behaviour considered in the study were smoking (yes, no), drinking (yes, no) and regular exercise every month (yes, no). In this study, breathing secondhand smoke was also regarded as smoking.

Health outcome in the study was sense of fairness (unhappy, fair, happy). According to Andersen *et al*,^{19 21} health outcomes referred to four secondary evaluation indicators of the individual's perception, evaluation, satisfaction and quality of life after receiving health services. Given data restrictions, we only selected the variable of satisfaction after receiving health services. The variable of satisfaction referred to the individual's feeling and evaluation of the quality of his/her daily life, and the evaluation indicators mainly included the sense of happiness and satisfaction.^{19 22}

Contextual characteristic considered in the study were the proportion of ethnic minorities, number of health facilities per capita in the community, sex ratio in the community, the service quality index of the community, the service quality index of the city, health index of the community population, region (east, central, west) and city level (subprovincial city and above; below subprovincial city). In this study, the service quality index of

the community, the service quality index of the city and health index of the community were designed based on the exploratory factor analysis method.

Coarsened exact matching (CEM)

It is more likely to neglect potential confounding influences in different comparison groups and break the assumption that there is no bias by roughly comparing the income-related inequity of health service utilisation between older rural-to-urban migrant workers and rural counterparts.^{23 24} Migration for work in cities represented a change in status for older rural-to-urban migrant workers, and our study tackled a methodological approach called CEM first proposed by Iacus *et al*^{24 25} to better yield estimates of the causal effect between the comparison groups with the lowest variance and biases for any sample size.^{26 27}

The change in status in our study (be employed outside the country for 6 months or more in the past year) was matched, and the increased efficiency and lower bias properties of CEM were attributed to exact matching defined by variables that explain variance in the decision to appoint the indistinguishable values with the same value and remove the coarsened data. CEM enables more comparable evaluation of treatment and comparison groups by creating proportionality among the factors contributing to the outcome of interest, making older rural-to-urban migrant workers and rural counterparts being (or very close to) identical in relation to individual characteristics after CEM.²⁸ Iacus *et al* pointed that more variables included would interfere exact matching, and another advantage of CEM is that no robustness checks after CEM are required.^{23 24} Age, gender, educational level, economic level and SAH were used for CEM, and weighting variables generated by CEM were used to equalise the number within comparison groups.²⁷ The multivariate imbalance measure L_1 ranges from 0 (perfect global balance) to 1 (maximal imbalance). Larger positive value represents a savager imbalance between comparison groups, which meant good matching performances would bring a substantial reduction in L_1 , and vice versa. CEM can be modelled by using the command code of 'cem' in Stata V.16.0.

CI and decomposition

Methods based on concentration curves and CI have been widely used for measuring inequalities in health service utilisation.^{29 30} CIs can capture socioeconomic dimensions of inequality in health service utilisation and the information of the whole distribution.³¹ The value of CI varies between negative one and positive one, where a negative CI value indicates low probability of health service utilisation is higher among the poor, and vice versa.³² The larger the absolute value of CI the greater is the severity of socioeconomic inequality. CI equals 0 indicating there is no socioeconomic inequality in health service utilisation. Equation (1) was used to calculate the CI:

$$CI = \frac{2}{\mu} \text{cov}(y_i, R_i) \quad (1)$$

where y_i is the indicator of health service utilisation; μ is the mean of the probability of health service utilisation; R_i is the fractional rank of economic status, ranging from 0 to 1. Furthermore, methods were available for calculating the CI using weighted data.³³

Decomposition methods can describe inequalities towards quantifying the importance of different determinants of inequalities and the degree of income-related inequalities in that particular determinant.³⁴ As the probability of health service utilisation in our study were dummy variables, a generalised linear model with binomial distribution and identity link was employed to decompose the inequality of the CIs. The income-related inequality could be further explained by decomposing the CI into its contributing factors using Equation (2):

$$y = \alpha^m + \sum_j \beta_j^m x_j + \varepsilon \quad (2)$$

where y represents the prevalence of probability of health service utilisation, β_j^m is the partial effects (ie, dy/dx_j) of each variable and evaluated at sample means; α^m is the constant term in the regression equation and ε stands for the error term. Calculating the CI of Equation (2) and the decomposition of the CI could be specified as in Equation (3):

$$CI = \sum_j \left(\frac{\beta_j^m \bar{x}_j}{\mu} \right) C_j + GC\varepsilon \quad (3)$$

where μ is the mean of the dependent variable; C_j indicates the CI for x_j ; \bar{x}_j is the means of x_j ; $\frac{\beta_j^m \bar{x}_j}{\mu}$ is the elasticity of x_j ; G is the elasticity in the health service utilisation of older rural migrant workers and older rural residents and ε stands for the error term. The absolute value of contribution signifies the extent to which inequality can be attributed to this variable. A positive contribution to socioeconomic inequality means that the relevant variable increases the inequality in health service utilisation, and vice versa.

The horizontal inequality (HI) index was measured by deducting the contributions of need variables from the CIs of health service utilisation across income groups, using the indirect method of standardisation to control for age, gender and SAH as a proxy for need.³³ The need variable in our study included age, gender and SAH. A positive (negative) HI index of health service utilisation indicated the pro-rich (pro-poor) inequality. The formula is as follows:

$$HI = CI - \sum_j (\beta_j^m x_{ji} / \mu) C_j \quad (4)$$

β_j^m presents the partial regression coefficient of the variable of need of health service utilisation. x_j and c_j presents the mean and the CI of need of health service utilisation. μ stands for the mean of the dependent variable. Sampling weights were used to adjust for sample design effects to produce nationally representative estimates. Data management and data analysis were performed by

using Stata V.16.0 (StataCorp LP, College Station, Texas, USA). The probability, p value ≤ 0.05 was considered to indicate statistical significance.

RESULTS

Table 1 shows the basic characteristics of respondents with and without weights and the multivariate L_1 statistics. Obviously, there were significant differences in many characteristics between older rural-to-urban migrant workers and older rural residents before CEM. A total of 2314 respondents were successfully matched by CEM (859 older rural-to-urban migrant workers and 1455 older rural residents). After matching, the L_1 of both groups were all actually close to 0, which were much lower than 0.6372 before CEM, revealing good matching performances. The p value statistically decreased, indicating good matching performances, and thus different groups became more comparable. The results of the matched sample showed that the probability of 2 weeks outpatient of older rural-to-urban migrant workers (5.59%) was significantly lower than older rural residents (8.11%), and the probability of inpatient of older rural migrant workers (7.57%) was significantly lower than older rural residents (9.07%).

Table 2 presents CIs of the health service utilisation after CEM. For older rural-to-urban migrant workers, the CI of the probability of 2 weeks outpatient was -0.2061 (95% CI: 0.01937 to 0.1364), and the negative CI indicated that there was the inequality in favour of low-income groups. The CI of the probability of inpatient was -0.0024 (95% CI: -0.0047 to 0.0639), but the CI was not significant. For older rural residents, the CI of the probability of 2 weeks outpatient was -0.2041 (95% CI: 0.0594 to 0.1469), and the negative CI indicated that there was inequality in favour of low-income groups. The CI of the probability of inpatient was -0.1412 (95% CI: 0.0235 to 0.1125), and the negative CI indicated that there was the inequality in favour of low-income groups.

Table 3 further highlights the decomposition of CIs. Contributions to the inequality of the health service utilisation and the proportion of contribution in the overall CIs were reported. Only the CI of 2 weeks outpatient utilisation of older rural-to-urban migrant workers was statistically significant, then we only showed the decomposition of the CI of the 2 weeks outpatient utilisation. The factors that contributed greatly to the inequality of 2 weeks outpatient utilisation of older rural-to-urban migrant workers were poor SAH (40.94%) and the richest group (19.98%). It meant that poor SAH and richest group increased the pro-poor inequality in inpatient utilisation. The factors that contributed greatly to the inequality of 2 weeks outpatient utilisation of older rural residents were poor SAH (44.86%) and the richest group (48.50%). The factors that contributed greatly to the inequality of inpatient utilisation of older rural residents were poor SAH (16.62%), fair SAH (28.60%) and sense of happiness (16.66%).

Table 1 Descriptive statistics of variables before and after CEM

Variable	Before matching N (%) Mean (SD)			After matching N (%) Mean (SD)		
	Older rural-to-urban migrant workers	Older rural residents	P value	Older rural-to-urban migrant workers	Older rural residents	P value *
Two weeks outpatient	57 (5.99)	240 (8.93)	<0.01	48 (5.59)	118 (8.11)	<0.01
Inpatient	75 (7.88)	284 (10.61)	<0.05	65 (7.57)	131 (9.07)	<0.05
Gender			<0.001			0.743
Men†	666 (69.96)	1448 (54.11)		617 (71.83)	822 (56.49)	
Women	286 (30.04)	1228 (45.89)		242 (28.17)	633 (43.51)	
Age			<0.001			0.892
50–54†	506 (53.15)	848 (31.69)		469 (54.6)	551 (37.87)	
55–60	198 (20.8)	511 (19.1)		164 (19.09)	210 (14.43)	
61–65	248 (26.05)	1317 (49.22)		226 (26.31)	694 (47.7)	
Living arrangement			0.151			0.807
Live without spouse†	45 (4.73)	160 (5.98)		15 (1.75)	27 (1.86)	
Live with spouse	907 (95.27)	2516 (94.02)		844 (98.25)	1428 (98.14)	
Educational attainment			<0.05			0.771
Below primary school†	420 (44.12)	1750 (65.4)		391 (45.52)	971 (66.74)	
Primary school	365 (38.34)	731 (27.32)		333 (38.77)	395 (27.15)	
Middle school and above	167 (17.54)	195 (7.29)		135 (15.72)	89 (6.12)	
Type of industry						
Manufacturing and construction†	406 (44.76)	--		413 (48.08)	48.08	
Wholesale, retail trade and catering	146 (16.1)	--		128 (14.9)	14.9	
Transportation and other non-agricultural sectors	355 (39.14)	--		318 (37.02)	37.02	
Farming	--	2676(100)		--	1455(100)	
Working hours						
Moderate labour†	724 (76.05)	--		408 (47.5)	47.5	
Excessive labour	228 (23.95)	--		451 (52.5)	52.5	
NCMS			<0.01			<0.01
Yes†	869 (91.28)	2501 (93.46)		781 (90.92)	1372 (94.3)	
None	83 (8.72)	175 (6.54)		78 (9.08)	83 (5.7)	
Basic endowment scheme			<0.05			<0.01
Yes†	878 (92.23)	2540 (94.92)		794 (92.43)	1390 (95.53)	
None	74 (7.77)	136 (5.08)		65 (7.57)	65 (4.47)	
Income (yuan)	34580.93 (49329.07)	13680.62 (26025.95)		34704.53 (50287)	18575.50 (31076.34)	
Income quantiles			0.326			0.897
Poorest†	190 (19.96)	535 (19.99)		171 (19.91)	291 (20.00)	
Poorer	191 (20.06)	536 (20.03)		172 (20.02)	291 (20.00)	
Middle	190 (19.96)	535 (19.99)		172 (20.02)	291 (20.00)	
Richer	191 (20.06)	535 (19.99)		172 (20.02)	291 (20.00)	
Richest	190 (19.96)	535 (19.99)		172 (20.02)	291 (20.00)	
SAH			<0.001			0.833
Good†	583 (61.24)	1159 (43.31)		538 (62.63)	709 (48.73)	
Fair	276 (28.99)	821 (30.68)		246 (28.64)	461 (31.68)	
Poor	93 (9.77)	696 (26.01)		75 (8.73)	285 (19.59)	
Number of friends			0.078			0.398
≤5†	543 (57.04)	1628 (60.84)		491 (57.16)	858 (58.97)	

Continued

Table 1 Continued

Variable	Before matching N (%) Mean (SD)			After matching N (%) Mean (SD)		
	Older rural-to-urban migrant workers	Older rural residents	P value	Older rural-to-urban migrant workers	Older rural residents	P value *
6–10	226 (23.74)	551 (20.59)		201 (23.4)	312 (21.44)	
≥11	183 (19.22)	497 (18.57)		167 (19.44)	285 (19.59)	
Smoke			<0.001			<0.05
Yes†	331 (34.77)	631 (23.58)		396 (46.1)	349 (23.99)	
No	621 (65.23)	2045 (76.42)		463 (53.9)	1106 (76.01)	
Drinking			<0.001			0.099
Yes†	320 (33.61)	697 (26.05)		288 (33.53)	394 (27.08)	
No	632 (66.39)	1979 (73.95)		571 (66.47)	1061 (72.92)	
Regular exercise every month			<0.001			<0.05
Yes†	232 (24.37)	510 (19.06)		202 (23.52)	292 (20.07)	
No	720 (75.63)	2166 (80.94)		657 (76.48)	1163 (79.93)	
Sense of fairness			0.246			0.152
Unhappy†	58 (6.09)	204 (7.62)		49 (5.7)	87 (5.98)	
Fair	283 (29.73)	809 (30.23)		248 (28.87)	430 (29.55)	
Happy	611 (64.18)	1663 (62.14)		562 (65.42)	938 (64.47)	
Proportion of ethnic minorities (%)	3.99 (15.35)	10.61 (25.37)	<0.01	4.17 (15.95)	8.34 (19.15)	<0.05
Sex ratio in the community (%)	1.04 (1.78)	1.62 (6.08)	<0.001	1.01 (1.54)	1.91 (8.03)	<0.05
Number of health facilities per capita in the community	0.01 (0.01)	0.01 (0.01)	<0.001	0.01 (0.01)	0.01 (0.02)	<0.05
Service quality index of the community	0.66 (1.31)	0.49 (1.31)	<0.001	−0.01 (0.09)	0.6651	<0.01
Service quality index of the city	0.80 (1.67)	0.57 (1.12)	<0.001	0.09 (0.81)	0.8073	<0.01
Health index of the community population	0.69 (0.64)	1.02 (0.61)	<0.01	0.01 (0.21)		<0.01
Region			<0.001			<0.05
East†	55 (21.24)	1071 (40.02)		612 (71.25)	594 (40.82)	
Middle	60 (23.17)	851 (31.8)		147 (17.11)	488 (33.54)	
West	144 (55.6)	754 (28.18)		100 (11.64)	373 (25.64)	
City level			<0.01			0.08
Subprovincial city and above†	71 (16.82)	497 (18.57)		123 (14.32)	307 (21.1)	
Below subprovincial city	108 (25.59)	2179 (81.43)		736 (85.68)	1148 (78.9)	
L_1	0.6372			0.0001		

N (%) and mean (SD) were reported.

*P value indicated the actual p values after matching.

†The control group; virtual variables for χ^2 test.

‡P value indicated the weight to be considered.

CEM, coarsened exact matching; NCMS, New cooperative medical scheme; SAH, self-assessed health.

As table 4 shows, the contribution of need variable to the inequality of the probability of 2 weeks outpatient utilisation of older rural-to-urban migrant workers was 35.89%, and the HI index was −0.1321. For older rural residents, the contribution of need variable to the inequality of probability of 2 weeks outpatient utilisation and inpatient utilisation were 69.72% and 52.28%, respectively. HI indices of the probability of 2 weeks outpatient utilisation and inpatient utilisation of older rural residents were −0.0992 and −0.0396, respectively. It showed that

accounting for need for health services decreased the pro-poor inequality of 2 weeks outpatient utilisation of older rural-to-urban migrant workers, 2 weeks outpatient utilisation of older rural residents and inpatient utilisation of older rural residents.

DISCUSSION

The comparative analysis provided new evidences indicating inequalities and horizontal inequalities in health

Table 2 CIs of health service utilisation among matched older rural-to-urban migrant workers and older rural residents

	CI	SE	P value	95% CI	
				Lower limit	Higher limit
Older rural-to-urban migrant workers					
Two weeks outpatient	-0.2061	0.0299	0.0009	0.0193	0.1364
Inpatient	-0.0024	0.0298	0.2720	-0.0047	0.0639
Older rural residents					
Two weeks outpatient	-0.2041	0.0223	<0.001	0.0594	0.1469
Inpatient	-0.1412	0.0027	<0.001	0.0235	0.1125

CI, concentration index.

service utilisation of older rural-to-urban migrant workers, as compared with their rural counterparts, especially the first such comparative evidence from a developing country. When it comes to compare two groups' distributions, CEM allowed our analysis to draw more attention to migration for work, which would provide scientific evidences on the comparison in health service utilisation. This study introduced CI and its decomposition to quantify inequalities in health service utilisation due to circumstances and explain sources of the inequalities. Importantly, the foci research provided scientific evidences that we cannot rule out the inequality of need-driven for better meeting their health service need to improve the equity of their health service utilisation.

The probability of 2 weeks outpatient and inpatient of older rural-to-urban migrant workers were far less than older rural residents. Several reasons could partially explain it as follows. First, parallel to similar studies,³⁵⁻³⁷ older rural-to-urban migrant workers in better health are more likely to choose to migrate over long distances, because of medical prescreening, selection bias and healthy behaviours. That is, factors contributing to 'healthy migrant effect' may begin prior to migration itself.³⁸ Many Chinese evidences⁴⁻³⁹ have demonstrated that rural-to-urban migrant workers had better physical health status than their non-migrant counterparts in receiving countries or their non-migrating peers at home. Second, the awareness of accessing health service is still an important obstacle to integrated development in China. Indeed, it is well acknowledged that China has supported phased reform of Hukou, giving older rural-to-urban migrant workers affordable access to urban services. Nevertheless, as a matter of fact, the cultural values and norms concerning their health service utilisation would constitute a barrier to raise their awareness of health service. It is consistent with evidences that rural-to-urban migrant workers move to cities for the main purpose of earning money, they were more likely to delay seeking medical treatment in case of illness considering the time and financial costs of health service.¹³⁻⁴⁰ Additionally, some evidences also revealed that, rural-to-urban migrant workers have a strong tolerance for diseases, and they resort to self-treatment rather than requiring

professional health service.⁴¹ The actual health service need of older rural-to-urban migrant workers even exists is extraordinary enough. Our study informed that the heterogeneity of older rural-to-urban migrant workers in China should be embedded in the formulation of health policies. It also suggested that the social policy to reduce barriers to healthcare access are normally circumvented through the implementation of programmes that ensure the delivery of healthcare.

Among the contributors of inequalities in four dynamics in the Andersen model, individual characteristics and health outcome affect healthcare utilisation more than contextual characteristic, and health behaviour. Our results showed income quantiles was important contributors of the inequalities. Under the dual pressure of interdenominational feeding and interdenominational transmission of family poverty, older rural-to-urban migrant workers have to continue to work to support elderly parents, make money for their children's education and marriage and even the upbringing of the third generation. The average annual income of migrant workers in the Survey Report on Rural-to-Urban Migrants is 39 300 yuan,⁴² and the average annual income of older rural-to-urban migrant workers in our study is 34 704.53 yuan, which is far lower than 42 833 yuan of urban private employees in China.⁴³ Older rural-to-urban migrant workers are often paid by the hour or by piece work and therefore they are reluctant to seek healthcare during working hours. When combined with high costs of physical examination and cure diseases due to ill-health, there can be catastrophic consequences for their families, which may include falling into poverty or being pushed into deeper poverty. That requires social policy to target these middle-income groups, allowing a healthy standard of living below which nobody should fall because of circumstances beyond his or her control.⁴⁴ Echoing with previously published studies,¹⁶⁻⁴⁵ hospitalisation might reduce their paid working hours, thus affecting their wages. Hence, the low-level income faced by older rural-to-urban migrant workers cannot be blamed on their 'not working hard', but is a social problem that governments should value. As a result, many of them prefer self-care methods (eg, buying drugs in pharmacies), which

Table 3 CI decomposition of health service utilisation between matched older rural-to-urban migrant workers and older rural residents

Variable	Two weeks outpatient of older rural-to-urban migrant workers		Inpatient of older rural-to-urban migrant workers		Two weeks outpatient of older rural residents		Inpatient of older rural residents	
	dy/dx	Con/%	dy/dx	Con/%	dy/dx	Con/%	dy/dx	Con/%
Men*								
Women	0.1302	-3.42	0.0977	11.78	0.1215	10.94	0.1000	9.00
50-54*								
55-60	-0.0259	-1.45	0.0263	0.81	-0.0857	-1.70	-0.0494	-0.98
61-65	-0.0284	-1.78	0.0841	5.77	-0.0388	-2.51	-0.0304	-1.96
Live without spouse*								
Live with spouse	0.0619	-0.55	-0.7879	3.34	0.3262	-1.50	0.2752	-1.26
Educational attainment								
Below primary school								
Primary school	0.0151	-2.18	0.0827	-2.91	0.0177	-0.47	-0.1384	3.72
Middle school and above	0.0142	-1.49	-0.0083	0.82	0.0133	-0.99	-0.0405	3.01
Manufacturing and construction*								
Wholesale, retail trade and catering	-0.0297	0.50	-0.0066	-0.22	--	--	--	--
Transportation and other non-agricultural sectors	-0.0025	-0.16	0.0228	0.25	--	--	--	--
Working hours								
Moderate labour*								
Excessive labour	0.0434	-0.40	0.1852	-2.69	--	--	--	--
NCMS								
Yes								
None	-0.0111	0.58	0.0102	0.14	0.0148	0.63	0.0010	0.04
Basic endowment scheme								
Yes*								
None	-0.0396	0.03	-0.024	0.14	-0.0092	-0.37	0.0022	0.09
Income quantiles								
Poorest*								
Poorer	-0.0248	2.66	-0.0151	-2.83	-0.0255	-9.53	-0.0149	-5.55
Middle	-0.0074	0.04	-0.0063	0.01	-0.0406	-9.27	-0.0339	-7.74
Richer	-0.0514	1.36	0.0681	-12.48	-0.1246	-1.97	0.0286	0.45
Richest	-0.0176	19.98	0.0981	-38.12	-0.2598	48.50	-0.0066	1.23
SAH								
Good*								
Fair	0.2324	1.60	0.1269	5.47	0.2037	9.18	0.3690	16.62
Poor	0.1890	40.94	0.2605	45.89	0.2515	44.86	0.1603	28.60
Number of friends								
≤5*								
6-10	0.0120	0.53	0.0172	-0.23	-0.001	0.04	0.0484	-1.74
≥11	0.0372	-0.38	0.0666	-2.09	-0.0815	2.25	-0.0137	0.38
Smoke								
Yes*								
No	0.1903	2.03	-0.0471	-1.54	0.0397	1.08	-0.1800	-4.89
Drinking								
Yes*								
No	-0.2528	6.75	-0.222	-7.88	0.2191	3.5	-0.0134	-0.21
Regular exercise every month								
Yes*								
No	0.0034	-2.27	-0.5305	-4.77	-0.161	0.1	0.0060	0.01

Continued

Table 3 Continued

Variable	Two weeks outpatient of older rural-to-urban migrant workers		Inpatient of older rural-to-urban migrant workers		Two weeks outpatient of older rural residents		Inpatient of older rural residents	
	dy/dx	Con/%	dy/dx	Con/%	dy/dx	Con/%	dy/dx	Con/%
Sense of fairness								
Unhappy*								
Fair	-0.2470	0.10	-0.2102	-6.05	-0.0783	-2.36	-0.1853	-5.58
Happy	-0.0164	5.29	-0.0411	8.79	-0.1368	2.41	-0.9472	16.66
Proportion of ethnic minorities (%)	-0.3565	-1.01	0.0252	1.56	-0.0002	-0.02	-0.0253	-2.65
Sex ratio in the community (%)	-0.0329	1.28	-0.0648	0.23	-0.0127	0.93	0.0556	0.93
Number of health facilities per capita in the community	0.0265	-1.06	-0.01	-0.32	-0.0226	0.2	0.1502	0.20
Service quality index of the community	0.0061	-3.93	-0.001	-2.19	-0.0357	-1.48	-0.0357	-1.48
Service quality index of the city	-0.0006	-1.47	0.0065	-1.57	-0.0223	1.56	-0.0223	1.56
Health index of the community population	-0.0259	-1.64	0.0001	0.41	-0.0584	0.1	-0.0584	0.10
Region								
East*								
Middle	0.0130	0.46	0.0449	0.78	0.1389	0.01	0.1389	0.01
West	0.3104	1.29	0.0104	1.02	-0.0252	-1.05	-0.0252	-1.05
City level								
Subprovincial city and above*								
Below subprovincial city	-0.0017	0.51	0.0354	0.06	-0.1018	-0.02	-0.1018	-0.02
Note: Con for contributions. *The control group. CI, concentration index; SAH, self-assessed health.								

may lead to a considerable risk of health deterioration. Therefore, their potential health service needs cannot be translated into actual health service utilisation. This is consistent with the explanation given by Peng *et al.*⁴⁶ In addition to affordability, the presence of a social environment was central to the desire and opportunity to actual health service utilisation. Public policy including protesting unpaid wages and raising the minimum wage, play significant roles in shaping income distribution and

protecting the legitimate rights and interests of older rural-to-urban migrant workers.

The results of CI decomposition showed that poor SAH increased the inequality of health service utilisation, which is beneficial to less well-off older rural-to-urban migrant workers and rural residents. An alternative explanation is the support of the health poverty alleviation policy for the poor rural elderly. SAH depends on the socioeconomic status of older rural-to-urban migrant workers

Table 4 Horizontal index of the health service utilisation between matched older rural-to-urban migrant workers and older rural residents

	Older rural-to-urban migrant workers				Older rural residents			
	Two weeks outpatient		Inpatient		Two weeks outpatient		Inpatient	
	CI	Con/%	CI	Con/%	CI	Con/%	CI	Con/%
CI	-0.2061	100	-0.0125	100.00	-0.2041	100	-0.0718	100
Need	-0.074	35.89	-0.0093	74.52	-0.1049	69.72	-0.0322	52.28
Economy	-0.0495	24.04	0.005	-53.42	0.0091	-53.42	-0.0102	-11.61
Other	-0.0207	10.03	-0.0004	-8.08	0.0006	-9.27	-0.0007	7.82
Residual	0.3004	35.88	-0.0003	86.98	0.0003	6.95	-0.0005	52.51
HI	-0.1321		-0.0032		-0.0992		-0.0396	
Note: Con for contributions. CI, concentration index; HI, horizontal inequality.								

and older rural residents, and the relationship of SAH and the income-related inequality was found complex and controversial.^{47 48} Given that health is a multidimensional concept, different measures (eg, SAH, chronic disease) arguably capture different dimensions of health status as a construct. SAH may influence socioeconomic status through health shocks on some labour market outcomes, such as wage, injury insurance,^{9 49} jointly with the role of mental conditions along with cognitive biases in measuring SAH. Therefore, the causal mechanisms underlying this relationship in our study is difficult to disentangle. Beyond all doubt, it was necessary to improve their health by improving many factors, such as health knowledge, time preference, risk aversion rates, or the like.

Our study highlighted that the sense of happiness was an important contributing factor to the inpatient utilisation for older rural residents, and it showed that the sense of happiness increased the inequality of inpatient utilisation in favour of older rural residents with poor economic level. It also reminded us that sustainable healthcare management programmes that strengthen the construction of their elderly life and ensure the quality should be planned. Improving the sense of happiness gave substance to narrowing differences in health service utilisation. Previous studies demonstrated that NCMS offered an explanation for potential influence factors of health service utilisation of rural-to-urban migrant workers.⁹ Conversely, our findings found that despite medical coverage being in place, significant inequalities in healthcare remain pervasive. Importantly, the financial coordination and mutual aid of NCMS is mainly based on the county or district as a unit, thus NCMS embodies the cross-regional characteristics. When designing the system of health service utilisation and a high-quality universal health coverage, it should be inclined to lower the threshold of cross-regional medical treatment and improve the accessibility of health service utilisation of low-income older rural residents and older rural-to-urban migrant workers.

Our results concluded that there were no statistically significance between age and health service utilisation of both groups. Our study showed that half of rural-to-urban migrant workers were aged between 50 and 54 years, whereas half of older rural residents were aged between 61 and 65 years. Therefore, we commenced CEM for matching older rural-to-urban migrant workers and older rural dwellers, to guarantee better balance of empirical distributions of covariates between the comparison groups. By matching across multiple variables (ie, age, gender, educational level, economic level and SAH), CEM allowed the analysis to focus on whether those who migrate for work have significantly different health when compared with those who did not.⁵⁰ In lines with existing studies, our results proved that health inequality prevailed in old age. It is worth emphasising that the need to use healthcare increases with age. During the period of ageing, it is important to neutralise the effects

of progressive involution changes in order to ensure the comfort and quality of life, as well as to maintain optimal functional fitness for the next stages of old age. The convergence effect and the accumulative hypothesis were two contrary propositions on the authoritative exposition of age-related health and social economic status for the elderly. The convergence hypothesis held that the impact of socioeconomic status on systematic health differences first expanded with the increasing age, then the health differences narrowed gradually disappeared in the old age stage. The accumulation hypothesis held that the health differentiation continued to expand, and the degree of health differentiation of the elderly group was greater than that of younger groups.^{51 52} Based on these grounds, the elderly experiencing a greater level of cumulative illness would have higher total healthcare costs, which even increased inequalities. Healthy ageing has become a very important theme for China, and further work is required to identify the extent of income-related inequality and age-related inequality should be evolved widely to incorporate advances based decomposition.

Nonetheless, not all inequalities in health service utilisation are determined by socioeconomic position. Our study focused on reasonable inequalities in the health service utilisation between older rural-to-urban migrant workers and older rural residents, rather than the superficial inequality. Assuming that an older rural-to-urban migrant worker spends 5000 yuan to cure serious diseases, but due to restrictive schedule demands and lack of favourable reimbursement policies, only 3000 yuan is spent. The cost of an older rural resident suffering from a small pathogen was only 1000 yuan, and 3000 yuan was spent due to the favourable reimbursement policy and other socioeconomic factors. Therefore, it is necessary to control the 'need variable', which has been ignored in previous studies. The absolute value of HI indices were lower than the absolute value of CIs indicating that accounting for need for health services reduces the magnitude of the pro-poor inequality. This finding deserves some attention in assessing inequality in access to the health services of older rural-to-urban migrant workers and older rural residents, and aid in the creation of policies that will allow for equitable access to care. In fact, health service utilisation can better meet the health service needs of low-income groups. In this sense, the issue of HI index matters for income-related inequality on health service utilisation and it should be given a due attention in policymaking. Therefore, opportunities and policy actions for equity-oriented health service utilisation should be motivated to make sure that future health improvements are shared by the population.

Our study still suffered from major shortcomings. First, our data in 2016 are a little old, although CLDS 2016 is the latest data we can get. In addition, CLDS 2016 was based on a cross-sectional study, and cause-effect relationship, such as 'healthy choice effect' could not be derived. Second, crude measures of health service utilisation and limited understanding of factors explained



the production process of health service utilisation and sources of inequalities, such as type of disease, severity of disease and medical costs. Also, our study only compared income-related inequality on health service utilisation between older rural-to-urban migrant workers and older rural residents. Our future study will include older urban residents for the stringency of the study. Third, we selected sample by our severe standards. There may be such a problem that inadequate identification of what stands behind measures of socioeconomic position for older rural-to-urban migrants and older rural residents, which differ across the lifestyle. Fourth, our study only paid close attention to the one-way relationship, that is, how different variables affect the health service utilisation. Our study cannot directly verify the multiple interactions of contextual characteristics and individual characteristics. Evidently, further studies on multiple interactions of four dimensions should be investigated to make the health service utilisation more comprehensive. Finally, in terms of research methods, because CI can only examine the inequality of health service utilisation related to a single factor; it cannot comprehensively measure the overall inequality of health service utilisation.

CONCLUSIONS

Our study demonstrated that older rural-to-urban migrants had systematically lower use of health service utilisation than older rural residents. Substantial pro-poor inequality on health service utilisation among older rural-to-urban migrants and older rural residents were observed. Economic status, SAH and sense of happiness emerged as dominant contributors of inequalities in health service utilisation. This document highlighted that the need of health service utilisation increased the inequality. Our study may shed light on the heterogeneity of older rural-to-urban migrant workers in China and should be embedded in the formulation of health policies.

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