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Association of socioeconomic status with financial burden of disease among elderly patients with cardiovascular disease: evidence from the China Health and Retirement Longitudinal Survey

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ABSTRACT

Objectives The prevalence of cardiovascular diseases (CVD) within low-income and middle-income countries has reached epidemic proportions. However, the association between out-of-pocket (OOP) payment and socioeconomic status (SES) of patients with CVD is not well studied. We aimed to understand the financial burden among Chinese middle-aged and older patients with CVD, and whether there was an association with SES.

Settings A nationally representative survey—*The China Health and Retirement Longitudinal Survey* (CHARLS)—was conducted in 28 provinces of mainland China in 2011 and 2013.

Participants Of the over 18 000 CHARLS respondents, eligible participants were those aged 45 years and over who had been previously diagnosed with CVD.

Outcome measures Financial burden was measured by *individual* OOP payment and *household* catastrophic health expenditure (CHE) occurrence (ie, the annual household health expenditure was 40% or more of the total non-food household expenditure). Multilevel regression models were used to explore the association between financial burden and SES.

Results Among CHARLS respondents, CVD prevalence increased from 14.7% in 2011 to 16.6% in 2013. Average annual CVD OOP payment increased from 5000 RMB (770 USD) to 6120 RMB (970 USD). Furthermore, CHE occurrence increased from 44.2% to 48.1%. Patients spent almost twice on outpatient as on inpatient services. Two of the three SES indicators (total household expenditure, occupation type) were found to be associated with CVD OOP payment amount, and the likelihood of CHE. Unemployed patients had a higher likelihood of CHE compared with agricultural workers. Rural-urban difference was associated with the likelihood of CHE in 2011 alone.

Conclusion The Chinese health system should use this health expenditure pattern among patients with CVD to create more equitable health insurance schemes that financially balance between outpatient and inpatient care, and provide better financial risk protection to patients with low SES.

Strengths and limitations of this study

- ► Use nationally representative household survey data to estimate health expenditure among patients with cardiovascular disease (CVD).
- ► Apply multilevel regression model to explore how both individual and contextual socioeconomic features were associated with financial burden among patients with CVD.
- ► Cost estimation was based on the cost for last medical visit among patients whose reason for their last outpatient/inpatient visit was CVD, which reduces estimation bias resulting from co-occurrence of other non-communicable diseases.
- ► The database (China Health and Retirement Longitudinal Survey) is a self-reported survey that might result in recalling bias.

INTRODUCTION

WHO reports that cardiovascular diseases (CVD) (eg, coronary heart disease and cerebrovascular disease) account for 31% of deaths globally. While CVD mortality rates are globally pervasive, 75% of CVD deaths occur in low-income and middle-income countries.[1] The response to this global epidemic has been to better study the risk factors associated with CVD incidence.[2] However, of equal importance is the need to understand healthcare costs associated with CVD *after* diagnosis, and the financial burden that it places on a household. Since CVD is a chronic disease, there is a consistent demand for healthcare services and medication among those affected.

The concept of 'new public health' attributes individual's health and their health behaviours partly to the upstream causes of poor health.[3] These include contextual variables such as physical features of the environment, service availability and sociocultural features within a neighbourhood, which significantly influence

medical cost.[4] Persons living in the aforementioned disadvantaged conditions often face higher risk of negative health outcomes,[5] but have lower financial capacity to pay for adequate healthcare services. In other words, patients with lower socioeconomic status (SES) may spend less money purchasing health services,[6] but have a higher risk of catastrophic health expenditure (CHE).

According to the 2016 National Report on Cardiovascular Diseases, one in five Chinese adults live with a CVD (including cerebrovascular disease, coronary heart disease, arrhythmia, heart failure, pulmonary arterial hypertension, cardiovascular surgery and chronic kidney disease), and the annual inpatient care cost has risen at a steady rate of 30% since 2004.[7] Researchers with an interest in Chinese health policies may be aware of the ongoing, extensive health reform in the country since 2009, which aims to expand universal health coverage and to provide a basic public health package to all citizens.[8] For instance, the Chinese government now supports basic medical insurance for over 95% of the population and, as such, service utilisation has more than doubled.[9] However, health outcomes among the Chinese population have not improved commensurately with the government's effort. One possible reason for this could be that the insurance system is organised into multiple benefit packages that differ by one's employment status and ID registration type. Briefly, at the time of birth Chinese residents may register for an urban ID or a rural ID, mostly based on the family's location. The ID type together with employment status directly impacts their ability to receive various healthcare benefit packages. For example, urban employees are enrolled in the Urban Employee Basic Medical Insurance, whose funding comes from individuals and employers (monthly premium). Urban unemployed residents are enrolled in Urban Resident Basic Medical Insurance (URBMI); and rural residents, regardless of employment status, are enrolled in the New Rural Cooperative Medical Insurance (NRCMI). Those enrolled in either the URBMI or NRCMI individually pay an annual premium and receive some subsidisation by the government.[10]

In addition to basic medical insurance schemes, patients from low-income households and/or who have severe physical conditions may be protected by special medical aid packages, but it often requires that the patient has knowledge of how and when to apply for it, *and* that they possess the health literacy level to finish the complex application form within their local social insurance department. The inclusion criteria for the special medical aid packages varies across cities. Such a differential design in healthcare benefits has at times resulted in social inequality issues—with higher SES patients typically enjoying better insurance schemes (eg, a higher reimbursement rate, more kinds of covered medical care and medicines) and higher rates of service utilisation.[11 12] Chinese policymakers have acknowledged the unequal nature of the medical insurance design[11] and are actively trying to decrease inequalities through investing money in rural health systems and providing supplemental medical aid for patients from poor households. However, the ongoing health reform is not as cost-effective as it could be due to existing inefficiencies in the healthcare system, and scarcity and maldistribution of qualified health workforce across the country.[13] The healthcare system's disproportionate emphasis on reimbursing inpatient services while not addressing the expensive outpatient services for those suffering with for chronic diseases contribute to the government's poor performance in *actually* reducing financial burden on patients.[14] One study based in the Shandong province showed that the NRCMI for rural residents fails to prevent poor households from CHE (defined as *the annual household health expenditure is 40% or more of household's capacity to pay*).[15] Further evidence shows that the NRCMI only reduced the incidence of CHE among the richer households from 2009 to 2012.[15]

Prior research has shown that the financial burden associated with CVD is disproportionate across patient demographics (eg, gender, age).[16 17] While these two particular studies suggest that SES indicators (income, employment and education) are associated with OOP payment among patients in low-income and middle-income countries,[16 18] we sought to explore whether there was evidence of association within Chinese patients with CVD specifically, and if SES is associated with both *individual* OOP payment and *household* CHE. Findings from this provide critical evidence that will enable Chinese policymakers to develop population-appropriate and pro-poor insurance schemes, helping to achieve a more effective and equitable health system. Additionally, evidence from this study contributes to the global body of health systems reform research and is useful in addressing WHO's call for future cross-country comparative research.[19]

METHODS

Database

The rationale and methodology of China Health and Longitudinal Retirement Survey (CHARLS) has been reported previously.[20] Briefly, CHARLS is a nationally representative, longitudinal household survey that examines the social, financial and health circumstances of citizens. Based on a probability proportionate to size sampling strategy, CHARLS covers 450 communities in 150 counties from 28 of the 32 provinces in the mainland China. Households are randomly selected from maps and listings within each rural or urban community. Only residents aged 45 years or older and their spouses (if any, and of any age) were interviewed at baseline and after a 2-year time period. There were a total number of 17 708 respondents from 10 253 households interviewed in 2011, of which 15 775 respondents from 9195 households were successfully followed-up in 2013 (89.08% retention rate). Another 2841 respondents from 1706 households were recruited in 2013 to the cohort in order to acquire a similar sample size.[20]

Participants

Eligible participants were residents within the 450 aforementioned communities and their spouses (if

applicable) that participated in CHARLS. Specifically, we applied two approaches to select patients with CVD from all CHARLS participants: (1) when asked if they had been diagnosed with having a chronic disease by a doctor, respondents who reported being diagnosed with a 'heart attack, coronary heart disease, angina, congestive heart failure or other heart problems' or 'stroke' by a doctor were identified as patients with CVD; (2) respondents who reported one of those diseases as the reason for their last outpatient visit or inpatient hospitalisation, but not necessarily meeting the first inclusion criteria (ie, self-reported as patients with CVD being diagnosed by doctors), were also identified as patients with CVD in our analyses. A total of 2568 respondents in 2011 (14.5%) and 3056 respondents in 2013 (16.4%) met both our two-step inclusion criteria. In total, 1775 patients out of the 2568 patients (69.1%) enrolled in 2011 were retained in 2013.

Measures

OOP payment and CHE

Health expenditure data contained in the CHARLS questionnaire measures both the direct and indirect costs associated with CVD. *Direct costs* included OOP payment for self-medication (such as buying over-the-counter medicines, taking home-made herbal medications during the past month prior to the survey) and inpatient and outpatient services (from the last clinic/hospital visit). While *indirect costs* included OOP spending by the patient on transportation to the outpatient visit, or by the patients and families on transportation, accommodation, food and hiring care workers during inpatient hospitalisation. This study reported direct and indirect spending by outpatient/inpatient visits separately, and used the total annual OOP expenditure as the dependent variable in regression models. It should be noted that in consideration of the potential co-occurrence of other non-communicable diseases (NCDs) among patients with CVD that might increase individual health expenditure, we only included patients whose reason for their last outpatient/inpatient visit *was* CVD in our cost estimation. Hence, the estimated annual cost was based on the self-reported cost for the last treatment of patients with CVD.

Individual health expenditure in this study was calculated for each patient with CVD, through the following formulas: (1) annual self-medication cost (self-reported self-medication cost during the past month×12); (2) annual direct/indirect outpatient cost (self-reported direct/indirect cost of last outpatient visit×outpatient visit times during the past month×12) and (3) annual direct/indirect inpatient cost (self-reported direct/indirect cost of last inpatient visit×inpatient hospitalisation times during the past year). The occurrence of CHE was measured at household level. Previous research has recommended that CHE be defined as 40% or more of the total non-food household expenditure allocated towards the annual household health expenditure.[21 22] We used this definition to create a dichotomous variable in order to indicate the presence of CHE within each household ('1=yes' (≥40%) and '0=not' (<40%)).

SES indicators

Individual-level SES was measured by three indicators: education level, occupation type and household expenditure. Previous studies have shown that individual education level might be negatively associated with frequency of health services utilisation (because they are more likely to live healthier lifestyles),[23] but positively associated with willingness to pay for health services if in need.[24] Based on respondents' answers, we categorised educational attainment into four levels: primary school, middle school, high school and vocational school and above. Individual occupation at the time of survey is also measured and categorised into five groups: agricultural work (engaged in agricultural work for at least 10 days in the past year, and not self-identified as employed by others, self-employed, retired or unemployed), employed, self-employed, retired (including receded, ie, people who quit their job before retiring age while enjoying the same benefits as normal retirement) and unemployed. Those categorised as unemployed also included urban residents who self-identified as unemployed, and rural residents who did not engage in agricultural work for at least 10 days. As described earlier (in China), a resident's ability to enrol within a particular basic medical insurance scheme depends on his/her employment status and rural/urban residence, thus occupation could play a role in healthcare-seeking behaviour due to medical insurance restrictions.

We used total household expenditure over the past 12 months as the third indicator of SES. We chose to use *total household expenditure* over *household income* because past studies have intimated that the ratio of health payments to income might not be responsive to catastrophic expenditure when a household finances healthcare costs from their personal savings.[21] In CHARLS, household expenditure is measured by a series of factors, such as food expenditure, durable goods purchase, utility bills, communication and transportation cost. Interviewees were asked to report the cost estimate for a specific factor in accordance with the likely frequency of cost. For example, *during the past week* (eg, food expenditure), *month* (eg, communication and transportation cost) or *year* (eg, furniture purchase). It should be noted that when defining the occurrence of CHE, we used household annual non-food expenditure (ie, we do not include food expenditure in the denominator).[21] To reduce the influence on household economic status from the variation of economy development across different cities, we adopted a relative approach to present one's household annual expenditure level. First, we divided the exact amount of one household annual expenditure by the median level in the city where the household resides, and then grouped all the quotients into five equal partitions (from the lowest 20% to the highest 20%). In addition to the aforementioned three indicators, the rural-urban difference of the patient's

residency region was also treated as an important SES indicator in this study.

Control variables

There were four individual-level and five community-level control variables. Individual-level control variables for patients with CVD included: (1) age (45–54, 55–64, 65–74, 75 and older); (2) sex; marital status (living with a spouse or partner, not living with a spouse or partner) and (3) health status. Health status was indicated by the number of co-occurring NCDs (eg, diabetes, dyslipidemia, cancer or malignant tumour, hypertension, chronic lung diseases, kidney diseases, liver disease, stomach or other digestive disease, psychiatric problems, memory-related disease, arthritis or rheumatism, asthma) to CVD (none, one to two co-occurrences, more than three co-occurrences).

Community-level control variables included: (1) population size (<1500, 1500–7000 and >7000); (2) per capita annual net income; (3) regional location (east/middle/west part of China); (4) availability of healthcare services and (5) availability of transportation services. The latter two factors were included in our model for potential confounding effects. Here, we used the number of public bus routes (none=not good, 1–2 routes=good, ≥3 routes=very good) to indicate the accessibility of transportation service, and the number and type of healthcare facilities (none, only primary care centres and having secondary or tertiary hospitals) within the community to indicate the availability of healthcare services at the community level. All information at the community level was directly collected from local officials through a constructed questionnaire.

Statistical analysis

All statistical analyses were conducted using data from 2011 and 2013 separately. We reported the prevalence of CVD by SES groups first, and then examined the statistical differences by groups with the X^2 tests. We used a multilevel linear regression analysis (ie, a two-level random-intercept model with individuals at the first level and communities at the second level) to study the association of individual SES characteristics with the annual OOP payment, among patients with CVD. To normalise the distribution of the error items, the numeric value of OOP payment was log-transformed in the regression model. Subsequently, another two-level random-intercept model using logistic regression was performed to analyse the odds of CHE occurring within family of a patient with CVD, compared with the first group of each SES indicator. In all regression models, *individual-level variables* included SES indicators (education, occupation and household living expenditure), age, sex, marital status and NCD co-occurrence, as well as *community-level characteristics* including rural-urban difference, regional location, population size, transportation, number of health facilities and per capita annual net income. All data cleaning and statistical analyses were done using Stata V.14.1 (StataCorp, College Station, Texas, USA). Statistical significance level was set as P value 0.05.

Using both datasets from the CHARLS (2011 baseline, 2013 follow-up), we examined the individual OOP payment for both outpatient and inpatient services among patients with CVD who reported that their last outpatient/inpatient visit was CVD-related. We then applied multilevel regression analyses to explore the association between one's financial burden (as measured by OOP payment and household CHE occurrence), and individual SES factors and rural-urban difference.

RESULTS

Prevalence of CVD and patients' demographic characteristics

Table 1 summarises the characteristics of patients with CVD in 2011 and 2013. Overall, the number of female patients was slightly higher than male patients, and around 70% of the patients with CVD were aged 55–74 years. Over 80% were living with a spouse. Most patients with CVD suffered from a co-occurring NCD, with >80% having one or more complications. There were slightly more rural than urban patients included (51.8% vs 48.2% in 2011, and 53.0% vs 47.0% in 2013); furthermore, patients living in the middle part of China were slightly over-represented compared with residents of west and east China. Online supplementary table 1 presents the prevalence of CVD across different SES subgroups and the χ^2 test results. Overall, with all covariates controlled, the difference of prevalence is more significant across education levels and occupation categories (P<0.05). Respondents from the education level of 'vocational and above' were more likely to have CVD (19.8% in 2011 and 22.1% in 2013), as were those from the occupation levels of 'retired/receded' (28.6% in 2011 and 31.6% in 2013) and 'unemployed' (21.9% in 2011 and 24.2% in 2013).

OOP payment

Regarding health service utilisation, about 15% of patients with CVD (334/2568 in 2011; 463/3056 in 2013) reported being hospitalised at least once in the past year because of CVD, and 10% of patients with CVD (260/2568 in 2011; 279/3056 in 2013) used outpatient services because of CVD at least once during the past month. From 2011 to 2013, a higher proportion of patients with CVD used inpatient service (from 13.0% to 15.1%), and used outpatient service more frequently over 1 year (from 8.8 visits/patient to 9.7 visits/patient).

The median number of OOP payment by service type is reported in table 2. While the median, annual household expenditure among CHARLS respondents was 16 290 Yuan (2506 USD) in 2011, and 19 715 Yuan (3129 USD) in 2013 (data not shown), for patients with CVD, the total OOP payment over 12 months was 5000 Yuan (770 USD) in 2011, and 6120 Yuan (970 USD) in 2013 per capita. Thus, patients with CVD, on average, attributed 30.69% and 31.04% of expenses to OOP payment in 2011 and 2013, respectively. From 2011 to 2013, the direct

Table 1 Demographic characteristics of the patients with CVD in CHARLS

Characteristics	2011 (n=2568)		2013 (n=3056)	
	Urban	Rural	Urban	Rural
Total*	1238 (48.2)	1330 (51.8)	1435 (47.0)	1621 (53.0)
Sex (%)				
Male	540 (43.6)	548 (41.2)	618 (43.1)	672 (41.5)
Female	696 (51.4)	781 (58.8)	814 (56.9)	944 (58.5)
Age (%)				
45~54 years	210 (17.0)	280 (21.1)	239 (16.7)	315 (19.4)
55~64 years	472 (38.1)	488 (36.7)	519 (36.2)	543 (33.5)
65~74 years	348 (28.1)	377 (28.3)	395 (27.5)	518 (32.0)
≥75 years	208 (16.8)	185 (13.9)	282 (19.7)	244 (15.1)
Marital status (%)				
With spouse	1037 (83.8)	1107 (83.2)	1177 (82.0)	1330 (82.0)
Without spouse	200 (16.2)	223 (16.8)	257 (18.0)	291 (18.0)
NCD co-occurrence (%)				
None	132 (10.7)	160 (12.0)	217 (15.1)	242 (15.0)
1~2 kinds of NCD	681 (55.0)	670 (50.4)	728 (50.7)	873 (52.4)
≥3 kinds of NCD	425 (34.3)	500 (37.6)	490 (34.1)	506 (32.6)
Regional location (%)				
East	365 (29.5)	393 (29.5)	436 (30.4)	483 (29.8)
Middle	488 (39.4)	461 (34.7)	564 (39.3)	563 (34.7)
West	385 (31.1)	476 (35.8)	435 (30.3)	575 (35.5)

*Numbers across the subgroups of some certain characteristics do not add up to the total because of missing values.
CHARLS, China Health and Retirement Longitudinal Survey; CVD, cardiovascular disease; NCD, non-communicable disease.

outpatient cost for a single visit decreased (by 5%) from 400 Yuan/visit (62 USD) to 380 Yuan/visit (58 USD) per capita, but the direct inpatient cost for a single visit increased (by 22%) from 2050 Yuan/visit (325 USD) to 2500 Yuan/visit (397 USD) per capita. Even though the cost for a single outpatient visit was lower than that of a single inpatient visit, patients with CVD spent more on outpatient services over 1 year due to higher visit frequencies, higher deductibles and lower deductions. In both 2011 and 2013, the annual burden for outpatient care (around 5930 Yuan; 912 USD) was almost twice as much as that for inpatient care (around 3350 Yuan; 515 USD), and such a difference could be found in both urban and rural patients. The results also showed that urban patients spent more on direct cost than their rural counterparts (77 Yuan/12 USD more on single inpatient visit, and 200 Yuan/31 USD more on single outpatient visit), but less on indirect cost such as transportation and accommodation. Regarding the indirect cost, for outpatient services in 2011, rural patients spent >10 Yuan/1.5 USD for a single visit, but urban patients spent <5 Yuan/0.8 USD (such a gap disappeared in 2013); for inpatient service, rural patients spent as much as 200 Yuan/31 USD for a single visit while urban patients spent 0 (such a gap consisted in 2011 and 2013). According to the third quartile of indirect cost for last inpatient hospitalisation, both urban and rural patients spent as much as 500–600 Yuan/77–92 USD.

According to the multilevel linear regression analysis (table 3), results indicate that at individual level, the amount of OOP payments increased significantly with the household annual living expenditure increase. In 2011, patients with CVD from the wealthiest (top 20%) households spent 85% more on OOP payments as patients from the poorest (lowest 20%) households (coefficient=0.852, P<0.05), while the patients with CVD from the wealthier (higher 20%) households spent 74% more as compared with the poorest (coefficient=0.737, P<0.05). In 2013, the difference increased to 217% (P<0.05). Education level, occupation type and rural-urban difference was not found to be significantly associated with the amount of OOP payment among patients with CVD.

Catastrophic health expenditures

We further measured the incidence of catastrophic payments for healthcare in the households with at least one patient with CVD. In 2011, 44.2% of all interviewed CVD households encountered CHE (38.7% in urban households and 49.1% in rural households). In 2013, 48.1% of the CVD households encountered CHE, but the gap between urban (45.2%) and rural (50.6%) narrowed down to 5% points (data not shown).

Table 2 Average amount of OOP paid for per visit among patients with cardiovascular diseases during 2011–2013

	2011						2013					
	Urban		Rural		Total		Urban		Rural		Total	
Cost type	Median	Q1/Q3	Median	Q1/Q3	Median	Q1/Q3	Median	Q1/Q3	Median	Q1/Q3	Median	Q1/Q3
Per capita direct cost per outpatient visit	500	*100* *1500*	300	*81* *800*	400	*83* *1000*	400	*130* *1100*	300	*100* *900*	380	*114* *1000*
Per capita indirect cost per outpatient visit	4	*1* *20*	12	*4* *40*	10	*2* *28*	12	*2* *26*	11	*2* *40*	12	*2* *30*
Per capita direct cost per case of hospitalisation	2500	*1100* *5000*	2000	*900* *4000*	2050	*1000* *4000*	2500	*1100* *6000*	2050	*800* *5000*	2500	*1000* *5500*
Per capita indirect cost per case of hospitalisation	0	*0* *500*	200	*0* *500*	100	*0* *500*	0	*0* *500*	195	*0* *600*	100	*0* *600*
Per capita self-medication cost per month	11	*3* *34*	11	*3* *23*	11	*3* *29*	21	*6* *86*	21	*6* *54*	21	*6* *64*
Per capita OOP payment for outpatient care in 1 year	7224	*1836* 24000	5340	*1800* 18204	6096	*1800* 20160	6240	*2520* 19776	5280	*1620* 18240	5760	*2160* 199656
Per capita OOP payment for inpatient care in 1 year	3060	*1500* *8000*	3000	*1200* *7150*	3000	*1200* *7500*	4000	*1600* *9000*	3000	*1100* 10050	3700	*1400* 10000
Per capita total OOP payment in 1 year	5576	*2073* 16530	4626	*1894* 13738	5000	*2000* 15000	6597	*3000* 18426	5904	*1959* 16288	6120	*2379* 17220

OOP, out-of-pocket.

Table 3 Association between per capita OOP payment† in 1 year and socioeconomic factors among patients with CVD during 2011–2013 (multilevel linear regression‡)

	2011			2013		
SES indicator	Coefficient	SE	P value	Coefficient	SE	P value
Education (ref: primary school)						
Middle school	−0.248	0.267	0.353	−0.193	0.236	0.414
High school	0.047	0.373	0.900	−0.477	0.399	0.233
Vocational school and above	0.370	0.396	0.349	−0.619	0.426	0.146
Occupation (ref: agricultural work)						
Employed	0.277	0.326	0.395	−0.592	0.506	0.242
Self-employed	0.198	0.530	0.709	−0.436	0.473	0.357
Retired/receded	0.209	0.282	0.458	−0.179	0.310	0.563
Unemployed	0.253	0.243	0.298	0.124	0.174	0.476
Household expenditure (ref: the lowest 20%)						
Lower 20%	0.122	0.283	0.667	0.384	0.272	0.158
Middle 20%	0.388	0.296	0.190	0.913	0.273	0.001*
Higher 20%	0.737	0.320	0.021*	0.603	0.278	0.030*
Highest 20%	0.852	0.331	0.010*	1.168	0.263	<0.001*
Urban/rural (ref: rural)						
Urban	−0.053	0.226	0.814	0.049	0.263	0.852
Random effect						
SD/SE	0.565/0.457			<0.001/0.002		

*P<0.05.
†Per capita annual OOP was log-transformed to normalise its distribution.
‡Variables adjusted in the model include: (1) individual level: age, sex, marital status, NCD co-occurrence and (2) community level: population size, per capita annual net income, regional location (east/middle/west part of China), availability of healthcare services and transportation condition.
CVD, cardiovascular disease; NCD, non-communicable disease; OOP, out-of-pocket; SES, socioeconomic status.

In the following multilevel logistic regression model, we explored how SES indicators were associated with the patient's household encountering catastrophic health spending (table 4). Occupation, household living expenditure level and urban-rural difference were all found to be significantly associated with the odds of encountering CHE (P<0.05). Regarding urban-rural difference, the odds of encountering CHE for the families from urban communities were 39% lower (OR=0.61, 95% CI 0.47 to 0.80) than their rural counterparts in 2011; although in contrast to the analysis results in 2013, there was no relation between any community-level variables and CHE occurrence. At individual level, the odds of CHE were higher among the respondents who were unemployed than those who did agricultural work, both in 2011 (OR=1.42, 95% CI 1.13 to 1.79) and in 2013 (OR=1.30, 95% CI 1.06 to 1.60). Compared with the patients from poorest households (ie, the lowest 20% of annual living expenditure), the odds of encountering CHE were significantly lower among patients from more wealthy households. The OR for each household group from the richest to the poorer is 0.42 (95% CI 0.47 to 0.80), 0.55 (95% CI 0.42 to 0.73), 0.71 (95% CI 0.54 to 0.93), 1.05 (95% CI 0.81 to 1.37), respectively. In addition, a descending trend of odds of encountering CHE in families of patients with CVD could be observed with the increase of household living expenditure level, although the 95% CIs were overlapped.

DISCUSSION

This study used the CHARLS data set to provide evidence on the average OOP payment and occurrence of CHE among patients with CVD. Furthermore, we explored how OOP payment and CHE were associated with individual SES and community urban-rural difference. Findings show that from 2011 to 2013, the average annual OOP payment for each patient with CVD increased from 5000 RMB to 6120 RMB (770 USD to 970 USD), while the occurrence rate of CHE in both urban and rural CVD households increased from 44.2% to 48.1%. Relying heavily on outpatient care, patients with CVD spent almost twice on outpatient service as on inpatient service. Individual-level SES indicators including household living expenditure level and occupation type were found to be significantly associated with OOP payment and CHE occurrence. The urban-rural difference was significantly associated with CHE occurrence in the 2011 data. These findings underline the importance of considering individual SES and

Table 4 OR of the occurrence of catastrophic health expenditure for each level of the socioeconomic status (SES) to the lowest group during 2011–2013 (multilevel logistic regression‡)

	2011	2013
SES indicator	OR (95% CI)	OR (95% CI)
Education (ref: primary school)		
Middle school	0.99 (0.78 to 1.26)	1.07 (0.86 to 1.33)
High school	0.95 (0.65 to 1.38)	1.15 (0.83 to 1.58)
Vocational school and above	0.94 (0.64 to 1.40)	0.84 (0.59 to 1.19)
Occupation (ref: agricultural activities)		
Employed	1.07 (0.75 to 1.52)	1.02 (0.74 to 1.42)
Self-employed	0.75 (0.48 to 1.18)	0.76 (0.54 to 1.08)
Retired/receded	1.05 (0.76 to 1.46)	1.34 (1.00 to 1.78)
Unemployed	1.42 (1.13 to1.79)*	1.30 (1.06 to 1.60)*
Household expenditure (ref: the lowest 20%)		
Lower 20%	1.05 (0.81 to 1.37)	0.73 (0.57 to 0.94)*
Middle 20%	0.71 (0.54 to 0.93)*	0.59 (0.46 to 0.76)*
Higher 20%	0.55 (0.42 to 0.73)*	0.53 (0.41 to 0.68)*
Highest 20%	0.42 (0.31 to 0.56)*	0.43 (0.33 to 0.55)*
Urban/rural (ref: rural)		
Urban	0.61 (0.47 to 0.80)*	0.86 (0.68 to 1.09)
Random effect		
SD†	0.472	0.405

*P<0.05.
†Stata only reports SD for multilevel logistic regression.
‡Variables adjusted in the model include: (1) individual level: age, sex, marital status, NCD co-occurrence and (2) community level: population size, per capita annual net income, regional location (east/middle/west part of China), availability of healthcare services and transportation condition.

urban-rural difference when designing health cost-control strategies, and emphasise the need to understand and examine variation in health expenditure among different patient groups with CVD.

Although we used nationally representative household survey data to estimate health expenditure among patients with CVD and show an association with SES, our study also had some limitations. First, we estimated the average OOP payment of patients with CVD over 12 months who self-reported that their last medical visit was for a CVD. It is possible that additional patients with CVD were not included (because their last medical visit was not CVD-related), thus leading to an underestimation in actual CVD-related costs for patients. It is also possible some patients visited the doctor for co-occurring diseases, which could lead to an overestimation of cost. Second, the natural ageing process of the followed-up patients, the price fluctuation in health cost, along with currency inflation could potentially have influenced patients' healthcare cost between 2011 and 2013. Third, given that, at the time of analysis, CHARLS had only released its full 2011 and 2013 survey data (part of the 2015 follow-up data has been released in 2017), we only captured the data in 2 years and were therefore unable to evaluate the long-term effects of the current medical insurance scheme. Since CHARLS is a household survey and all cost variables were self-reported data, a further parallel study using health administrative databases could help to better understand the changing trend of OOP payment among patients with CVD with different SES features.

Compared with the two other studies conducted in China that estimated the direct cost of patients with CVD, our estimations of the annual medical cost were in the middle: Wang *et al* reported the average cost per CVD hospitalisation in 2012 was 2236.29 USD (around 14 700 RMB) in Shanghai alone[25]; Liu *et al* estimated the annual financial burden of patients with CVD in urban areas was 8569.3 RMB (1320 USD) using a nationwide household survey conducted between 2007 and 2011.[26] Such differences could be influenced by the price factor as well as the sampling areas. As mentioned earlier, only those whose reason for their last medical visit was CVD were included. This could lead to us having underestimated individual annual cost while also potentially missing some genuine patients with CVD. Furthermore, unlike the aforementioned papers, our analysis used national data from *both* urban and rural areas, which could impact the estimated direct cost, relative to other studies. The readers should thus be cautious when comparing the present results directly to other studies.

An unexpected finding from our study is that annual cost for outpatient service is higher than annual cost for inpatient service among these patients with CVD. Normally, the relatively high cost for a CVD inpatient service, like coronary artery bypass or cerebral artery bypass, would incur higher OOP payment for CVD inpatient service than for outpatient services. Our results could be explained by the fact that patients with CVD had much higher utilisation of outpatient service (as compared with inpatient services), higher deductibles and copayment rate and a lower maximum reimbursement limit. To date, some insurance schemes do not cover outpatient services in certain provinces. In general, the Chinese basic medical insurance schemes do not address the demand for frequent outpatient visits among patients with chronic conditions (Yip and Hsiao, 2009).[14]

Previous studies have reported that patients from wealthier households have more access to health services, and are more likely to both use the services and stick with treatment plans because financial hardship is not a barrier to this group.[27–29] Our study similarly found that patients with CVD with higher SES levels were more likely to spend more on health services and medication, and had lower odds of encountering catastrophic spending when compared with the lowest level. It was a reasonable conjecture that the poor have limited access to healthcare services as well as a higher tendency to not visit a doctor because of financial hardships when encountering

chronic illness.[30] Jian *et al* also found that rural Chinese people with chronic diseases were two times more likely to drop out of treatment because of financial difficulties than those from urban areas.[31] In this study, we also found that rural patients were less likely to use inpatient services compared with urban patients, but no significant difference was observed regarding outpatient care. On one hand, due to the fact that health resources tend to gather in economically developed areas in China, it is hard for patients living in rural and remote areas to get access to appropriate health services.[32] On the other hand, patients with a higher economic status in China have higher payment capacity, and hence, they are more likely to use health services when in need.[15] Indeed, although there is more governmental subsidisation directed towards patients with CVD who need inpatient services, the utilisation among the rural patients is lacking. This defeats the goal of the basic medical insurance introduced by the Chinese government.

Although the existing inequality of disease burden across different SES groups is acknowledged, the Chinese medical insurance system is still somewhat *pro-rich*. Our findings show that, with regard to inpatient service costs only, patients from the poorest households had the highest actual copayment rate of 70%, whereas the wealthiest had only 56%. Besides direct medical costs, people living in lower SES communities, which in most cases also lack advanced medical centres, have to spend more money on transportation or accommodation in order to receive appropriate healthcare.[18] In our study, rural patients spent 200 Yuan (30 USD) more than their rural counterparts on indirect cost to receive inpatient service. Thus, policymakers should take indirect medical costs into consideration when re-allocating health resources, and work towards lowering copayment rates among the poor.

One positive finding from this study is that the different odds of encountering CHE between urban and rural CVD households was only significant in 2011, but not in 2013. This could be in part due to the efforts of the 2009 Chinese health reform in China, which invested resources to strengthen the primary healthcare system (eg, increasing community health centres and village clinics). It also might be due to the process of merging the two basic medical insurance schemes, URBMI and NRCMI. This is currently being piloted in several cities. The aim of this merge is to provide identical insurance schemes to both urban unemployed residents and rural residents. It should be pointed out that although almost all the provinces adopt the structure of three basic insurance schemes, the benefit design regarding copayment rate, deductibles and covered services might vary greatly across provinces and even cities in one province. Citizens from richer provinces normally have better insurance schemes, as well as more accessible and higher quality of health services. This is partly due to the political development and enactment of medical insurance schemes. Briefly, the Chinese Central Government devises general national health policies and guidance documents, then the individual province government enacts its own specific health policies and guidance (eg, copayment rate, annual maximum limit). Thus, the healthcare benefits may vary by province. Future studies should build on our work by doing a cross-comparison of provincial policies and its association with CVD inpatient and outpatient services by employment, economic and education status.

Although the results from this study could not be generalisable to the general patient population in China, neither could it represent patients with CVD as a whole, our results of cost analysis and its association with patients' SES reveal an unfortunate fact: the current health system in China still has health inequity across different income-groups for patients with chronic diseases like CVD. The medical insurance scheme structure hinders the poor from obtaining adequate health services, while increasing the likelihood of financial burden due to disproportionate health expenditure.[33] Reasons behind the insufficient implementation of such national policies might include lack of health professionals in primary care centres and in rural areas, relatively shallow benefit design of the three basic medical insurance schemes and incomplete transformation from the hospital-centred system to a primary care-based delivery system.[34] Much is still to be desired with regard to our understanding of how to effectively alleviate medical financial risk for the poor. We implore that more research be conducted in this area.

CONCLUSION

In conclusion, through using nationally representative data from CHARLS, this study has provided the cost estimation for patients with CVD and investigated whether, and to what extent, an individual's SES level and community conditions were associated with health expenditure. The findings suggest that wealthier people spend more money on the health services but are less likely to encounter CHE. Accumulatively, patients with CVD have higher financial burden for outpatient service (which they use overwhelmingly more) as compared with that for inpatient service. The medical insurance scheme should be more financially balanced between outpatient and inpatient care, which could provide better financial risk protection to patients with chronic conditions. There is a need for Chinese policymakers to alter current pro-rich medical insurance policies to ensure that the poor can access essential health services without having to worry about incurring *or* worsening financial hardship.

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Patient consent Detail has been removed from this case description/these case descriptions to ensure anonymity. The editors and reviewers have seen the detailed information available and are satisfied that the information backs up the case the authors are making.

Ethics approval CHARLS was approved by the Ethical Review Committee (IRB) at Peking University, Beijing, China.

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Data sharing statement Technical appendix, statistical code and dataset available from the CHARLS repository, http://charls.pku.edu.cn.

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