

# BMJ Open Socioeconomic determinants of out-of-pocket pharmaceutical expenditure among middle-aged and elderly adults based on the China Health and Retirement Longitudinal Survey

Jinglin Du,<sup>1</sup> Xue Yang,<sup>1</sup> Mingsheng Chen,<sup>1,2</sup> Zhonghua Wang<sup>1,2</sup>

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<sup>1</sup>School of Health Policy and Management, Nanjing Medical University, Nanjing, China

<sup>2</sup>Creative Health Policy Research Group, Nanjing Medical University, Nanjing, China

**Correspondence to**  
Dr Zhonghua Wang;  
wzh04@njmu.edu.cn

## ABSTRACT

**Objective** Out-of-pocket pharmaceutical expenditure (OOPPE) is a considerable burden for middle-aged and elderly adults due to their high prevalence of diseases, insufficient income and absence of medical insurance in China. The objective of this study was to assess the determinants of OOPPE among Chinese middle-aged and elderly adults.

**Methods** This is a cross-sectional study based on the China Health and Retirement Longitudinal Survey conducted in 2015. The Andersen behavioural health model was used to select the factors. Binary multivariable logistic and generalised linear regressions were both applied to examine the determinants of OOPPE.

**Results** Of the respondents, 15.28%, 5.20% and 51.35% reported an OOPPE for outpatient services, inpatient services and self-medication, respectively. The OOPPE for outpatient services, inpatient services and self-medication was US\$6.66, US\$17.93 and US\$15.32, respectively. Increased age significantly influenced the likelihood of OOPPE, and older people (aged >65 years) had lower OOPPE for outpatient services. Having health insurance significantly reduced the likelihood of OOPPE for outpatient and inpatient services but increased OOPPE for self-medication. In general, compared with the low-income group, higher income groups had a significantly lower likelihood of having an OOPPE, and when they did the amounts were less. Generally, middle-aged and elderly people with poor self-reported health status, limitation of daily activities, and critical or chronic diseases had a significantly higher likelihood of having an OOPPE and at a significantly higher amount.

**Conclusion** Policy-making efforts should focus on reducing self-medication OOPPE and alleviating its associated socioeconomic determinants to ease the economic burden of diseases among middle-aged and elderly adults in China.

## INTRODUCTION

While overall health, average income and life expectancy have improved worldwide over recent decades, the quality of life in older individuals has not generally followed suit.<sup>1</sup> Ageing on average is associated with an increased prevalence of non-communicable

## Strengths and limitations of this study

- This study focused on a considerable economic burden of disease, out-of-pocket pharmaceutical expenditures (OOPPEs), rather than the total cost or out-of-pocket expenditure for health services.
- The China Health and Retirement Longitudinal Survey is the first national and representative survey of Chinese middle-aged and elderly adults.
- This was the first analysis of OOPPEs among Chinese middle-aged and elderly people with chronic diseases.
- Indicators were obtained without considering the impact of household factors on OOPPE.

chronic diseases (NCDs) and complex medical conditions, indicating that the demand for healthcare services will continue to rise. A short supply of medical specialists and inequity in resource distribution further reduce access to healthcare of the most vulnerable patients.<sup>2-3</sup> In addition, older patients typically have greater healthcare and medication needs than the younger population.<sup>4</sup> Previous studies have reported that healthcare utilisation, drug consumption and medical expenditure of elderly populations are all higher than in the general population.<sup>5-7</sup> The most recent projections of the Organisation for Economic Co-operation and Development (OECD) regarding the impact of population ageing on public expenditures suggest that health and long-term care will account for about half of the increase in age-related social costs between 2000 and 2050.<sup>8</sup> Such ever-increasing costs already overburden the elderly, even resulting in catastrophic health expenditure (CHE) and poverty.<sup>9-10</sup> The definition of CHE is that a family's medical expenditure is equal to or more than 40% of the family's affordability.

Although an equitable financial system can protect households from suffering from a CHE,<sup>11 12</sup> it is unable to provide all required health services for free. The out-of-pocket expenditure (OOPE) thus remains a source of CHE and poverty.<sup>13</sup> Out-of-pocket expenditure means the direct payment of money that may or may not be later reimbursed from a third-party source. Furthermore, out-of-pocket pharmaceutical expenditure (OOPPE), in particular, accounts for a high proportion of the total OOPE. According to data obtained from OECD member states, the out-of-pocket share of the total pharmaceutical spending (41% in 2011) is more than twice as much as the out-of-pocket share of the total healthcare spending.<sup>14</sup> High OOPPE is a burden for people, especially the older populations whose medication use and medication expenditures have been rising faster with the increase in the prevalence of chronic diseases.<sup>15</sup> OOPPE can be classified according to the type of medical services provided or the reimbursement policy. Sanwald and Theurl<sup>16</sup> classified OOPPE into three types: one involving over-the-counter (OTC) medicines obtained by self-medicating individuals, another involving medicines prescribed by a physician and pharmaceuticals not covered by insurance, and a third type involving pharmaceuticals covered by insurance that only needed a copayment on dispensing. Park *et al* estimated the OOPPE of outpatients,<sup>6</sup> while Tobe *et al*<sup>17</sup> quantified the extent to which beneficiaries of the National Health Insurance Program incurred out-of-pocket medical expenses for inpatient care. Some studies used an absolute value while others applied the relative ratio of OOPPE as a portion of family drug expenses or total household health expenditure when calculating OOPPE.<sup>6 16 18</sup>

As OOPPE is a form of health outcome, it can be influenced by demographic or socioeconomic factors such as age, gender, marital status, education, health insurance and location of residence. Rovira and Habibov<sup>19 20</sup> found that health status, economic standing, possession of health insurance and other demographic factors were strong determinants of OOPPE both in Catalonia and Tajikistan. Health insurance certainly plays an important role in pharmaceutical expenditure. Look and Arora<sup>21</sup> examined short-term changes in prescription drug use and expenditure after implementation of the Affordable Care Act and expansion of health insurance coverage in the young adult population of the USA. They found that out-of-pocket drug expenditure subsequently decreased by 30% in this age group.<sup>21</sup> Park *et al* and Kim *et al*<sup>7</sup> compared the OOPPE between patients covered by national health insurance and medical aid recipients, reporting the OOPPE of national health insurance participants to be lower than that of medical aid recipients. Other health factors such as morbidity (especially of chronic diseases) can contribute to an increase in OOPPE. Rodbard *et al*<sup>22</sup> found that individuals with type 2 diabetes mellitus (T2DM) had a significantly larger total number of prescriptions and higher OOPPE both annually and monthly in comparison with respondents

without T2DM. Furthermore, as the number of chronic diseases increased, OOPPE of patients was also found to increase.<sup>6 20</sup>

More than 30% of adults in China are over 50 years of age, and this proportion is expected to approach 40% by 2050.<sup>23</sup> Although China instituted universal health coverage over the last several decades,<sup>24</sup> elderly people, as a vulnerable group, are more prone to greater medical expenditures due to a high prevalence of diseases, insufficient income and absence of social security mechanisms in this population.<sup>10</sup> In addition, serious health conditions often cause poverty in this group. Although some prior studies have examined OOPPE worldwide, most have focused on whole adult populations rather than specific and more vulnerable groups. With the rapid ageing of the population, reducing the financial burden of elderly patients has become of vital importance in China. As the major component of OOPE, it is necessary to examine OOPPE as well as related factors among elderly adults. The aim of the present study was to calculate the OOPPE according to various types of health services and to estimate the determinants of OOPPE among middle-aged and elderly Chinese adults to provide evidence to policymakers and address the economic burden of disease associated with an ageing society.

## DATA AND METHODS

### Data source

This study used data from the China Health and Retirement Longitudinal Survey (CHARLS), conducted and directed by the National School of Development of Peking University. This survey, which included people from 150 counties in 28 provinces, constructed a high-quality, nationally representative sample of Chinese community-dwelling adults for research purposes concerning the elderly. The national baseline of the survey was conducted in 2011, and detailed information pertaining to 17 708 individuals  $\geq 45$  years of age from 10 257 households was obtained. The follow-up study was carried out every 2 years; 15 180 individuals responded to the survey in 2015. Data from 2015 were used in our study.

County-level units (counties or urban districts) were sampled directly. These counties covered 28 of 30 provinces in mainland China, excluding Tibet. Village and community units within county units were chosen with the help of the National Bureau of Statistics, using recently updated village-level population data. The sample used administrative villages (cun) in rural areas and neighbourhoods (shequ) in urban areas as primary sampling units (PSUs). Three PSUs were selected within each county-level unit, using probability proportional to size sampling, to select a total of 450 PSUs. Household units were selected from each PSU. The sampling frame was constructed using Google Earth base maps, and a computer-assisted personal interview program was then used to sample households and to conduct interviews via laptop computers. The OOPPE for outpatient, inpatient

and self-medication was recalled by participants combined with their receipts during the health services.

The survey questionnaire collected information on demographic backgrounds, family, health status, health-care and insurance, occupation, retirement and pension, income, expenditure, and assets. OOPPE was calculated from the provided data, and related information was extracted as well.

### Patient and public involvement

On the basis of 450 PSUs, households were randomly selected by CHARLS-Geographic Information System (GIS) software. Individuals over 45 years old and their households were identified. The participants provided written informed consent before participating in the study. Patients and the public were not involved in the study analysis.

### Variable selection

The independent variable OOPPE can be classified according to the type of medical service provided. For our study, we considered outpatient, inpatient and self-medicated OOPPE types. Self-medication mainly refers to the purchase of medicine in pharmacies, such as prescription medicine, OTC medicine, Chinese traditional herbs and health supplement. The definitions of the three types of OOPPE are given in [table 1](#).

Independent variables were selected based on the Andersen healthcare utilisation model. This model has guided systematic investigations into factors that lead to use of healthcare services, including predisposing, enabling and need factors. Andersen's model has been widely used to elucidate utilisation of healthcare services since it was created in the late 1960s.<sup>25</sup> Predisposing factors include demographics (age, gender and marital status), health beliefs (values or attitudes related to health and illness) and social structure (acculturation, immigration and literacy). In this study, predisposing factors included age, gender, marital status and education. Enabling factors included personage, household and resource characteristics permitting healthcare accessibility to individuals. Thus, household income level, individual health insurance and place of residence were considered as enabling factors in this study. Need factors were related to either perceived need for care or as diagnosed or evaluated by a healthcare professional. Perceived need was measured by self-reported health. Evaluated or diagnosed need was considered as a health status determined by physicians and involved specific indicators, such as the presence of chronic or critical disease, body mass index (BMI), limitations in activities of daily living and limitations in instrumental activities of daily living. Smoking and drinking are also included as components of need factors.

### Data analysis

The OOPPE for outpatient, inpatient and self-medication was calculated based on data obtained from the questionnaires. Outpatient OOPPE was the amount

spent on physician visits as reported by individuals over the past month. Inpatient OOPPE included the cost of hospitalisation reported by individuals over the past year. Self-medication OOPPE was the amount reported paid by individuals for OTC medications over the past month.

Logistic regression and multiple linear regression models were conducted to evaluate how the three kinds of factors affect the likelihood and amount of OOPPE, respectively. The likelihood of an OOPPE was dichotomised into 0='reported no OOPPE' and 1='reported OOPPE'. Amounts of OOPPE were processed using a log (U) function to avoid data non-stationarity. The regression of OOPPE for outpatient, inpatient and self-medication was conducted separately. Individual sampling weight was corrected by non-response based on household sampling weight. Individual weight and family weight were constructed by inverse probability weighting factor. All independent variables were categorised into predisposing, enabling and need factors, which were then processed as dummy variables. Dependent and independent variables are described in [table 1](#).

The follow-up 2015 survey included a total of 15 180 participants. Respondents with any missing variables were excluded to ensure an accurate analysis. A final number of 9932 participants were enrolled in this study.

## RESULTS

### Basic information of samples

Descriptive statistics of the samples evaluated are shown in [table 2](#). The numbers and percentages of respondents who reported outpatient, inpatient and self-medication OOPPE were 1518 (15.28%), 516 (5.20%) and 5100 (51.35%), respectively. Among individuals included in the survey, 27.54% were >65 years of age and 10.96% had received at least a secondary education. Only 4.82% did not participate in basic health insurance, and 78.29%, 10.44% and 4.38% of respondents were enrolled in New Cooperative Medical Insurance (NCMI), Urban Employee Medical Insurance (UEMI) and Urban Resident Medical Insurance (URMI), respectively. Of the individuals, 76.15% were concentrated in a low-income group (US\$0–US\$1639), and nearly 65% of middle-aged and elderly people lived in the countryside. Most elderly individuals surveyed did not report limitation in daily or instrumental activities of daily living. Nearly half of the middle-aged and elderly individuals surveyed had a BMI of greater than 24, signifying obesity. All three types of OOPPE (outpatient, inpatient and self-medication) revealed the sample distribution of each variable to generally follow the same trend of the overall sample distribution.

### OOPPE for outpatient services, inpatient services and self-medication

As shown in [table 3](#), the OOPPEs for outpatient services, inpatient services and self-medication of the 9932 individuals were US\$6.66, US\$17.93 and US\$15.32, respectively.

**Table 1** Description for the dependent and independent variables

	Categories	Indicators/Survey questions
<b>Dependent variables</b>		
OOPPE for outpatient	Reported out-of-pocket expenditure for outpatient services. The amount of OOPPE for outpatient services.	How much will you eventually pay out-of-pocket for the medications, including prescriptions obtained during your most recent physician visits last month?
OOPPE for inpatient	Reported out-of-pocket expenditure for inpatient services. The amount of OOPPE for inpatient services.	How much did you pay out-of-pocket for medication costs during your most recent inpatient care last year?
OOPPE for self-medication	Reported out-of-pocket expenditure for self-medication. The amount of OOPPE for self-medication.	How much did you pay out-of-pocket for self-medication last month?
<b>Independent variables</b>		
Predisposing factors		
Age	≤50/50–65/>65	
Gender	Male/Female	
Education	Less than lower secondary Upper secondary and vocational training Tertiary	What is the highest level of education you obtained?
Marital status	Married/Partnered Separated/Divorced/Widowed/Single	What is your marital status?
Enabling factors		
Insurance	No social health insurance Urban Employee Medical Insurance (UEMI) Urban Resident Medical Insurance (URMI) New Cooperative Medical Insurance (NCMI) Urban and Rural Resident Medical Insurance (URRMI)	Are you the policy holder/primary beneficiary of any of the types of health insurance options listed below?
Income	Low-income group (≤US\$1639) Median-income group (US\$1639–US\$8197) High-income group (>US\$8197)	Total income includes money earned by labour, pension and money provided as support by relatives over the past year.
Living	Rural/Urban	
Need factors		
Self-reported health	Very good/Good/Fair/Poor/Very Poor	Would you say your health is very good, good, fair, poor or very poor?
ADL	Without ADL/with any ADL	Respondents reported any problems with activities including dressing, bathing, eating, getting in or out of bed, using the toilet, controlling urination and defaecation.
IADL	Without IADL/with any IADL	Respondents reported any problems with instrumental activities including managing money, taking medications, shopping for groceries, preparing meals, cleaning the house and making phone calls.
Chronic diseases	No chronic diseases One chronic disease Multiple chronic diseases	Have you been diagnosed with any common chronic diseases (hypertension, dyslipidaemia, diabetes, stroke)?
Critical disease	No critical disease One or multiple critical diseases	Have you been diagnosed with any critical diseases (cancer, stroke, psychiatric problems, heart attack)?
BMI	<18.5/18.5–24/≥24	BMI (calculated as weight divided by height squared).

Continued

Table 1 Continued

	Categories	Indicators/Survey questions
Drinking	Never drank/ever drank	Respondent reported whether they drank alcoholic beverages in the past.
Smoking	Never smoked/ever smoked	Respondent reports whether they smoked in the past.

The UEMI for those who were employed in the urban sector was formally established in 1998. After this, the NCMI for rural residents as well as URMI covering urban residents who had no formal employment were introduced in 2003 and 2007, respectively. In 2012, the integration of URMI and NCMI was gradually carried out nationwide to form URRMI. ADL, activities of daily living limitations; BMI, body mass index; IADL, instrumental activities of daily living limitations; OOPPE, out-of-pocket pharmaceutical expenditure.

Predisposing factor analysis revealed that individuals aged 50–65 preferred to pay for outpatient services and self-medication. The highest OOPPE for inpatient services was found to have been spent by individuals younger than 50. Compared with men, women paid slightly higher amounts for outpatient and inpatient services. Middle-aged and elderly adults who had a tertiary education paid more for self-medication but less for outpatient services. Individuals who had an upper secondary and vocational training level of education paid the highest for inpatient services, the mean of which was 17.93. Compared with separated, divorced, widowed or single persons, the cost paid by married or partnered persons for outpatient services, hospitalisation and self-medication was relatively high.

Analysis of enabling factors revealed that those enrolled in URMI paid the highest OOPPE for outpatient services. The lowest amount was paid by persons enrolled in Urban and Rural Resident Medical Insurance (URRMI). Individuals enrolled in URMI paid the highest cost for hospitalisation and self-medication. The high-income group paid a greater amount of cost for outpatient services and self-medication, but the low-income group paid the highest cost for inpatient care. Urban residents paid a higher amount of cost for inpatient services and self-medication. However, they paid a slightly lower cost for outpatient care than did rural residents.

Analysis of the need factors revealed that the OOPPE for outpatient care, hospitalisation and self-medication generally increased as the level of self-reported health decreased from 'very good' to 'very poor'. The costs borne by individuals who reported their health to be poor were about four to nine times as much as those who reported excellent health. Individuals who are not restricted in daily activities paid much less money for self-medication than those who were restricted, as did persons with or without limitations in instrumental activities of daily living. Individuals with one or multiple chronic diseases paid a greater cost for outpatient care, hospitalisation and self-medication, and those who suffered from multiple chronic diseases or had critical diseases paid more for medicine than those with only one chronic disease or without critical diseases. Middle-aged and elderly adults who were obese and reported unhealthy living habits

(such as drinking) also had higher cost than those who lived healthier lifestyles.

### Result of logistic regression on the OOPPE incidence

Table 4 shows the results of the applied binary logistic regression on the likelihood of an OOPPE among middle-aged and elderly adults. Among the predisposing factors, age significantly affected the likelihood of an OOPPE for any type of healthcare. Compared with younger middle-aged people (age  $\leq 50$ ), older individuals had a lower likelihood of having an OOPPE. Most enabling factors were predicted to significantly impact the likelihood of an OOPPE. Specifically, enrolment in social health insurance schemes significantly reduced the likelihood of having an OOPPE for outpatient and inpatient care among middle-aged and elderly people. Furthermore, among the three kinds of social health insurance schemes available, persons enrolled in URRMI had the lowest likelihood of OOPPE (OR=0.42; OR=0.34). Compared with participants in UEMI, those enrolled in resident health insurance (both NCMI and URMI) had a relatively lower likelihood of having any OOPPE. In addition, middle-aged and elderly adults with higher income were found to have a lower likelihood of any OOPPE in comparison with those in the low-income group. Apart from some life habit indicators, other need factors were all found to significantly associate with an OOPPE. Compared with those who reported their health to be 'very good', middle-aged and elderly persons with 'poor' and 'very poor' self-reported health levels were found to have a high likelihood of having an OOPPE for outpatient care and self-medication. Individuals with a self-reported health that was 'good' and 'fair' demonstrated a lower likelihood of OOPPE for inpatient services. Individuals who were limited in their daily activities and suffered from chronic diseases were found to have a higher likelihood of OOPPE for outpatient care and self-medication. Individuals afflicted with chronic or critical diseases exhibited a higher likelihood of OOPPE for outpatient care, inpatient care and self-medication, and the likelihood increased as the number of chronic diseases suffered by individuals increased. Middle-aged and elderly adults with a normal BMI were found to have a lower likelihood of OOPPE involving any types of health services.

**Table 2** Description of sample

	Total N=9932	OOPPE for outpatient services n=1518	OOPPE for inpatient services n=516	OOPPE for self- medication n=5100
<b>Predisposing factors</b>				
Age (%)				
≤50	17.91	17.90	14.53	17.80
50–65	54.55	54.30	51.94	55.50
>65	27.54	27.90	33.53	26.70
Gender (%)				
Male	46.89	40.30	48.06	45.60
Female	53.11	59.70	51.94	54.40
Education (%)				
Less than lower secondary	89.05	89.70	87.60	89.30
Upper secondary and vocational training	9.57	9.30	10.66	9.40
Tertiary	1.39	1.10	1.74	1.30
Marital status (%)				
Married/Partnered	87.55	86.60	87.02	88.10
Separated/Divorced/Widowed/Single	12.45	13.40	12.98	11.90
<b>Enabling factors</b>				
Insurance (%)				
No basic insurance	4.82	4.30	3.49	3.90
UEMI	10.44	9.80	10.85	10.20
URMI	4.38	3.90	4.46	4.80
NCMI	78.29	80.10	79.26	78.90
URRMI	2.06	1.90	1.94%	2.20
Income (%)				
Low-income group	76.15	79.30	80.43	77.20
Median-income group	18.63	15.70	14.92	18.40
High-income group	5.23	4.90	4.65	4.40
Living (%)				
Rural	64.86	65.20	62.79	64.30
Urban	35.14	34.80	37.21	35.70
<b>Needing factors</b>				
Self-reported health (%)				
Very good	8.00	3.20	4.46	5.40
Good	13.95	5.50	8.14	11.00
Fair	53.13	49.10	40.89	52.70
Poor	20.18	34.10	33.72	24.70
Very poor	4.73	8.10	12.79	6.20
ADL (%)				
Without ADL	83.08	75.20	75.78	79.50
With any ADL	16.92	24.80	24.22	20.50
IADL (%)				
Without IADL	77.63	70.40	66.86	75.60
With any IADL	22.37	29.60	33.14	24.40

Continued

Table 2 Continued

	Total N=9932	OOPPE for outpatient services n=1518	OOPPE for inpatient services n=516	OOPPE for self- medication n=5100
<b>Chronic diseases (%)</b>				
No chronic diseases	60.16	49.70	42.64	52.40
One chronic disease	27.44	31.40	31.20	31.30
Multiple chronic diseases	12.40	18.80	26.16	16.40
<b>Critical disease (%)</b>				
No critical disease	77.03	66.10	56.78	71.60
One or multiple critical diseases	22.97	33.90	43.22	28.40
<b>BMI (%)</b>				
<18.5	5.88	6.90	6.59	5.20
18.5–24	48.99	46.00	46.90	46.50
≥24	45.13	47.20	46.51	48.30
<b>Drinking (%)</b>				
Never drank	55.69	59.40	53.10	55.90
Ever drank	44.31	40.60	46.90	44.10
<b>Smoking (%)</b>				
Never smoked	57.68	63.90	58.33	58.30
Ever smoked	42.32	36.10	41.67	41.70

Calculations were weighted using individual sampling weights and adjusted for household and individual responses.

ADL, activities of daily living limitations; BMI, body mass index; IADL, instrumental activities of daily living limitations; NCMI, New Cooperative Medical Insurance; OOPPE, out-of-pocket pharmaceutical expenditure; UEMI, Urban Employee Medical Insurance; URMI, Urban Resident Medical Insurance; URRMI, Urban and Rural Resident Medical Insurance.

### Result of multiple regression model evaluation of OOPPE

Data obtained from multiple regression model analysis of OOPPE amounts are presented in table 5. The goodness of fit of regression of the OOPPE for outpatient, inpatient and self-medication was 0.51, 0.42 and 0.93, respectively. Among individuals with predisposing factors, older people (age >65) were found to have a lower amount of OOPPE for outpatient care. Women had significantly higher cost for outpatient services, but lower amounts for inpatient care in comparison with men. Individuals with a higher level of education paid a greater amount of OOPPE for inpatient services and self-medication. In addition, the amount of OOPPE for self-medication was significantly higher in the married or partnered population. The presence of enabling factors revealed a significantly positive correlation between possession of social health insurance and OOPPE, implying that participation in health insurance significantly increased OOPPE. Individuals covered by the NCMI paid significantly higher amounts for all three kinds of OOPPE in comparison with those without health insurance. Individuals covered by UEMI, URMI and URRMI spent greater OOPPE on self-medication, and coefficients were estimated to be greater than those of OOPPE for outpatient or inpatient services. Compared with the low-income group, the median-income and high-income groups were significantly

associated with lower amounts of OOPPE for inpatient services and self-medication. Respondents living in urban areas spent more on OOPPE involving self-medication. Persons whose self-reported health status was poor or very poor paid the highest for all three kinds of OOPPE. Individuals with physical or instrumental limitations were also significantly associated with high OOPPE. Furthermore, as chronic diseases increased in individuals, their cost for all types of healthcare increased. This effect was estimated to be greatest in OOPPE for self-medication. Individuals suffering from critical diseases were also found to have higher OOPPE. BMI also positively associated with OOPPE for self-medication. Drinkers paid significantly more OOPPE for inpatient services, while smokers paid less.

### DISCUSSION

As the prevalence of NCDs in the older population increases, the demand for health utilisation also increases. As the Chinese population continues to age, CHE and impoverishment due to medical costs will become increasingly widespread. While many studies evaluated factors affecting health and out-of-pocket costs rather than OOPPE itself, especially among vulnerable groups, this study aimed to evaluate OOPPE in middle-aged

**Table 3** OOPPE among middle-aged and elderly individuals (US\$)

	OOPPE for outpatient services		OOPPE for inpatient services		OOPPE for self-medication	
	Mean	SD	Mean	SD	Mean	SD
<b>Predisposing factors</b>						
<b>Age</b>						
≤50	6.40	39.07	24.10	440.03	12.68	42.02
50–65	6.86	82.72	15.23	120.97	16.02	52.03
>65	6.43	50.33	19.25	178.76	15.66	48.02
<b>Gender</b>						
Male	6.39	84.25	17.00	131.73	14.56	50.03
Female	6.90	50.89	18.75	285.61	15.99	48.62
<b>Education</b>						
Less than lower secondary	6.68	71.50	15.59	138.22	14.64	46.17
Upper secondary and vocational training	6.98	39.50	37.69	595.90	20.95	71.71
Tertiary	2.94	10.99	31.78	184.15	20.32	50.71
<b>Marital status</b>						
Married/Partnered	6.69	70.93	18.39	237.36	15.62	50.53
Separated/Divorced/Widowed/Single	6.42	49.02	14.71	130.93	13.19	39.42
<b>Enabling factors</b>						
<b>Insurance</b>						
No basic insurance	5.42	40.83	14.93	130.78	11.99	36.27
UEMI	7.23	48.86	20.35	150.62	22.34	65.45
URMI	7.71	41.19	60.84	873.59	23.64	73.98
NCMI	6.67	74.06	15.54	137.16	14.02	45.35
URRMI	4.06	16.86	12.00	69.86	19.22	53.61
<b>Income</b>						
Low-income group	7.16	76.19	19.10	251.37	14.76	48.23
Median-income group	4.20	19.80	14.22	121.98	16.81	49.96
High-income group	8.16	63.24	14.01	104.49	18.22	60.61
<b>Living</b>						
Rural	7.07	76.59	16.06	143.51	13.44	43.75
Urban	5.89	50.56	21.37	329.28	18.80	57.99
<b>Needing factors</b>						
<b>Self-reported health</b>						
Very good	4.47	58.82	9.28	73.71	5.07	17.40
Good	1.12	10.65	10.12	98.48	7.48	24.34
Fair	4.83	35.09	12.47	105.87	12.97	41.85
Poor	13.90	132.41	26.41	194.12	25.37	67.32
Very poor	16.37	64.93	80.70	871.68	39.32	93.15
<b>ADL</b>						
Without ADL	5.85	66.58	16.90	237.72	13.48	45.28
With any ADL	10.61	77.56	22.97	163.15	24.36	64.74
<b>IADL</b>						
Without IADL	5.99	69.20	16.38	243.99	13.60	44.47
With any IADL	8.99	66.34	23.32	153.04	21.27	62.86
<b>Chronic diseases</b>						

Continued



Table 3 Continued

	OOPPE for outpatient services		OOPPE for inpatient services		OOPPE for self-medication	
	Mean	SD	Mean	SD	Mean	SD
No chronic diseases	4.96	69.49	16.50	274.38	11.28	44.04
One chronic disease	8.26	74.02	13.77	93.87	17.92	49.81
Multiple chronic diseases	11.34	48.43	34.07	173.07	29.18	66.39
Critical disease						
No critical disease	4.49	58.79	12.52	131.17	11.50	40.52
One or multiple critical diseases	13.94	93.93	36.06	407.40	28.14	69.70
BMI						
<18.5	6.72	37.94	16.85	101.96	13.93	47.66
18.5–24	5.48	64.46	17.66	289.44	12.92	41.31
≥24	7.93	75.65	18.36	147.41	18.11	56.75
Drinking						
Never drank	6.33	47.57	17.49	272.39	15.23	44.49
Ever drank	7.07	88.16	18.48	151.29	15.43	54.73
Smoking						
Never smoked	6.31	47.87	20.19	280.29	15.56	48.52
Ever smoked	7.13	89.40	14.85	120.44	15.00	50.31
Total	6.66	68.58	17.93	226.84	15.32	49.29

Calculations were weighted using individual sampling weights and adjusted for household and individual responses.

ADL, activities of daily living limitations; BMI, body mass index; IADL, instrumental activities of daily living limitations; NCMI, New Cooperative Medical Insurance; OOPPE, out-of-pocket pharmaceutical expenditure; UEMI, Urban Employee Medical Insurance; URMI, Urban Resident Medical Insurance; URRMI, Urban and Rural Resident Medical Insurance.

and elderly individuals. Results suggested that socioeconomic factors influenced the likelihood and amounts of OOPPE for outpatient services, inpatient services and self-medication.

#### OOPPEs for outpatient, inpatient and self-medication have huge difference

In this study, 15.28%, 5.20% and 51.35% of respondents reported an OOPPE for outpatient services, inpatient services and self-medication, and the OOPPEs were US\$6.66, US\$17.93 and US\$15.32, respectively (tables 2 and 3). Noticeable differences were likely determined by types of the health services considered for utilisation by individuals. According to the health statistics of 2015, the number of outpatient visits and hospitalisations was 6.931 billion and 0.185 billion in China in 2015. The incidence of hospitalisation was lower than that of outpatient care or self-medication. Individuals tended to choose the type of health service most in accordance with the severity of their illness and physician advice received. Most mild conditions could be treated using outpatient care or self-medication, which results in a dramatically lower proportion of OOPPE and the mean value was noted. A higher proportion and amount of OOPPE for self-medication in comparison with outpatient services might be explained by middle-aged and elderly adults preferring to use drugs based on health information available to

them and perceptions concerning their conditions rather than physician advice in the setting of mild illness. Poor awareness of the importance of physician visits among this group or irrational allocation of health resources in China may have influenced such behaviour as well.

#### Predisposing factors and OOPPE for outpatient, inpatient and self-medication

Unlike the findings reported by prior studies, our analysis of predisposing factors revealed that older individuals were less likely to pay OOPPE (table 4).<sup>1 16 18 22</sup> Furthermore, elderly individuals 65 years and older paid less OOPPE for outpatient services than did younger adults (table 5). These findings may have been due to elderly individuals not making full, effective use of available health and medication resources. As the age of individuals increased, the likelihood of foregoing care rose due to advanced age, lack of insurance, insufficient income and absence of social safety nets.<sup>4 10</sup> Educated, middle-aged and elderly individuals were found to pay higher OOPPE for inpatient services and self-medication (table 5), indicating that highly educated individuals had better health awareness and were better able to make fuller use of healthcare and treatment options. Married or partnered persons had a higher likelihood of self-medication OOPPE and tended to pay greater amounts (tables 4 and 5), as reported previously.<sup>6 7 16</sup>

**Table 4** Logistic regression on the OOPPE among middle-aged and elderly adults

	OOPPE for outpatient services		OOPPE for inpatient services		OOPPE for self-medication	
	OR	SE	OR	SE	OR	SE
<b>Predisposing factors</b>						
Age, ref: ≤50						
50–65	0.74***	0.05	0.69**	0.08	0.86**	0.05
>65	0.62***	0.06	0.73**	0.10	0.73***	0.05
Gender, ref: male						
	0.75***	0.06	0.47***	0.06	0.86**	0.05
Education, ref: less than lower secondary						
Upper secondary and vocational training	1.01	0.11	1.14	0.18	1.00	0.08
Tertiary	0.76	0.22	1.24	0.47	0.95	0.18
Marital status, ref: married/partnered						
	1.03	0.09	0.89	0.13	0.87**	0.06
<b>Enabling factors</b>						
Insurance, ref: no basic insurance						
UEMI	0.60***	0.09	0.62**	0.14	0.94	0.11
URMI	0.48***	0.08	0.45**	0.12	1.05	0.14
NCMI	0.50***	0.05	0.37***	0.05	0.89	0.07
URRMI	0.42***	0.10	0.34**	0.12	1.02	0.17
Income, ref: low-income group						
Median-income group	0.81**	0.08	0.55***	0.09	0.91	0.06
High-income group	0.89	0.14	0.41***	0.11	0.65***	0.07
Living, ref: rural						
	0.98	0.07	1.04	0.11	1.04	0.05
<b>Needing factors</b>						
Self-reported health, ref: very good						
Good	0.43***	0.06	0.38***	0.08	0.97	0.08
Fair	1.04	0.11	0.47***	0.07	1.38***	0.10
Poor	1.87***	0.21	0.85	0.13	1.95***	0.16
Very poor	1.69***	0.25	1.28	0.25	2.17***	0.27
ADL, ref: without ADL						
	1.25**	0.10	0.93	0.12	1.33***	0.08
IADL, ref: without IADL						
	1.11	0.08	1.23*	0.14	0.98	0.05
Chronic disease, ref: no chronic diseases						
One chronic disease	1.19**	0.08	1.27**	0.14	1.54***	0.08
Multiple chronic diseases	1.32**	0.14	1.89***	0.29	1.91***	0.16
Critical disease, ref: no critical diseases						
	1.32***	0.10	1.61***	0.19	1.18**	0.07
BMI, ref: ≤18.5						
18.5–24	0.49***	0.05	0.43***	0.06	0.84**	0.07
>24	0.49***	0.05	0.40***	0.06	0.94	0.08
Drinking, ref: never drank						
	0.91	0.06	0.97	0.10	1.00	0.05
Smoking, ref: never smoked						
	0.62***	0.05	0.54***	0.07	0.90*	0.05

Estimates were weighted using individual sampling weights and adjusted for household and individual responses.

\*\*\*P<0.001, \*\*p<0.01, \*p<0.05.

ADL, activities of daily living limitations; BMI, body mass index; IADL, instrumental activities of daily living limitations; NCMI, New Cooperative Medical Insurance; OOPPE, out-of-pocket pharmaceutical expenditure; Ref, Reference; UEMI, Urban Employee Medical Insurance; URMI, Urban Resident Medical Insurance; URRMI, Urban and Rural Resident Medical Insurance.

**Table 5** Multiple regression model evaluation of OOPPE among middle-aged and elderly adults

	OOPPE for outpatient services		OOPPE for inpatient services		OOPPE for self-medication	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
<b>Predisposing factors</b>						
Age, ref: ≤50						
50–65	–0.01	0.02	0.01	0.02	0.02	0.03
>65	–0.04*	0.02	0.03	0.02	–0.02	0.03
Gender, ref: male						
	0.04*	0.02	–0.03*	0.01	0.05*	0.02
Education, ref: less than lower secondary						
Upper secondary and vocational training	0.04	0.03	0.05**	0.02	0.06*	0.03
Tertiary	–0.03	0.06	0.09	0.06	0.10	0.09
Marital status, ref: married/partnered						
	0.00	0.02	–0.02	0.02	–0.09**	0.03
<b>Enabling factors</b>						
Insurance, ref: no basic insurance						
UEMI	0.05	0.04	0.06	0.04	0.22***	0.05
URMI	0.05	0.05	0.06	0.04	0.28***	0.06
NCMI	0.06**	0.02	0.05**	0.02	0.19***	0.04
URRMI	0.03	0.06	0.04	0.05	0.28***	0.08
Income, ref: low-income group						
Median-income group	0.00	0.02	–0.03*	0.01	0.02	0.03
High-income group	0.06	0.04	–0.06	0.04	–0.12**	0.04
Living, ref: rural						
	0.02	0.02	0.03*	0.01	0.07**	0.03
<b>Needing factors</b>						
Self-reported health, ref: very good						
Good	0.00	0.03	0.01	0.03	0.13***	0.04
Fair	0.14***	0.02	0.02	0.02	0.33***	0.03
Poor	0.35***	0.03	0.13***	0.03	0.60***	0.04
Very poor	0.34***	0.04	0.26***	0.04	0.76***	0.06
ADL, ref: without ADL						
	0.06**	0.02	–0.01	0.02	0.14***	0.03
IADL, ref: without IADL						
	0.05**	0.02	0.05**	0.02	0.02	0.03
Chronic disease, ref: no chronic diseases						
One chronic disease	0.04**	0.02	0.02	0.02	0.20***	0.02
Multiple chronic diseases	0.06**	0.03	0.10***	0.03	0.29***	0.04
Critical disease, ref: no critical diseases						
	0.12***	0.02	0.08***	0.02	0.18***	0.03
BMI, ref: ≤18.5						
18.5–24	0.00	0.03	0.01	0.03	0.13***	0.04
>24	0.01	0.03	0.01	0.03	0.19***	0.04
Drinking, ref: never drank						
	0.00	0.02	0.03*	0.01	0.03	0.02
Smoking, ref: never smoked						
	–0.03	0.02	–0.03*	0.01	0.04	0.03

Estimates were weighted using individual sampling weights and adjusted for household and individual responses.

\*\*\* $P < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ .

ADL, activities of daily living limitations; BMI, body mass index; IADL, instrumental activities of daily living limitations; NCMI, New Cooperative Medical Insurance; OOPPE, out-of-pocket pharmaceutical expenditure; Ref, Reference; UEMI, Urban Employee Medical Insurance; URMI, Urban Resident Medical Insurance; URRMI, Urban and Rural Resident Medical Insurance.

### Enabling factors and OOPPE for outpatient, inpatient and self-medication

Insured middle-aged and elderly individuals had a lower likelihood of OOPPE for outpatient and inpatient services (table 4), indicating that enrolment in health insurance protects participants from OOPPE and large healthcare costs, in agreement with prior studies.<sup>26–28</sup> However, no significant effect on the likelihood of OOPPE for self-medication reflected the limited coverage provided by health insurance benefit packages in China. In addition, we found that enrolment in NCMi significantly increased OOPPE for all types of health services, as reported by Wang *et al.*<sup>9</sup> However, enrolment in URMI, UEMI or URRMI alone significantly improved OOPPE for self-medication. This finding reveals that enrolment in health insurance actually resulted in a significant OOPPE increase among middle-aged and elderly adults. In particular, it is important to note that this inductive effect was relatively greater in OOPPE for self-medication among all three health insurance schemes. This also reflects that social health insurance does not significantly ease the burden of self-medication costs in China. In many cases, self-medication costs were not completely covered by health insurance or the required drugs were not considered as essential medicines by medical insurances. Middle-aged and elderly individuals thus had to cover the majority of or all pharmaceutical costs themselves. Social health insurance policies should therefore be further adjusted to expand benefit packages and effectively protect individuals from drastic OOPPE for self-medication and thus effectively reduce disease burden among the elderly. The higher income group was found to have a significantly lower likelihood of paying OOPPE and lower amounts of OOPPE as well (tables 4 and 5), indicating that Chinese health insurances or other social security policies may be more inclined to protect the rich from OOPPE.

### Needing factors and OOPPE for outpatient, inpatient and self-medication

Individuals with a poor self-reported health status, limitation in daily activities, and critical or chronic diseases exhibited a significantly higher likelihood of paying OOPPE and of paying a greater amount (tables 4 and 5). Poor health conditions may force this population to use health services more and thus bear greater costs for doing so. Specifically, individuals suffering from one or multiple chronic diseases had a higher likelihood of OOPPE and were likely to pay significantly more in comparison with those without any chronic illness; these findings were in agreement with previous studies.<sup>6 20 29</sup> While strategies aimed at preventing and controlling chronic diseases should be further strengthened to reduce OOPPE among middle-aged and elderly individuals, policy efforts should focus on increasing welfare subsidies and optimising benefit packages of health insurance schemes to alleviate the burden of OOPPE among individuals suffering from chronic illness. In addition, greater attention should be paid to OOPPE for self-medication among individuals

suffering from chronic diseases as this has been found to exert the greatest alleviating effect on OOPPE. Middle-aged and elderly adults with normal BMI values were found to have a lower likelihood of OOPPE for all types of health services. Therefore, health initiatives should focus on prevention of obesity or low weight to avoid unnecessary OOPPE.

### Limitations of the study

Our findings suggest approaches to policymakers for alleviating the economic burden of diseases associated with an ageing society. However, some limitations should be taken into consideration when interpreting our findings. First, indicators were selected based on Andersen's model; however, definitions of some indicators were not entirely perfect. For example, health insurance was a kind of health insurance that patients were enrolled in rather than insurance actually used during the occurrence of health services. Such incongruence may have influenced our calculation accuracy to some extent. Second, in order to ensure the accuracy of the analysis, the samples with missing data were excluded. This will affect representation of the sample to the population to some extent. Third, even if the amount of OOPPE was acquired from the most recent medical services, recall and response bias still existed. Recall among Chinese middle-aged and elderly people is psychologically expensive. Therefore, the costs of drugs may be overestimated to some extent. Fourth, all indicators were obtained without considering the impact of household factors on OOPPE. Finally, cross-sectional data cannot be used to draw any causal conclusions about why these individuals paid OOPPE.

### CONCLUSION

Although China has instituted universal health coverage and promoted its benefits over the last several decades, the incidence of OOPPE for self-medication remains much higher than OOPPE for outpatient and inpatient services. In addition, the average amount of OOPPE for self-medication is higher than that for outpatient services. Based on the Andersen healthcare utilisation model, predisposing factors such as age and enabling factors such as health insurance and income level were found to significantly affect OOPPE. Need factors, including self-reported health, multiple chronic diseases, limitations in daily activities and BMI, also significantly impacted OOPPE for health services. Policies aimed at reducing OOPPE should focus on alleviating OOPPE for self-medication and address socioeconomic and demographic factors affecting the OOPPE among middle-aged and elderly adults in China.

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**Data availability statement** Data are available in a public, open access repository.

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