



Factors Associated with Preventive Care Utilisation among Chinese Older Adults: Evidence from the 2018 Chinese Longitudinal Healthy Longevity Survey

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This research examined the sociodemographic factors associated with preventive care utilisation among Chinese older adults. Using the latest 2018 wave of the Chinese Longitudinal Healthy Longevity Survey (CLHLS), preventive care utilisation was defined as an annual physical examination. In the final study sample, approximately 69 per cent of the older adults had a physical examination annually. Older adults who had received a high level of formal education (eleven years or above) were more likely to use preventive care (all $p < 0.01$). Participants with a rural social health scheme and residing in rural areas were also more likely to use preventive care (all $p < 0.05$). For the interaction effect, rural older adults who could not afford healthcare expenses were less likely to use preventive care (AOR = 0.37, 95 per cent CI: 0.16, 0.84). More reforms should be directed toward reducing social disparities regarding preventive care utilisation.

Keywords: China, preventive care utilisation, older adults, social disparity, healthcare.

Introduction

Background

China has made good progress in improving its healthcare system over the past decades (Blumenthal and Hsiao, 2015). Starting in the 1960s, the Chinese healthcare system used the cooperative medical scheme (CMS, known as the commune system) for providing comprehensive yet convenient basic healthcare services to residents, especially in rural areas. Nevertheless, major health disparities between urban and rural areas appeared because Chinese strategic development relied heavily on the decentralisation of health funding to local government sectors (Bloom, 2011). Very limited resources from the central government were directed from wealthier to poorer areas. The central government redirected the resources away from the agricultural communes in rural areas to modern technology-based industries in the 1970s. This change made local government finance the local healthcare system. This sudden transition led to the collapse of the commune system between the 1970s and 1980s. The majority of the population was left without

coverage. Several efforts have been made to mitigate these disparities. For example, since the early 21st century, social health insurance coverage increased from 21 per cent and 56 per cent in rural and urban areas in 2003, respectively, to 95 per cent in the entire mainland in 2011 (Yip and Mahal, 2008; Yip and Hsiao, 2014).

In 2009, China initiated one of the most comprehensive health reforms to provide all Chinese citizens, regardless of their socioeconomic status, with more affordable, efficient, and high-quality healthcare services. Public healthcare spending by the Chinese central government increased from RMB 481.6 billion to RMB 836.6 billion in just three years following initiation of the reform (Yip and Hsiao, 2014). Since the early 21st century, China has offered three primary types of social insurance schemes targeting different populations and needs: the new cooperative medical scheme (NCMS, to cover all rural residents), the urban resident basic medical insurance (URBMI, for urban residents who do not work in the formal economic sector), and the urban employment basic medical insurance (UEBMI, for urban residents who work for formal sectors). These examples demonstrate the positive transition that the Chinese healthcare system has achieved within a short period of time.

However, barriers and challenges continue to thwart further reforms. Despite the nearly universal coverage by social health insurance schemes in rural and urban areas, disparities persist. For example, important socioeconomic factors such as residents' educational attainment and household income were still positively associated with access to a scheme with deeper coverage, such as the UEBMI (Lee *et al.*, 2018b). Schemes with shallower financial benefits, such as the NCMS and the URBMI, have lower subsidies as compared with the UEBMI (Yip and Hsiao, 2014). On the other hand, according to a qualitative study conducted in Shanghai, evidence-based chronic disease prevention implementation does not enjoy robust policy support and funding; as a result, public health practitioners and patients are still unaware of the effectiveness of this program (Shi *et al.*, 2019). Additionally, the Chinese healthcare delivery structure suffers from low system efficiency because the primary healthcare system remains poorly implemented (Zhang *et al.*, 2017).

Alongside the poor primary care system, the preventive care system is another major concern. For instance, according to the 2011 China Health and Nutrition Survey, approximately 7 per cent of research participants used preventive care services over the past four weeks, while only 4 per cent received a general physical examination prior to completion of the survey (Huang *et al.*, 2016). Large social gaps including educational attainment, rural and urban disparities, and income differences continue to thwart preventive care utilisation (Huang *et al.*, 2016; Liu *et al.*, 2016; Lee *et al.*, 2018a). In short, the effectiveness and utilisation of preventive care services have received little appreciation from most Chinese residents.

Literature gaps

As China is facing a growing older adult population, preventive care utilisation could be a solution to help reduce the increasing prevalence of chronic disease and enhance 'healthy ageing' (Liu *et al.*, 2009; Zhao *et al.*, 2018; Lee *et al.*, 2019; Zhang *et al.*, 2019). Lee *et al.* (2019) showed that preventive care utilisation was associated with better overall health status, health improvement, and life satisfaction among Chinese older adults. However, according to the aforementioned literature, large social disparities persist, threatening to thwart older adults' access to preventive care services. Although

Huang and colleagues (2016) investigated factors associated with preventive care utilisation, they considered all adult participants (age eighteen years and above) and thus may not have been able to identify the specific needs of older adults.

Huang *et al.* (2016) defined a general physical examination as a type of preventive care service. Among those who used preventive care services, 56.5 per cent of the study participants used physical examinations in China (Huang *et al.*, 2016). In North America, annual check-ups or examinations have a long history of visits usually including a review of each patient's health history, medications, allergies, and/or other health-related measurements (Birtwhistle *et al.*, 2017). Therefore, using physical examination as a major type of preventive care service can help understand the mechanism of social disparities with preventive care utilisation among older adults and what policy implications can be drawn from this empirical evidence in China.

In addition, because the previous studies used the 2011 CHNS dataset, collected only two years following the 2009 health reform (Huang *et al.*, 2016; Liu *et al.*, 2016; Lee *et al.*, 2018a), the data may not have captured the 2009 reform's effect on the healthcare system, especially on social disparities. It is thus imperative to examine what sociodemographic factors might be associated with preventive care utilisation among Chinese older adults. A newer dataset would be necessary to explore the transformation of the rapidly evolving Chinese healthcare system and help identify the vulnerable groups among Chinese older adults.

Purpose of the study

We conducted a secondary analysis using the 2018 Chinese Longitudinal Healthy Longevity Survey (CLHLS), which is the latest version available. Using the results of this research, scholars and policymakers can identify vulnerable groups among Chinese older adults and implement more effective policy for increasing their access to preventive care services.

Materials and methods

Study sample

The 2018 CLHLS, an internationally designed database of Chinese older adults, was launched in 1998 by Duke University, with grants from the National Institute on Aging (NIA) and the National Institutes of Health (NIH). Other collaborators included the Max Planck Institute for Demographic Research, the China Natural Sciences Foundation, the Hong Kong Research Grants Council in partnership with NIA and NIH, and others. The study participants included older adults who were centenarians, nonagenarians, octogenarians, and younger older adults aged sixty-five to seventy-nine years old. In the 2018 wave, data were collected from twenty-three provinces and megacities. The CLHLS covers a wide range of study subjects including substance use (tobacco and alcohol consumption), mental health (including a mini-mental state exam), dietary behaviour (with self-reported food consumption frequency), health policy (such as social health insurance), living arrangement, health status, and other items. The CLHLS investigators obtained informed consent from all research participants. Zeng (2012) provides further information regarding this dataset. As this research used de-identified and secondary data

in the public domain, approvals from the Institutional Review Boards (IRBs) at the authors' institutions were not required. Of the final study sample from the 2018 CLHLS, data without missing values were obtained on 10,383 participants aged sixty-five years or above ($n = 10,383$).

In our analysis, use of preventive care services by older adults refers to a regular annual physical examination (no/yes; a dichotomous variable). This type of regular annual physical examination was described as annually routine physical examination, according to the Chinese version of CLHLS questionnaire.

The biological factors included in this research were participants' age (sixty-five to eighty, eighty-one to ninety-five, above ninety-five; measured in years, a categorical variable) and gender (male, female; a dichotomous variable).

We included a set of socioeconomic determinants to describe the older adults' socioeconomic status. These variables were marital status (married, others [including those who were widowed, divorced, or never married]; a dichotomous variable), household income (1: less than or equal to 10,000 RMB, 2: between 10,001 and 30,000 RMB, 3: between 30,001 and 50,000 RMB, 4: between 50,001 and 70,000 RMB, 5: more than or equal to 70,001 RMB, and 'do not know,' a categorical variable), formal education received (none, one to five, six to ten, eleven or above; measured in years, a categorical variable), major source of coverage for healthcare expenses (UEBMI-URBMI, NCMS, others, self-payment, and 'can't afford to pay'; a categorical variable).

Regional measurements were also included in this research. The community of residence variable was dichotomised into rural and urban areas (urban/rural, a dichotomous variable). Older adults who resided in a city or town were categorised as 'urban,' and those living in rural areas as 'rural.' In addition, geographical regions were classified based on the locations of provinces or megacities (a categorical variable): 1. Beijing, Tianjin, Hebei, and Shanxi (North); 2. Liaoning, Jilin, and Heilongjiang (Northeast); 3. Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, and Shandong (East); 4. Henan, Hubei, Hunan, Guangdong, Guangxi, and Hainan (Central-South); and 5. Chongqing, Sichuan, and Shaanxi (West). This classification method was based on the recommendation of the CLHLS website¹. This variable provided additional information to describe the location of study participants.

Health-related and behavioural measurements characterised older adults' health behaviours and conditions in this research: number of times suffering from chronic diseases that required in-patient treatments in the last two years (none, once to twice, and above twice; an ordinal categorical variable), life satisfaction (very good, good, neutral, bad, and very bad; an ordinal categorical variable), current alcohol use status (no, yes; a dichotomous variable), current smoking status (no, yes; a dichotomous variable), and current exercise status (no, yes; a dichotomous variable). For the variable examining older adults' chronic conditions, the phrase 'in the past two years' refers to two years prior to older adults' participation in the CLHLS study.

Statistical analysis

As the outcome variable was dichotomous, we employed multivariable logistic regression for statistical data analysis. The first model included the aforementioned sociodemographic variables. The second model also added an interaction term between major sources of coverage for healthcare expenses and community of residence. This interaction

term was intended to capture potential disparities among different insurance schemes and between rural and urban areas in China (Yu, 2015; Liu *et al.*, 2016; Lee *et al.*, 2020). Adjusted odds ratio (AOR) and 95 per cent confidence intervals (95 per cent CI) were reported in the regression analysis results. The regression results were two-tailed with a level of significance of 0.05 ($p < 0.05$). All statistical tests were performed using the free and publicly available statistical software R (version 3.6.2). The package 'descr' was used for computing the descriptive statistics (Aquino, 2021).

Results

Descriptive statistics

Table 1 shows the characteristics of the final study sample ($n = 10,383$). Approximately 69 per cent of the older adults in the sample used preventive care services. Among the non-preventive care users, about 61 per cent were female. A majority of non-preventive care users were eighty-one years old or above and not married (70 per cent). Most non-preventive care users had household income lower than the 3rd quintile, had no formal education, relied on self-payment as the major source of coverage for healthcare expenses, resided in urban regions, and lived in the East and the Central-South parts of the country. Approximately 75 per cent of participants did not suffer from chronic diseases in the last two years, did not consume alcohol (86 per cent), did not smoke (85 per cent), and did not exercise (75 per cent). Roughly 47 per cent of participants and 22 per cent of older adults reported good and very good life satisfaction, respectively.

Among the preventive care users, around 53 per cent were female. The majority of preventive care users were eighty-one years old or younger and married (51 per cent). Most preventive care users had household income lower than the 3rd quintile, had some formal education (at least one year of formal education or above), relied on self-payment as the major source of coverage for healthcare expenses, resided in urban regions, and lived in the East and the Central-South parts of the country. Approximately 75 per cent of participants did not suffer from chronic diseases in the last two years, did not consume alcohol (85 per cent), did not smoke (84 per cent), and did not exercise (64 per cent). Close to 47 per cent of participants and 25 per cent of older adults reported good and very good life satisfaction, respectively.

Sociodemographic factors associated with preventive care utilisation among older adults, with and without the interaction effect of major source of coverage for healthcare expenses and community of residence, are shown in Table 2.

Table 2 presents the results of two multivariable logistic models. The first model excluded the interaction effect of major source of coverage for healthcare expenses and community of residence, while the second model included it. In the first model, participants' gender was not associated with preventive care utilisation. Older adults who were eighty-one years old or above had lower odds of using preventive care services, compared with those who were between sixty-five and eighty years old (all $p < 0.01$). Non-married participants also had lower odds of using preventive care services, compared with married older adults (AOR=0.77, 95 per cent CI: 0.69, 0.86; $p < 0.01$). Household income was not linked with preventive care utilisation. Older adults who received more than six years of formal education were significantly more likely to use preventive care (all $p < 0.05$). Older adults who relied on the NCMS for healthcare

Table 1 Descriptive statistics of preventive care utilization (physical examination) among research participants ($n = 10,383$): Chinese Longitudinal Healthy Longevity Survey (CLHLS), 2018.

	Preventive care utilization		<i>p</i> -value
	No (n, %) <i>n</i> = 3,220, 31.0%	Yes (n, %) <i>n</i> = 7163, 69.0%	
Biological characteristics:			
Gender			
Male	1267 (39.3%)	3341 (46.6%)	<0.001**
Female	1953 (60.7%)	3822 (53.4%)	
Age (in years)			
65-80	786 (24.4%)	3465 (48.4%)	<0.001**
81-95	1244 (38.6%)	2725 (38.0%)	
Above 95	1190 (37.0%)	973 (13.6%)	
Socioeconomic status:			
Marital status			
Married	967 (30.0%)	3647 (50.9%)	<0.001**
Others	2253 (70.0%)	3516 (49.1%)	
Household income (in quintiles, in RMB)			
1	927 (28.8%)	2177 (30.4%)	0.011*
2	571 (17.7%)	1343 (18.7%)	
3	454 (14.1%)	921 (12.9%)	
4	245 (7.6%)	491 (6.9%)	
5	833 (25.9%)	1899 (26.5%)	
Do not know	190 (5.9%)	332 (4.6%)	
Formal education received (in years)			
None	1781 (55.3%)	3037 (42.4%)	<0.001**
1-5	697 (21.6%)	1739 (24.3%)	
6-10	560 (17.4%)	1715 (23.9%)	
11 or above	182 (5.7%)	672 (9.4%)	
Major source of coverage for healthcare expenses			
UEBMI/URBMI	792 (24.6%)	1814 (25.3%)	<0.001**
NCMS	850 (26.4%)	2497 (34.9%)	
Commercial insurance	9 (0.3%)	18 (0.3%)	
Self-payment	1505 (46.7%)	2712 (37.9%)	
Can't afford to pay and others	64 (2.0%)	122 (1.7%)	
Health related measurements:			
Number of times suffering from chronic diseases in the last two years			
None	2424 (75.3%)	5350 (74.7%)	0.801
1 to 2	681 (21.1%)	1556 (21.7%)	
Above 2	115 (3.6%)	257 (3.6%)	
Life satisfaction			
Very good	698 (21.7%)	1775 (24.8%)	<0.001**
Good	1499 (46.6%)	3330 (46.5%)	

(Continued)

Table 1 (Continued)

	Preventive care utilization		<i>p</i> -value
	No (n, %) <i>n</i> = 3,220, 31.0%	Yes (n, %) <i>n</i> = 7163, 69.0%	
Neutral	896 (27.8%)	1863 (26.0%)	
Bad	104 (3.2%)	178 (2.5%)	
Very bad	23 (0.7%)	17 (0.2%)	
Current alcohol use status			0.05
No	2780 (86.3%)	6079 (84.9%)	
Yes	440 (13.7%)	1084 (15.1%)	
Current smoking status			0.187
No	2742 (85.2%)	6027 (84.1%)	
Yes	478 (14.8%)	1136 (15.9%)	
Current exercise status			<0.001**
No	2399 (74.5%)	4557 (63.6%)	
Yes	821 (25.5%)	2606 (36.4%)	
Regional information:			
Geographical region			<0.001**
North	277 (8.6%)	419 (5.8%)	
Northeast	211 (6.6%)	244 (3.4%)	
East	1265 (39.3%)	3226 (45.0%)	
Central-South	1020 (31.7%)	2266 (31.6%)	
West	447 (13.9%)	1008 (14.1%)	
Community of residence			<0.001**
Urban	1983 (61.6%)	4106 (57.3%)	
Rural	1237 (38.4%)	3057 (42.7%)	

p* < 0.05; *p* < 0.01.

expenses were also significantly more likely to use preventive care (AOR=1.25, 95 per cent CI: 1.25, 1.67; *p* < 0.01). Residents of the North-Eastern region were significantly less likely to use preventive care, but residents of the East, Central-South, and West displayed a significantly higher rate of preventive care utilisation. Rural residents had higher odds of using preventive care services, compared with older adults residing in urban areas (AOR=1.18, 95 per cent CI: 1.07, 1.30; *p* < 0.01). Respondents at all lower levels of life satisfaction were significantly less likely to use preventive care (*p* < 0.05). Smokers had significantly lower odds of using preventive care services, compared with non-smokers (AOR=0.82, 95 per cent CI: 0.71, 0.94; *p* < 0.01). Older adults who were physically active were significantly more likely to use preventive care (AOR=1.32, 95 per cent CI: 1.19, 1.47; *p* < 0.01). However, older adults' chronic conditions from the past two years and alcohol consumption behaviour were not related to preventive care utilisation (*p* > 0.05).

The results of the second model, including the interaction effect of major source of coverage for healthcare expenses with community of residence, were similar to the model without the interaction effect, with few exceptions. Only older adults with the highest level of formal education, eleven years or above, had significantly higher odds of using preventive care services, compared with those without any formal education (*p* < 0.01).

According to the interaction effect, older adults who were not able to pay for healthcare services in rural regions were less likely to use preventive care (AOR=0.37, 95 per cent CI: 0.16, 0.84; $p < 0.05$). Also, older adults who relied on self-payment for healthcare expenses in rural regions seemed less likely to use preventive care utilisation, but the results were borderline ($p = 0.052$).

Discussion

We conducted a secondary analysis using a large and nationally representative dataset to examine the sociodemographic factors associated with preventive care utilisation among Chinese older adults following the 2009 health reform. Furthermore, we investigated the potential interaction effect between sources of coverage for healthcare expenses and community of residence. With this interaction analysis, we observed that older adults who were not able to pay for healthcare services and resided in rural regions were significantly less likely to use preventive care services.

Gender and age

First, participants' gender was not associated with preventive care utilisation, although the percentage of females using preventive care services was higher than that of males. But it is noteworthy mentioning that the proportion of female older adults was much higher than that of male older adults among the non-users of preventive care (60.7 per cent females versus 39.3 per cent males). Interestingly, these findings diverge from observations in other countries such as the United States. Cameron and colleagues (Cameron *et al.*, 2010), using data from the Health and Retirement Study (HRS), found that women used significantly fewer cholesterol screenings and flu vaccinations compared with men. Females also had lower hospital admission rates and lower odds of using hospital services than males (Barker *et al.*, 1994; Wolinsky *et al.*, 1994; Lum and Chang, 1998; Song *et al.*, 2006; Cameron *et al.*, 2010). Even among participants who were hospitalised, women also had shorter stays than males (Lum and Chang, 1998).

There are several ways to interpret the insignificant association of older adults' gender with use of preventive care. Women in China tend not to visit doctors when they are sick. For example, Liu and Bryson (2017) found that for employed Chinese women financial constraints, distrust of doctors, and poor treatment environments are the primary barriers to seeking healthcare. Although these problems could also occur among Chinese men, a cultural stigma likely hinders women from using healthcare services. Liu and Bryson observed that Chinese women may not be comfortable discussing with healthcare providers issues related to their reproductive system, for fear of discrimination (Liu and Bryson, 2017). Another study (Song and Bian, 2014) argues that because Chinese women generally have lower socioeconomic status than men and confront gender inequality, they also confront a healthcare system that favours men.

In fact, China has a long history of its patriarchal system, with high prevalence of male dominance in the society and culture. There have been tremendous efforts for improving women's health since the 20th century, but progress toward gender equality has not shown sufficient progress in China (Yu and Sarri, 1997). In one example, Chinese females are more unlikely to be covered with a better health insurance scheme due to their lower rate of labour participation (Zhou *et al.*, 2021). Women remain a more vulnerable population

Table 2 Results of multivariable logistic regression for preventive care utilization (physical examination), with and without the interaction effect between major source of coverage for healthcare expenses and community of residence: Chinese Longitudinal Healthy Longevity Survey (CLHLS), 2018.

	Model I AOR ¹ 95%CI ²	Model II AOR 95%CI
Biological characteristics:		
Gender		
Male	–	–
Female	0.95 0.85, 1.06	0.95 0.85, 1.06
Age (in years)		
65-80	–	–
81-95	0.59 0.53, 0.67**	0.59 0.53, 0.67**
Above 95	0.24 0.21, 0.28**	0.24 0.21, 0.28**
Socioeconomic status:		
Marital status		
Married	–	–
Others	0.77 0.69, 0.86**	0.77 0.69, 0.86**
Household income (in quintiles, in RMB)		
1	–	–
2	1.07 0.93, 1.22	1.07 0.93, 1.22
3	0.90 0.77, 1.04	0.89 0.77, 1.03
4	0.87 0.72, 1.05	0.86 0.71, 1.04
5	0.92 0.80, 1.05	0.91 0.80, 1.04
Do not know	0.89 0.72, 1.09	0.88 0.72, 1.09
Formal education received (in years)		
None	–	–
5-Jan	1.04 0.92, 1.18	1.04 0.92, 1.18
10-Jun	1.16 1.00, 1.33*	1.15 1.00, 1.33
11 or above	1.61 1.30, 2.00**	1.61 1.30, 1.99**
Major source of coverage for healthcare expenses		
UEBMI/URBMI	–	–
NCMS	1.45 1.25, 1.67**	1.33 1.13, 1.58**
Commercial	1.00 0.44, 2.45	0.87 0.29, 2.91
Self-payment	0.90 0.79, 1.03	0.98 0.84, 1.13
Can't afford to pay and others	1.19 0.86, 1.67	1.46 1.00, 2.17
Regional information:		
Geographical region		
North	–	–
Northeast	0.74 0.57, 0.96*	0.74 0.57, 0.95*
East	1.88 1.56, 2.26**	1.88 1.56, 2.26**
Central-South	1.60 1.32, 1.93**	1.61 1.33, 1.95**
West	1.65 1.34, 2.03**	1.66 1.35, 2.04**
Community of residence		
Urban	–	–
Rural	1.18 1.07, 1.30**	1.45 1.06, 2.02*

Table 2 (Continued)

	Model I AOR ¹ 95%CI ²	Model II AOR 95%CI
Health related measurements:		
Number of times suffering from chronic diseases in the last two years		
None	–	–
1 to 2	1.03 0.92, 1.15	1.02 0.92, 1.14
Above 2	1.00 0.79, 1.27	1.00 0.79, 1.27
Life satisfaction		
Very good	–	–
Good	0.87 0.78, 0.98*	0.87 0.78, 0.98*
Neutral	0.71 0.62, 0.80**	0.71 0.62, 0.81**
Bad	0.67 0.51, 0.89**	0.68 0.52, 0.91**
Very bad	0.26 0.13, 0.52**	0.27 0.13, 0.52**
Current alcohol use status		
No	–	–
Yes	0.90 0.79, 1.03	0.90 0.79, 1.03
Current smoking status		
No	–	–
Yes	0.82 0.71, 0.94**	0.82 0.72, 0.94**
Current exercise status		
No	–	–
Yes	1.32 1.19, 1.47**	1.32 1.19, 1.47**
Interaction effect:		
Major source of coverage for healthcare expenses * Community of residence		
NCMS*Rural	–	0.96 0.67, 1.38
Commercial*Rural	–	1.15 0.20, 6.75
Self-payment*Rural	–	0.71 0.50, 1.00 ^a
Can't afford to pay and others*Rural	–	0.37 0.16, 0.84*

*p < 0.05; **p < 0.01.

¹AOR = Adjusted odds ratio.

²95% CI = 95% Confidence Interval.

^aThe result was borderline with a p-value of 0.052.

than men in China. With our inconsistent findings regarding gender, health, and preventive care utilisation, future research efforts are warranted to continue examining the implications of gender gaps.

Participants' age was negatively associated with preventive care utilisation in all analyses. As people age, diseases and health problems are more likely to occur. However, the negative associations were relatively surprising. On the one hand, these results could indicate that Chinese older adults may not consider preventive care as basic care. On the other hand, they could suggest that the majority of older adults in this research did not suffer from any chronic diseases that required inpatient treatments in the past two years (76 per cent). Further policy and public health efforts should emphasise to older individuals the importance of preventive care utilisation as a strategy to promote better

health. In the same vein, more reforms are needed to enhance the role of preventive care in the Chinese healthcare system (Yang *et al.*, 2015).

Socioeconomic factors

In this research, socioeconomic variables played an ambiguous role in predicting use of preventive care. First, older adults' household income was not associated with preventive care utilisation. This finding contrasts with previous research (Huang *et al.*, 2016; Lee *et al.*, 2018a), given that both studies demonstrated an income gap regarding preventive care utilisation. In China, most preventive care remains a luxury (SCMP Editorial, 2017). Moreover, financial hurdles will probably continue to exist because the Chinese central government has privatised public hospitals, so charges for private services will not be regulated (Yip and Hsiao, 2015). However, our results were somewhat surprising because the empirical evidence does not indicate an income gap regarding preventive care utilisation among Chinese older adults. This lack of an income effect might be due to the fact that Chinese social insurance schemes, especially the NCMS, have increased financial subsidies for enrollees. For example, although the personal payment increased from 10 RMB to 60 RMB per person, the basic financing standard also increased from 30 RMB to 300 RMB per person, and NCMS has additionally reduced the burden of disease among rural adults and provided partial coverage for outpatient care (Sun *et al.*, 2014; Zhou *et al.*, 2020).

Since 2009, the Chinese healthcare sector has provided annual physical examinations for older adults in some rural areas, and these services have been expanded nationally (Dong *et al.*, 2018). This might explain why rural enrollees with NCMS coverage had higher odds of using preventive care services, compared with those covered by urban schemes. Our empirical evidence also suggests that rural older adults have higher odds than urban residents of using preventive care services. However, we also should be careful regarding the effects of some exogenous factors. First, the 2018 version of the CLHLS questionnaire merged the UEBMI and the URBMI as one option. This combination may not allow an accurate comparison with NCMS coverage because we were not able to differentiate the coverage of the UEBMI from the URBMI. Of note, the UEBMI scheme provides a more comprehensive financial package to cover expenses for enrollees than do the URBMI and the NCMS (Yip and Hsiao, 2014; Yu, 2015). In most cases, UEBMI enrollees should have more financial flexibility to choose the care they want to receive. Specifically, we should point out that the URBMI did not cover some outpatient services, in which case sick individuals were responsible for their out-of-pocket expenses (Zhou *et al.*, 2020). The URBMI implementation also did not change individuals' preventive care utilisation (Dong *et al.*, 2018).

Second, Chinese preventive care services have been considered 'pro-rich,' perpetuating large social inequalities (Xu *et al.*, 2019). We did not know if the older adults included in this research used free annual physical examinations or sought more comprehensive preventive care services at medical centres. Older adults who used preventive care services may have incurred much higher medical expenses than those who used the free services. Further research efforts should attempt to resolve these related issues and distinguish among the different types of preventive care services.

In terms of formal education, participants with most years of formal education, eleven years or above, were positively associated with preventive care utilisation in two models.

These observations were consistent with previous studies that found individuals with a higher level of education might make greater use of preventive care services (Huang *et al.*, 2016; Lee *et al.*, 2018a). The potential educational gap in preventive care utilisation was the case not only in China but also in Western countries like the United States (Fletcher and Frisvold, 2009). This gap could be an example of how individuals with a higher level of education might be more aware of their own health. Consequently, they might use preventive care services as a type of health investment to monitor their health in the long term. Older adults without formal education may have lower health literacy as well (van der Heide *et al.*, 2013). Helping older adults without formal education to recognise the critical role of preventive care might be an effective way to reduce educational disparities.

Health related measurements

Life satisfaction and current exercise status were associated with higher preventive care utilisation among Chinese older adults. However, the number of times suffering from chronic diseases that required inpatient treatments in the past two years was not associated with preventive care utilisation. Among these variables, the insignificant finding of chronic conditions was rather surprising. In a previous report, Yang and colleagues argued that Chinese individuals are willing to use preventive care only when they are sick (Yang *et al.*, 2015). This also was demonstrated in an empirical study showing that participants who were sick in the past four weeks had higher odds of using preventive care compared with those who were healthy (Lee *et al.*, 2018a). The current research contradicts these perspectives. One might suspect that older adults with chronic diseases in the past two years could be more reluctant to use preventive care to examine their health condition, given that they need to receive more medical treatments for their conditions. This tendency could be stronger for Chinese older adults because older individuals with severe diseases and low socioeconomic status are more likely to struggle in their daily life (Ma *et al.*, 2019). Therefore, they may not need additional physical examinations to evaluate their health due to financial barriers.

The effects of life satisfaction and current exercise status were not as surprising. Participants who felt less satisfied with their life and did not exercise had lower odds of using preventive care, compared with those who felt very good with their life and exercised, respectively. A number of studies have pointed out that older adults who exercised had better health and more related benefits to lower the risk of chronic diseases (Chen *et al.*, 2016; Guo *et al.*, 2016; Zhu *et al.*, 2016). Older adults who exercised regularly, in turn, could pay more attention to their personal health. Similar findings regarding life satisfaction were observed in other countries. A study using US HRS data found that higher life satisfaction was associated with more frequent use of preventive care in the United States (Kim *et al.*, 2015). This evidence suggests that Chinese policymakers should enhance the role of preventive care with further system reform and focus on older adults who do not exercise or feel less satisfied with their life.

Interaction analysis and policy implications

Unsurprisingly, the interaction effect demonstrated that older adults who were not able to afford healthcare expenses and resided in rural areas made significantly less use of

preventive care. As previously mentioned, most annual physical examinations were free for older adults in some rural regions (Yang *et al.*, 2016). However, this finding was somewhat paradoxical. One might argue that Chinese with lower socioeconomic status may not use healthcare services at all, even when they are sick. With the availability of free preventive care services like annual physical examinations, policymakers and healthcare providers should consider more effective health communication strategies to publicise the free preventive care services. In rural regions, public and local bulletin boards have been very popular for spreading public health messages (Lee, 2010; Sun *et al.*, 2014) since Chairman Mao's era. Rural policymakers and healthcare providers should use this method to help older adults with lower socioeconomic status in their jurisdiction to understand the importance of using free preventive care. Such an approach would remove the need to pay any out-of-pocket expenses to cover the services, as well as demonstrate how preventive care might be an effective way to enhance personal health in the long term.

Jing and colleagues (2017) showed that previous changes in basic medical insurance were designed to achieve universal coverage and better health care through greater subsidies, reimbursement, and benefits. Although people enrolled in basic medical insurance were highly satisfied through near-universal coverage, contradictions emerged because of funding deficits and inadequate compensation. They argued for an integrated medical insurance system featuring universal coverage and vertical equity with satisfied enrollees (Jing *et al.*, 2017). Writing four years later, Gu *et al.* (2021) found that the 2017 reform decreased patients' average per-visit expenditure on Western medicine and traditional Chinese medicine but increased their average non-medicine expenditure, provides the opportunity to expand financial and healthcare assistance to disadvantaged groups, mitigates the increase in hospital revenue, incentivises a focus on patient volume and non-medicine revenue, and encourages price stability. However, Wu *et al.* (2022) noted that the hierarchical diagnosis and treatment system that is foundational to the latest iteration of medical reform requires innovative management policy and adaptability to local circumstances. An ideal policy would need to address this gap in the new system, especially addressing the social disparities within the preventive care system.

Study limitations

This study is not without limitations. First, as this is a cross-sectional study with a secondary dataset, we only investigated the associations of each sociodemographic factor on preventive care utilisation. However, this research focused on the latest social disparity of preventive care utilisation following initiation of the 2009 health reform in China. Hence, the cross-sectional design is sufficient to examine this topic of interest. Second, in survey-based research, self-report bias or recall bias might occur. This is a common limitation for most survey-based studies and not unique to this dataset. Third, as previously mentioned, a new series of reforms to reduce financial burdens on patients and the government sectors was launched in 2017 (Gu *et al.*, 2021). The latest 2018 CLHLS dataset may not be able to capture the immediate effectiveness of the 2017 reform on decreasing these financial barriers. Finally, annual physical examination was the only preventive care utilisation variable in this study because that is the only such measurement available in the CLHLS dataset. Further research efforts should include other types of preventive care services.

Conclusion

In spite of these limitations, this study adds to the body of literature investigating the effect of sociodemographic disparity on preventive care utilisation among Chinese older adults following the 2009 health reform. The results of this study point to persistent social disparities (e.g. in levels of education) with regard to preventive care utilisation among Chinese older adults. Some promising tendencies were also observed, such as the insignificant association between household income and preventive care utilisation. The Chinese central government needs further reforms to enhance the preventive care system while encouraging residents to view preventive care as a long-term health investment. Despite the persistent social disparities in the Chinese healthcare system, other countries can learn lessons from China. For example, the US healthcare system also should provide comprehensive yet affordable preventive care services to their residents, given that the US healthcare system is notoriously 'pro-rich.' Certainly, as this study shows, reducing household income disparity might be an effective strategy to promote preventive care utilisation. Both affordable and effective preventive care services should be available to everyone.

Note

1. See <https://sites.duke.edu/centerforaging/programs/chinese-longitudinal-healthy-longevity-survey-clhs/project-goals/coverage-of-sampled-provinces/>

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