RESEARCH



A specific role of village doctors in reducing disparities: a quantile regression analysis of end-of-life medical care



Yuan Fang¹, Shih-Ting Huang^{1*} and Chengrui Xiao²

Abstract

Background In developing countries, the delivery of medical care to rural residents has been experiencing longstanding challenges and disparities. Since the 1960s, China has established the village doctors' system to provide preventive and primary care to improve rural residents' health. Nevertheless, how village doctors affect the medical spending and the end-of-life (EOL) quality for older people in rural China has not received sufficient attention. Family care has long been the mainstream of old age care in rural China, the accessibility to appropriate medical care is hence crucial. Village doctors are the most accessible medical care providers for rural older people. As a result, this study aims to uncover the importance of village doctors in EOL medical care for rural older people in China.

Methods The analysis is based on the Chinese Longitudinal Healthy Longevity Survey (CLHLS), which has national representativeness and contains information about the oldest old at an average age of 80 in China, with available information from 2002 to 2019. We adopt the quantile regression to illustrate the heterogeneous impacts of village doctors on the EOL medical care spending from the distribution perspective. We then employ the ordered logit model and ordinary least squares regression to estimate the effects of village doctors on rural older people's EOL life quality measured by the status before dying and the number of bedridden days.

Results We find that the EOL medical care spending is significantly increased by the presence of village doctors, especially high-quality ones. The disparities in the EOL medical care in rural and urban China are significantly reduced by high-quality village doctors. However, high-quality village doctors are still insufficient to meet the needs of rural older people regarding the high-end EOL medical care. The empirical results suggest that village doctors can significantly improve older people's quality of life before death in rural China.

Conclusion Our analysis highlights the importance of village doctors in providing EOL medical care to older people in rural China. It is crucial for governments to improve the village doctors' system, so that older residents in rural China can obtain high-quality EOL medical care services in their own communities and have a better quality of life before death.

Keywords Village doctors, End-of-life medical care, Disparities, Rural health, Aging health

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Background

Village doctors are the main primary care and preventive care providers in rural China [1, 2]. Generally, rural people have difficulties accessing high-quality medical care services in urban areas for two reasons. First, rural residents are typically covered by the health insurance named New Cooperative Medical System (NCMS), which has restricted reimbursement rules when they seek care in higher-level facilities [3, 4]. Second, even if out-ofpocket cost is not a concern, they may have difficulties in moving due to health conditions, and it is costly for rural residents to travel outside their villages. They also have to pay for traveling expenses and cannot work to obtain income [5, 6]. Thus, village doctors play an essential role in the rural health care system because they offer accessible and affordable medical services to rural residents, and the health conditions of rural people have been significantly improved by the village doctors' system [7].

The older rural people need special attention. In developed countries, nursing homes are more widely available and usually staffed with trained workers and physicians. However, in China, family care has long been the mainstream of old age care, especially in rural areas [8, 9]. Home-based care is mainly provided by family members without professional knowledge and skills. Nowadays home-based care may become even more unsustainable. Rigorous family planning policies carried out in the past few decades have led to a shortage of family caregivers. The situation has been worse in rural China where a large portion of the labor force (young and middle-aged adults) has migrated from rural to urban areas for better job opportunities. In these circumstances, the burden of performing caregiving is huge, both physically and economically. For example, when older people seek health care in higher-level facilities outside the village, they usually need to be accompanied by family members. Family caregivers are likely forced to leave work to take the older people to hospitals. Consequently, village doctors are the most accessible medical care providers for most of the older people in rural China. However, how village doctors play a role at the end-of-life (EOL) stage is understudied.

Particularly, we study the oldest old deceased population at an average age of 80. They are considered to be vulnerable as they are approaching the end of life [10]. It has been widely recognized that access to high-quality care at the end of life is needed to experience less pain and have more dignity [11]. In addition, the oldest old population faces a deterioration in physical function, and their children presumably belong to the young-old group (aged 60–69), who usually take responsibility for the care of their older parents and younger grandchildren at the same time [12]. As a result, the burden of care is heavy for the young-old group. Thus, the village doctor system is of great significance, especially in terms of the EOL medical care and support.

Two scenarios exist in EOL care utilization in the absence of village doctors, and the situation would be distinct if there were any. Some people wouldn't (or couldn't) seek medical care if there were no doctors nearby, resulting in almost no spending. In this case, the availability of village doctors will improve the EOL care utilization and increase the medical care spending accordingly. Another case is that rural older people choose to seek health care in urban areas in the absence of village doctors, and it may incur huge EOL medical expenditures and other related costs, as described above. The presence of village doctors makes it possible for rural older people to be treated in local clinics with lower costs. Following the previous studies [13, 14], we adopt the EOL spending to approximate medical care utilization before death. The majority of rural residents¹ participate in the basic medical insurance system, which has similar reimbursement rules in different regions, ² suggesting that residents in rural China encounter similar prices for medical services. Hence, medical spending is proportional to medical utilization. Although numerous studies demonstrate that higher spending does not necessarily lead to an improved health outcome [17–20], it still indicates more/better treatment in areas where medical resources are insufficient [21] since the local supply of resources serves as an important driver for utilization [22].

This paper examines two questions. First, we explore the effects of the availability and qualifications of village doctors on older people's EOL medical spending in rural China and on the discrepancies in rural-urban EOL medical spending. Second, we study how high-quality village doctors affect life quality before death. To illustrate the heterogeneous effects, we use the quantile regression (QR) to investigate how the EOL spending of rural older people responds to the presence and qualifications of village doctors from the distribution perspective. We find that the presence of village doctors can significantly stimulate the EOL medical care spending in rural China. This positive effect is more prominent when village doctors have higher qualifications, defined as being licensed and having a college degree. Moreover, village doctors, especially high-quality ones, can significantly close the gap between rural-urban EOL medical spending at low

¹ Before 2016, rural residents were eligible for the NCMS. In 2008, 91.5% of rural residents participated in the NCMS, and in 2015, the participation rate was 98.8%. (See https://www.gov.cn/gzdt/2009-02/17/content_1233236.htm and https://www.gov.cn/xinwen/2016-07/21/content_5093411.htm for details). Starting from 2016, China integrated the basic medical insurance for urban residents and the NCMS and establish a unified basic medical insurance system for urban and rural residents.

² Even though there is variation in NCMS design across counties, the coinsurance rate, copayment levels, and reimbursement rates were similar across counties but varied among different levels of hospitals [15, 16].

to moderate quantiles. It is crucial for the Chinese government to improve the village doctors' system so that old residents in rural China are provided with the option to stay home with proper care and have better life quality before death. Our results might also be applicable to other developing countries in order to alleviate the pressure of older people's EOL care.

Methods

Data

The data is obtained from the Chinese Longitudinal Healthy Longevity Survey (CLHLS), a national representative study of the oldest old at an average age of 80 in China. The CLHLS initiated in 1998 was executed every three to four years. This survey conducted household interviews in person to ensure the accuracy and depth of the information obtained. The most recent available wave is 2018, ³ but some observations of the 2018 wave were interviewed in 2019. We pool the waves of 2005, 2008, 2011, 2014, and 2018, obtaining 5,874, 5,228, 5,642, 2,879, and 2,226 deceased observations, respectively. Our pooled cross-sectional sample only includes older people who died between 2003 and 2019, accounting for 21,849 observations in total, to alleviate the potential influences caused by the NCMS, which was introduced in October 2002. The NCMS serves as a community-based health insurance for rural residents, so the spending and utilization of the EOL care in rural China can be fundamentally different after the implementation of the NCMS. Note that the wave conducted preceding 2005 is the 2002 wave. Individuals who passed away between 2002 and 2005 are recorded as decedents in the 2005 wave. The EOL health care expenditures and health status of these individuals were ascertained via responses to survey questions answered by their family members⁴ in the 2005 wave. Specifically, more than 75% of the deceased's guestionnaires are answered by parents, spouse, child, spouse of child, grandchild or his/her spouse; 5.4% are answered by other relatives; the rest of around 18.5% are answered by neighbors, social workers, and others.

Deceased cohort

The deceased older people are reported in each wave, and the time of death is shown on an annual basis. The aggregated EOL medical spending includes two parts: the cost of treating chronic conditions and the cost of saving lives at the last minute. The cost of treating chronic conditions presents the regular utilization of EOL medical care and accounts for the most part of EOL medical spending [23]. The patterns of EOL spending at the last minute utterly differ between people who died of diseases and those with natural and accidental deaths [24]. We focus on those who have chronic diseases. In detail, we consider people who died of diseases by excluding observations that their main causes of death are recorded as natural deaths or accidental deaths. For panels that the main cause of death was not asked in the questionnaire, we eliminated those who do not have any of the 17 chronic diseases.

Key variables

The EOL medical spending is referred to as the total medical cost (in Chinese yuan, RMB) in the last year of life, including all expenses from inpatient, outpatient, emergency room visits, etc. The inflation-adjusted values are used, and 2019 is taken as the base year. In our sample, people who have chronic diseases but with no EOL medical spending account for around 9% of our sample. Therefore, we take the logarithm of (1+EOL medical spending) to avoid generating too many missing values in the dependent variable.

The questionnaire surveys whether there was a doctor in the village when deceased older people lived in rural China. This question does not apply to deceased older people who lived in urban areas. The questionnaire also provides information on the quality of village doctors, that is, the ones licensed with a college degree, those licensed without a college degree, and unlicensed ones.

We employ two indicators of the EOL quality of life. First, we use the survey question asking whether the deceased older people were in pain prior to death to measure the older residents' status. The responses are ordered on a scale of 1-5, indicating in extreme pain, in severe pain, in moderate pain, in mild pain, and no pain, respectively. Since our study focuses on older rural residents with chronic diseases, an important task for village doctors is pain relief. This survey question is answered by a family member, so the answer is based on the family member's observations.⁵

In addition, to better understand the deceased's condition before dying, we use the number of bedridden days to measure the EOL life quality. Many older people believe that there is an association between death and dying and being entirely bedridden was affirmed [26],

³ 2021 survey was conducted, but it is not publicly available. Also, the 2021 wave has an overlap period before and after COVID-19, which may substantially influence the medical system's operation.

⁴ Detailed information on the specific person who answered the survey questions only is provided in waves 2005 and 2018. In 2018, 86.89% of the deceased's questionnaires are answered by their family members, such as a spouse, child, spouse of child, grandchild, or his/her spouse, and 3.23% are answered by other relatives. The remaining 10% are answered by neighbors, social service workers, and others.

⁵ Although family members' responses might not be the perfect proxy for the dying individuals' status, family respondents still constitute a crucial source of information that can be utilized to trace trends over time and enable temporal associations with alterations in institutional policies, funding, and statutes [25].

and taking care of bedridden patients would be a burden to caregivers [27].

With respect to control variables, the income (logarithm) is used to control for family financial status. We adopt the ability to move indoors, which reflects an important aspect of activities of daily living (ADL), as the approximation of health conditions. We further include control variables, such as gender, age of death, place of death, and year of death, in the analyses.

Data process

We process the data as follows: (1) drop 968 observations with missing values in year of death or year of death earlier than 2003; (2) drop 6,384 observations whose main causes of death are natural deaths or accidental deaths or who do not have any of the 17 chronic diseases; (3) drop 1,101 observations with missing values in medical costs; (4) drop 127 observations with missing information in village doctors; (5) drop 833 observations with missing values in other explanatory variables, including income, age of death, in place of death, and the ability to move indoors; (6) drop 791 observations with missing values in the status prior to death. To summarize, we exclude 34.26% of observations with natural death and out of the study period, and 13.05% of observations with missing values in key variables. The final cohort contains 11,511 decedents, of which 3,043 lived in urban areas and 8,468 were in rural villages, with the time of death between 2003 and 2019.

Statistical analysis

We use the QR to investigate how the presence and the quality of village doctors would affect EOL medical spending in rural China. The point estimate in a linear regression focuses on the conditional mean, whilst the QR is more flexible to outlier values and provides a better understanding of the entire conditional distribution than the simple linear regression. We also use the ordered logit model and ordinary least squares (OLS) model to provide insight into the effect of village doctors on the quality of life before death measured by the status prior to death and the number of bedridden days.

Results

Descriptive statistics

Table 1 summarizes the individual characteristics of rural and urban older people. We find that there is no disparity in gender distribution and in the ADL approximated by the functioning of indoor transferring between rural and urban regions. Rural older people tend to pass away at a relatively younger age, although the difference is minor, yet the t-test is significant. Moreover, rural deceased individuals have a lower income than their urban counterparts. Regarding the place of death, nearly 94% of rural deceased people die at home, while the number is only 72% for urban older people. Additionally, urban residents (22.08%) have a greater tendency to die in hospitals than rural older people (4.19%). Thus, medical providers available near home are more important to rural residents compared to urban residents.

Table 2 shows that there is a disparity in EOL medical expenditures and life quality between urban China and rural areas. On average, urban residents spend 8,810 RMB (approximately \$1,321) in the last year of life, while rural residents only spend 6,062 RMB (approximately \$911). Also, in each quantile, the disparities in urbanrural EOL medical spending exist, and the gap is continuously expanding as the expenses increase. EOL medical care disparities also lie within rural areas. Regarding the availability of village doctors, Table 1 shows that more than 10% of deceased older people in rural China live in areas with no village doctors, and only roughly 20% of them live in villages with licensed doctors with college degrees. There is no difference in the average medical expenditures between those who have village doctors and those who do not have village doctors. But, in each quantile, those with village doctors tend to spend more than those without village doctors. For the quality of village doctors, in our dataset, we define high-quality doctors as those licensed with college degrees and low-quality doctors as those licensed but without college degrees or unlicensed. People living in areas with high-quality village doctors tend to spend more than those without village doctors or with low-quality village doctors on average and in each quantile.

Table 3 shows that the quality of life before death differs between urban and rural China. For the status before dying, the percentage of deceased older people who were in extreme pain or in severe pain prior to death in rural China (16.83%) is higher than that in urban areas (13.44%). The percentage of having no pain is 19.95% for the rural and 25.73% for the urban deceased. Regarding the different qualifications of village doctors, there are fewer variations in the status before dying. For the bedridden conditions, half of the deceased have 15 days or less in bedridden before death. On average, those with high-quality village doctors nearby tend to have fewer bedridden days than those without village doctors or with low-quality ones.

We scrutinize the effect of village doctors on EOL medical care in rural China from two perspectives. First, we examine how village doctors' presence and quality affect the EOL medical spending of deceased rural older residents. Second, we pay attention to how village doctors impact disparities in EOL medical spending in rural and urban China.

Table 1 Summary statistics-study population characteristics

	Rural		Urban		
Panel A: Variables	Mean	Std. Dev.	Mean	Std. Dev.	t-test
Gender (Male = 1)	0.411	0.005	0.421	0.009	0.326
Age of death	94.196	0.102	94.677	0.164	0.014
Income (inflation-adjusted)	13,269.00	178.99	18,625.41	374.50	< 0.001
Panel B: Variables	# of obs.	%	# of obs.	%	t-test
with village doctors	7,602		-	-	-
licensed					
with a college degree	1,661	19.62% [†]	-	-	-
w/o a college degree	5,224	61.69% [†]	-	-	-
unlicensed	717	8.47% [†]	-	-	-
w/o village doctors	866	10.22% [†]	-	-	-
Were the deceased older people in	n pain prior to death?				
In extreme pain	371	4.38%	121	3.98%	0.344
In severe pain	1,054	12.45%	288	9.46%	< 0.001
In moderate pain	2,259	26.68%	716	23.53%	< 0.001
In mild pain	3,095	36.55%	1,135	37.30%	0.462
No pain	1,689	19.95%	783	25.73%	< 0.001
Place of death					
Home	7,950	93.88%	2,192	72.03%	< 0.001
Hospital	355	4.19%	672	22.08%	< 0.001
Institutions	136	1.61%	157	5.16%	< 0.001
Other places	27	0.32%	22	0.72%	0.003
Functioning in indoor transferring					
Fully independent	1,838	21.71%	682	22.41%	0.419
Partially independent	1,661	19.62%	580	19.06%	0.507
Fully dependent	4,969	58.68%	1,781	58.53%	0.884
Number of observations	8,468		3,043		
Noto: + represents the percentage of	village dectors in rural area				

Note: † represents the percentage of village doctors in rural areas

Source: Chinese Longitudinal Healthy Longevity Survey (CLHLS) waves 2005, 2008, 2011, 2014, and 2018, Center for Healthy Aging and Development Studies Data from: The Chinese Longitudinal Healthy Longevity Survey (CLHLS)-Longitudinal Data (1998–2018), April 3, 2020. Peking University Open Research Data Platform, V2, https://doi.org/10.18170/DVN/WB07LK

Table 2 Summary statistics of medical expenditures by the availability and quality of village doctors

EOL medical expenditures (in Chinese currency)								
	Mean	SD	10%	25%	50%	75%	90%	
Urban	8,810.53	274.62	142.21	734.75	3,031.46	9,483.89	23,108.50	3,043
Rural	6,062.07	122.69	64.53	552.00	2,133.12	6,246.97	15,486.71	8,468
with village doctors	6,070.93	128.31	75.79	587.80	2,165.30	6,304.00	15,486.71	7,602
licensed	6,261.59	136.46	74.96	606.29	2,248.91	6,407.12	16,560.08	6,885
with a college degree	7,705.24	328.52	118.55	711.29	2,844.16	8,539.28	21,775.03	1,661
w/o a college degree	5,802.57	145.86	64.07	577.71	2,133.12	5,927.43	15,157.28	5,224
unlicensed	4,240.06	358.74	129.06	407.09	1,356.97	4,266.24	11,040.05	717
w/o village doctors	5,984.32	413.23	0	352.68	1,422.08	5,878.02	15,377.08	866

Source: Chinese Longitudinal Healthy Longevity Survey (CLHLS) waves 2005, 2008, 2011, 2014, and 2018

Baseline results

Table 4 Column (1) reports the result obtained from the OLS regression, while Columns (2)-(6) present the results of QR in the 10th, 25th, 50th, 75th, and 90th percentiles, respectively. The OLS result indicates that the EOL medical spending is significantly higher in rural areas with village doctors, no matter whether licensed or not, compared to those without village doctors. The QR results

show that the positive effects of village doctors on EOL medical care are more prominent in the lower quartiles, that is, the deceased rural older people with less EOL medical spending. Our results resonate with the previous study suggesting that village clinics and village doctors have a specific role in delivering primary health care services to older people and the impoverished in rural regions [28].

of obs.

of obs

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	Panel A W	hether the dec	eased older pe	ople were in pain	prior to dea	th		
	Extreme		Severe	Moderate	Mild		No pain	# of o
Urban	3.98%		9.46%	23.53%	37.30%		25.73%	3043
Rural	4.38%		12.45%	26.68%	36.55%		19.95%	8,468
with village doctors	4.42%		12.50%	26.60%	36.71%		19.77%	7,602
licensed	4.42%		12.49%	26.67%	36.72%		19.71%	6,885
with a college degree	4.64%		12.16%	26.01%	35.40%		21.79%	1,661
w/o a college degree	4.35%		12.60%	26.88%	37.14%		19.05%	5,224
unlicensed	4.46%		12.55%	25.94%	36.68%		20.36%	717
w/o village doctors	4.04%		12.01%	27.37%	35.10%		21.48%	866
	Panel B Nu	umber of bedri	dden days					
	Mean	SD	10%	25%	50%	75%	90%	# of o
Urban	133.55	399.19	0	0	15	60	362	3,037
Rural	120.04	415.71	0	0	10	45	265	8,418
with village doctors	117.09	406.12	0	0	10	45	240	7,553
licensed	116.18	407.44	0	0	10	40	240	6,837
with a college degree	116.88	426.14	0	0	10	30	200	1,645
w/o a college degree	115.96	401.38	0	0	10	45	250	5,192
unlicensed	125.78	393.51	0	2	15	60	300	716
w/o village doctors	145.77	491.04	0	0	10	50	365	865

Table 3	Summarv	statistics	quality	of life by	/ the	availabilitv	and	quality	of village	doctors
Tuble 5	Junnary	statistics	quanty	or nic by	/ LIIC	avanability	unu	quanty	or vinage	uociors

Source: Chinese Longitudinal Healthy Longevity Survey (CLHLS) waves 2005, 2008, 2011, 2014, and 2018. The numbers of observations in each category are fewer than those in Table 2 because of missing values in the number of bedridden days

The estimated results of Table 4 also suggest that the quality of village doctors is positively associated with EOL medical spending in rural areas. To be specific, living in areas with licensed village doctors having college degrees almost generates significantly higher EOL medical spending in each quantile compared to that in areas without village doctors. The positive effects are larger at lower quantiles. The impacts of unlicensed village doctors and licensed village doctors without college degrees on EOL medical spending of deceased rural older people only stay positive and significant at the 10th and 25th percentiles, indicating that relatively low-quality village doctors have a limited impact on older people's EOL medical care spending in rural China. To sum up, the availability of high-quality village doctors is essential for the effective delivery of EOL medical care in rural areas.

For control variables, we find that males tend to spend more at the end of life than females in OLS and QR regressions. The income is positively associated with EOL medical spending. This significantly positive relationship is consistent across OLS and QR with different percentile specifications, although the magnitudes are smaller at the upper quantiles. It is worth noting that both the OLS and QR results show that the age of death is negatively associated with EOL medical spending of deceased rural older people. This finding is consistent with the previous literature showing that the medical spending incurred near death is negatively associated with age [29, 30]. Indeed, the aging of the population is not a leading factor in high health care costs [31]. Advanced age itself does not necessarily mean severe health conditions and rising medical spending. Furthermore, deceased rural older people with worse health conditions are inclined to have a higher level of EOL medical spending, and the magnitudes of coefficients become smaller at higher quantiles. Unsurprisingly, the place of death is an essential determinant of EOL medical spending. Rural older residents who pass away in hospitals and other medical institutions incur higher EOL medical spending than those who pass away at home. Similarly, the effects are more prominent at the lower quantiles. We conduct the robustness checks by applying the weights to the analysis (see Table 5 for details) and consider the two-step selection issues in medical spending (see Table 6), reaching consistent results in Table 4.

To analyze the changes in rural-urban EOL medical spending discrepancies, the EOL medical spending of deceased older people in urban areas is taken as the baseline. Columns (1) and (2)-(6) in Table 7 summarize the OLS and QR results, respectively. Regardless of village doctors' qualifications, the discrepancies in rural-urban EOL medical spending become larger at higher quantiles. It indicates that the presence of village doctors is insufficient to meet the need of high-end EOL medical care for rural older people.

As shown in Table 7, there is no significant difference between rural and urban China on EOL medical spending in the 10th percentile when village doctors are available. That is, deceased older people in rural areas receive similar EOL medical care from village doctors regardless of qualifications as their counterparts in urban areas. In the 25th to 90th percentiles, we find that the discrepancies in rural-urban EOL medical spending are much less

Table 4 EOL care disparities within rural communities

Dependent Variables: Log EOL Medical Expenditures (inflation-adjusted)								
	OLS	Quantile Reg	gressions					
	(1)	(2)	(3)	(4)	(5)	(6)		
		10%	25%	50%	75%	90%		
Access to care								
No village doctors	Base	Base	Base	Base	Base	Base		
licensed with a college degree	0.432***	0.691***	0.481***	0.334***	0.275***	0.071		
	(0.110)	(0.223)	(0.128)	(0.095)	(0.071)	(0.080)		
licensed w/o a college degree	0.236**	0.618***	0.321**	0.117	0.031	-0.126*		
	(0.098)	(0.173)	(0.126)	(0.085)	(0.065)	(0.072)		
unlicensed	0.258**	0.721***	0.315**	0.107	0.088	-0.124		
	(0.125)	(0.206)	(0.142)	(0.104)	(0.077)	(0.087)		
Male	0.277***	0.141	0.228***	0.204***	0.221***	0.165***		
	(0.056)	(0.114)	(0.045)	(0.043)	(0.036)	(0.045)		
Age of death	-0.060***	-0.087***	-0.059***	-0.049***	-0.042***	-0.040***		
	(0.003)	(0.006)	(0.002)	(0.002)	(0.002)	(0.002)		
Place of death								
Home	Base	Base	Base	Base	Base	Base		
Hospital	1.355***	1.861***	1.295***	1.080***	0.947***	0.774***		
	(0.103)	(0.147)	(0.075)	(0.076)	(0.067)	(0.114)		
Institutions	0.444**	0.616**	0.364**	0.207	0.391**	0.099		
	(0.208)	(0.277)	(0.182)	(0.235)	(0.184)	(0.103)		
Other places	-0.636	-1.952***	-0.613	-0.058	-0.455	0.173		
	(0.654)	(0.385)	(0.522)	(0.513)	(0.492)	(0.901)		
Log income	0.124***	0.206***	0.175***	0.098***	0.077***	0.068***		
	(0.016)	(0.023)	(0.020)	(0.015)	(0.009)	(0.010)		
Functioning in indoor transferring								
Fully independent	Base	Base	Base	Base	Base	Base		
Partially independent	1.345***	3.986***	1.661***	0.895***	0.617***	0.502***		
	(0.089)	(0.180)	(0.160)	(0.068)	(0.056)	(0.066)		
Fully dependent	1.572***	4.176***	1.837***	1.119***	0.897***	0.676***		
	(0.077)	(0.121)	(0.156)	(0.058)	(0.048)	(0.058)		
Fixed effects for the year of death	Yes	Yes	Yes	Yes	Yes	Yes		
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes		
Constant	9.725***	5.593***	8.436***	9.907***	10.864***	11.882***		
	(0.469)	(0.818)	(0.526)	(0.438)	(0.235)	(0.368)		
Number of observations	8,468	8,468	8,468	8,468	8,468	8,468		

Notes: Robust standard errors are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1

Source: Chinese Longitudinal Healthy Longevity Survey (CLHLS) waves 2005, 2008, 2011, 2014, and 2018

when the EOL medical care is provided by licensed village doctors with college degrees than that provided by relatively low-quality village doctors. Meanwhile, such discrepancies between unlicensed village doctors and those licensed without college degrees are not statistically different. These findings suggest that high-quality village doctors are associated with high-quality EOL medical care close to those provided in urban areas, and improving the quality of village doctors is a convincing way to reduce the discrepancies in rural-urban EOL medical care and meet the needs of rural older people.

Previous studies indicated that those with greater access to health care experience less pain before death [32, 33], but few studies measure the effect of the qualification of providers on it. The ordered logit model is adopted to quantify the effect of high-quality village doctors on the status prior to death of deceased older people in rural areas. The marginal effects are reported in Table 8 Columns (1)–(5). The indicator "licensed with a college degree" takes the value of one if the rural older people live in the areas where village doctors are licensed and have a college degree and takes the value of zero if there are no village doctors or there are only low-quality village doctors. ⁶ Further, we employ the number of bed-

⁶ We also re-do the regressions, including three types of village doctors, to compare with those without village doctors, and we find that neither type of village doctors' effect is significant.

Dependent Variables: Log EOL Medical Expenditures (inflation-adjusted)								
	OLS	Quantile Regressions						
	(1)	(2)	(3)	(4)	(5)	(6)		
		10%	25%	50%	75%	90%		
Access to care								
No village doctors	Base	Base	Base	Base	Base	Base		
licensed with a college degree	0.565***	0.827**	0.705***	0.456***	0.252**	0.096		
	(0.191)	(0.387)	(0.153)	(0.139)	(0.103)	(0.120)		
licensed w/o a college degree	0.030	0.349	0.174	-0.042	-0.217**	-0.224**		
	(0.171)	(0.399)	(0.139)	(0.133)	(0.110)	(0.110)		
unlicensed	0.325	0.649	0.506***	0.300*	-0.039	0.030		
	(0.214)	(0.460)	(0.148)	(0.154)	(0.287)	(0.152)		
Control variables	Yes	Yes	Yes	Yes	Yes	Yes		
Fixed effects for the year of death	Yes	Yes	Yes	Yes	Yes	Yes		
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes		
Number of observations	8,140	8,140	8,140	8,140	8,140	8,140		

Table 5 EOL care disparities within rural communities (weighted)

Notes: The weights in waves 2005 and 2008 were calculated based on the numbers of old persons by age, sex, and rural/urban residence in 2005 and 2008 from the 2000 census 100% data tabulations for the 22 provinces where the 2005 and 2008 surveys were conducted. The weights in waves 2011, 2014, and 2018 were calculated based on the numbers of old persons by age, sex, and rural/urban residence in 2011, 2014, and 2018 from the 2010 census 100% data tabulations for the 22 provinces where the ural/urban residence in 2011, 2014, and 2018 from the 2010 census 100% data tabulations for the 22 provinces where surveys were conducted. The total number of the weighted individual cases of the survey is equal to the total sample size. Robust standard errors are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1. Control variables included in the regressions are the same as in Table 4. The number of observations is reduced to 8,140 due to the missing value in weights

Source: Chinese Longitudinal Healthy Longevity Survey (CLHLS) waves 2005, 2008, 2011, 2014, and 2018

Table 6 EOL care disparities within rural communities with selection models

Dependent Variables: Log EOL Medical Expenditures (inflation-adjusted)

	First stage		Second st	age				
	OLS		Quantile r	Quantile regression				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
			10%	25%	50%	75%	90%	
Access to care								
No village doctors	Base	Base	Base	Base	Base	Base	Base	
licensed with a college degree	0.193***	0.173**	0.262*	0.202**	0.225**	0.206**	0.034	
	(0.072)	(0.072)	(0.148)	(0.095)	(0.100)	(0.091)	(0.097)	
licensed w/o a college degree	0.146**	-0.005	0.215*	0.076	-0.011	-0.041	-0.123	
	(0.060)	(0.062)	(0.128)	(0.089)	(0.088)	(0.083)	(0.089)	
unlicensed	0.280***	-0.026	0.154	-0.016	-0.003	0.003	-0.166	
	(0.091)	(0.091)	(0.164)	(0.122)	(0.109)	(0.109)	(0.131)	
Inverse Mills ratio		-0.605						
		(0.615)						
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Fixed effects for the year of death	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Number of observations	8,443	8,443	8,443	8,443	8,443	8,443	8,443	

Notes: Robust standard errors are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1. Control variables in Column (1) included in the regressions are the same as in Table 4, and we add an additional variable of number of people living together before dying in control variables. Control variables in Columns (2)–(7) included in the regressions are the same as in Table 4. The number of poservations is reduced to 8,443 due to the missing value in the additional variable of the number of people living together before dying in control variables. Control variables in Columns (2)–(7) included in the regressions are the same as in Table 4. The number of observations is reduced to 8,443 due to the missing value in the additional variable of the number of people living together before dying. Among 8,443 observations, 7,694 have non-zero medical expenses, and 749 have zero medical expenses. Columns (2)–(7) share the same results in the first stage estimations. The inverse Mills ratio in Column (2) is statistically insignificant, indicating that the selection issue is not a concern

Source: Chinese Longitudinal Healthy Longevity Survey (CLHLS) waves 2005, 2008, 2011, 2014, and 2018

Table 7 EOL care disparities between urban and rural areas

Dependent Variables: Log EOL Medical Expenditures (inflation-adjusted)							
	OLS	Quantile Reg	gressions				
	(1)	(2)	(3)	(4)	(5)	(6)	
		10%	25%	50%	75%	90%	
Access to care							
Urban areas	Base	Base	Base	Base	Base	Base	
licensed with a college degree	-0.034	0.117	0.005	-0.123*	-0.167***	-0.268***	
	(0.080)	(0.183)	(0.066)	(0.063)	(0.059)	(0.045)	
licensed w/o a college degree	-0.247***	0.052	-0.148**	-0.358***	-0.436***	-0.465***	
	(0.065)	(0.110)	(0.058)	(0.046)	(0.047)	(0.044)	
unlicensed	-0.201**	0.090	-0.168*	-0.344***	-0.379***	-0.486***	
	(0.101)	(0.155)	(0.100)	(0.079)	(0.077)	(0.078)	
Male	0.290***	0.150*	0.227***	0.244***	0.279***	0.245***	
	(0.049)	(0.090)	(0.043)	(0.036)	(0.035)	(0.032)	
Age of death	-0.056***	-0.075***	-0.054***	-0.045***	-0.039***	-0.036***	
	(0.003)	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)	
Place of death							
Home	Base	Base	Base	Base	Base	Base	
Hospital	1.350***	1.848***	1.281***	1.042***	0.871***	0.785***	
	(0.072)	(0.124)	(0.061)	(0.048)	(0.063)	(0.039)	
Institutions	0.017	-0.019	0.030	0.023	0.070	0.046	
	(0.167)	(0.688)	(0.114)	(0.097)	(0.161)	(0.060)	
Other places	-0.193	-1.730***	-0.453*	-0.113	-0.087	0.560	
	(0.446)	(0.254)	(0.270)	(0.246)	(0.366)	(0.552)	
Log income	0.126***	0.239***	0.162***	0.104***	0.087***	0.069***	
	(0.015)	(0.026)	(0.019)	(0.013)	(0.008)	(0.008)	
Functioning in indoor transferring							
Fully independent	Base	Base	Base	Base	Base	Base	
Partially independent	1.308***	4.125***	1.441***	0.900***	0.629***	0.448***	
	(0.079)	(0.160)	(0.116)	(0.060)	(0.057)	(0.053)	
Fully dependent	1.547***	4.450***	1.651***	1.145***	0.905***	0.655***	
	(0.068)	(0.091)	(0.109)	(0.050)	(0.046)	(0.049)	
Fixed effects for the year of death	Yes	Yes	Yes	Yes	Yes	Yes	
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	
Constant	9.849***	5.731***	8.869***	9.940***	10.736***	11.673***	
	(0.346)	(0.729)	(0.329)	(0.277)	(0.224)	(0.227)	
Number of observations	10,645	10,645	10,645	10,645	10,645	10,645	

Notes: Robust standard errors are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1

Source: Chinese Longitudinal Healthy Longevity Survey (CLHLS) waves 2005, 2008, 2011, 2014, and 2018

ridden days to measure the EOL quality of life in Table 8 Column (6), showing the OLS estimation of the impact of village doctors on reducing the number of bedridden days for those who are bedridden. We do not anticipate the probability of being bedridden to be decreased, but the village doctors can assist in reducing the number of days spent in bed. To summarize, we provide evidence that high-quality village doctors have significant impacts on pain relief, reducing the number of bedridden days and promoting older people's life quality before death in rural China. We conclude that only high-quality village doctors can improve the EOL life quality regarding pain relief.

Further analysis

Our baseline regression results point out that the presence of village doctors is positively associated with EOL medical spending, and the effects are more prominent among lower quantiles. To further understand how village doctors increase medical care utilization, we report OLS regression results by subgroups divided by living arrangement and mobility. We first divide our sample by the living arrangement. Based on the survey question, we combine the answers into two groups: living with family members and living alone. Living with family members consists of situations of living with a spouse, children, grandchildren, or other relatives while living alone includes circumstances of never being married, widowed,

Table 8 EOL care quality in rural communities

Dependent variable:	Whether th	e deceased old	der people were	in pain prior to	death	Number of bedridden days
	Extreme	Severe	Moderate	Mild	No pain	(intensive margin)
	(1)	(2)	(3)	(4)	(5)	(6)
Access to care						
licensed with a college degree	-0.004*	-0.009*	-0.009*	0.007*	0.015*	-48.566*
	(0.002)	(0.005)	(0.005)	(0.004)	(0.008)	(29.087)
licensed w/o a college degree						-65.915**
						(25.938)
unlicensed						-61.370**
						(30.882)
Male	0.005***	0.012***	0.012***	-0.010***	-0.020***	-65.948***
	(0.002)	(0.004)	(0.004)	(0.003)	(0.006)	(13.238)
Age of death	-0.002***	-0.004***	-0.004***	0.003***	0.007***	2.214***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.657)
Place of death						
Home	Base	Base	Base	Base	Base	Base
Hospital	0.012**	0.024**	0.022***	-0.022**	-0.035***	-100.234***
	(0.005)	(0.010)	(0.008)	(0.010)	(0.013)	(20.823)
Institutions	0.001	0.002	0.002	-0.001	-0.003	-69.433**
	(0.006)	(0.014)	(0.014)	(0.011)	(0.022)	(31.061)
Other places	0.047**	0.086**	0.052***	-0.088**	-0.097***	-118.523**
	(0.024)	(0.035)	(0.008)	(0.039)	(0.027)	(53.487)
Log income	-0.002***	-0.004***	-0.004***	0.004***	0.007***	1.189
	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(3.467)
Functioning in indoor transferring						
Fully independent	Base	Base	Base	Base	Base	Base
Partially independent	0.015***	0.036***	0.044***	-0.025***	-0.071***	94.632***
	(0.002)	(0.005)	(0.006)	(0.004)	(0.010)	(15.488)
Fully dependent	0.018***	0.043***	0.050***	-0.031***	-0.081***	178.746***
	(0.002)	(0.004)	(0.005)	(0.003)	(0.009)	(11.738)
Fixed effects for the year of death	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	8,468	8,468	8,468	8,468	8,468	5,614

Notes: An ordered logit model is estimated, and marginal effects are reported in Columns (1)–(5). The indicator "licensed with a college degree" takes the value of 1 if the rural older people live in the areas where village doctors are licensed and have a college degree, and it takes the value of zero if there are no village doctors or there are low-quality village doctors. Low-quality village doctors are licensed but without a college degree or those who are unlicensed. We also run the regressions including three types of villages to compare with those without village doctors, and we find that neither type of village doctors' effects is significant. Column (6) shows the OLS estimation of village doctors' effect on bedridden days at the intensive margin. Among 8,418 observations with information of the number of bedridden days, 2,804 observations (33.3%) have zero days in bedridden and are excluded in the regressions in Column (6). We also include observations with zero bedridden days in the regressions and find that neither type of village doctors' effect is significant. We conclude that only high-quality village doctors will improve EOL life quality in terms of pain relief. Robust standard errors are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1

Source: Chinese Longitudinal Healthy Longevity Survey (CLHLS) waves 2005, 2008, 2011, 2014, and 2018

or divorced. The living arrangement reflects not only accompaniment but the availability of support when in need. Note that individuals who live in the institutions are excluded from the study because they may receive medical care from institutions, and the number of people is relatively small (around 1.7%), which shows that this type of living arrangement is not common in rural China. We further divide the subsamples by mobility to get a close look at the function of local primary medical care providers. Our estimated results in Table 9 show that the deceased rural older people who live alone and could move, indicated by the fully independent or partially independent in indoor transferring activities, are inclined to have more EOL medical spending if high-quality village doctors are available. High-quality village doctors could also help those who live with their families, regardless of their ADL assessment. Family members could take older people to visit village doctors nearby. However, we do not find a significant effect on those who live alone without the ability to move. This group of people is the most vulnerable among our sample. It is likely that they do not receive sufficient care, even though the Chinese

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	Live alone		Live with families	
	fully or partially independent	fully dependent	fully or partially independent	fully dependent
Access to care				
No village doctors	base	base	base	base
licensed with a college degree	1.142*	-0.152	0.459**	0.343*
	(0.625)	(0.573)	(0.222)	(0.179)
licensed w/o a college degree	0.684	0.459	0.385**	0.301*
	(0.508)	(0.479)	(0.195)	(0.161)
unlicensed	0.898	0.026	0.365	0.256
	(0.555)	(0.535)	(0.243)	(0.191)
Control variables	Yes	Yes	Yes	Yes
Fixed effects for the year of death	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes
Number of observations	300	345	2,253	3,147

Notes: 2,319 observations with missing information in the living arrangement and 104 living in institutions are excluded. Reported coefficients are from OLS

regressions. Robust standard errors are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1

Source: Chinese Longitudinal Healthy Longevity Survey (CLHLS) waves 2005, 2008, 2011, 2014, and 2018

government provides welfare programs to support them [8]. ⁷

Table 10 shows the heterogeneous effects on chronic conditions and income levels estimated using OLS regressions. Cancer/tumor leads to catastrophic health expenditure during the end of life in China [34], so we compare cancer with other types of chronic diseases. The regression results in Column (1) in Table 10 show that both the presence of village doctors and cancer increase the log value of EOL medical expenditures, but the coefficient of the interaction terms of cancer and high-quality village doctors is negative and statistically significant, indicating that village doctors could only provide the primary care for non-severe health conditions. Those who need intensive treatment may still go to higher-level facilities to seek better health care services. Estimated results reported in Column (2) in Table 10 reflect that village doctors are expected to help those who have low income because the coefficients of different qualifications of village doctors are positive and that of the interaction terms with income are negative. Tables 9 and 10 conclude that village doctors, especially high-quality ones, could help those who are low-income, with non-severe health conditions, and those who have caregivers or could go to doctors by themselves. In other words, village doctors do not serve as perfect substitutes for health care services in higher-level facilities. The rural older residents still need to go outside to search for better health care services under severe conditions. Nevertheless, village doctors provide access to care for those who cannot go outside or who cannot afford the cost of seeing doctors outside and offer an alternative to those who do not need advanced treatment.

Discussion

We provide empirical evidence on whether better-qualified village doctors help reduce rural-urban EOL spending discrepancies. Medical spending discrepancies are caused by unmet medical care or low prices of medical services. On one hand, residents in urban areas are generally believed to have more access to medical resources, particularly high-quality ones [35–37]. Even though more health care might not be better [22], the discrepancies in medical spending between urban and rural areas could still be employed to measure the medical care disparities since the local supply of resources serves as an important driver for utilization [22]. On the other hand, it is intuitive to assume that medical services prices are generally lower in rural areas. Given that medical spending is lower in rural areas, medical utilization in rural areas could be either higher or lower than that in urban areas. However, there is some evidence that compared to that in urban areas, out-of-pocket (OOP) payments are higher in rural areas [38-40], 8 so it is reasonable to derive that medical care utilization is lower in rural areas. Therefore, low

⁷ The Chinese government provides welfare programs to support those identified as Three No's, i.e., have no ability to work, have no source of income, and have no families or relatives. Especially, local government in rural areas guarantees food, clothing, housing, medical care, and burial expenses to this type of individual.

⁸ There were three types of health insurance in China before 2016, NCMS, Urban Resident Basic Medical Insurance (URBMI), and Urban Employees Basic Medical Insurance (UEBMI). All health insurance programs' reimbursement rates are designed to encourage patients to seek health care locally. They set the highest reimbursement rates at the primary care level (e.g., township health centers in rural areas and community health centers in urban areas) and the lowest in municipal and higher-level hospitals. However, the number of health services and medicines covered by the health insurance programs is very limited, and a lot of medical examinations and drugs are out of pocket. In addition, NCMS and URBMI offer fewer benefits than UEBMI. In short, OOP is still higher for rural residents than for urban residents.

Table 10 EOL medical expenditures heterogeneity analysis

Dependent Variables: Log EOL Medical Expenditures (inflation-adjusted)			
	(1)	(2)	
Access to care			
No village doctors	base	base	
licensed with a college degree	0.469***	1.177**	
	(0.113)	(0.556)	
licensed w/o a college degree	0.268***	1.083**	
	(0.101)	(0.475)	
unlicensed	0.278**	0.764	
	(0.129)	(0.608)	
Cancer	1.808***		
	(0.231)		
Cancer * Access to care			
Cancer* licensed with a college degree	-0.727**		
	(0.301)		
Cancer* licensed w/o a college degree	-0.460*		
	(0.249)		
Cancer* unlicensed	-0.399		
	(0.323)		
Log income		0.206***	
		(0.050)	
Log income* Access to care			
Log income * licensed with a college degree		-0.086	
		(0.061)	
Log income * licensed w/o a college degree		-0.098*	
		(0.053)	
Log income * unlicensed		-0.058	
		(0.071)	
Control variables	Yes	Yes	
Fixed effects for the year of death	Yes	Yes	
Province fixed effects	Yes	Yes	
Number of observations	8,468	8,468	

Notes: Reported coefficients are from OLS regressions. Robust standard errors are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1

Source: Chinese Longitudinal Healthy Longevity Survey (CLHLS) waves 2005, 2008, 2011, 2014, and 2018

medical spending implies low medical care utilization in this study.

Aside from that, we present some empirical evidence that the availability of village doctors is positively associated with medical spending and helps relieve the suffering of older people at the end of life. Because of entrenched cultural norms, older people in China usually harbor a deep-seated preference for staying at their lifelong homes in their final days, so they favor home-based palliative services over institutional care at the end of life [41, 42]. In this case, if qualified and reliable village doctors are available, older people in rural China are provided with an alternative to be treated locally. Although some studies criticize the rural clinic's poor medical quality [43, 44], the village doctor could provide accessible medical services to the poor and older people with restricted mobility. Furthermore, as discussed in the previous section, older people who live alone without mobility are not affected by the presence of village doctors. If it is the case that the vulnerable group is undertreated, regular home visits arranged by village doctors should enhance their well-being. Village doctors may also provide emotional support before death because of the trust built on close ties between villagers. In the case of special needs, village doctors can be trained to fill the gap of lacking specialists and professionals. For example, some studies show that village doctors can be trained to act as health workers in mental health [45] and hypertension [46]. Accordingly, during the EOL period, village doctors can also be trained to perform hospice care to improve the life quality of older people.

To summarize, village doctors could help residents access EOL care in an effective way by providing timely, convenient, affordable, and reliable services. Unfortunately, the current village doctors' system in rural China suffers from both quantity and quality issues. First, the number of health workers per 1,000 people in rural areas is far below the national average. In 2020, the national average number of health workers per 1,000 people was 6.24, while this number was 1.62 in rural areas, merely a quarter of the national average [47]. Second, the qualifications of village doctors, which determine the quality of care delivered [43], are in great need of improvement. The village doctors' system has its roots in barefoot doctors, who were the main primary care and preventive care⁹ providers in rural China from 1968 to 1985 [1, 49]. These barefoot doctors were originally farmers and received only short-term medical and paramedical training. In 1985, the village doctors' system was introduced. Barefoot doctors who passed examinations could be qualified as village doctors. However, in practice, those who failed exams still serve as health workers under the code of village doctors [7]. In addition, most village doctors in China are underqualified [50] and aging rapidly [51, 52]. The disparities in the quantity and quality of doctors in rural and urban areas are tremendous [53]. The government should take action to encourage young medical graduates to develop their careers in rural China and to provide qualified village doctors to serve rural residents.

There are limitations in this study. First, we use the presence of village doctors to proxy access to health care. The CLHLS lacks detailed information on rural medical resources, such as the distance to village clinics, the time traveling to village clinics, or even the number of village doctors, for further analysis. However, our results suggest that the presence of village doctors benefits rural residents in terms of EOL care. Second, it is worth noting that we only discuss the total medical cost instead of the OOP payments during the last year of life since the survey does not report the OOP payments in each wave. In essence, disparities in the total EOL medical spending portray the whole picture of differences in the utilization of EOL care between rural and urban China, while such differences in the OOP payments mainly reflect the differences in health insurance plans between rural and urban China.

Conclusions

This paper demonstrates the pivotal role that village doctors play in providing EOL medical care services to older people in rural China. Although village doctors are criticized regarding the suboptimal quality of care they offer, our empirical results show that the mere presence of primary care providers significantly aids in the delivery of EOL care. We find that high-quality village doctors effectively bridge the wide gap in rural-urban EOL medical care. Our study also sheds light on the effect of highquality village doctors on older people's quality of life in their final stages in rural China. Nonetheless, it remains a pressing challenge for rural older people to access highquality EOL care in their communities, highlighting the need for further improvements in the health care system.

The quality and quantity of primary care cannot be improved without government financial support. The allocation of health resources and government subsidies are presently distributed unevenly among the hospital sectors and the clinics conducting primary and preventive care [54]. Medical care providers generally earn less and receive fewer benefits than professionals in urban areas [55]. To ameliorate this disparity, governments should craft and implement supportive policies to encourage young and qualified doctors to serve in remote areas. The supportive policies should be two-pronged. First, from the economic perspective, governments can use competitive salaries and compensations to attract high-quality doctors to practice in rural China. Although governments have introduced subsidies to increase village doctors' income after the reform of the rural health system in 2009 [1], the average income of village doctors is still much lower than that of their counterparts in urban areas. It is also important for governments to provide better housing conditions to bolster the attractiveness of rural postings, so that high-quality doctors could be more willing to stay in rural areas to provide sustained medical care to rural residents [56]. Second, from the non-economic perspective, village doctors should be offered with the opportunity for reasonable and achievable career development [57]. Village doctors and rural health care providers should be treated as formal employees of health facilities in urban areas to receive professional development, training, and assessment opportunities. An additional strategic measure would be to prioritize doctors with rural service experience for career advancement, thereby recognizing their contributions and fostering a sense of professional fulfillment.

Abbreviations

EOL	End-of-life	

- CLHLS Chinese Longitudinal Healthy Longevity Survey
- NCMS New Cooperative Medical System
- QR Quantile regression
- ADL Activities of daily living
- OLS Ordinary least squares
- OOP Out-of-pocket
- URBMI Urban Resident Basic Medical Insurance
- UEBMI Urban Employees Basic Medical Insurance

Acknowledgements

Not applicable.

⁹ As it is shown that older adults in rural China prioritize the need of symptomatic relief rather than disease prevention and curing when seeking medical services [48], preventive care is not a major concern in the context of our study. To control for the potential effects due to the preventive medical care provided by local governments, we include the year of death-by-province fixed effects and re-do the OLS estimation. The results are similar to our baseline findings and are available upon request.

Author contributions

YF analyzed the data and drafted the manuscript. All authors contributed to the interpretation of the results. SH and CX critically revised the manuscript for important intellectual content. All authors have read and approved the final manuscript. YF and SH are the study guarantors.

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Data availability

Data from: Center for Healthy Aging and Development Studies, 2020, "The Chinese Longitudinal Healthy Longevity Survey (CLHLS)-Longitudinal Data (1998–2018)", https://doi.org/10.18170/DVN/WBO7LK, Peking University Open Research Data Platform, V2.

Declarations

Ethics approval and consent to participate Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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