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ORIGINAL ARTICLE

Socio-demographic disparities in health-related quality of life after hip fracture in China: evidence from the China Health and Retirement Longitudinal Study

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Abstract

Summary This study analyzed the impact of hip fractures on people's health-related quality of life and its socio-demographic disparities in China.

Purpose Hip fractures cause high mortality and worsened health-related quality of life (HRQoL). This study aimed to investigate whether socio-demographic-related inequities in post-hip fracture participants' HRQoL exist in China.

Methods Data from the China Health and Retirement Longitudinal Study (waves 2013, 2015, and 2018) were used. The measurement of HRQoL in this study focused on 5 health dimensions: depression, body pain, mobility, basic activities of daily living, and instrumental activities of daily living. A difference-in-differences (DID) analysis with multiple time periods was performed to gauge the impact of hip fracture on HRQoL. A multivariate regression approach was used to explore socio-demographic-related factors associated with inequities of HRQoL.

Results A total of 23,622 individuals were included, and 341 participants reported hip fracture events during the survey period. In participants with hip fracture, the presentation rate of body pain increased by 14% ($p < 0.01$) and the HRQoL of other health dimensions worsened ($p \leq 0.01$) after hip fracture. The DID analysis showed that hip fracture had a negative impact on all HRQoL dimensions ($p < 0.01$). Socioeconomic-related factors of HRQoL inequities included school education level and location of residence. Study participants with hip fracture with greater educational attainment or living in urban areas had higher ($p < 0.05$) levels of HRQoL. In addition, comorbidities also correlated with a worse HRQoL ($p < 0.05$).

Conclusion Hip fracture significantly affects people's HRQoL in China, and the impact is more profound for those with lower educational attainment or living in rural areas. Targeted interventions should be designed to narrow this inequity.

Keywords Hip fracture · Health-related quality of life · Disparities · China

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Introduction

There are 2 types of fracture—namely, traumatic and non-traumatic. Age is an unavoidable risk factor for non-traumatic fractures; hence, non-traumatic fractures should be paid more attention to in the era of population aging [1]. Osteoporosis and osteopenia are leading causes of fractures in older adults. Approximately one-third of women and one-fifth of men aged ≥ 50 years worldwide were expected to experience an osteoporotic fracture in their remaining lifespan [2]. The residual lifetime fracture risk in the Chinese population is even higher due to the high prevalence of osteoporosis and low bone mineral density [3]. China has the largest aging population worldwide, and it was estimated that the number of osteoporotic fractures nationwide will double by 2035 [4].

Given osteoporotic fracture is a major cause of morbidity, mortality, and disability [5–8], it is not surprising that the impacts on both physical and mental health-related quality of life (HRQoL) can persist long after the event [9–11]. Numerous studies on HRQoL loss after fracture have been conducted in Western countries, most of which highlighted the major negative impact of the event on participants' HRQoL [11, 12] often varying by age, fracture history, comorbidity burden, and fracture site [13]. Among all types of fractures, hip fractures were evidenced to have the most profound impact on HRQoL [11, 14, 15].

Research on equity in health outcomes, health resource utilization, and HRQoL has been broadly conducted in many chronic diseases, such as chronic obstructive pulmonary disease (COPD) and cancer [16, 17], revealing HRQoL disparities across socioeconomic groups, such as the location of residence [16]. While there is strong evidence of the impact of fracture on the HRQoL on individuals, little is known about disparities in HRQoL. The aim of this study is therefore to conduct an equity analysis to determine socio-demographic disparities in HRQoL in China.

Methods

Data source and participants

Data from the China Health and Retirement Longitudinal Study (CHARLS) was used. CHARLS is a nationally representative longitudinal study that included participants aged ≥ 45 years in which details of study participants' social, economic, and health status; type of health insurance; and health care service use were collected [18]. The first wave survey was conducted in 2011, including 17,705 participants from 28 provinces in mainland China. The follow-up surveys were conducted in 2013, 2015, and 2018. In this study, we used only data collected in 2013 or later; as no hip fracture-related information was collected in the 2011 survey.

Participants who sustained a hip fracture during the study were identified by the question "have you fractured your hip since the last interview?" with the fracture time then recorded. Study participants who answered "yes" in the 2015 wave were considered to have experienced a hip fracture from 2013–2015. Similarly, those who answered "yes" in the 2018 wave were considered to have experienced a hip fracture from 2015 to 2018. Hip fracture occurrence was self-reported by participants. All study participants were divided into a post-hip fracture group covering study participants who reported hip fracture in 2015 and 2018 waves and a control group containing study participants with no history of hip fracture throughout the research period.

Measures

While CHARLS did not use a generic HRQoL instrument, there were 31 questions deployed related to HRQoL across different health domains. We selected the HRQoL questions applied in CHARLS that reflected the 5 health domains in the EuroQol 5-dimension (EQ-5D) questionnaire, which is the most commonly used generic HRQoL instrument in the field of hip fracture [19].

HRQoL questions that assessed mobility, self-care, usual activities, pain/discomfort, and anxiety/depression [20] were thus included in our study. Specifically, 9 items related to simple physical moving activities, such as walking, climbing stairs, stooping, carrying weights, and extending arms, were included to reflect the HRQoL in the area of mobility. Each item was scored from 1 ("no, do not have any difficulty") to 4 ("cannot do it") points. The sum of the scores of all 9 items ranged from 9–36 points, with a lower score indicating a better HRQoL in the area of mobility.

Usual activities were measured using the Activities of Daily Living (ADL) questionnaire, which covered Basic ADL (BADL, the ability to perform fundamental activities to care for oneself) and Instrumental ADL (IADL, the ability to perform complex activities in daily life) [21]. Possible scores ranged from 6 to 24 points for BADL and IADL. Similar to the total score for mobility, a lower score indicated a better HRQoL in the area of usual activities.

The existence of pain or discomfort was assessed by asking "are you often troubled with any body pains?" The answer was coded as a dichotomous variable to reflect whether the participant reported pain or not.

Depression was measured using the Center for Epidemiologic Studies Depression (CES-D-10) scale, which is a reliable and validated instrument to screen for depression

[22]. There are 10 items in the CES-D-10, and each item investigates the frequency of depression-related symptoms. Each response ranges from 1 (rarely or none of the time) to 4 (most or all the time) points, and the total score of the CES-D-10 scale ranges from 10 to 40 points. A lower CES-D-10 score indicated a better HRQoL in the area of depression. Details on the item selection are provided in Supplementary Table 1.

Control variables

Previous studies found that several demographic, socioeconomic, and health factors were associated with HRQoL among adults with fractures [14, 23–26]. Those variables informed the selection of control variables in our study. Demographic variables included sex and age. Socioeconomic variables included economic status and school educational level. Economic status was assessed using annual household consumption expenditure per capita [27]. School education was categorized into 4 groups: (1) no school education, (2) primary school, (3) middle school, and (4) high school and above. Region of residence was geographically divided into rural and urban. Health insurance was classified as (1) Urban Employee Basic Medical Insurance (UEBMI), (2) Urban–Rural Residents Basic Medical Insurance (URRBMI), (3) other health insurance (including commercial health insurance), and (4) no health insurance. The presence of comorbidities was also included as a control variable [28]. CHARLS respondents were asked whether they had been diagnosed with one or more diseases from 14 pre-defined chronic conditions (hypertension; dyslipidemia; diabetes or high blood sugar; cancer or malignant tumor; chronic lung diseases; liver disease; heart disease; stroke; kidney disease; stomach or other digestive diseases; emotional, nervous, or psychiatric problems; memory-related disease; arthritis or rheumatism; and asthma). In our study, the presence of comorbidities was categorized into 5 groups by the total number of chronic conditions (0, 1, 2, 3, and ≥ 4 chronic diseases).

Statistical analysis

A descriptive analysis was used to summarize the characteristics of all study participants. In study participants with a hip fracture, difference tests on matched data and McNemar's chi-squared test were performed to evaluate the change in HRQoL between before and after hip fracture. Furthermore, a generalized difference-in-differences (DID) analysis with multiple time periods was conducted to quantify the effects of hip fracture on HRQoL between post-hip fracture group and the control group. The generalized DID analysis was performed using the following formula:

$$y_{it} = \alpha + \delta \text{fracture}_{it} + \beta X_{it} + \varepsilon_{it}$$

where y_{it} is the HRQoL of individual i at time t, fracture_{it} is a dummy variable indicating whether individual i experienced fracture at time t, X_{it} denotes a set of control variables, α is a constant term, and ε is a residual term. δ captures the impact of fracture on HRQoL.

To explore the socioeconomic disparity in HRQoL, a multivariate regression analysis was conducted for the post–hip fracture participants. The dependent variables were changes of each HRQoL dimension and the independent variables were the control variables. For depression, mobility, BADL, and IADL dimensions, a multivariate linear regression analysis was performed while for the pain dimension, a multivariate logistic regression analysis was used. Statistical significance was determined if the 2-tailed p value was < 0.05. STATA (version 15.0; Stata Corporation, College Station, TX, USA) was used for statistical analyses.

Results

A total of 23,622 study participants from 3 waves of CHARLS were included in this study and 341 respondents were identified as study participants with hip fracture, among which 210 participants had hip fracture between 2013 and 2015, and 131 had hip fracture between 2015 and 2018. The basic characteristics of the respondents are summarized in Table 1. The mean age of the total sample was 59.8 (standard deviation, 10.9) years, and there were more women than men enrolled (52.3% vs. 47.8%). Most of the respondents had a low school education level. Approximately 41% did not complete a primary school education, and 13% had at least a high school education. More than half of the respondents were from rural areas, and 73.6% of the respondents were covered by the URRBMI, while 8% of the study participants did not have any health insurance. About 70% of the study participants reported chronic diseases, with 43.1% suffering from ≥ 2 chronic diseases. Study participants with hip fracture had less household expenditure ($p < 0.05$) and lower educational attainment ($p < 0.05$) and suffered from more chronic diseases ($p < 0.05$), compared with the non-hip fracture group. Besides, more study participants with hip fracture were living in rural areas ($p < 0.05$).

Figure 1 displays the HRQoL values and the proportions of participants who reported any issue by health domain and before/after hip fracture. All of the 5 HRQoL dimensions were worsened after hip fracture ($p < 0.05$). The values for CES-D-10, mobility, BADL, and IADL were increased by 0.61 ($p = 0.01$), 1.50 ($p < 0.01$), 0.60 ($p < 0.01$), and 0.87 ($p < 0.01$) points for participants with a post-fracture status. The prevalence of body pain increased by 14% ($p < 0.01$) after hip fracture.

Table 1 Characteristics of participants [#], *n* (%)

Variables		Total sample		Non-hip fracture participants		Hip fracture participants	
		n	%	*n*	%	*n*	%
Age (mean ± SD)		59.81 ± 10.85		59.72 ± 10.80		60.21 ± 9.65	
Sex	Male	11,279	47.75	11,109	0.48	170	49.85
	Female	12,343	52.25	12,172	0.52	171	50.15
Annual household expenditure (RMB, mean ± SD)*		15,341 ± 27,618		15,400 ± 23,889		11,281 ± 10,636	
Educational attainment*	Lower than primary school	9776	41.39	9589	0.41	187	54.84
	Primary school	6018	25.48	5943	0.26	75	21.99
	Middle school	4756	20.13	4699	0.20	57	16.72
	High school and above	3072	13.00	3050	0.13	22	6.45
Number of chronic diseases*	0	7429	31.45	7350	0.32	79	23.17
	1	6006	25.43	5912	0.25	94	27.57
	2	4378	18.53	4299	0.18	79	23.17
	3	2693	11.40	2654	0.11	39	11.44
	≥4	3116	13.19	3066	0.13	50	14.66
Rural–urban*	Rural	13,513	57.21	13,279	0.57	234	68.62
	Urban	10,109	42.79	10,002	0.43	107	31.38
Health insurance	UEBMI	2855	12.09	2824	0.12	31	9.09
	URRBMI	17,390	73.62	17,125	0.74	265	77.71
	Other health insurance	1483	6.28	1467	0.06	16	4.69
	No insurance	1894	8.02	1865	0.08	29	8.50

[#] For participants who had enrolled in more than one wave of CHARLS, only their first year's information was used in the summary statistics. * *P*-value of the difference test between non-hip fracture group and hip fracture group is lower than 0.05. *UEBMI*, Urban Employee Basic Medical Insurance; *URRBMI*, Urban–Rural Residents Basic Medical Insurance

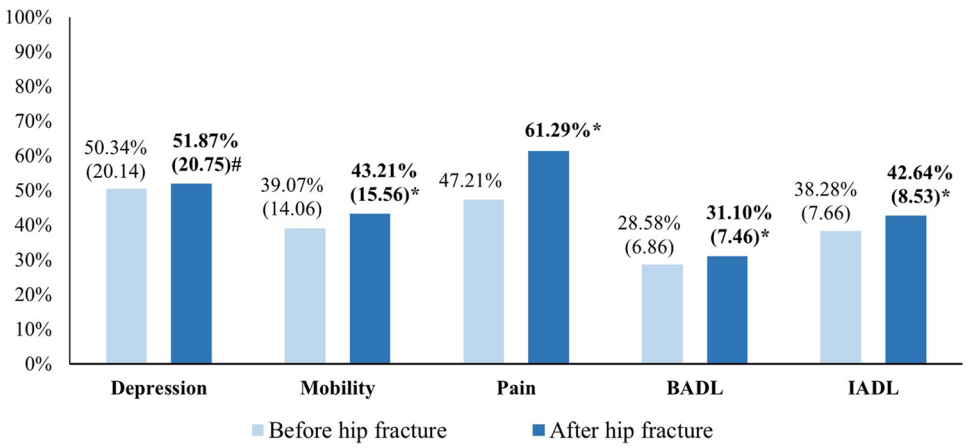

Fig. 1 HRQoL scores and proportions of participants who reported any issue both before and after a hip fracture (percent (score)). [#] $p = 0.01$. [*] $p < 0.01$

Figure 2 displays the effect of hip fracture on the 5 HRQoL dimensions. After controlling covariates, hip fracture displayed a significantly negative effect ($p < 0.01$) on all the fracture participants' HRQoL domains. Specifically, the CES-D-10 score increased by 2.2 points after hip fracture compared to the scores of respondents without the occurrence of hip fracture. Similarly, the hip fracture group also showed increased scores for morbidity, BADL, and IADL by about 2.3, 1.3, and 1.6 points, respectively. Furthermore, likelihood of study participants with hip fracture suffering from body pain increased by 1.5-fold after hip fracture.

The results presented in Table 2 reveal the disparities in HRQoL in each dimension. Specifically, an older age was significantly associated with lower HRQoL values. Study participants with hip fracture living in urban areas had higher depression ($\beta = -1.39$, $p < 0.05$) and IADL values ($\beta = -0.60$, $p < 0.05$) compared to their rural counterparts. Besides, a higher school education level was positively

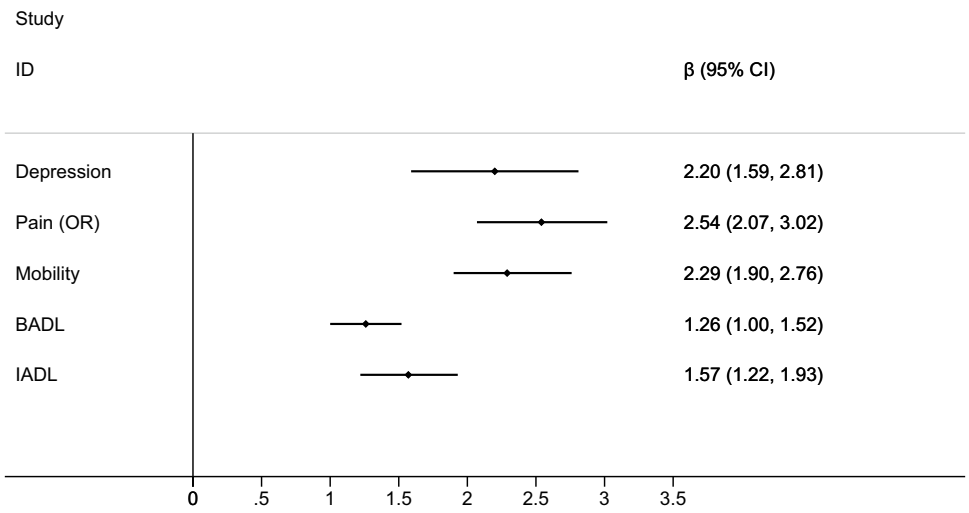

Fig. 2 Effect of hip fracture in each domain of HRQoL among study participants with hip fracture. Note: The results were extracted from generalized DID analysis for all 5 HRQoL domains. Depression, mobility, BADL, and IADL were continuous variables; hence, the effects were determined using β values. Meanwhile, the pain dimension was a dichotomous variable, so an odds ratio (OR) was used to capture the effect. Sex, age, economic status, education level, health insurance coverage, presence of chronic disease, and region of residence were included as control variables. All of the β values and the OR were statistically significant ($p < 0.01$)

related with higher values for depression, BADL, and IADL and a lower occurrence of pain ($p < 0.05$). Furthermore, the presence of chronic diseases was associated with a low level of HRQoL, though statistical significance was only found among those with ≥ 4 chronic diseases ($p < 0.05$) across all 5 HRQoL domains. Body pain was more prevalent among those with ≥ 2 chronic diseases.

Discussion

This study quantifies the effect of hip fracture on HRQoL and evaluates socio-demographic disparities among hip fracture people in China. Using data from the CHARLS, we found that hip fracture had a negative impact on people's physical and mental HRQoL and led to a higher likelihood of pain. Besides, the impact on HRQoL was not evenly distributed across socio-demographic groups in terms of educational attainment and location of residence. This disparity in HRQoL was evident across different HRQoL dimensions, where mental health was more closely related to education and the location of residence, while physical domains were associated with participants' age and health status.

Previous studies have generally shown that HRQoL can gradually recover after hip fracture but does not return to the pre-fracture level [12, 23]. A multinational study demonstrated that hip fracture was associated with HRQoL declines of 115.6%, 36.4%, and 22.1% immediately, 4 months, and 12 months after fracture, respectively [8]. A systematic review documented a 19–34% HRQoL loss among participants even 2 years after a hip fracture [11]. Our study results support such previous findings; even 2–3 years after hip fracture, participants still suffered from a 2.2 points reduction in mental health and a 2.5 points reduction in physical mobility. The proportion of study participants with hip fracture who reported body pain was increased by 14% compared to that before fracture.

Hip fracture has varied impacts in different HRQoL domains. We found that the change in score for depression was smallest after a hip fracture, reflecting the lowest depression occurrence and severity among all dimensions of HRQoL. This finding echoed those of many previous studies [10, 29], indicating that hip fracture impacts physical health more than mental health. However, other studies have reported conflicting results, in which a larger impact on psychological health compared to physical health was evident [9, 30, 31].

We obtained a similar result, determining that a large proportion of our sample suffered from body pain after hip fracture [32]. Moreover, pain was not only present in the short term but could last for several months after fracture [33, 34]. Persistent pain in study participants with hip fracture can also adversely affect other HRQoL dimensions, leading to reduced physical activity [35] and depression symptoms [36]. Pain management is therefore of major importance in improving post–hip fracture participants' overall quality of life.

Socioeconomic aspects, such as education and the location of residence, can contribute to disparities in HRQoL among elderly study participants with hip fracture. We found a close relationship between less educational attainment and a lower level of HRQoL in those who had suffered a hip

Table 2 Socio-demographic inequities in HRQoL for study participants with hip fracture

Variables		Depression		Pain		Mobility		BADL		IADL	
		β	95% CI	OR	95% CI	*β*	95% CI	*β*	95% CI	*β*	95% CI
Age		0.04	(−0.02,0.10)	1.00	(0.98,1.02)	0.18**	(0.14,0.23)	0.05**	(0.03,0.07)	0.09**	(0.06,0.12)
Sex	Male										
	Female	0.58	(−0.62,1.78)	1.34	(0.94,1.92)	1.65*	(0.68,2.62)	0.15	(−0.29,0.59)	0.29	(−0.32,0.90)
Income		0.25	(−1.15,1.65)	0.84	(0.53,1.34)	0.09	(−0.99,1.17)	0.37	(−0.10,0.84)	0.10	(−0.54,0.75)
Education	None										
	Primary school	−1.83*	(−3.34, −0.32)	0.58*	(0.38,0.90)	−0.93	(−2.05,0.18)	−0.37	(−0.80,0.06)	−0.85*	(−1.54, −0.16)
	Middle school	−0.64	(−2.26,0.98)	1.13	(0.69,1.86)	−0.30	(−1.57,0.97)	−0.07	(−0.69,0.56)	−0.68	(−1.42,0.06)
	High school and above	−2.24*	(−4.24, −0.24)	0.56	(0.26,1.21)	−0.98	(−2.56,0.61)	−0.72*	(−1.27, −0.16)	−1.26**	(−2.17, −0.35)
Insurance	UEBMI										
	URRBMI	0.97	(−0.85,2.78)	1.93	(0.95,3.89)	1.37	(−0.03,2.78)	0.19	(−0.37,0.75)	0.59	(−0.26,1.43)
	Other	−1.36	(−4.02,1.30)	1.23	(0.52,2.91)	2.15	(−0.09,4.38)	1.01*	(0.12,1.90)	1.48*	(0.15,2.81)
	None	0.99	(−1.70,3.69)	1.17	(0.48,2.85)	2.68**	(0.75,4.60)	0.72	(−0.18,1.63)	1.29*	(0.12,2.45)
Location of residence	Rural										
	Urban	−1.39*	(−2.70, −0.07)	0.79	(0.52,1.18)	−0.41	(−1.41,0.59)	−0.31	(−0.73,0.12)	−0.60*	(−1.19,0.00)
Chronic diseases	0										
	1	−0.93	(−2.58,0.71)	1.45	(0.86,2.44)	−0.60	(−1.87,0.67)	−0.25	(−0.75,0.25)	−0.58	(−1.31,0.16)
	2	0.28	(−1.33,1.88)	1.84*	(1.11,3.04)	−0.06	(−1.35,1.24)	−0.08	(−0.58,0.42)	−0.15	(−0.98,0.68)
	3	1.24	(−0.68,3.16)	2.86**	(1.58,5.18)	0.93	(−0.51,2.36)	0.03	(−0.58,0.65)	−0.22	(−1.11,0.67)
	≥4	5.25*	(3.29,7.21)	8.91**	(4.75,16.72)	3.50**	(2.06,4.95)	1.18**	(0.55,1.80)	1.03*	(0.07,1.98)

*$p<0.05$; **$p<0.01$; *UEBMI*, Urban Employee Basic Medical Insurance; *URRBMI*, Urban–Rural Residents Basic Medical Insurance

fracture in both the areas of psychological health, as measured by depression symptoms, and physical functions, such as people's mobility and daily activities. Studies that investigated educational disparity found that there was an additional 7–11% loss in HRQoL among those with a lower educational level [23, 26, 37]. A similar association was found in other disease areas, such as cardiovascular diseases and COPD [16, 38]. Potential explanations for this trend include the existence of less access to disease-prevention knowledge, less guidance regarding a healthy lifestyle among lower educated individuals, and consequent less access to good quality care and rehabilitation [39]. However, most previous research mainly focused on overall HRQoL or physical functions; a single study that analyzed post-fracture mental HRQoL indicated a higher level of HRQoL loss in a lower- or medium-educated population but not those having higher educational levels [40]. The observed educational disparity in our study supported these findings and helps to direct attention toward mental HRQoL in hip fracture research.

Comorbidities are prevalent among the elderly, as over half of them have ≥ 2 chronic diseases [41], and they have been widely reported to be negatively correlated with individual HRQoL in either chronic disease people or the general population [41]. As comorbidities usually predict a worse treatment outcome, less function recovery, and more health care needs [42], understanding their association with HRQoL is of major importance for targeted policy-making and intervention implementation. In hip fracture research, an obviously higher risk of mortality in participants having comorbidities was reported by investigators [43]. Our study adds to the evidence on HRQoL, reporting that study participants with hip fracture had an increased risk by 5 times for depression, 9 times for body pain, 4 times for mobility difficulty, and 1 time for daily activities ability loss, respectively, if they suffered from more chronic diseases. Particular attention should be paid to individuals suffering from both a past hip fracture and comorbidities to improve their health status and life quality.

Another interesting finding in this study was the observed rural–urban disparities in HRQoL after hip fracture. We recorded a substantially higher HRQoL among people living in urban places compared to those residing in rural areas after controlling other covariates, especially in the areas of depression symptoms and IADL. A similar disparity has been found in the context of other chronic diseases like hypertension and cancer [17, 44] and in a general Chinese elderly adult population, where rural residents had lower HRQoL [45]. Urbanization usually comes with timely medical diagnosis and treatment, better access to rehabilitation care, and more resources of health management knowledge [46], potentially facilitating the provision of high-level health care to study participants with hip fracture. With some evidence from other diseases, however, studies investigating rural–urban disparities in hip fracture have not been consistent with these results. Notwithstanding well-documented evidence that hip fracture incidence rates are higher in urban regions [47], data from developed countries like Norway, Canada, and the USA showed no rural–urban difference [48] or even a lower mortality rate in rural areas [35, 49]. However, considering the cultural differences and region characteristics across these countries and the indicators used to evaluate health outcomes, a cross-national comparison should be performed very cautiously. As there is no agreement on rural–urban differences in HRQoL after hip fracture, future studies are needed to provide clarification.

A key strength of this study is that we included pre-fracture HRQoL data so that the real condition of participants before and after their fracture could be evaluated. As seen from previous studies, most HRQoL measurement tools lack the ability to compare to baseline [50]. Therefore, most prior studies did not report pre-fracture quality of life data, while other scholars used retrospective ones [8], potentially leading to recall bias [50]. Using a longitudinal survey, we acquired more accurate HRQoL data before the hip fracture. Another advantage is the DID analysis method used in this study. Compared to previous studies that only reported correlations, this study explored the causality of the significant impact of hip fracture in all HRQoL dimensions.

Still, limitations to our study should be noted. First, this study failed in evaluating the precise HRQoL changes at specific time-points after hip fracture due to data unavailability, instead, we only know that hip fracture occurred within last 2–3 years; therefore, we could not treat time after fracture as a continuous variable. Second, we could not identify whether a reported hip fracture was the first fracture or a re-fracture, and these events might have different impacts on HRQoL. If a participant reported a hip fracture in both the 2015 and 2018 waves, we identified them as 2 independent hip fracture participants, which could cause misestimation or bias. Third, the CHARLS only included study participants aged ≥ 45 years, so our results cannot be generalized to the younger population. Nevertheless, as hip fracture is more prevalent with age, our results might still represent the hip fracture population. Fourth, the study participants of CHARLS are representative for general middle-aged and elderly people in China [18]. However, considering that hip fracture is not evenly distributed in the general population, data used in this study may not completely represent the hip fracture population in China. Fifth, this study did not use a standard HRQoL instrument to evaluate the post-hip-fracture HRQoL, and 31 items of HRQoL questions were selected from the CHARLS to reflect those on the EQ-5D questionnaire. The reliability and validity of the selected questions as an HRQoL instrument need to be tested in future studies. While a similar approach has been employed in the previous study [51], the validity in evaluating the

composite HRQoL in study participants with hip fracture is to be tested. Finally, the hip fracture occurrence was self-reported by study participants. Hip fracture usually causes symptoms and severe health consequences, therefore most people are hospitalized or receive medical treatment after a hip fracture. There is little risk of reporting bias to identify study participants with hip fracture.

In order to gain a better understanding of the socio-demographic disparities of post-hip fracture HRQoL, further studies should be performed. First, HRQoL disparity at specific time points after hip fracture should be further analyzed to provide more accurate evidence about the potential effective intervention implementation. Second, as many findings were gathered from Western countries [8, 40], additional studies in China as well as cross-national comparisons should also be performed to identify country-specific characteristics for the purpose of developing targeted policies.

Practice implications

Hip fractures have remarkably negative effects on individual HRQoL even after 2–3 years. We found that a lower HRQoL existed among people living in rural areas, with less educational attainment, and with more comorbidities. Hip fracture people who meet these conditions usually have less material resources and less access to health knowledge and professional medical care [52]. Targeted policies should strive to improve HRQoL equities—that is, to prevent more physical function reduction or mental health loss. For instance, integration of Urban Residents Basic Medical Insurance which covered urban population and New Rural Cooperative Medical Schemes covering rural residents has been shown to promote both financial and geographic access to healthcare utilization and improve its equity between rural and urban areas in China [53]; nonetheless, more effort should be made to enhance their access to high-quality care. For hip fracture people who suffered from other chronic diseases, integrated health services, instead of a simple treatment of diseases episode by episode, are of great importance. Multidisciplinary healthcare teams should be developed to enable coordinated management and treatment of coexisting diseases [54]. Lessons from other diseases could also be borrowed. Policies increasing healthcare access in rural areas that could potentially improve its utilization [55], health education programs targeting the elderly aimed at equipping them with essential knowledge to control disease [56] and disease-screening strategies for older adults [57] have been proven to remarkably improve health outcomes such as reducing mortality, and to achieve better HRQoL. However, due to the limited available literature, more evidence is still needed concerning the intervention effect in post-hip fracture people.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s11657-023-01220-2.

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Data availability The data that support the findings of this study are openly available in China Health and Retirement Longitudinal Study (CHARLS) website at http://charls.pku.edu.cn/.

Declarations

Ethics approval and consent to participate The current study is a secondary analysis of the de-identified China Health and Retirement Longitudinal Study (CHARLS) public data. The original CHARLS was approved by the Ethical Review Committee of Peking University, and all participants signed the informed consent at the time of participation.

Competing interest Lizheng Xu, Mingsheng Chen, Ke Peng, Mickael Hiligsmann, Stephen Jan, and Lei Si declare that they have no conflict of interest.

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