Liang *et al.*
Health and Quality of Life Outcomes (2024) 22:91
https://doi.org/10.1186/s12955-024-02309-z

Health and Quality of Life Outcomes

RESEARCH

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Impacts of chronic diseases and multimorbidity on health-related quality of life among community-dwelling elderly individuals in economically developed China: evidence from cross-sectional survey across three urban centers

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Abstract

Objective As the ageing process in China further accelerates and the average life expectancy increases, chronic disease prevalence and multimorbidity rates are constantly rising, especially among elderly individuals. However, few previous studies have explored the impacts of chronic diseases and multimorbidity on health-related quality of life (HRQoL). This study aimed to investigate this association among community-dwelling elderly individuals in China.

Methods A cross-sectional study was conducted in communities in three cities (Suzhou, Qingdao, and Guangzhou). The basic characteristics, chronic diseases and HRQoL of participants were collected, and HRQoL was measured by the EuroQol 5-Dimensions 3-Level version (EQ-5D-3L). Logistic regression, Tobit regression and generalized linear models were used to assess the impacts of chronic diseases and multimorbidity on HRQoL.

Results Approximately 83.2 percent of the 1,218 respondents had chronic conditions, with 30 percent having multimorbidity. After controlling for sociodemographic and health behaviour factors, patients with stroke were more likely to report problems in all five dimensions of the EQ-5D and had a lower EQ-5D utility index (UI) (b = -0.342) than patients with other chronic conditions. Patients with chronic pulmonary obstruction had a lower EuroQol Visual Analog Scale (EQ-VAS) (b = -11.169) than patients with other chronic conditions. Furthermore, patients with multimorbidity had worse HRQoL (P < 0.001).

Conclusions Both chronic condition probability and multimorbidity rates were high among Chinese community-dwelling elderly individuals. Different disease types had varying degrees of impact on HRQoL, and patients with multimorbidity had worse HRQoL. This study proposes that the government enhance the quality of life of community-dwelling elderly individuals with multimorbidity by establishing long-term care insurance and expanding comprehensive community-based home health care services.

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Keywords Community-dwelling elderly individuals, Chronic diseases, EQ-5D, HRQoL, Multimorbidity

Introduction

According to the findings of China's seventh census in 2020, 18.7% and 13.5% of the total population were aged 60 years and above and 65 years and above, respectively, representing a 5.44% and 4.63% increase over the 2010 census [1]. The rapid aging and increased average life expectancy have heightened the risk of developing chronic diseases and multimorbidity. Between 1998 and 2018, the prevalence of multimorbidity among elderly people in China increased from 15.60% to 30.76% [2]. Chronic diseases and multimorbidity in the elderly have imposed a significant financial burden on families. In 2013, the direct economic burden of hospitalization for patients with chronic diseases in China amounted to 138.997 billion yuan. Among this, the direct economic burden of patients with cardiovascular and cerebrovascular diseases, cancer, chronic respiratory diseases, and diabetes accounted for 38.99%, 38.87%, 15.00%, and 7.14%, respectively [3]. This situation has had a profound impact on family well-being and societal advancement. Additionally, chronic diseases and multimorbidity can lead to high rates of disability, reduced bodily function, anxiety, and depressed mood, all of which severely affect health-related quality of life (HRQoL) [4, 5].

HRQoL represents an individual's perception of their own health status, and the factors influencing quality of life have been extensively examined in previous studies. Zhang et al. identified significant factors affecting the HRQoL of elderly individuals in Chinese communities, including sex, age, education level, frailty, and functional status [6]. Chen et al. highlighted the positive impact of healthy lifestyle habits, such as abstaining from alcohol consumption and maintaining good sleep quality, on HRQoL, providing valuable insights for enhancing the well-being of seniors [7]. Previous research has underscored the substantial impact of chronic diseases and multimorbidity on the quality of life of elderly individuals. Studies conducted in Singapore and Korea revealed that multimorbidity in the elderly was associated with reduced HRQoL [8, 9]. Subramaniam et al. also observed that multimorbidity contributed to physical inactivity and diminished HRQoL [10]. Despite the rapid growth in the elderly population, the prevalence of chronic diseases, and multimorbidity in China, and the increased focus on HRQoL in older adults, limited studies have investigated the relationship between multimorbidity and HRQoL among seniors. Furthermore, little attention has been given to the association between multimorbidity, disease types, and HRQoL. The escalating challenges of an aging population and rising chronic disease burden in China have significant repercussions on HRQoL, constituting a public health concern. Enhancing our understanding of these relationships within the context of aging and the escalating prevalence of chronic diseases in China could empower policymakers to better manage multimorbidity in elderly individuals, refine healthcare strategies, and enhance HRQoL outcomes.

As the medical model transitions from a purely biomedical approach to a comprehensive biopsychosocial perspective, the focus has shifted towards not only prolonging life but also enhancing Health-Related Quality of Life (HRQoL). Commonly used tools for measuring HRQoL include the Short Form-6 Dimensions (SF-36), the EuroQol-5 Dimensions (EQ-5D), and the World Health Organization Quality of Life-Brief (WHOQOL-BREF) [11]. The EuroQol 5-Dimensions 3-Level version (EQ-5D-3L), developed by the EuroQol group, is extensively employed to assess quality of life across various health conditions such as hypertension, diabetes, stroke, cancer, among others, in diverse populations globally (Korea, Malaysia, the Netherlands, Sweden, China, and more) [12–19]. The EQ-5D has demonstrated superior applicability across different health conditions and populations compared to other tools, making it the most widely utilized instrument globally for health-economic evaluations [20], offering robust reliability and validity.

China is categorized into three major economic regions based on their economic development level and geographical location: the eastern region, characterized by early adoption of the coastal opening policy and high economic development; the central region, the second most economically advanced region; and the western region, the least economically developed area. Given the prevailing demographic shift towards an aging population, the rising prevalence of chronic diseases and multimorbidity in China, and limited research on the association between chronic diseases, multimorbidity, and HRQoL among Chinese elderly individuals, we conducted a cross-sectional study among community-dwelling elders (aged $\geq$60 years) residing in economically developed Chinese cities (Guangzhou, Suzhou, Qingdao) using the EQ-5D scale. The study aimed to 1) assess the probability of chronic diseases among elderly residents in economically developed urban areas and 2) investigate the impact of chronic diseases and multimorbidity on HRQoL.

Materials and methods

Sampling methods

A questionnaire survey was carried out from September to December 2021. A multistage stratified random sampling approach was employed to select specific neighbourhoods based on geographical location, while convenience sampling was used to select individual participants.

In the process of selecting the specific neighbourhoods, initially, 3 provinces were randomly chosen from among the 12 provinces in the eastern region, which include Liaoning Province, Hebei Province, Beijing Municipality, Tianjin Municipality, Shandong Province, Jiangsu Province, Shanghai Municipality, Zhejiang Province, Fujian Province, Guangdong Province, Guangxi Zhuang Autonomous Region, and Hainan Province. The selected provinces were Shandong Province, Jiangsu Province, and Guangdong Province. Subsequently, one municipality was randomly chosen from each province—specifically, Qingdao city in Shandong Province, Suzhou city in Jiangsu Province, and Guangzhou city in Guangdong Province. Next, a county/district within the jurisdiction of each city was randomly chosen, followed by the random selection of two streets from each county/district. Finally, two neighbourhoods were chosen randomly from each street.

Once the specific neighbourhoods were identified, convenience sampling was utilized to select approximately 100 elderly individuals from each neighbourhood. The inclusion criteria comprised individuals aged 60 years and above with local household registration. Exclusion criteria encompassed failure to meet the inclusion requirements, refusal to participate, and other reasons.

Data collection

The survey team comprised graduate and undergraduate students from the School of Public Health at Zhengzhou University, who conducted household visits in pairs following standardized training. The instructions for each questionnaire were read out by the investigator on site, and necessary guidance was provided to the participants during their response process. Questionnaires were required to be completed on the spot, reviewed for accuracy, and cross-checked. Any discrepancies or issues were promptly resolved to ensure data integrity. Quality control measures were further enhanced through regular team meetings to discuss challenges encountered during data collection, provide additional training if needed, and reinforce adherence to study protocols. Additionally, data entry verification processes were implemented to validate the accuracy and consistency of collected information before analysis.

Measurements of demographics and chronic diseases

This study used a self-reported questionnaire that included basic personal information, including sex, age, education, income, marital status, and occupation or lifestyle factors, including smoking status, alcohol consumption and sleep schedule. The survey on chronic diseases was conducted by interviewers who asked respondents, "have you ever been diagnosed by a doctor with any chronic disease?". The chronic diseases investigated in this study included stroke, hypertension, cardiopathy (coronary heart disease, rheumatic heart disease, angina pectoris, myocardial infarction), chronic pulmonary obstruction, diabetes, dyslipidaemia, tumours, rheumatic diseases (rheumatoid arthritis, osteoarthritis, gout, osteoporosis, etc.), diseases of the urinary system (chronic nephritis, urinary tract infection, chronic renal failure), musculoskeletal diseases (lumbar disc herniation, cervical spondylosis, fractures), and other chronic diseases. Multimorbidity was defined in this study as three or more chronic diseases occurring simultaneously [21, 22].

Measurement of HRQoL

HRQoL was assessed using the EQ-5D-3L. The EQ-5D-3L consists of two components: the EQ-5D descriptive system and the EQ-VAS. The EQ-5D descriptive system consists of five dimensions: mobility, self-care, usual activities, pain/discomfort and mood. Each dimension includes three levels: no problem, moderate problem and extreme problem. The health utility score of the target population was calculated using the Chinese version of the EQ-5D-3L utility value system developed by Liu et al. [23]. The formula was as follows: health utility score = 1.0—constant term—corresponding standard coefficients for different health states of each dimension—additional term, and the range of values was [-0.149 ~ 1] (See Table 1). The EQ-VAS is a 20-cm long visual scale with scores ranging from 0 to 100, with 0 representing the worst condition in the mind and 100 representing the best condition in the mind. The EQ-VAS has been extensively utilized among the Chinese elderly population. To assess the internal consistency reliability of the scale for this study, we employed the alpha method to validate its reliability prior to analysis. The findings revealed a Cronbach's α coefficient of 0.847, indicating that the scale exhibited a high level of internal consistency in this study.

Statistical analysis

Frequencies and percentages are used to describe the basic characteristics of the respondents. After the normality test, the EQ-5D utility index (UI) and EQ-VAS scores conformed to a skewed distribution, so the P50 percentile (P25, P75) was used for statistical description, and the Wilcoxon rank-sum test and Kruskal–Wallis H test were used to detect differences in EQ-5D and EQ-VAS scores between subgroups. Binary logistic

Table 1 TTO integral conversion of the Chinese version of the EQ-5D-3L

Variables	Definition	Coefficient
Constant term	some or extreme problems in at least one dimension	0.039
Mobility	no problem	0.000
	some problems	0.099
	extreme problems	0.246
Self-care	no problem	0.000
	some problems	0.105
	extreme problems	0.208
Usual activities	no problem	0.000
	some problems	0.074
	extreme problems	0.193
Pain/discomfort	no problem	0.000
	some problems	0.092
	extreme problems	0.236
Mood	no problem	0.000
	some problems	0.086
	extreme problems	0.205
Additional item	at least one dimension is severely difficult	0.022

regression was used to compare the responses of the five EQ-5D domains that reported "moderate and severe problems".

Since the EQ-5D scale has a strong ceiling effect, if this effect is ignored, the traditional regression method of analysing the factors that influence EQ-5D scores would certainly produce erroneous estimates. The range of values of the EQ-5D in this study was [-0.149,1], as the dependent variable was restricted and intercepted. The Tobit model can solve the problem of the ceiling effect and restricted values of the dependent variable [24]. Therefore, a Tobit regression model was used to explore the factors influencing chronic diseases and multimorbidity on EQ-5D UIs, and a generalized linear model was used to explore the impact of chronic diseases and multimorbidity on EQ-VAS scores. Data were analysed using SPSS 28.0 and Stata 16.0 with a test level of $\alpha = 0.05$.

Results

Demographic information of respondents

Ultimately, 1250 participants were chosen from 12 neighbourhoods, with 32 respondents excluded due to incomplete data. This led to the collection of 1218 questionnaires for data analysis, yielding an effective response rate of 97.44%. Table 2 shows the basic characteristics of the respondents. The proportion of the respondents with no chronic diseases was 16.8%, those with one chronic condition was 28.1%, those with two chronic conditions was 25.1%, and those with three or more chronic conditions was 30%. As the number of chronic conditions increased, respondents showed a downward trend in EQ-5D UI and EQ-VAS scores. Respondents were mainly female (56.0%), 80 ~ years old (36.8%), married (67.9%), and had a junior high school education and above (42.0%).

Distribution characteristics of chronic diseases

Figure 1 shows the probability of chronic diseases among the respondents. The top three chronic diseases were hypertension (50.57%), musculoskeletal disease (26.52%), and rheumatic disease (24.63%).

Distribution of HRQoL with multimorbidity

Figure 2 depicts the effect of the number of chronic diseases on the EQ-5D UI. The proportion of respondents reporting perfect health (UI = 1) in the EQ-5D UI decreased as the chronic disease probability increased, with 80% of respondents without chronic diseases reporting perfect health and only 25.8% of respondents with ≥ three diseases reporting perfect health. In addition, the fluctuation of the EQ-5D UI decreased with increasing numbers of chronic diseases.

Figure 3 shows the effect of the number of chronic diseases on the EQ-VAS. The EQ-VAS decreased with increasing numbers of chronic diseases, with respondents without chronic diseases having EQ-VAS scores mainly in the 80–100 range and respondents with ≥ three diseases having EQ-VAS scores mainly in the 50–70 range.

The associations of chronic diseases and multimorbidity with HRQoL

Table 3 demonstrates the relationship between multimorbidity and EQ-5D health status across dimensions, adjusted for sociodemographic factors and health behaviour factors. Stroke patients were most likely to report problems in five dimensions, especially in usual activities [*OR (95% CI)*: 6.811 (4.277, 10.846), $P < 0.001$]. According to the Tobit model, respondents with hypertension ($\beta = -0.059$), musculoskeletal diseases ($\beta = -0.098$), diabetes ($\beta = -0.075$), stroke ($\beta = -0.342$), and chronic pulmonary obstruction ($\beta = -0.192$) had a lower EQ-5D UI. Respondents with one, two, or ≥ three chronic conditions were more likely to report problems in five dimensions (*OR*: mobility, 1.878, 2.328, 5.635; self-care, 2.768, 3.739, 9.172; usual activities, 3.672, 5.168, 12.936; pain/discomfort, 2.892, 4.031, 6.930; mood, 3.910, 4.858, 6.057) compared to respondents without chronic conditions. The

Table 2 Sociodemographic characteristics of the participants ($N=1218$)

Variables	Frequency(%)	UI	*Z/H*	*P*	VAS	*Z/H*	*P*
Sex			-26.861	< 0.001		-30.238	< 0.001
Male	536(44.0)	0.887(0.683,1.000)			80(60,90)		
Female	682(56.0)	0.875(0.745,1.000)			80(65,90)		
Age (years)			166.130	< 0.001			< 0.001
60 ~ 69	419(34.4)	1.000(0.869,1.000)			85(75,95)		
70 ~ 79	351(28.8)	1.000(0.783,1.000)			80(68,90)		
80 ~	448(36.8)	0.782(0.546,1.000)			70(60,80)		
Marital status			-23.689	< 0.001			< 0.001
Married	827(67.9)	1.000(0.862,1.000)			80(70,90)		
Single	391(32.1)	0.788(0.591,1.000)			70(57,80)		
Educational level			40.228	< 0.001			0.017
Illiterate	352(28.9)	0.869(0.591,1.000)			80(60,90)		
Primary school	355(29.1)	0.869(0.683,1.000)			80(65,90)		
Junior high school and above	511(42.0)	1.000(0.788,1.000)			80(65,90)		
Occupation			-24.019	< 0.001			< 0.001
Other	862(70.8)	1.000(0.769,1.000)			80(65,90)		
Farmer	356(29.2)	0.869(0.683,1.000)			79(60,90)		
Monthly income(CNY)			17.422	< 0.001		28.767	< 0.001
≤ 1000	452(37.1)	0.869(0.699,1.000)			80(60,90)		
1001 ~ 3000	324(26.6)	1.000(0.856,1.000)			80(70,90)		
≥ 3001	442(36.3)	0.875(0.683,1.000)			75(61,90)		
Alcohol consumption			-3.597	< 0.001		-30.243	< 0.001
Yes	302(24.8)	1.000(0.788,1.000)			80(64,90)		
No	916(75.2)	0.875(0.683,1.000)			80(65,90)		
Smoking			-24.265	< 0.001		-30.243	< 0.001
No	876(71.6)	0.943(0.709,1.000)			80(66,90)		
Yes	346(28.4)	0.869(0.683,1.000)			75(60,90)		
Hours of sleep (h/d)			17.902	< 0.001		17.771	< 0.001
< 6	379(30.9)	0.869(0.696,1.000)			78(60,90)		
6 ~ 8	551(45.2)	1.000(0.783,1.000)			80(70,90)		
> 8	291(23.9)	0.869(0.591,1.000)			80(60,90)		
Number of chronic diseases			185.988	< 0.001		244.361	< 0.001
0	205(16.8)	1.000(1.000,1.000)			90(80,95)		
1	342(28.1)	1.000(0.862,1.000)			80(70,90)		
2	306(25.1)	0.869(0.766,1.000)			80(70,88)		
≥ 3	365(30.0)	0.776(0.591,1.000)			68(52,80)		

Tobit regression model reported the association between the number of chronic diseases and EQ-5D UI. Respondents with chronic diseases had a significantly lower EQ-5D UI than those without chronic diseases ($P<0.05$), and respondents with more chronic diseases [one ($\beta=$-0.227), two ($\beta=$-0.313), and ≥ three ($\beta=$-0.462)] tended to have a lower EQ-5D score.

Generalized linear model estimates of the association between chronic diseases and the EQ-VAS were reported after controlling for other covariates. The generalized linear model showed that respondents with hypertension ($\beta=$-2.787), musculoskeletal diseases ($\beta=$-2.596), rheumatic diseases ($\beta=$-3.235), diabetes ($\beta=$-3.770), cardiopathy ($\beta=$-4.219), stroke ($\beta=$-8.282), diseases of the urinary system ($\beta=$-5.868), and chronic pulmonary obstruction ($\beta=$-11.169) reported lower EQ-VAS scores. Respondents with chronic diseases had significantly lower EQ-VAS scores than those without chronic diseases ($P<0.05$), and respondents with a greater number of chronic diseases [one ($\beta=$-5.316), two ($\beta=$-7.239), and ≥ three ($\beta=$-17.473)] tended to have lower EQ-VAS scores. (See Table 4).

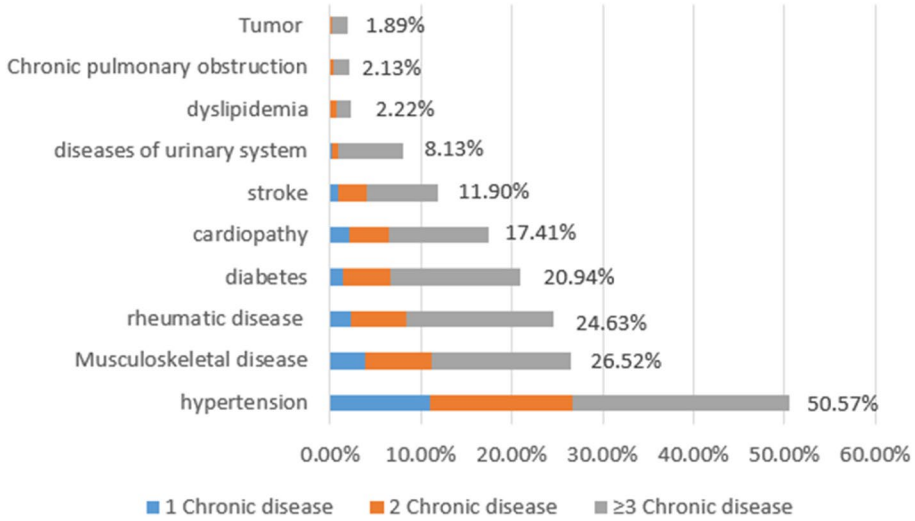

Fig. 1 Distribution of chronic disease probability

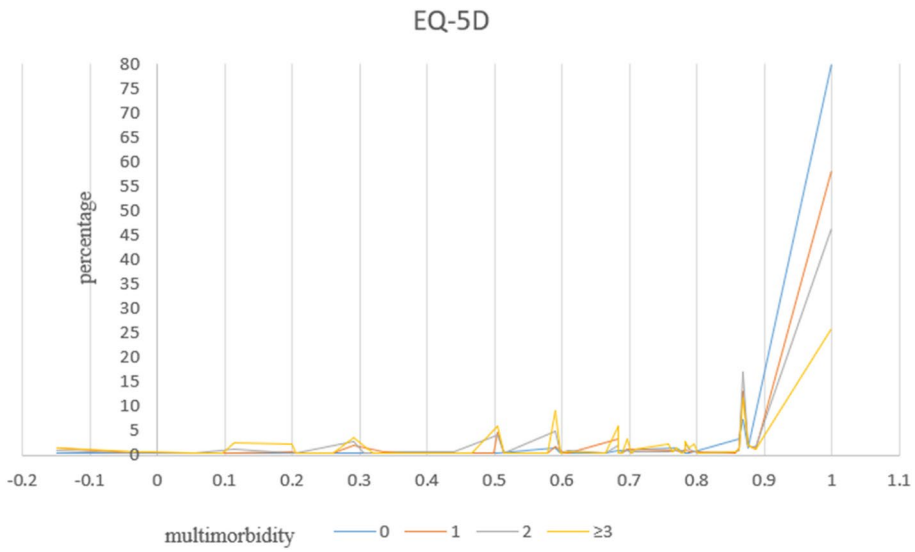

Fig. 2 The distribution of EQ-5D UIs for multimorbidity

Discussion

The results of this study confirmed the impact of chronic diseases and multimorbidity on HRQoL among community-dwelling elderly individuals in economically developed China. Overall, the probability of chronic diseases was high, with hypertension topping the list, but it did not have the greatest impact on HRQoL. After adjusting for sociodemographic characteristics and health behaviour factors, stroke patients reported more problems in five domains of the EQ-5D and had a lower EQ-5D UI; patients with chronic pulmonary obstruction were more likely to report a lower EQ-VAS score, whereas multimorbidity was significantly associated with a worse HRQoL.

Probability of chronic diseases and multimorbidity

In our study, the probability of chronic diseases among community-dwelling elderly individuals was 83.2%, which was slightly higher than the prevalence of chronic diseases among Chinese elderly individuals reported by Zhang et al. [25]. The reason for the discrepancy may be the high proportion of elderly people over 80 years old in

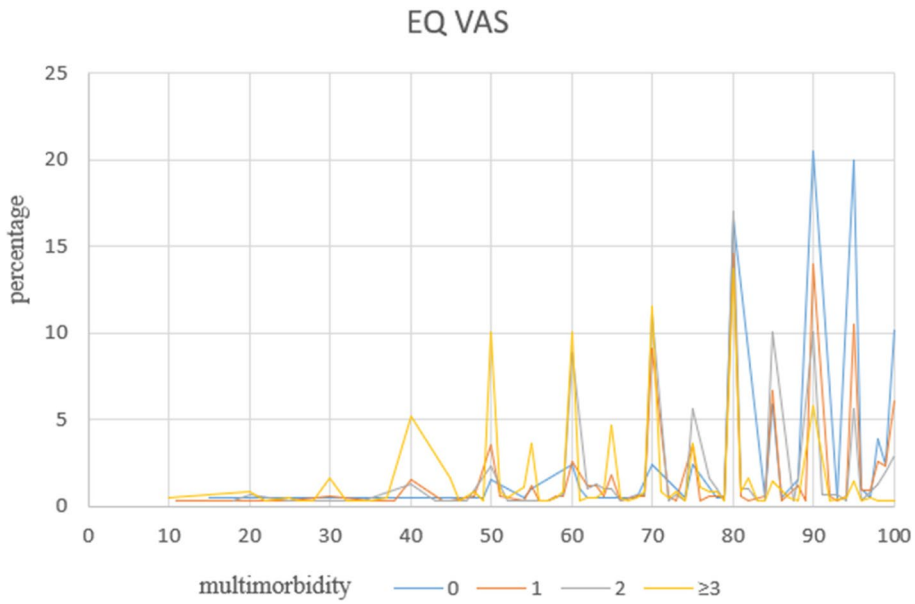

Fig. 3 The distribution of EQ-VAS scores for multimorbidity

this study and the increase in the probability of chronic diseases with increasing age. The proportion of multimorbidity (30%) was higher than that in Korea (23.7%) [16] and Switzerland (20.0%) [26] but lower than that in countries such as Canada (45.6%) [27], Japan (62.8%) [28] and the United States (91.5%) [29]. The wide variation in multimorbidity in different countries may be due to the controversial definition of multimorbidity, with one view considering multimorbidity as having two or more diseases and another view considering multimorbidity as having three or more diseases [21, 30, 31]. Second, the level of economic development of the country and the survey involved would affect the multimorbidity probability rate [32]. The highest probability of chronic disease in this study was attributed to hypertension (50.57%). This is similar to the findings of previous studies [33]. Hypertension is globally recognized as a major public health problem and is one of the main risk factors for cardiovascular disease and premature death [34]. How to effectively control hypertension to reduce the burden of disease and mortality has become a critical issue.

Impact of stroke on HRQoL

Among the 10 chronic diseases involved in this study, stroke had the most significant negative impact on EQ-5D UI. In this study, stroke patients reported more problems with mobility, usual activities, self-care, pain/discomfort, and mood and had a lower EQ-5D score than patients with other chronic conditions. This is similar to the results obtained in the study by Hartley T et al., in which stroke patients reported poorer HRQoL than healthy age-matched individuals [35]. Stroke incidence increases with age, and stroke is associated with high death and disability rates [36]. Stroke patients suffer difficulties such as physical dysfunction, linguistic impairment, cognitive dysfunction, and visual impairment, which affect self-care and independence in family life [37–39]. In the elderly population, stroke patients experience increasing physical weakness due to degenerative changes in body organs [40], which seriously impairs their physical health. In addition, elderly stroke patients suffer from psychological damage. Depression is one of the sequelae of stroke, and a study found that approximately 30% of stroke victims experience depression [41]. Changes in physical function after stroke reduce self-efficacy and social participation levels, while heavy financial pressures add to the psychological burden. This ultimately leads to a lower HRQoL in elderly stroke patients compared to other chronic disease patients. This suggests that relevant units need to pay attention to the treatment of elderly patients with stroke and improve their quality of life and well-being.

Impact of chronic pulmonary obstruction on EQ-VAS scores

Among the 10 chronic diseases involved in this study, chronic pulmonary obstruction had the most significant negative impact on EQ-VAS scores. The EQ-VAS is a self-assessment by respondents based on their health status, which is more sensitive and more likely to reflect small changes in the quality of survival [42]. Chronic pulmonary obstruction is a lung disease that causes a continuous loss

Table 3 Effect of chronic diseases on the 5 domains of the EQ-5D

	Mobaility *OR (95% CI)*		**Self-care *OR(95% CI)***		**Usual activities *OR(95% CI)***	
	Model I[#&]	**Model II[a]**	**Model III**	**Model IV**	**Model V**	**Model VI**
Multimorbidity						
0		Ref		Ref		Ref
1		**1.878 (1.084,3.254)***		**2.768(1.390,5.511)****		**3.672(1.866,7.227)*****
2		**2.328(1.341,4.042)****		**3.739(1.874, 7.459)*****		**5.168(2.620,10.192)*****
≥3		**5.635(3.308,9.601)*****		**9.172(1.697,17.908)*****		**12.936(6.655,25.146)*****
Chronic diseases						
Hypertension	1.305(0.959,1.775)		**1.903(1.366,2.652)*****		**1.939(1.402,2.680)*****	
Musculoskeletal diseases	1.059(0.751,1.493)		1.188(0.824,1.712)		1.189(0.831,1.702)	
Rheumatic diseases	1.228(0.868,1.738)		0.854(0.588,1.239)		1.137(0.792,1.632)	
Diabetes	1.280(0.889,1.843)		**1.460(1.003,2.127)***		**1.615(1.112,2.345)***	
Cardiopathy	1.033(0.705,1.513)		0.969(0.644,1.458)		0.832(0.556,1.245)	
Stroke	**6.391(4.034,10.130)*****		**4.983(3.196,7.771)*****		**6.811(4.277,10.846)*****	
Diseases of the urinary system	**2.359(1.336,4.164)****		**2.192(1.234,3.894)****		**2.827(1.573,5.083)****	
Dyslipidemia	0.382(0.118,1.236)		0.328(0.087,1.233)		0.388(0.119,1.269)	
Chronic pulmonary obstruction	2.381(0.954,5.940)		2.372(0.942,5.973)		**4.393(1.703,11.336)****	
Tumour	**0.283(0.083,0.961)***		0.993(0.323,3.055)		0.708(0.227,2.208)	
	Pain/Discomfort *OR(95% CI)*		**Mood *OR(95% CI)***		**EQ-5D UI *β(95% CI)***	
	Model VII	**Model VIII**	**Model IX**	**Model X**	**Model XI**	**Model XII**
Multimorbidity						
0		Ref		Ref		Ref
1		**2.892(1.771,4.721)*****		**3.910(1.714,8.920)****		**-0.227(-0.313, -0.141)*****
2		**4.031(2.465,6.591)*****		**4.858(2.128,11.088)*****		**-0.313(-0.400, -0.225)*****
≥3		**6.930(4.260,11.274)*****		6.057(2.684,13.671)***		**-0.462(-0.548, -0.376)*****
Chronic diseases						
Hypertension	**1.314(1.008,1.713)***		1.098(0.779, 1.548)		**-0.059(-0.107, -0.012)***	
Musculoskeletal diseases	**2.312(1.727,3.095)*****		1.282(0.879, 1.870)		**-0.098(-0.152, -0.046)*****	
Rheumatic diseases	**1.362(1.006,1.844)***		0.824(0.554, 1.226)		-0.008(-0.063,0.046)	
Diabetes	1.122(0.810,1.555)		**1.538(1.044,2.268)***		**-0.075(-0.133, -0.017)***	
Cardiopathy	**1.622(1.166,2.256)****		1.208(0.794,1.838)		-0.045(-0.105,0.014)	
Stroke	**2.018(1.364,2.985)*****		**2.546(1.642,3.947)*****		**-0.342(-0.410, -0.274)*****	
Diseases of the urinary system	0.728(0.433,1.223)		1.226(0.675,2.227)		-0.060(-0.150,0.030)	
Dyslipidemia	1.604(0.688,3.740)		1.374(0.493,3.829)		-0.075(-0.129,0.177)	
Chronic pulmonary obstruction	1.782(0.763,4.162)		2.327(0.942,5.748)		**-0.192(-0.337 , -0.047)****	
Tumour	0.519(0.184,1.460)		0.194(0.023,1.609)		0.091(-0.062,0.046)	

[#] Model I = mobility chronic condition model, Model II = mobility multimorbidity model, Model III = self-care chronic condition model, Model IV = self-care multimorbidity model, Model V = usual activities chronic condition model, Model VI = usual activities multimorbidity model, Model VII = pain/discomfort chronic condition model, Model VII = pain/discomfort multimorbidity model, Model IX = anxiety/depression chronic condition model, Model X = anxiety/depression multimorbidity model, Model XI = EQ-5D utility chronic condition model, Model XII = EQ-5D utility multimorbidity model

[&] Models I, II, III, IV, V, VI, VII, VIII, IX, and X were binary logistic regression models, Model XI and Model XII were Tobit regression models

[a] Adjustments were made for sex, age, education level, preretirement occupation, monthly income, smoking status, alcohol consumption status, and hours of sleep

[*] p value < 0.5

[**] p value < 0.01

[***] p value < 0.001

Table 4 Generalized linear model of chronic diseases for the EQ-VAS

	EQ-VAS *β*(*95% CI*)	
	Model XIII[#]	**Model XIV**[a]
Multimorbidity		
0		Ref
1		**-5.316(-7.946, -2.686)**[***]
2		**-7.239(-9.956, -4.522)**[***]
≥ 3		**-17.473(-20.172, -14.774)**[***]
Chronic diseases		
Hypertension	**-2.787(-4.576, -0.998)**[**]	
Musculoskeletal diseases	**-2.596(-4.629, -0.563)**[*]	
Rheumatic diseases	**-3.235(-5.359, -1.112)**[**]	
Diabetes	**-3.770(-6.018, -1.522)**[**]	
Cardiopathy	**-4.219(-6.520, -1.918)**[***]	
Stroke	**-8.282(-11.044, -5.519)**[***]	
Diseases of the urinary system	**-5.868(-9.471, -2.265)**[**]	
Dyslipidemia	1.160(-4.632,6.592)	
Chronic pulmonary obstruction	**-11.169(-17.111,-13.572)**[***]	
Tumour	4.360(-2.648,11.368)	

[#] Model XIII = EQ-VAS chronic condition model, Model XIV = EQ-VAS multimorbidity model

[a] Adjustments were made for sex, age, education level, preretirement occupation, monthly income, smoking status, alcohol consumption status, and hours of sleep

[*] p value < 0.5

[**] p value < 0.01

[***] p value < 0.001

in lung function and is frequently linked with comorbidities. Numerous studies have demonstrated that the number and severity of comorbidities associated with chronic pulmonary obstruction with increasing age [43] not only seriously affect the physical health of elderly people but also makes them have negative perceptions of their health status and affects their mental state. Moreover, chronic pulmonary obstruction tends to show progressive aggravation, and when the disease is severe, control is difficult, and treatment is short. Thus, older patients with chronic pulmonary obstruction eventually have a lower EQ-VAS score. Choi HS et al. showed that HRQoL in patients with chronic pulmonary obstruction worsened with disease aggravation and that patients' assessment of their health status was poorer [44].

Enhancing HRQoL in elderly individuals with multimorbidity

Our study also found that elderly individuals with multimorbidity had worse HRQoL, which was consistent with previous studies [45]. Multimorbidity can exacerbate the deterioration of physical health in elderly individuals, increasing disease-related pain, financial burden, mental stress, and medical needs, all of which can lead to poorer HRQoL [46]. How to improve the HRQoL of elderly individuals with multimorbidity is one of the issues that the government should focus on. It is recommended that the government first improve health insurance policy and establish a long-term care insurance system to reduce the financial burden of elderly individuals with multimorbidity. Second, we should accelerate the investment medical resources and build and improve combined community home medical and health care services to meet the demand for medical services for elderly people with multimorbidity. Finally, it is important to pay attention not only to the physical condition of elderly individuals with multimorbidity but also to their mental health and to relieve their mental stress.

Strengthens and limitations

Our study contributes to addressing the research gap regarding the impact of chronic diseases and multimorbidity on the health-related quality of life (HRQoL) of elderly individuals in China. By examining this influence among community-dwelling older adults in economically developed regions of China, our findings offer insights into strategies for preventing and managing chronic diseases and multimorbidity to enhance the quality of life for older adults.

It is important to note some limitations of this study. Firstly, the diagnosis of chronic diseases relied on self-reporting, which may have introduced errors or

underreporting. Secondly, the area sampling method may have included municipalities, counties/districts, and neighbourhoods within the eastern region that are less developed. Thirdly, the use of convenience sampling in community selection may not have accounted for differences in community size and did not involve geographic weighting, potentially affecting the representativeness of the sample. Lastly, the subjective nature of the EQ-VAS metric could lead to subjective biases, potentially impacting the reliability of the results obtained.

For future research, it would be valuable to conduct more extensive studies on the influence of chronic diseases and multimorbidity on HRQoL among elderly Chinese individuals using more robust and objective diagnostic methods. Additionally, exploring the longitudinal effects of interventions aimed at improving HRQoL in older adults with chronic conditions could provide insights into effective strategies for enhancing their well-being and quality of life.

Conclusion

This study focused on the impacts of chronic diseases and multimorbidity on HRQoL. The findings suggested that community-dwelling elderly individuals had higher rates of chronic diseases and multimorbidity. In addition, HRQoL was negatively affected by chronic diseases such as stroke, chronic pulmonary obstruction, hypertension, and diabetes. Last, elderly patients with multimorbidity had a worse HRQoL. With rapid aging and the increasing probability of chronic diseases in China, how to improve the HRQoL of elderly individuals with multimorbidity is one of the issues that the government should focus on. The HRQoL of elderly individuals with multimorbidity living at home in the community can be improved by constructing a long-term care insurance system and improving integrated community home health care services, paying attention to mental health and focusing on chronic disease treatment to improve HRQoL among community-based older adults with comorbidity.

Abbreviations

HRQoL	Health-related quality of life
EQ-5D-3L	EuroQol 5-Dimensions 3-Level version
UI	Utility index
EQ-5D	EuroQol-5 Dimensions
EQ-VAS	EuroQol Visual Analog Scale
SF-36	Short Form-6 Dimensions
WHOQOL-BREF	World Health Organization Quality of Life-Brief

Acknowledgements

We acknowledge the EuroQol Group for permitting us to use the EQ-5D-3L, all researchers involved in the study, and the participants. We also appreciate the editors and reviewers for their constructive feedback on the article.

Authors' contributions

Conceptualization: Xiaoxiao Liang & Huiyan Wei; Data curation: Guangmei Yang & Leping Wan Formal Analysis: Xiaoxiao Liang, Huiyan Wei, Guangmei Yang, Leping Wan, Haiying Dong; Funding acquisition: Yan He; Investigation: Xiaoxiao Liang, Huiyan Wei, Guangmei Yang, Leping Wan, Haiying Dong; Methodology: Huiyan Wei; Project administration: Yan He; Resources: Yan He; Software: Huiyan Wei & Xiaoxiao Liang Supervision: Yan He & Hongfei Mo; Validation: Hongfei Mo; Visualization: Huiyan Wei; Writing—original draft: Xiaoxiao Liang & Huiyan Wei; Writing—review & editing: Hongfei Mo.

Funding

This study received support from: 1) Zhengzhou University Professor Team Supports Enterprise Innovation-Driven Development Project (JSZLQY2022023); 2) Zhengzhou University Curriculum Ideological and Political Education Teaching Reform Demonstration Course (2022ZZUKCSZ040); 3) National Key R&D Plan Key Special Project for Proactive Health and Aging Science and Technology Responses (2020YFC2006100).

Data availability

The datasets generated and analysed in the current study are not publicly available due to funding regulations but are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

This study was approved by the Life Sciences Ethics Review Board of Zhengzhou University (No. ZZUIRB2022-07). All methods were carried out in accordance with relevant guidelines and regulations. All participants gave written informed consent at the recruitment stage of the study.

Competing interests

The authors declare no competing interests.

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Received: 15 September 2023 Accepted: 19 October 2024
Published online: 26 October 2024

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