Risk Management and Healthcare Policy Dovepress

Open Access Full Text Article ORIGINAL RESEARCH

Predicting Health-Related Quality of Life Among Chinese Residents: Latent Class Analysis Based on Panel Survey Data

Qing-Lin Li[1,2,*], Xue-Jiao Liu[1,2,*], Shu-E Zhang[3], Chao-Yi Chen[1,2], Liang Zhang[4], Xiang Zhang[1,2]

[1]Department of Health Administration, School of Medicine and Health Management, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, 430030, People's Republic of China; [2]The Key Research Institute of Humanities and Social Science of Hubei Province, Huazhong University of Science and Technology, Wuhan, 430030, People's Republic of China; [3]Department of Health Management, School of Health Management, Harbin Medical University, Harbin, 150081, People's Republic of China; [4]School of Political Science and Public Administration, Wuhan University, Wuhan, 430030, People's Republic of China

*These authors contributed equally to this work

Correspondence: Xiang Zhang, Department of Health Administration, School of Medicine and Health Management, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, 430030, People's Republic of China, Tel +86 18907145152, Email zhangchxiang@163.com

Purpose: This study aimed to identify distinct trends among Chinese residents based on their health-related quality of life (HR-QoL) outcomes and to analyze the demographic characteristics that contribute to these trends.

Materials and Methods: The study conducted latent class analysis using baseline data obtained from a survey of health service utilization behaviors (from July to December 2016) among residents of Hubei Province, China (N = 1517). Latent classes were used to implement the HR-QoL grouping of different trends among the respondents. Multinomial logistic regression analysis was used to identify demographic characteristic factors affecting HR-QoL in the trend groups.

Results: A three-class model emerged as the most suitable grouping classification for HR-QoL among Chinese residents: the low HR-QoL class, exhibiting a downward trend (5.5%); the medium HR-QoL class, exhibiting an upward trend (12.1%); and the stable HR-QoL class, exhibiting high HR-QoL (82.4%). Participants in the medium class were more likely to be without chronic diseases, aged 45–64 years, and employed than those in the low class. Conversely, urban participants had a higher likelihood of belonging to the low class. Participants in the stable class were more likely to be without chronic diseases, aged 15–44 years or 45–64 years, and employed than those in the low class. Conversely, urban participants had a higher likelihood of belonging to the low class.

Conclusion: Three latent trend classes of HR-QoL were observed, which exhibited distinct characteristics. Residents without chronic diseases, residents under 65 years of age, and employed residents had better HR-QoL than individuals in other classes, while urban residents had poorer HR-QoL than individuals in other classes.

Plain Language Summary: Health-related quality of life (HR-QoL) is an essential predictor of healthcare utilization, mortality, morbidity, and poor health. The rapid pace of modernization has corresponded with changes in the HR-QoL of the population. However, more empirical research is needed on the changes in HR-QoL among the Chinese population. In this study, we identified different trends in HR-QoL among Chinese residents and the demographic factors influencing HR-QoL among these trends. This study highlighted variations in longitudinal HR-QoL trends among Chinese residents. HR-QoL for Chinese residents is divided into three classes: low, exhibiting a downward trend; medium, exhibiting an upward trend; and stable, exhibiting high HR-QoL. Residents without chronic diseases, residents under the age of 65, and employed residents had better HR-QoL than other classes of individuals, while urban residents had worse HR-QoL than other classes of individuals. Understanding these HR-QoL trends could aid the development of targeted interventions for Chinese residents and improve their health and quality of life.

Keywords: Chinese resident, health-related quality of life, latent class analysis

Received: 22 April 2024
Accepted: 2 October 2024
Published: 25 October 2024

Introduction

Human health is increasingly influenced by factors such as population structure, socioeconomic development, environmental conditions, and changes in lifestyle and dietary habits. The cumulative impact of these factors has increased the prevalence of chronic diseases such as obesity,[1] hypertension,[2] and cardiovascular diseases,[3] as well as the risk of cancer,[4] thereby affecting individuals' physical health status. Moreover, these factors contribute to stress, fatigue, sleep disorders, anxiety, and depression,[5,6] reducing psychological and social well-being. Human health faces threats from multiple sources, resulting in significant impacts on quality of life. Accordingly, health-related quality of life (HR-QoL) is a crucial concern.

HR-QoL is a multidimensional measure, reflecting the aspects of physical, mental, emotional, and social health,[7] and is a critical predictor for health care utilization,[8] mortality,[8] morbidity,[9] and poor health.[10] For individuals to lead fulfilling lives and for society to thrive, it is crucial to maintain high HR-QoL.[11] HR-QoL is a pressing issue in China due to a combination of factors, including an aging population, high rates of chronic disease, and environmental challenges.[12] These issues are compounded by disparities in access to healthcare services, with rural areas and low-income individuals facing greater barriers to care.[13] The health status of residents in developing countries has improved in recent years,[14] as both individuals and governments have become increasingly focused on health.[15] China's new "Healthy China" strategy and other health-related policies have improved residents' health status and quality of life and promoted research on health, health services, and influencing factors.[16,17] However, due to increasing social competition and the ongoing effects of the COVID-19 pandemic, the overall QoL of the Chinese population decreased between 2008 and 2020.[18] The generalizability of findings regarding HR-QoL is inconsistent, as studies have been conducted on different populations and at different times. China is the largest developing country in the world, and the HR-QoL of Chinese residents is constantly changing. Therefore, it is necessary to re-evaluate the changing trends in the HR-QoL of Chinese residents.

HR-QoL is an important indicator of the comprehensive health of a population and may be affected by many factors. One study found that need factors, such as self-reported health, had the most significant impact on HR-QoL among older adults in Korea.[19] The predisposing factors were age and education level, and the enabling factors were income and daily living activities. One study in China found that poor HR-QoL was associated with lower socioeconomic status, lack of family support, and lack of social support.[20] Several studies have shown that HR-QoL is affected by various demographic characteristics.[19,21] Other study have found that social capital factors have less of an impact on HR-QoL than do demographic characteristics.[22] Thus, demographic characteristics can be used to predict the HR-QoL of Chinese residents, and intervention strategies based on demographic characteristics can help improve it.

Most studies on HR-QoL have used cross-sectional surveys.[23–25] The cross-sectional nature of these studies precludes the effect of time on HR-QoL, making it difficult to obtain information on the health trends of the population. Moreover, studies in this area have focused on particular groups, such as older adults,[10] pregnant women,[26] adolescents,[27] children,[28] college students,[29] patients with cancer,[30] patients with cardiopathy,[31] patients with sarcoidosis,[32] and stone formers.[33] By contrast, longitudinal studies assessing HR-QoL across entire populations remain relatively scarce. Moreover, few studies have sought to identify latent classes in HR-QoL domains and factors that distinguish these classes. Thus, studies should use data obtained from random sampling of the entire population, and panel survey data should be employed to analyze and predict the health trends and influencing factors of various population groups. This study aimed to identify distinct trends in HR-QoL among Chinese residents and to analyze the demographic characteristics contributing to these trends.

Materials and Methods

Design

Building on a pilot study conducted in 2015, the Statistical Information Center of the National Health and Family Planning Commission of China initiated the second phase of monitoring of residents' healthcare service utilization in 2016. This study used data from a survey of healthcare service utilization behavior among the residents of Hubei Province, China. From July to December 2016, residents' healthcare service utilization was monitored monthly. The monitoring process primarily consisted of field investigators and auditors visiting households. They conducted one-on-

one interviews using standardized monitoring questionnaires, including the Baseline Monitoring Form and Monitoring Form, developed by the Chinese National Health and Family Planning Commission's Statistical Information Center.[34] The Baseline Monitoring Form includes information on the general situation of the family and the personal situation of the family members, with a primary focus on basic demographic characteristics and the prevalence of chronic diseases. The Monitoring Form includes changes in family members, their health status, disease surveillance, medical visits and hospitalizations during the monitoring cycle. It primarily focuses on the residents' HR-QoL, diseases, and medical behavior.

The investigators were trained to use the instruments and interviewed the participants prior to the survey. During the survey, the investigators provided guidance for all questionnaire responses. After data collection, households were contacted to verify data accuracy, and the data were then anonymized. All participants provided informed consent before participating in the survey.

Participants

The survey was a long-term follow-up investigation requiring a high level of trust and commitment from the participants. Fostering trust and long-term cooperation among the surveyed households required obtaining a firm understanding of their fundamental circumstances prior to home visits. A pilot that was conducted in two places (urban city and rural town) in Hubei Province monitored residents' healthcare service utilization behavior from July to December 2016. Five communities and townships within each of the two sample areas were selected as sampling points. The survey used stratified random sampling to select the initial set of participants, and then tracked their health and other related data on a monthly basis. Initially, 1597 participants were selected and monitored. Complete basic information was obtained from 1517 participants, resulting in an effective response rate of 94.99% (1517/1597). Missing data were obtained using interpolation methods.

Instruments

Demographic characteristic measures included respondents' district, gender, presence of chronic diseases, family annual income, age, education level, marital status, and employment status.

The European Quality of Life Instrument (EuroQol; later named "EQ-5D") is a five-item, patient-based utility instrument that measures HR-QoL.[35] The EQ-5D is a brief self-reported questionnaire that assesses the respondents' general health. Respondents were asked to rate their health on the day that the questionnaire was administered. The EQ-5D scale has good reliability and validity when used to assess HR-QoL among various populations,[18,36–39] including the Chinese population.[18,39] The EQ-5D questionnaire contains two parts. The first is a descriptive component comprising five dimensions: mobility (MO), self-care (SC), usual activities (UA), pain/discomfort (PD), and anxiety/depression (AD). This is commonly used to calculate the EQ-5D index in economic analyses using a country-specific value set. The second is the EQ-visual analog scale (EQ-VAS), which measures the respondents' self-rated health on a 20-cm vertical line (VAS), with endpoints labeled "worst imaginable health state" at 0 and "best imaginable health state" at 100.[40] The EQ-VAS scores range from 0 to 1 and are calculated by dividing the number marked on the scale by 100. To more accurately reflect changes in the HR-QoL of Chinese residents, facilitate the comparison of various results, and minimize the impact of respondents' cultural background and comprehension on the accuracy of the findings, we selected a utility index specifically suited for the Chinese population. This index was used to calculate health utility values, providing a clearer reflection of the HR-QoL in this demographic. Health utility values were divided into scores ranging from 0 (death) to 1 (full health) using the Chinese version of the time trade-off (TTO).[41]

Analysis Methods

The data were presented as frequencies. Longitudinal latent class analysis (LLCA) was used to analyze participants with similar HR-QoL trajectories. Multinomial logistic regression was used to examine the association between the demographic characteristics and class membership. LLCA was used to obtain the main types of HR-QoL, which were then matched with the demographic characteristics of the participants to obtain the characteristics of each class and predict the tendency of health changes based on specific features.

The data were coded, revised, entered, and double-checked by investigators. The gathered information was loaded into EpiData 3.2 version for sorting and subsequently extracted into Excel 2019 for filtering and cleaning. Data were analyzed using SPSS 26.0 (IBM Corp., Armonk, NYC, USA), Mplus 8.5 (Muthen & Muthen, Los Angeles, NY, USA), and Stata 12 (STATA Corp). First, the general characteristics of the participants were analyzed to determine frequencies and percentages. Second, a latent class analysis was performed for HR-QoL. The Akaike information criterion (AIC), Bayesian information criterion (BIC), sample size-adjusted BIC (saBIC), Lo–Mendel–Rubin likelihood ratio test (LMR), and bootstrap likelihood ratio test (BLRT) were used to assess the goodness of fit for the selection of latent classes. The lowest absolute values of the AIC and BIC indicate excellent model fitness.[42] The AIC and BIC are affected by sample size, whereas saBIC is not.[43] The LMR and BLRT provide significance probabilities for the class models. The null hypothesis posits that the latent class model will be rejected, whereas the alternative hypothesis posits that the latent class model will be accepted. The alternative hypothesis was accepted if probable significance was less than 0.05. Third, a multinomial logistic regression analysis was used to identify the demographic characteristics that predicted the HR-QoL in individual latent classes. In this analysis, the dependent variable was the HR-QoL class of residents, and various demographic factors served as independent variables to assess their predictive influence on HR-QoL classes. The low HR-QoL class, representing individuals in poorer health who may require additional resources and attention, was used as the reference class. By using the low HR-QoL class as a reference, the model offers a more nuanced understanding of how demographic factors are associated with different health trajectories, thus providing a foundation for targeted health interventions. Statistical significance was set at $P < 0.05$.

Results

Baseline Characteristics

A total of 1597 participants were included in the analysis, of whom 1517 had complete baseline variables (Table 1). The percentages of participants who were urban residents, women, chronic disease sufferers, in a relationship, and employed were 53.1, 52.5, 38.9, 80.9, and 89.6%, respectively. Among the participants, 45.6% had an annual family income below 50,000 RMB. Furthermore, 27.8% of the participants were 15–44 years of age, and 17.8% had a higher education background.

Table 1 Baseline Characteristics of Participants in the Complete Data Group by HR-QOL Trends During a Six-Month Follow-Up (N = 1517)

Characteristics	Total (N = 1517), n (%)	The Low HR-QoL Class (n = 83), Row n (%)	The Medium HR-QoL Class (n = 184), Row n (%)	The Stable HR-QoL Class (n = 1250), Row n (%)
District				
Urban	806 (53.1)	52 (6.5)	70 (8.7)	684 (84.9)
Rural	711 (46.9)	31 (4.4)	114 (16.0)	566 (79.6)
Gender				
Men	720 (47.5)	41 (5.7)	79 (11.0)	600 (83.3)
Women	797 (52.5)	42 (5.3)	105 (13.2)	650 (81.6)
Chronic disease				
No	927 (61.1)	8 (0.9)	58 (6.3)	861 (92.9)
Yes	590 (38.9)	75 (12.7)	126 (21.4)	389 (65.9)
Family annual income (RMB)				
0–50,000	692 (45.6)	43 (6.2)	96 (13.9)	553 (79.9)
50,001–100,000	673 (44.4)	36 (5.3)	82 (12.2)	555 (82.5)
> 100,000	152 (10.0)	4 (2.6)	6 (3.9)	142 (93.4)

(*Continued*)

Table 1 (Continued).

Characteristics	Total (N = 1517), n (%)	The Low HR-QoL Class (n = 83), Row n (%)	The Medium HR-QoL Class (n = 184), Row n (%)	The Stable HR-QoL Class (n = 1250), Row n (%)
Age (years)				
15–44	421 (27.8)	3 (0.7)	26 (6.2)	392 (93.1)
45–64	655 (43.2)	19 (2.9)	79 (12.1)	557 (85.0)
≥ 65	441 (29.1)	61 (13.8)	79 (17.9)	301 (68.3)
Education level[a]				
Unedu & primary	813 (53.6)	50 (6.2)	119 (14.6)	644 (79.2)
Secondary	434 (28.6)	27 (6.2)	38 (8.8)	369 (85.0)
Higher	270 (17.8)	6 (2.2)	27 (10.0)	237 (87.8)
Marital status[b]				
Single	289 (19.1)	18 (6.2)	42 (14.5)	229 (79.2)
In a relationship	1228 (80.9)	65 (5.3)	142 (11.6)	1021 (83.1)
Employment status[c]				
Employed	1359 (89.6)	61 (4.5)	140 (10.3)	1158 (85.2)
Unemployed	158 (10.4)	22 (13.9)	44 (27.8)	92 (58.2)
Total	1517 (100.0)	83 (5.5)	184 (12.1)	1250 (82.4)

Notes: [a]Education level: unedu and primary = no educated or primary education; secondary = junior school or high school education; higher = technical school, secondary school, junior college, undergraduate education, or higher. [b]Marital status: single = never married, widowed, separated, or divorced; in a relationship = married, common-law, or in a romantic relationship. [c] Employment status: employed = employed or retired; unemployed = unemployed, school students and jobless.

Latent Class Analysis

LLCA was used to investigate the different tendencies of the EQ-5D (Table 2). The latent class analysis model fit statistics indicated that a three-class solution was optimal for the EQ-5D, which was thus selected as the final model. The analysis was performed using both complete cases and those containing missing values, and the classifications of the results for the two cases were similar. All data and complete data groups were defined based on the conditional response probabilities, as illustrated in Figures 1 and 2, respectively. Changes in EQ-5D scores were divided into three classes: the low HR-QoL class, which indicates a downward trend (Class 1); the medium HR-QoL class, indicating an upward trend (Class 2); and the stable HR-QoL class, indicating high scores (Class 3). As the complete data were consistent with the classification results of "all" data, descriptive statistics were conducted using complete baseline data for testing. The descriptive statistics of the demographic characteristics for each class were presented in Table 1. The low HR-QoL class

Table 2 Fit Indices of Latent Class Analysis

Number of Classes	AIC	BIC	SaBIC	LMR (*P*)	BLRT (*P*)
All data (N = 1597)					
1	21,379.900	21,451.580	21,382.061	n/a	n/a
2	14,059.470	14,209.998	14,064.025	<0.001	<0.001
3	13,454.544	13,683.909	13,461.451	<0.001	<0.001
4	13,534.284	13,842.508	13,543.562	1.000	1.000
Complete data (N = 1517)					
1	20,014.246	20,085.396	20,016.408	n/a	n/a
2	13,134.370	13,283.785	13,138.836	<0.001	<0.001
3	12,608.226	12,835.906	12,615.022	<0.001	<0.001
4	12,628.742	12,934.687	12,638.891	1.000	1.000

Abbreviations: AIC, Akaike information criterion; BIC, Bayesian information criterion; saBIC, sample size adjusted BIC; LMR, Lo-Mendell-Rubin likelihood ratio test; BLRT, bootstrap likelihood ratio test.

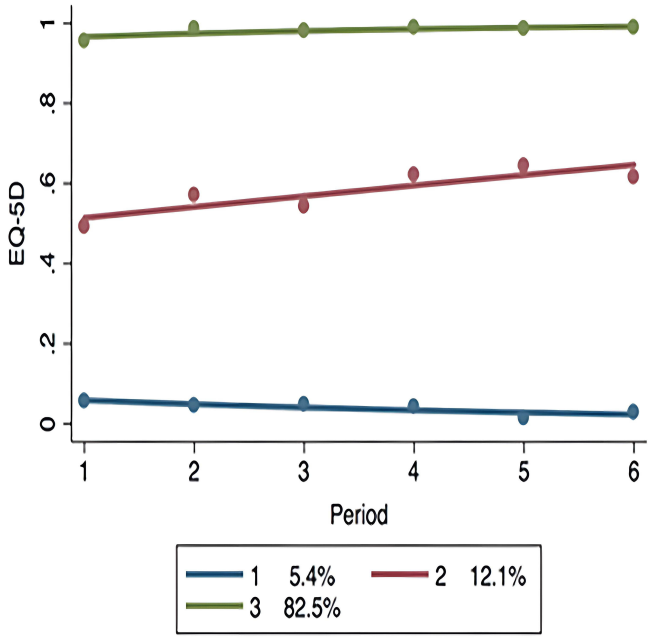

Figure 1 Latent classes of HR-QoL of participants in all data group (N = 1597).

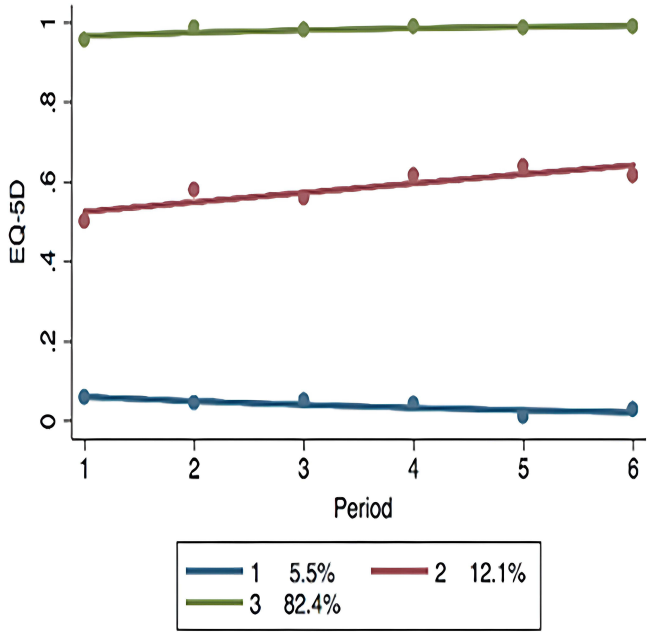

Figure 2 Latent classes of HR-QoL of participants in complete data group (N = 1517).

was the smallest of the sample (5.5%), followed by the medium HR-QoL class (12.1%), while the stable HR-QoL class accounted for the majority (82.4%).

Predictors of Latent Classes of HR-QoL

To investigate the influence of the demographic characteristics on HR-QoL, multinomial logistic regression analysis was conducted using complete baseline data. As depicted in Table 3, for the medium HR-QoL class, the analysis revealed that district, chronic disease, age, and employment status were significant ($P < 0.05$). Participants without chronic diseases

Table 3 Prediction of Latent Class Based on Demographic Characteristics (N = 1517)[a]

Characteristics	The Medium HR-QoL Class (Class 2)			The Stable HR-QoL Class (Class 3)		
	OR[b]	*95% CI*	*P*	*OR*	*95% CI*	*P*
District						
Urban	0.215	(0.094, 0.492)	<0.001	0.419	(0.202, 0.866)	0.02
Rural	1.000	-[c]	-	-	-	-
Gender						
Men	0.708	(0.415, 1.210)	0.21	0.899	(0.579, 1.395)	0.64
Women	1.000	-	-	-	-	-
Chronic disease						
No	3.323	(1.342, 8.227)	0.009	12.832	(5.580, 29.512)	<0.001
Yes	1.000	-	-	-	-	-
Family annual income (RMB)						
0–50,000	4.237	(0.748, 24.002)	0.10	0.365	(0.129, 1.033)	0.06
50,001–100,000	2.865	(0.498, 16.489)	0.24	0.433	(0.152, 1.237)	0.12
>100,000	1.000	-	-	-	-	-
Age (years)						
15–44	1.748	(0.406, 7.519)	0.45	7.849	(2.133, 28.886)	0.002
45–64	2.196	(1.114, 4.328)	0.02	3.834	(2.093, 7.024)	<0.001
≥ 65	1.000	-	-	-	-	-
Marital status						
Single	1.222	(0.585, 2.551)	0.59	1.536	(0.810, 2.911)	0.19
In a relationship	1.000	-	-	-	-	-
Education level						
Unedu & primary	0.625	(0.201, 1.950)	0.42	0.656	(0.253, 1.697)	0.38
Secondary	0.479	(0.144, 1.596)	0.23	0.523	(0.192, 1.426)	0.21
Higher	1.000	-	-	-	-	-
Employment status						
Employed	3.422	(1.596, 7.340)	0.002	8.164	(4.034, 16.520)	<0.001
Unemployed	1.000	-	-	-	-	-

Notes: [a]Reference group = the low HR-QoL class (Class 1). [b]OR: odds ratio. [c]Reference (not applicable).

(OR = 3.323, 95% CI = 1.342–8.227), those aged 45–64 years (OR = 2.196, 95% CI = 1.114–4.328), and employed individuals (OR = 3.422, 95% CI = 1.596–7.340) were more likely to be in the medium HR-QoL class. Conversely, urban participants (OR = 0.215, 95% CI = 0.094–0.492) were more likely to be in the low HR-QoL class. However, the influences of education, annual family income, and marital status were not significant ($P > 0.05$). For the stable HR-QoL class, district, chronic disease, age, and employment status were significant ($P < 0.05$). Specifically, participants without chronic disease (OR = 12.832, 95% CI = 5.580–29.512), those aged 15–44 years (OR = 7.849, 95% CI = 2.133–28.886) or 45–64 years (OR = 3.834, 95% CI = 2.093–7.024), and employed individuals (OR = 8.164, 95% CI = 4.034–16.520) were more likely to be in the stable HR-QoL class. Conversely, urban participants (OR = 0.419, 95% CI = 0.202–0.866) were more likely to be in the low HR-QoL class. Similar to the medium HR-QoL class, the impacts of education, annual family income, and marital status were not significant ($P > 0.05$).

Discussion

This study identified three distinct classes of HR-QoL among Chinese residents. District, chronic disease, age, and employment status predicted these classes. A 2010 study on HR-QoL among the Chinese population found that 6.3% of the participants reported poor or very poor health status.[13] This finding may reflect the quality and effectiveness of China's healthcare system.

Influence of District

This study found that the health of urban residents was more likely to deteriorate than that of rural residents. The results contradicted recent findings on older populations in China.[44,45] This discrepancy may be attributed to differences in study groups and levels of economic development, indirectly demonstrating the impact of economic growth on public health. This study used baseline survey data from the entire Chinese population in 2016, providing a comprehensive overview. It found that rural China experienced slower economic development than urban China during this period. Most rural residents have better subjective experiences of their living conditions, such as goals, expectations, and standards, than urban residents do. Consequently, mental pressure and competition among rural residents are lower than among urban residents.[46,47] Moreover, production and lifestyle in rural areas provide more opportunities for rural residents to interact with each other; whereas inconvenience, insecurity, and numerous obstacles to building in urban areas hinder communication between urban residents.[48] In addition, population density is higher in urban areas of China than in rural areas; consequently, crime, mortality, social isolation, air pollution, and noise pollution are higher in urban areas, and social and environmental problems are more common.[48] Therefore, Chinese urban residents experience worse the physical, mental, and social health levels than those of rural residents, and their HR-QoL is more likely to deteriorate. Thus, policies must ensure the provision of facilities that can be used for social public services based on individual needs, such as sports facilities, leisure activity centers, lifelong education centers, and volunteer work centers. This would improve the environment for urban participation in such facilities and establish a safe living space with appropriate activities for urban residents. Furthermore, policy makers should also focus on developmental differences between urban and rural areas and make timely policy adjustments to provide appropriate support for key groups and ensure fairness, coordination, and sustainability between urban and rural areas.

Influence of Chronic Diseases

This study found that chronic diseases had a significant impact on the HR-QoL of Chinese residents, finding that was consistent with those of most other studies.[49,50] Patients with chronic diseases are more likely to suffer from pain and reduced physical function, limiting their ability to perform daily activities and exercise, and leading to a range of psychological problems that cause stress, anxiety, and depression.[50,51] In addition, some patients with chronic diseases require long-term care, which imposes physical, psychological, and financial burdens on their primary caregivers and affects the patients' HR-QoL.[50,52] Therefore, healthcare providers should incorporate these insights to enhance the early detection and continuous management of chronic diseases, which can improve patient outcomes and reduce healthcare costs over time. Additionally, policymakers should consider these factors when designing health services, highlighting the importance of integrated care that encompasses medical treatment, psychological and social support, and health education.

Influence of Employment Status

We found that employed participants had higher levels of HR-QoL, which was in line with a study of the Chinese population[18] but contradicted the findings of another study on Nigerian maternity,[53] which found that employed women had lower HR-OoL than unemployed women. This discrepancy may be explained by differences in research objects. Generally, employment provides socioeconomic status and wealth.[54] Unemployed people with a relatively low socioeconomic status and material wealth may be more vulnerable to impairments in their social functioning and psychological resources than employed people. This vulnerability influences health outcomes through associations with behavioral and psychological risk factors. For instance, people with low socioeconomic status may experience more pressure and engage in poorer health behaviors than those with higher socioeconomic status. These factors can lead to depression, withdrawal, inattention, and aggressive behavior, which can impair quality of life.[53] Therefore, policymakers should explore strategies to enhance employment opportunities and support systems, particularly for individuals at risk of job loss. Such strategies may include job training programs, financial incentives for employers, and targeted interventions aimed at improving job retention and career development. These measures would foster a more inclusive and supportive socio-economic environment, ultimately enhancing the health and well-being of the residents.

Influence of Age

The analysis revealed that residents under 65 years old had better HR-QoL, indicating that this age was an important turning point for the HR-QoL of residents in China. This result was generally consistent with population health studies conducted in other countries and population health studies conducted in China.[13,55,56] However, some differences are worth noting. For instance, one study showed that age 55 was an important turning point for HR-QoL among Chinese urban residents in 2015.[57] Another study conducted in Zhejiang, China, in 2018 showed that individuals over the age of 75 had worse HR-QoL than those younger.[45] Although differences in the study population may influence the comparison of results, differences in results could also reflect an overall improvement in the health of the Chinese population and development of healthcare services in China. Older adults may gradually lose vestibular function as they age, affecting not only their expected areas of vulnerability, such as vision and walking, but also "healthy" areas, such as speech, dexterity, and emotions.[55] Vestibular symptoms (especially dizziness and vertigo) are associated with social isolation, reduced autonomy, and difficulties performing daily living activities among older adults.[58,59] The emotional burden caused by these symptoms can lead to adverse reactions such as depressive symptoms, anxiety, and panic, which can significantly reduce their quality of life along multiple dimensions of well-being.[55] Moreover, older adults face threats from loneliness, chronic diseases, and low health service satisfaction.[60] Loneliness impairs the immune and cardiovascular systems of older adults, affecting their physical and mental health and contributing to behaviors that lead to poor health outcomes and ultimately impair their quality of life.[61] Older adults also have a high incidence of chronic diseases, which have a negative impact on their daily lives and affect their physical and mental health, resulting in reduced HR-QoL.[62] Therefore, policymakers should prioritize expanding access to geriatric care and implementing community-based programs that promote healthy aging. These programs could include regular health check-ups, mental health support, and social engagement activities designed to reduce loneliness and isolation. Additionally, healthcare professionals should receive enhanced training to better meet the unique needs of older residents, providing them with more personalized and effective care, which would support their independence and quality of life.

Limitations

This study had several limitations. First, we used the EQ-5D to measure HR-QoL rather than the more generic HR-QoL, as measured by older people's quality of life questionnaire (OPQOL) or self-enumerated scale of quality of life (CASP-19). The HR-QoL trajectory and its predicted value may differ from the more generic QoL. Therefore, this study may have underestimated changes in HR-QoL. Furthermore, although a representative population area of China was sampled, the findings cannot be generalized, as the sampling points were selected based on the last national pilot, and variations exist in social environments across areas of China. Moreover, as this study used secondary data, we could not control for all related factors. In addition, the non-random selection of the reference group in the multinomial logistic regression analysis could have introduced a selection bias, which could limit our ability to draw causal inferences. Finally, the data lag stemming from the analysis of potentially outdated data may limit the ability of the study to fully capture current conditions. Despite these limitations, this study was significant due to the use of large-scale panel and monitoring data for six consecutive months, which effectively reflected trends in the health of Chinese residents over time, identified latent classes of HR-QoL among Chinese residents and assessed their predictors.

Conclusion

HR-QoL is closely related to health outcomes. This study identified classes with different HR-QoL outcomes among Chinese residents and factors influencing these trends. Three latent classes of HR-QoL scores were confirmed: those with a downward trend, those with an upward trend, and those with stable and high scores. Among them, a small number of residents experienced low and declining HR-QoL, whereas the majority maintained a consistently high HR-QoL. This study found different long-term HR-QoL trajectories for Chinese residents with different lifestyles and health conditions, and that residents without chronic diseases, residents under age 65, and employed residents had better HR-QoL. Conversely, urban residents had poor HR-QoL. However, education level, income, and other demographic characteristics

did not significantly affect long-term health. These classes and their predictors revealed the importance of considering multiple factors when seeking to understand and address HR-QoL disparities among Chinese residents. Future research should build on these findings and develop targeted interventions to improve the HR-QoL of specific subgroups of Chinese residents.

Abbreviations

HR-QoL, Health-related quality of life; EQ-5D, EuroQol-5D; EQ-VAS, EQ-visual analog scale; LLCA, Longitudinal latent class analysis; TTO, Time trade-off; OPQOL, Older people's quality of life questionnaire; CASP-19, Self-enumerated scale of quality of life; AIC, Akaike information criterion; BIC, Bayesian information criterion; saBIC, sample size adjusted BIC; LMR, Lo-Mendell-Rubin likelihood ratio test; BLRT, Bootstrap likelihood ratio test.

Data Sharing Statement

The data sets generated and/or analyzed during this study are available from the corresponding author upon reasonable request.

Ethics Approval and Consent to Participate

All procedures performed in this study involving human participants comply with the principles embodied in the Declaration of Helsinki and the ethics committee of the Institutional Review Board of Huazhong University of Science and Technology. As this study was retrospective, and all personal information was eliminated, the ethics approval requirement was waived. Informed consent was obtained from all individual participants included in the study.

Acknowledgments

The authors would like to thank the researchers and respondents who participated in the longitudinal survey. We would like to thank Editage (www.editage.cn) for English language editing.

Funding

This research was funded by National Science Foundation of China (Grant Number: 72074084). The funding body only provided financial support for the research, and did not participate in any part of the research, such as research design, data analysis, manuscript writing, etc.

Disclosure

The authors have declared that no competing interests exist.

References

1. Seppälä T, Mäntyselkä P, Saxen U, Kautiainen H, Järvenpää S, Korhonen PE. Weight change and health related quality of life: population-based longitudinal study of the effects of health related quality of life on the success of weight management. *J Community Health*. 2014;39(2):349–354. doi:10.1007/s10900-013-9768-8
2. Yu C, Ren X, Cui Z, et al. A diagnostic prediction model for hypertension in Han and Yugur population from the China National Health Survey (CNHS). *Chin Med J*. 2023;136(9):1057–1066. doi:10.1097/CM9.0000000000001989
3. Plans E, Gullón P, Cebrecos A, et al. Density of Green Spaces and Cardiovascular Risk Factors in the City of Madrid: the Heart Healthy Hoods Study. *Int J Environ Res Public Health*. 2019;16(24):4918. doi:10.3390/ijerph16244918
4. Hurt CN, Mukherjee S, Bridgewater J, et al. Health-Related Quality of Life in SCALOP, a Randomized Phase 2 Trial Comparing Chemoradiation Therapy Regimens in Locally Advanced Pancreatic Cancer. *Int J Radiat Oncol Biol Phys*. 2015;93(4):810–818. doi:10.1016/j.ijrobp.2015.08.026
5. Clancy B, Bonevski B, English C, et al. Health risk factors in Australian Stroke Survivors: a latent class analysis. *Health Promot J Austr*. 2024;35(1):37–44. doi:10.1002/hpja.706
6. Haight BL, Peddie L, Crosswell AD, Hives BA, Almeida DM, Puterman E. Combined effects of cumulative stress and daily stressors on daily health. *Health Psychol*. 2023;42(5):325–334. doi:10.1037/hea0001281
7. Hendriksz CJ, Berger KI, Lampe C, et al. Health-related quality of life in mucopolysaccharidosis: looking beyond biomedical issues. *Orphanet J Rare Dis*. 2016;11(1):119. doi:10.1186/s13023-016-0503-2
8. Singh JA, Nelson DB, Nichol KL. Recent health-related quality of life, but not change, predicted mortality and healthcare utilization. *J Clin Epidemiol*. 2021;140:13–21. doi:10.1016/j.jclinepi.2021.08.023

9. Kendrick D, Kelllezi B, Coupland C, et al. Psychological morbidity and health-related quality of life after injury: multicentre cohort study. *Qual Life Res*. 2017;26(5):1233–1250. doi:10.1007/s11136-016-1439-7
10. Ortíz-Barrios LB, Granados-García V, Cruz-Hervert P, Moreno-Tamayo K, Heredia-Ponce E, Sánchez-García S. The impact of poor oral health on the oral health-related quality of life (OHRQoL) in older adults: the oral health status through a latent class analysis. *BMC Oral Health*. 2019;19 (1):141. doi:10.1186/s12903-019-0840-3
11. A UM. Calidad de vida relacionada con la salud: elementos conceptuales [Health related quality of life: conceptual elements]. *Rev Med Chil*. 2010;138(3):358–365.
12. Dong X, Simon MA. Health and aging in a Chinese population: urban and rural disparities. *Geriatr Gerontol Int*. 2010;10(1):85–93. doi:10.1111/j.1447-0594.2009.00563.x
13. Dong WL, Li YC, Wang ZQ, et al. Self-rated health and health-related quality of life among Chinese residents, China, 2010. *Health Qual Life Outcomes*. 2016;14(1):5. doi:10.1186/s12955-016-0409-7
14. Yang X. Health expenditure, human capital, and economic growth: an empirical study of developing countries. *Int J Health Econ Manag*. 2020;20 (2):163–176. doi:10.1007/s10754-019-09275-w
15. Cole WM. Wealth and health revisited: economic growth and wellbeing in developing countries, 1970 to 2015. *Soc Sci Res*. 2019;77:45–67. doi:10.1016/j.ssresearch.2018.09.003
16. Xu X, Zhao Y, Zhou J, Xia S. Quality-of-Life Evaluation among the Oldest-Old in China under the "Active Aging Framework". *Int J Environ Res Public Health*. 2022;19(8):4572. doi:10.3390/ijerph19084572
17. Feng XL, Zhang Y, Hu X, Ronsmans C. Tracking progress towards universal health coverage for essential health services in China, 2008–2018. *BMJ Glob Health*. 2022;7(11):e010552. doi:10.1136/bmjgh-2022-010552
18. Wang D, Xie S, Wu J, Sun B. The trend in quality of life of Chinese population: analysis based on population health surveys from 2008 to 2020. *BMC Public Health*. 2023;23(1):167. doi:10.1186/s12889-023-15075-2
19. Kim GM, Hong MS, Noh W. Factors affecting the health-related quality of life in community-dwelling elderly people. *Public Health Nurs*. 2018;35 (6):482–489. doi:10.1111/phn.12530
20. Zheng X, Xue Y, Dong F, et al. The association between health-promoting-lifestyles, and socioeconomic, family relationships, social support, health-related quality of life among older adults in China: a cross sectional study. *Health Qual Life Outcomes*. 2022;20(1):64. doi:10.1186/s12955-022-01968-0
21. Sun L, Wong HM, McGrath CPJ. The factors that influence oral health-related quality of life in young adults. *Health Qual Life Outcomes*. 2018;16 (1):187. doi:10.1186/s12955-018-1015-7
22. Lubetkin EI, Jia H, Franks P, Gold MR. Relationship among sociodemographic factors, clinical conditions, and health-related quality of life: examining the EQ-5D in the U.S. general population. *Qual Life Res*. 2005;14(10):2187–2196. doi:10.1007/s11136-005-8028-5
23. Doherty MK, Leung Y, Su J, et al. Health utility scores from EQ-5D and health-related quality of life in patients with esophageal cancer: a real-world cross-sectional study. *Dis Esophagus*. 2018;31(12). doi:10.1093/dote/doy058
24. Hernandez G, Garin O, Dima AL, et al. EuroQol (EQ-5D-5L) Validity in Assessing the Quality of Life in Adults With Asthma: cross-Sectional Study. *J Med Internet Res*. 2019;21(1):e10178. doi:10.2196/10178
25. Huang W, Yang J, Liu Y, et al. Assessing health-related quality of life of patients with colorectal cancer using EQ-5D-5L: a cross-sectional study in Heilongjiang of China. *BMJ Open*. 2018;8(12):e022711. doi:10.1136/bmjopen-2018-022711
26. Estebsari F, Kandi ZK, Bahabadi FJ, Filabadi ZR, Estebsari K, Mostafaei D. Health-related quality of life and related factors among pregnant women. *J Educ Health Promot*. 2020;9(1):299. doi:10.4103/jehp.jehp_307_20
27. Hourani EM, Hammad SM, Shaheen A, Amre HM. Health-Related Quality of Life Among Jordanian Adolescents. *Clin Nurs Res*. 2017;26 (3):337–353. doi:10.1177/1054773815626667
28. Sisk C. Promoting Children's Health-Related Quality of Life. *Pediatr Nurs*. 2016;42(2):86–88.
29. White HM, Hoch JM, Hoch MC. Health-Related Quality of Life in University Dance Students. *Med Probl Perform Art*. 2018;33(1):14–19. doi:10.21091/mppa.2018.1004
30. Abegaz TM, Ayele AA, Gebresillassie BM. Health Related Quality of Life of Cancer Patients in Ethiopia. *J Oncol*. 2018;2018:1467595. doi:10.1155/2018/1467595
31. Höfer S. Health-related quality of life in heart disease. *Rev Port Cardiol*. 2020;39(7):375–376. doi:10.1016/j.repc.2020.06.007
32. Korenromp IHE, van de Laar MAFJVD. Health-related quality of life in sarcoidosis. *Curr Opin Pulm Med*. 2014;20(5):503–507. doi:10.1097/MCP.0000000000000079
33. Bryant M, Angell J, Tu H, Goodman M, Pattaras J, Ogan K. Health related quality of life for stone formers. *J Urol*. 2012;188(2):436–440. doi:10.1016/j.juro.2012.04.015
34. Chen-Xiao S, Ai-Jun XU. Health-related Quality of Life and Utilization of Health Services in Patients with Diabetes Alone versus Those with Comorbid Diabetes Mellitus: a Comparative Study. *Chin Gen Pract*. 2018;21(15):1785–1789.
35. Rabin R, de Charro F. EQ-5D: a measure of health status from the EuroQol Group. *Ann Med*. 2001;33(5):337–343. doi:10.3109/07853890109002087
36. Lee WJ, Song KH, Noh JH, Choi YJ, Jo MW. Health-related quality of life using the EuroQol 5D questionnaire in Korean patients with type 2 diabetes. *J Korean Med Sci*. 2012;27(3):255–260. doi:10.3346/jkms.2012.27.3.255
37. Tsang HHL, Cheung JPY, Wong CKH, Cheung PWH, Lau CS, Chung HY. Psychometric validation of the EuroQoL 5-dimension (EQ-5D) questionnaire in patients with spondyloarthritis. *Arthritis Res Ther*. 2019;21(1):41. doi:10.1186/s13075-019-1826-x
38. Shetty AJ, Balaraju G, Shetty S, Pai CG. Quality of life in dyspepsia and its subgroups using EQ-5D (EuroQol) questionnaire. *Saudi J Gastroenterol*. 2017;23(2):112–116. doi:10.4103/sjg.SJG_487_16
39. Gao M, Zeng Z, Jiang X, Ge J, Song J. Long-term quality of life and influencing factors in elderly patients after vertebroplasty based on the EQ-5D-3L Chinese utility scoring system: a retrospective study. *BMC Geriatr*. 2024;24(1):686. doi:10.1186/s12877-024-05249-x
40. Om CK, Oppe M, Rabin R (on behalf of the EuroQol Group). EQ-5D User Guide, Version 2.0. 2009. Available from: http://www.euroqol.org/. Accessed November 30, 2022.
41. Hongyan WU, Guoen L, Haijing G. Construction and Study of EQ-5D Health Scale Utility Integral System-Based on Empirical Analysis of Southwest Area of China. *China Pharm*. 2016;2016(14):1877–1881.

42. Nagin DS. Analyzing Developmental Trajectories: a Semiparametric, Group-Based Approach. *Psychological Methods*. 1999;4(2):139–157. doi:10.1037/1082-989X.4.2.139
43. Sclove SL. Application of model-selection criteria to some problems in multivariate analysis. *Psychometrika*. 1987;52(3):333–343. doi:10.1007/BF02294360
44. Zhou Z, Zhou Z, Gao J, Lai S, Chen G. Urban-rural difference in the associations between living arrangements and the health-related quality of life (HRQOL) of the elderly in China-Evidence from Shaanxi province. *PLoS One*. 2018;13(9):e0204118. doi:10.1371/journal.pone.0204118
45. Lu J, Yu Z, Zhang X, et al. Association between social health status and health-related quality of life among community-dwelling elderly in Zhejiang. *Health Qual Life Outcomes*. 2020;18(1):110. doi:10.1186/s12955-020-01358-4
46. Zhou K, Tan J, Watanabe K. How does perceived residential environment quality influence life satisfaction? Evidence from urban China. *J Community Psychol*. 2021;49(7):2454–2471. doi:10.1002/jcop.22545
47. Zhuge Y, Qian H, Zheng X, et al. Residential risk factors for childhood pneumonia: a cross-sectional study in eight cities of China. *Environ Int*. 2018;116:83–91. doi:10.1016/j.envint.2018.03.022
48. Hernandez-Huayta J, Chavez-Meneses S, Carreazo NY. Salud y calidad de vida en adultos mayores de un área rural y Urbana del Perú [Health related quality of life of the elderly population in a rural and urban area of Peru]. *Rev Peru Med Exp Salud Publica*. 2016;33(4):680–688. doi:10.17843/rpmesp.2016.334.2551
49. Rothrock NE, Hays RD, Spritzer K, Yount SE, Riley W, Cella D. Relative to the general US population, chronic diseases are associated with poorer health-related quality of life as measured by the Patient-Reported Outcomes Measurement Information System (PROMIS). *J Clin Epidemiol*. 2010;63(11):1195–1204. doi:10.1016/j.jclinepi.2010.04.012
50. Patel N, Brown RD, Sarkissian C, De S, Monga M. Quality of life and urolithiasis: the patient - reported outcomes measurement information system (PROMIS). *Int Braz J Urol*. 2017;43(5):880–886. doi:10.1590/S1677-5538.IBJU.2016.0649
51. Angell J, Bryant M, Tu H, Goodman M, Pattaras J, Ogan K. Association of depression and urolithiasis. *Urology*. 2012;79(3):518–525. doi:10.1016/j.urology.2011.10.007
52. Chung SD, Keller JJ, Lin HC. Increased risk of depressive disorder within 1 year after diagnosis with urinary calculi in Taiwan. *Psychiatry Res*. 2012;198(2):332–333. doi:10.1016/j.psychres.2012.01.007
53. Chinweuba AU, Okoronkwo IL, Anarado AN, Agbapuonwu NE, Ogbonnaya NP, Ihudiebube-Splendor CN. Differentials in health-related quality of life of employed and unemployed women with normal vaginal delivery. *BMC Womens Health*. 2018;18(1):13. doi:10.1186/s12905-017-0481-0
54. Choi Y, Kim JH, Park EC. The effect of subjective and objective social class on health-related quality of life: new paradigm using longitudinal analysis. *Health Qual Life Outcomes*. 2015;13:121. doi:10.1186/s12955-015-0319-0
55. Agrawal Y, Pineault KG, Semenov YR. Health-related quality of life and economic burden of vestibular loss in older adults. *Laryngoscope Investig Otolaryngol*. 2017;3(1):8–15. doi:10.1002/lio2.129
56. Corbi IS, Dantas RA, Pelegrino FM, Carvalho AR. Health related quality of life of patients undergoing oral anticoagulation therapy. *Rev Lat Am Enfermagem*. 2011;19(4):865–873. doi:10.1590/s0104-11692011000400003
57. Chang R, Qian X, Xuan Z, et al. Health related quality of life and its impacts by chronic diseases in urban community population, Shanghai, China in 2015. *Psychol Health Med*. 2021;26(8):931–939. doi:10.1080/13548506.2020.1856896
58. Mueller M, Strobl R, Jahn K, et al. Impact of vertigo and dizziness on self-perceived participation and autonomy in older adults: results from the KORA-Age study. *Qual Life Res*. 2014;23(8):2301–2308. doi:10.1007/s11136-014-0684-x
59. Holmes S, Padgham ND. A review of the burden of vertigo. *J Clin Nurs*. 2011;20(19–20):2690–2701. doi:10.1111/j.1365-2702.2010.03585.x
60. Zhu Y, Liu J, Qu B, Yi Z. Quality of life, loneliness and health-related characteristics among older people in Liaoning province, China: a cross-sectional study. *BMJ Open*. 2018;8(11):e021822. doi:10.1136/bmjopen-2018-021822
61. Chen Y, Hicks A, While AE. Quality of life and related factors: a questionnaire survey of older people living alone in Mainland China. *Qual Life Res*. 2014;23(5):1593–1602. doi:10.1007/s11136-013-0587-2
62. Pan CW, Cong XL, Zhou HJ, et al. Evaluating health-related quality of life impact of chronic conditions among older adults from a rural town in Suzhou, China. *Arch Gerontol Geriatr*. 2018;76:6–11. doi:10.1016/j.archger.2018.01.008