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Relationship Between Health-Related Quality of Life and Health Service Utilization Among Rural Residents in Ningxia Hui Autonomous Region Using EQ-5D-3L (Postprint)

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Abstract

Background Exploring factors that influence health service utilization plays an important role in optimizing the allocation of health service resources. Health-Related Quality of Life (HRQoL), as a subjective evaluation indicator, can reflect residents' judgment of their own health status to a certain extent and influence their health-seeking behavior. Currently, there are few domestic studies on the impact of HRQoL on health service utilization among rural residents.

Objective To explore the relationship between HRQoL and health service utilization among rural residents in Ningxia Hui Autonomous Region, and to provide references and evidence for policy/program formulation and the optimization of rural health services.

Methods From July to August 2019, data from the 2019 "Rural Residents' Household Health Survey" in 4 sample counties (Haiyuan, Pengyang, Xiji, and Yanchi) of Ningxia Hui Autonomous Region were used. A total of 9,310 subjects aged $ $15 years with complete important information (such as gender, age, HRQoL indicators, health service utilization indicators, etc.) were selected as the study population. Data were collected on five aspects: socio-economic and demographic characteristics, health service accessibility, chronic disease prevalence, HRQoL, and health service utilization. The HRQoL of respondents was measured using the European Quality of Life Five-Dimension Three-Level Scale (EQ-5D-3L), and binary Logistic regression was used to analyze the impact of health utility values and Visual Analogue Scale (VAS) scores on their outpatient and inpatient health service utilization.

Results The outpatient health service utilization rate among rural residents in Ningxia Hui Autonomous Region was 10.85% (1,010/9,310), and the inpatient

health service utilization rate was 18.86% (1,756/9,310). The mean health utility value was (0.965$±0.090), $and the mean VAS score was (69.97±$17.84) points. The results of difference tests showed that individuals with problems in the self-care dimension of the EQ-5D health description system were more likely to utilize outpatient and inpatient health services compared to those with problems in other dimensions [OR (95%CI) = 3.197 (2.633, 3.883) and 4.802 (4.059, 5.681), respectively, P<0.001]. The results of binary Logistic regression analysis showed that after adjusting for various confounding factors, both health utility values and VAS scores were influencing factors for outpatient and inpatient health service utilization among rural residents in Ningxia Hui Autonomous Region (P<0.05). In addition, whether suffering from chronic diseases also had a significant impact on outpatient and inpatient health service utilization among rural residents (P<0.05).

Conclusion HRQoL and chronic disease status are the dominant factors influencing outpatient and inpatient service utilization among rural residents in Ningxia Hui Autonomous Region. As an independent predictor of health service utilization among rural residents, HRQoL can be used to assist in evaluating and monitoring the quality and effectiveness of health services, and can provide guidance for the rational allocation of health resources.

Full Text

Health-Related Quality of Life Measured Using the EQ-5D-3L and Health Service Utilization in Rural Residents of Ningxia

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【Abstract】
Background: Exploring the factors affecting health service utilization is crucial for optimizing health service resource allocation. Health-related quality of life (HRQoL), as a subjective evaluation indicator, can reflect residents' self-assessment of their health status and influence their health-seeking behaviors. Currently, there are few domestic studies on the impact of HRQoL on health service utilization among rural residents. **Objective:** To explore the relationship between HRQoL and health service utilization among rural residents in Ningxia Hui Autonomous Region, and to provide references for policy/plan development and optimization of rural health services. **Methods:** Data were collected from the "Health Survey of Rural Resident Families 2019" conducted

in four sample counties (Haiyuan, Pengyang, Xiji, and Yanchi) in Ningxia Hui Autonomous Region from July to August 2019. A total of 9,310 residents aged $ 15*years with complete key information (gender, age, HRQoL indicators, health service utilization indicators, e socio-economic and demographic characteristics, health service accessibility, chronic disease prevalence, HRQ 5D-3L). Binary Logistic regression was used to analyze the effects of health utility values and Visual Analogue Sc *Results: **The outpatient health service utilization rate was 10.85±0.090), and the mean VAS score was (69.97±9 Difference testing showed that residents with problems in the self-care dimension of the EQ-5D-3L descriptive system had higher probabilities of using outpatient services [OR (95%CI)=3.197 (2.633, 3.883), P<0.001] and inpatient services [OR (95%CI)=4.802 (4.059, 5.681), P<0.001] compared with those with problems in other dimensions. Binary Logistic regression analysis showed that after adjusting for confounding factors, both health utility values and VAS scores were significantly associated with outpatient and inpatient health service utilization (P<0.05). Additionally, chronic disease status also significantly affected outpatient and inpatient health service utilization (P<0.05). **Conclusion:** HRQoL and chronic disease status are dominant factors influencing outpatient and inpatient service utilization among rural residents in Ningxia. As an independent predictor of health service utilization, HRQoL can be used to assist in evaluating and monitoring health service quality and effectiveness, and to guide rational allocation of health resources.

[Key words] Health-related quality of life; Health service utilization; Health care quality, access, and evaluation; Rural residents; European Quality of Life 5 Dimensions 3 Level Version; Health equity; Ningxia

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Introduction

With socio-economic development and increasing health demands, residents' health service needs continue to grow. To achieve the goal of universal primary health care, optimizing rural health services to improve rural residents' health status has become an important task in primary health care work [1]. Research indicates that analyzing factors influencing health service utilization plays a significant role in optimizing health service resource allocation [2]. The Andersen Behavioral Model of Health Services Use suggests that environmental factors, population characteristics, health behaviors, and health outcomes all influence residents' health service utilization [3]. The concept of health-related quality of life (HRQoL) aligns with a multi-dimensional view of health, encompassing physical health, mental health, role functioning, social functioning, and overall health assessment [4]. The association between HRQoL and health service utilization has been validated in various populations, including chronic disease patients [5], primary care patients [6], community residents [7], and new industrial workers [8]. Currently, when examining determinants of health service utilization among rural residents, researchers have primarily focused on objec-

tive indicators such as socio-demographic characteristics and disease status [9]. As a subjective indicator that reflects residents' self-assessment of their health status and influences their health-seeking behaviors [10], the impact of HRQoL on rural residents' health service utilization has not been adequately studied in China. Based on this, this study utilized data from the "Health Survey of Rural Resident Families" in Ningxia Hui Autonomous Region to analyze the impact of HRQoL on outpatient and inpatient health service utilization among rural residents, providing references for policy development and optimization of rural health services.

Methods

Data Sources

This study utilized data from the "Health Survey of Rural Resident Families 2019," a dataset from the pilot project "Innovative Payment System to Improve Health Benefits" conducted by the Ningxia Hui Autonomous Region Health Commission in collaboration with Harvard/Oxford University research teams. From July to August 2019, data were collected from four sample counties (Haiyuan, Pengyang, Xiji, and Yanchi) in Ningxia. Detailed information about the survey can be found in reference [11]. Rural residents aged $ $15 years were selected as study subjects. Those with missing key information (gender, age, HRQoL indicators, health service utilization indicators) were excluded, resulting in a final sample of 9,310 subjects for analysis.

Data Extraction

Data were extracted on five aspects: (1) socio-economic and demographic characteristics (gender, age, occupation, education level, marital status, household size, economic level, and medical insurance status); (2) health service accessibility; (3) chronic disease prevalence; (4) HRQoL; and (5) health service utilization. Economic level was measured by annual per capita household income, which was ranked from low to high and divided into five groups using quintiles (P20, P40, P60, P80 as cut points): low-income, lower-middle-income, middle-income, upper-middle-income, and high-income groups. Health service accessibility was measured by distance from residence to the nearest medical institution (township health center). Chronic disease status was determined by responses to the question: "Have you ever been diagnosed with a chronic disease by a doctor?" HRQoL indicators included self-reported results on each dimension of the EQ-5D health descriptive system and VAS scores. Health service utilization included outpatient and inpatient utilization, measured by two-week consultation status and one-year hospitalization status, respectively.

Measurement Tools

HRQoL Measurement HRQoL was measured using the European Quality of Life 5 Dimensions 3 Level Version (EQ-5D-3L), which consists of the EQ-5D

descriptive system and the VAS. Both the health utility value (U) derived from the descriptive system and the VAS score can be used to evaluate HRQoL, each with advantages and disadvantages. The health utility value is a population-based evaluation that is relatively stable, but its utility scoring system is influenced by regional and cultural differences. The VAS score is an individual-based evaluation that can be read directly from the scale, making it more sensitive to small changes in HRQoL, but it may not accurately reflect HRQoL in respondents with low education levels [13]. Therefore, this study used both measures.

The EQ-5D descriptive system includes five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each dimension has three levels: no problems (level 1), some problems (level 2), and extreme problems (level 3). Health utility values were calculated using the Chinese value set for EQ-5D-3L established in 2018 [14-15], which uses the time trade-off method based on population preferences. The utility value ranges from -0.1702 to 1.0000, calculated as:
U = 1 - 0.0664×MO2 - 0.2421×MO3 - 0.0365×SC2 - 0.2912×SC3 - 0.0370×UA2 - 0.0538×UA3 - 0.0274×PD2 - 0.0409×PD3 - 0.0539×AD2 - 0.1771×AD3, where MO2, SC2, UA2, PD2, AD2 indicate level 2 in each dimension (1 if present, 0 otherwise), and MO3, SC3, UA3, PD3, AD3 indicate level 3.

The VAS is a scale ranging from 0 to 100 points, where respondents indicate their health status on the day of survey, with 0 representing the worst imaginable health state and 100 representing the best.

Health Service Utilization Indicators Two-week consultation rate and one-year hospitalization rate were used to evaluate outpatient and inpatient health service utilization, respectively.
Two-week consultation rate (%) = (Number of people who consulted a doctor within two weeks prior to survey / Total number surveyed) × 100%
One-year hospitalization rate (%) = (Number of people hospitalized within one year prior to survey / Total number surveyed) × 100%

Statistical Analysis

Data were entered using EpiData 3.02 software with double parallel entry and logical error checking. SPSS 26.0 was used for statistical analysis. Continuous variables were expressed as ($\bar{x}\pm s$), and categorical variables as relative frequencies. Chi-square tests were used for group comparisons. Binary Logistic regression was used to analyze the effects of health utility values and VAS scores on outpatient and inpatient health service utilization. $P<0.05$ was considered statistically significant.

Results

General Characteristics of Study Subjects

Among the 9,310 subjects, 4,830 (51.88%) were male; ages ranged from 15-99 years, with a mean age of (49.5$±$15.9) years; 3,459 (37.15%) were aged 45-59 years; 5,861 (62.95%) were engaged in farming; 3,199 (34.36%) had no formal education; 7,897 (84.82%) were married; 3,624 (38.92%) had household sizes of 4-5 people; 2,316 (24.88%) had middle income levels; 9,199 (98.81%) had medical insurance; 4,147 (44.54%) lived $ $5.0 km from the nearest medical institution; and 5,745 (61.71%) had no chronic diseases . The two-week consultation rate (outpatient utilization rate) was 10.85% (1,010/9,310), and the one-year hospitalization rate (inpatient utilization rate) was 18.86% (1,756/9,310).

HRQoL of Rural Residents in Ningxia

Self-Reported Results on EQ-5D Dimensions and Health Utility Values On the EQ-5D descriptive system dimensions: (1) The proportions reporting no problems, from highest to lowest, were self-care [8,697 (93.41%)], usual activities [8,269 (88.82%)], mobility [8,131 (87.34%)], anxiety/depression [7,990 (85.82%)], and pain/discomfort [7,263 (78.01%)]; (2) The proportions reporting some problems, from highest to lowest, were pain/discomfort [1,848 (19.85%)], anxiety/depression [1,219 (13.09%)], mobility [1,073 (11.52%)], usual activities [862 (9.26%)], and self-care [511 (5.49%)]; (3) The proportions reporting extreme problems, from highest to lowest, were pain/discomfort [199 (2.14%)], usual activities [179 (1.92%)], mobility [106 (1.14%)], self-care [102 (1.10%)], and anxiety/depression [101 (1.09%)]. The mean health utility value was (0.965$±$0.090).

VAS Scores and Distribution The mean VAS score was (69.97$±$17.84). Score distributions were: 0-<10 points: 24 (0.26%); 10-<20: 35 (0.38%); 20-<30: 106 (1.14%); 30-<40: 222 (2.38%); 40-<50: 389 (4.18%); 50-<60: 1,067 (11.46%); 60-<70: 1,463 (15.71%); 70-<80: 1,875 (20.14%); 80-<90: 2,298 (24.68%); 90-100: 1,469 (15.78%); and 362 (3.89%) scored 100.

Health Service Utilization by Characteristics

Comparisons by Socioeconomic and Demographic Characteristics Statistically significant differences were found in outpatient and inpatient utilization rates by gender, age, occupation, education level, marital status, household size, economic level, and chronic disease status ($P<0.05$). Additionally, inpatient utilization rates differed significantly by distance to nearest medical institution ($P<0.05$) .

Comparisons by EQ-5D Dimension Levels Using each EQ-5D dimension as a unit, respondents reporting no problems were classified as the “no

problem" group, while those reporting some or extreme problems were classified as the "problem" group. Significant differences in outpatient and inpatient utilization rates were found between groups for all dimensions (P<0.001). Notably, those with self-care problems had higher probabilities of using outpatient [OR (95%CI)=3.197 (2.633, 3.883), P<0.001] and inpatient services [OR (95%CI)=4.802 (4.059, 5.681), P<0.001] compared with those with problems in other dimensions .

Binary Logistic Regression Analysis of HRQoL Effects on Health Service Utilization

Outpatient Service Utilization Three models were constructed: Model 1 included significant socioeconomic and demographic variables; Model 2 added chronic disease status; Model 3 further added HRQoL indicators (health utility value and VAS score as continuous variables). Gender, age, and marital status significantly affected outpatient utilization in all models (P<0.05). Compared with males, those aged <45, and unmarried individuals, females, those aged 45-59, and married/divorced/widowed individuals had higher probabilities of outpatient service use. Household size and economic level also showed significant effects (P<0.05). Those with chronic diseases had 2.405 times higher odds of outpatient utilization than those without (P<0.05). In Model 3, both health utility value and VAS score had ORs <1.000, indicating that better HRQoL was associated with lower outpatient utilization (P<0.05) .

Inpatient Service Utilization Similar models were constructed for inpatient utilization. Gender, age, and marital status significantly affected inpatient utilization (P<0.05). Occupation and household size also showed significant effects (P<0.05), with farmers and those from larger households having lower utilization. Education level and economic level affected inpatient utilization in Models 1 and 2 (P<0.05), but not in Model 3 (P>0.05). Chronic disease status significantly increased inpatient utilization (P<0.05). In Model 3, health utility value and VAS score had ORs <1.000, indicating that better HRQoL was associated with lower inpatient utilization (P<0.05) .

Discussion

Insufficient Outpatient Service Utilization in Ningxia Rural Residents

The chronic disease prevalence was 38.29%, two-week consultation rate was 10.85%, and one-year hospitalization rate was 18.86%. According to the National Sixth Health Services Survey Report, in 2018, rural residents in China had a chronic disease prevalence of 35.2%, two-week consultation rate of 24.8%, and one-year hospitalization rate of 14.7% [16]. These findings indicate that while Ningxia rural residents have high chronic disease-related health service needs, their outpatient service utilization is severely insufficient. Interventions should be implemented promptly, including improving the top-level design of

rural health service supply and conducting health education and promotion programs to guide residents toward appropriate health-seeking behavior.

Influence of Socioeconomic and Demographic Factors

Binary Logistic regression showed that gender, age, marital status, household size, and economic level were the main socioeconomic and demographic factors affecting health service utilization, consistent with domestic studies [17-18]. Females had higher utilization rates than males, possibly due to physiological and psychological differences, as well as heavier domestic workloads that have been shown to increase disease risk [19]. This suggests that health service providers should pay more attention to women's health needs. Compared with those aged <45, individuals aged 45-59 had higher outpatient and inpatient utilization, while those $ 60 had higher inpatient utilization, likely due to age-related physical decline. Married individuals had higher utilization than unmarried individuals, possibly because people), possibly because family support helps prevent disease [21]. Higher-income individuals had lower outpatient utilization than low-income individuals, possibly due to better health literacy and preventive care. Farmers had lower inpatient utilization than non-farmers, consistent with findings that agricultural laborers have better physical health [22].

Chronic Disease as a Dominant Factor

Chronic disease status significantly increased health service utilization, consistent with research in western China [18]. Chronic diseases are major health threats characterized by insidious onset, long treatment cycles, and persistent conditions. Patients generally have lower immunity and poorer health status, creating greater demand for outpatient and inpatient services. Primary care institutions should prioritize chronic disease prevention and control, conduct health education campaigns, and encourage regular health screenings. Additionally, the medical security system should be improved by increasing reimbursement rates for chronic disease outpatient and inpatient expenses and establishing a multi-level rural medical security system with basic medical insurance as the foundation, supplemented by charitable assistance/commercial insurance, and catastrophic illness insurance and medical assistance as a safety net [23].

Predictive Value of HRQoL for Health Service Utilization

HRQoL is a cross-cutting, multi-dimensional indicator that reflects subjective health status and influences health-seeking behavior. The mean health utility value of (0.965$±0.090) was similar to community residents in the Pearl River Delta (0.977±0.093) [7] but higher tha [25], indicating generally good HRQoL among Ningxia rural residents. However, the VAS score of 69.97 was substantially lower than Pearl River Delta residents (79.70) and Lanzhou residents (87.9), possibly because VAS scores are influenced by education level, and 34.36% of respondents had no formal education. The high proportions reporting problems in "pain/discomfort" and "anxiety/depression" dimensions align with other studies [24,26-27].

Analysis of health service utilization by EQ-5D dimension showed that those with self-care problems had higher utilization probabilities than those with problems in other dimensions. Individuals with impaired self-care often suffer from long-term serious illnesses with limited prospects for short-term improvement, creating substantial health service demand. Multifactorial analysis confirmed that age and chronic disease status affect health service utilization. Elderly individuals (27.53% of the sample) and those with chronic diseases (38.29% prevalence) showed declining self-care capacity [28]. Therefore, reducing self-care difficulties among rural residents, particularly the elderly and chronic disease patients, could improve HRQoL and health service utilization.

Previous studies have demonstrated HRQoL's predictive value. DOMINICK et al. [2] found that HRQoL indicators, particularly pain frequency, could predict future health service use among elderly osteoarthritis patients. SINGH et al. [29] used the SF-36 to show HRQoL predicted hospitalization, outpatient utilization, and mortality among veterans with osteoarthritis. LU et al. [8] applied the SF-36 to rural-to-urban female migrant workers in China, finding HRQoL significantly affected health service utilization. WANG [30] reported that EQ-5D-measured HRQoL independently affected outpatient and inpatient utilization. Our results align with these findings: after adjusting for confounders, EQ-5D-3L-measured HRQoL significantly affected both outpatient and inpatient utilization, with higher health utility values and VAS scores associated with lower utilization ($P<0.05$).

Given that EQ-5D can identify patients likely to use more medical resources and offers a brief, simple measurement tool, HRQoL should be included as an observation indicator in large-scale surveys of specific populations. Future research on rural residents' health service needs and utilization should strengthen the application of this subjective evaluation indicator to inform health decision-making and enable rational, effective allocation of health resources.

Limitations

First, due to data limitations, this study could not include important influencing factors such as individual behavioral characteristics and health service satisfaction. Second, the study could not reveal causal relationships between HRQoL and health service utilization or examine mediating or moderating effects. Future research should address these limitations to further explore influencing factors and mechanisms of rural residents' health service utilization.

Conclusion

HRQoL and chronic disease status are dominant factors influencing outpatient and inpatient service utilization among rural residents in Ningxia. As an independent predictor of health service utilization, HRQoL can assist in evaluating and monitoring health service quality and effectiveness, and guide rational allocation of health resources.

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