EQ-5D-Based Study on the Relationship Between Health-Related Quality of Life and Health Service Utilization Among Rural Residents in Ningxia: Postprint

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Abstract

Background: Factors influencing health service utilization play a crucial role in optimizing health service allocation. As a subjective indicator that affects health judgment and help-seeking behavior, research on the impact of health-related quality of life on health service utilization among rural residents in China remains limited.

Objective: To explore the relationship between health-related quality of life and health service utilization among rural residents in Ningxia, and to provide an evidence base for policymakers and health service providers to develop plans and optimize health services for residents.

Methods: This study selected individuals aged $ $15 years from the 2019 "Rural Residents' Family Health Interview Survey" in Ningxia as study subjects (n=9,310). Health-related quality of life was measured using the EQ-5D scale. Binary logistic regression analysis was employed to examine the effects of EQ-5D health utility values and VAS health scores on health service utilization.

Results: The outpatient service utilization rate among rural residents in Ningxia was 10.85%, and the inpatient service utilization rate was 18.86%. The mean overall health utility value of study subjects was $(0.965\$\pm0.090), and the mean VAS health score was (69.97\pm\$17.84)$. Difference test results indicated that the "self-care" dimension was associated with higher risks for both two-week outpatient visits and hospitalization within one year, with OR values of 3.197 and 4.802, respectively. Logistic regression analysis showed that after adjusting for various confounding factors, both health utility values and VAS scores significantly influenced residents' health service utilization.

Conclusion: Health-related quality of life and chronic disease status are the dominant factors influencing residents' utilization of outpatient and inpatient services. As an independent predictor of residents' health service utilization, health-related quality of life can be used to assist in evaluating and monitoring the quality and effectiveness of health services, thereby providing information for the rational allocation of health resources.

Full Text

Study on the Relationship Between Health-Related Quality of Life and Health Service Utilization Among Rural Residents in Ningxia Based on the EQ-5D Scale

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Abstract

Background: Factors influencing health service utilization play a crucial role in optimizing health service allocation. As subjective indicators that affect health judgment and health-seeking behavior, research on the impact of health-related quality of life (HRQoL) on health service utilization among rural residents remains limited in China.

Objective: To explore the relationship between HRQoL and health service utilization among rural residents in Ningxia, providing evidence for policymakers and health service providers to develop plans and optimize health services.

Methods: A total of 9,310 individuals aged $ $15 years from the 2019 "Rural Household Health Interview Survey" in Ningxia were selected as study subjects. HRQoL was measured using the EQ-5D scale. Binary logistic regression was employed to analyze the effects of EQ-5D health utility values and VAS health scores on health service utilization.

Results: The outpatient service utilization rate was 10.85% and the inpatient service utilization rate was 18.86% among rural residents in Ningxia. The mean overall health utility value was $(0.965\$\pm0.090), and the mean VAS health score was (69.97\pm\$17.84)$. Differential tests indicated that the "self-care" dimension posed the greatest risk for both two-week outpatient visits and one-year hospitalization, with OR values of 3.197 and 4.802, respectively. Logistic regression analysis revealed that, after adjusting for confounding factors, both health utility values and VAS scores significantly affected residents' health service utilization.

Conclusion: HRQoL and chronic disease status are dominant factors influencing outpatient and inpatient service utilization. As an independent predictor of health service utilization, HRQoL can be used to assist in evaluating and monitoring health service quality and effectiveness, thereby informing the rational allocation of health resources.

Keywords: EQ-5D scale; health-related quality of life; health service utilization; rural residents

Introduction

With socioeconomic development and increasing health demands, residents' need for health services continues to grow. To achieve the goal of universal access to primary health care, optimizing health services to improve rural residents' health has become a primary task of grassroots health work. Research indicates that factors affecting health service utilization play an important role in optimizing service allocation. Anderson' s Behavioral Model of Health Services Use demonstrates that environmental factors, population characteristics, health behaviors, and health outcomes all influence residents' health service utilization. Currently, studies on determinants of health service utilization among rural residents primarily focus on objective indicators such as sociodemographic characteristics and disease status. However, as subjective indicators affecting health judgment and health-seeking behavior, research on the impact of health-related quality of life (HRQoL) on health service utilization among rural residents remains scarce in China.

HRQoL aligns with the multidimensional concept of health, encompassing physical health, mental health, role functioning, social functioning, and overall health. Associations between HRQoL and health service utilization have been reported among chronic disease patients, primary care patients, community residents, and migrant worker populations. Building on this foundation, this study utilizes data from the "Rural Household Health Interview Survey" in Ningxia to examine the impact of HRQoL on health service utilization among rural residents, providing reference for policymakers and health service providers to develop plans and optimize health services.

Methods

Data Sources

This study utilized data from the 2019 "Rural Household Health Interview Survey" conducted by the Ningxia Health and Family Planning Commission in collaboration with research teams from Harvard and Oxford Universities as part of the "Innovative Payment System to Improve Health Efficiency" pilot project. The survey covered four sample counties in Ningxia (Haiyuan, Pengyang, Xiji,

and Yanchi). A multi-stage stratified cluster random sampling method was employed: all administrative villages in the four counties were stratified into three levels (good, medium, and poor economic status), with 40% of villages randomly selected from each stratum; 20-33 households were then systematically sampled from each selected village based on household head rosters; finally, all permanent residents (living in the household for six months or more) were surveyed. This study selected data from rural residents aged $ $15 years, resulting in a final analytical sample of 9,310 individuals after excluding cases with missing key variables.

Survey Content

The survey included sociodemographic and economic characteristics, health service accessibility, chronic disease diagnosis by a physician, HRQoL, and health service utilization. Household per capita annual income was used as the economic indicator, with respondents divided into five income groups (low, lower-middle, middle, upper-middle, and high) based on percentiles P20, P40, P60, and P80. Health service accessibility was measured by distance to the nearest medical facility (township health center). HRQoL was assessed using the EQ-5D scale, with the EQ-5D portion required to be completed by the respondent personally. Health service utilization included outpatient and inpatient services: outpatient utilization was assessed by asking "During the 14 days before the survey, did you seek medical care for any illness?" and inpatient utilization by asking "During the past year, were you ever advised by a doctor that you needed hospitalization?"

HRQoL Assessment

HRQoL was measured using the European Quality of Life Five-Dimension Three-Level Scale (EQ-5D-3L), which consists of the EQ-5D descriptive system and the Visual Analogue Scale (VAS). Both the health utility value (U) derived from the descriptive system and the VAS score can evaluate population quality of life, each with distinct advantages and limitations. The utility value U provides a population-based assessment requiring conversion through a value set, yielding stable results but influenced by regional and cultural differences in value set construction. The VAS score offers an individual-based assessment with simple calculation directly from the scale, demonstrating greater sensitivity to minor changes in quality of life but potentially yielding unreliable results among respondents with low literacy. Therefore, this study employed both health utility values and VAS scores to represent HRQoL among rural residents.

EQ-5D Descriptive System: The EQ-5D descriptive system comprises five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, each with three levels (no problems, some problems, extreme problems). This study calculated health utility values using the Chinese value set for EQ-5D-3L established in 2018, which converts scale results using time

trade-off methods based on population preferences to obtain health utility values U ranging from -0.1702 to 1. The calculation formula is:

$$U = 1-(0.0660\times MO2+0.1771\times MO3+0.0359\times SC2+0.0409\times SC3+0.0274\times UA2+0.0538\times UA3+0.0370\times PD2$$

where MO2, SC2, UA2, PD2, AD2 indicate coefficients of 1 when the respective dimension (mobility, self-care, usual activities, pain/discomfort, anxiety/depression) is at level 2, and 0 otherwise; MO3, SC3, UA3, PD3, AD3 indicate coefficients of 1 when at level 3, and 0 otherwise.

Visual Analogue Scale (VAS): The VAS is a 0-100 scale on which respondents indicate the point that best represents their health status on the day of survey, where 0 indicates the worst imaginable health and 100 indicates the best imaginable health.

Health Service Utilization

This study used "whether sought care within two weeks" as the indicator for outpatient service utilization and "whether hospitalized within the past year" as the indicator for inpatient service utilization.

Statistical Methods

Data were entered using EpiData 3.02 software with double-entry and logical verification. Statistical analysis was performed using SPSS 26.0. Continuous variables were expressed as (mean ± standard deviation), and categorical variables as rates or proportions. Inter-group comparisons used ^{2} tests. Binary unconditional logistic regression was employed to examine the effects of EQ-5D health utility values and VAS scores on health service utilization. Statistical significance was set at $P<0.05$.

Results

Socio-demographic Characteristics

The survey included 9,310 rural residents aged $ 15$years, comprising$4,830$males$(51.88±$15.95) years, concentrated primarily in the 45-59 age group (3,459 individuals, 37.15%). Most respondents were married (7,897, 84.82%), engaged in farming (5,861, 62.95%), and had either no formal education (3,199, 34.36%) or primary school education (3,117, 33.48%). The majority lived in households of 4-5 people (3,624, 38.93%), and 2,316 (24.88%) had middle income levels. Health insurance coverage was 98.81% (9,199 individuals). Distance to the nearest medical facility exceeded 5 km for 4,147 residents (44.54%). Chronic disease prevalence was 38.29% (3,565 individuals), while 61.71% (5,745) reported no chronic conditions. The two-week outpatient visit rate was 10.85% and the annual hospitalization rate was 18.86% (see Table 1).

VAS Health Scores and Distribution

The mean VAS health score for rural residents in southern Ningxia mountainous areas was (69.97$±$17.84), with scores concentrated primarily between 50-100. Scores below 50 accounted for 8.34% of respondents, while 362 individuals (3.89%) rated their health as perfect (100 points) (see Figure 2).

[Figure 2: see original paper]

Comparison of Health Service Utilization Rates Among Rural Residents with Different Characteristics

Univariate analysis revealed statistically significant differences in outpatient and inpatient service utilization rates across gender, age, occupation, education level, marital status, household size, income level, and chronic disease status ($P<0.05$). Additionally, distance to the nearest medical facility showed significant association with annual hospitalization rates ($P<0.05$) (see Table 2).

Comparison of Health Service Utilization Rates Across EQ-5D Dimensions

For analysis, level 1 in each EQ-5D dimension was defined as "no problems" and levels 2-3 as "problems." ^{2} tests revealed significant differences in health service utilization across all dimensions ($P<0.001$). The "self-care" dimension showed the strongest association with both two-week outpatient visits and one-year hospitalization, with OR values of 3.197 and 4.802, respectively (see Table 3).

Impact of HRQoL on Health Service Utilization

Factors showing statistical significance in univariate analysis were included in binary logistic regression models to examine determinants of health service utilization. Variable assignments are shown in Table 4. Model 1 included sociodemographic variables (gender, age, education, occupation, marital status, household size, income level). Model 2 added health service accessibility and chronic disease status. Model 3 further included HRQoL indicators (health utility value and VAS score) to analyze their impact after adjusting for confounders.

Impact on Outpatient Service Utilization Across all three models, gender, age, and marital status showed significant effects with OR>1, indicating that females, older individuals, and married/divorced/widowed persons had higher probabilities of seeking outpatient care than males, younger individuals, and unmarried persons. Household size and income level were also significant across models with OR<1, suggesting that residents from larger households and higher income groups had lower outpatient utilization probabilities. Model 2, which included chronic disease status, showed an OR of 2.405, indicating that individuals with chronic diseases were 2.405 times more likely to seek outpatient

care. Model 3, incorporating HRQoL indicators, demonstrated improved model fit. Both health utility values and VAS scores showed OR<1, indicating that better HRQoL was associated with lower outpatient utilization (see Table 5).

Impact on Inpatient Service Utilization Across all three models, gender, age, and marital status were significant with OR>1, indicating that females, older individuals, and married persons had higher hospitalization probabilities. Household size was also significant, with larger households showing higher hospitalization probabilities (OR<1). Unlike outpatient utilization, occupation type affected inpatient service utilization (OR<1), with farmers showing lower utilization than other occupational groups. Education level and income affected inpatient utilization in Models 1 and 2, with higher education associated with lower utilization and lower income groups showing higher utilization; however, these effects became non-significant (P>0.05) after adding HRQoL variables in Model 3. Model 2 showed that chronic disease status significantly increased hospitalization utilization. Model 3 revealed that both health utility values and VAS scores had OR<1, indicating that better HRQoL was associated with lower hospitalization probability (see Table 6).

Discussion

This study analyzed factors influencing health service utilization among rural residents in southern Ningxia, finding that HRQoL and chronic disease status are dominant factors affecting both outpatient and inpatient service utilization. Additionally, gender, age, marital status, household size, income level, and health service accessibility significantly influence utilization. As an independent predictor of health service utilization, HRQoL can assist in evaluating and monitoring health service quality and effectiveness, thereby informing rational health resource allocation.

Severe Underutilization of Outpatient Services Among Rural Residents in Southern Ningxia

The study found a chronic disease prevalence of 38.29%, a two-week outpatient visit rate of 10.85%, and an annual hospitalization rate of 18.86% among rural residents in southern Ningxia. According to the Sixth National Health Services Survey, chronic disease prevalence among rural residents nationwide was 35.2% in 2018, with outpatient and hospitalization rates of 24.8% and 14.7%, respectively. These comparisons reveal high health service needs due to chronic diseases but severe underutilization of outpatient services in southern Ningxia. Interventions should be implemented promptly to improve the top-level design of rural health service delivery and develop health education and promotion programs to guide appropriate health-seeking behavior.

Significant Influence of Socioeconomic and Demographic Factors

Binary logistic regression identified socioeconomic and demographic characteristics, chronic disease status, and HRQoL as main determinants of health service utilization. Consistent with domestic research, gender, age, marital status, household size, and income level were primary factors affecting utilization. Females showed higher utilization than males, possibly due to physiological and psychological differences and greater exposure to disease risk factors from domestic labor. This highlights the need for greater attention to women' s health needs. Older age was associated with higher utilization, likely due to age-related physiological decline and increased health needs. Healthier lifestyles are recommended for older adults. Married individuals showed higher utilization than unmarried persons, possibly because of older average age and greater risk factor exposure. Residents from larger households had lower utilization than those from smaller households, potentially due to greater social support for disease prevention and management. Lower-income groups showed higher utilization than higher-income groups, possibly because higher-income individuals have better economic security, health literacy, and preventive care practices. Occupation type affected inpatient utilization, with farmers showing lower rates than non-farmers, possibly due to better physical condition from agricultural labor.

Chronic Disease Status as a Dominant Factor

Model 2 demonstrated that chronic disease status significantly increased health service utilization, consistent with research in western China. Chronic diseases, characterized by insidious onset, long treatment duration, and persistent symptoms, impair immunity and overall health, creating greater demand for outpatient and inpatient services. This underscores the importance of chronic disease prevention and health education, regular screening for early detection and treatment, and improvement of the medical insurance system for chronic disease patients through multi-level coverage combining basic medical services, charitable assistance, commercial insurance, catastrophic illness insurance, and medical aid.

Predictive Value of HRQoL for Health Service Utilization

HRQoL is a multidimensional indicator measuring subjective health status and influencing health-seeking behavior. The mean health utility value of $(0.965\$\pm0.090)in this study is similar to findings among community residents in the Pearl River Delta(0.977\pm0.09$ suggesting relatively good overall HRQoL in southern Ningxia. However, the VAS score of 69.97 was lower than in the Pearl River Delta (79.70) and Lanzhou (87.9), possibly due to the high proportion of respondents without formal education (34.36%) affecting VAS measurement accuracy. Among EQ-5D dimensions, "pain/discomfort" and "anxiety/depression" showed greater health quality loss than other dimensions. The "self-care" dimension had the strongest impact on both outpatient and inpatient utilization. This may be explained by the high chronic disease prevalence (38.29%) and elderly

proportion (27.53%), as chronic diseases and aging can impair self-care abilities. Multivariate analysis confirmed that age and chronic disease status significantly affect health service utilization. Addressing self-care difficulties among rural residents, particularly the elderly and chronic disease patients, is crucial for improving HRQoL and health service utilization.

International and domestic studies have reported associations between HRQoL and health service utilization. DOMINICK et al. found that HRQoL variables, particularly pain frequency, predict future health service use among elderly osteoarthritis patients. SINGH et al. demonstrated that HRQoL predicts future hospitalization, outpatient utilization, and mortality among veterans with arthritis. Chinese scholar Lu et al. found HRQoL significantly affects health service utilization among rural-to-urban female migrants, while Wang et al. reported that EQ-5D-measured HRQoL independently influences outpatient and inpatient utilization. Our findings align with these studies: after adjusting for confounders, EQ-5D-measured HRQoL significantly affected both outpatient and inpatient utilization probabilities among rural residents in southern Ningxia, with higher health utility values and VAS scores associated with lower utilization (OR<1). The five EQ-5D dimensions can help identify patients likely to use more medical resources. The brief, simple HRQoL items can be easily incorporated into large-scale surveys, suggesting that HRQoL should be emphasized as a subjective indicator in rural health research to assist in understanding service needs and rationally allocating resources for health decision-making.

Limitations

First, due to data limitations, this study could not include important utilization factors such as individual behavioral characteristics and health service satisfaction. Second, the study could not establish causal relationships between HRQoL and health service utilization or examine mediating and moderating effects, which warrant further investigation.

Author Contributions: Li Peiwen conducted data analysis, conceptualized the article, and wrote the manuscript, taking overall responsibility; He Jiahui and Ma Ximing were responsible for data organization and manuscript revision; Qiao Hui oversaw quality control and final approval.

Conflict of Interest: The authors declare no conflict of interest.

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Note: Figure translations are in progress. See original paper for figures.