The Effect of Health Literacy, Self-management Behavior, Self-efficacy and Social Support on the Health-related Quality of Life of Kazakh Hypertension Patients in a Low-income Rural Area of China: a structural Equation Model

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Research

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Abstract

Background

Considering the High Blood Pressure-Health Literacy (HBP-HL) has not been included in the study of Health-Related Quality of Life (HRQoL). The synergistic effects and the potential mechanism HBP-HL, self-management behavior, medication adherence, self-efficacy, social support on HRQoL remain unclear. This study aimed to introduce the conception of HBP-HL, and develop a structural equation model to identify the factors influencing of the HRQoL among Kazakh hypertensive patients.

Methods

A cross-sectional investigation study was conducted to collect data. Patients with hypertension were recruited through random cluster sampling in Kazakh settlements in Urumqi County, Xinjiang. The one-on-one household interviews were conducted by Kazakh investigators. The questionnaires regarding HBP-HL, HRQoL, self-management behavior, medication adherence, self-efficacy, and social support were collected. In addition, the results of physical examination were also included. A structural equation model was used to assess the association between the measured factors and HRQoL.

Results

516 Kazakh patients were recruited, and 94.4% of them had a relatively low HBP-HL score. The mean standardized scores of HRQoL, self-management, medication adherence were poor; they were 63.5, 66.2, and 64.4, respectively. But 96.1% and 98.3% of the participants had high levels of self-efficacy and social support. The structural equation model of the HRQoL had a good overall fit ($\chi^2$/df = 2.078, AGFI = 0.944, GFI = 0.968, CFI = 0.947, IFI = 0.949, RMSEA = 0.046). The model indicated that the HBP-HL has the highest correlation with HRQoL, following with self-management behavior, social support, and self-efficacy.

Conclusions

Evidence from this study demonstrates that low HBP-HL is a major influenced factor of HRQoL among Kazakh hypertensive patients. Future programs should consider HBP-HL as the breakthrough point when designing targeting intervention strategies for Kazakh hypertension patients. Firstly, researchers should give a priority to evaluate patient’s HBP-HL before intervention. Next, tailored interventions are implemented for patients, and and ultimately it will contribute to control blood pressure and improve patients’ HRQoL.
Health-related Quality of Life (HRQoL) has become an important outcome measure indicator in health care fields, and is commonly used as an effective assessment of any disease management plan and health status\(^1,^2\). Compared with previous objective indicators such as mortality, cure rate, and morbidity, the measurement of HRQoL can comprehensively and accurately assess the health status and prevention effects of chronic diseases such as hypertension\(^3,^4\). It reflects not only physical health but also psychological, social, and emotional health. Furthermore, it describes the appearance of a disease and also indicates the consequences of a disease or treatment\(^5,^6\). Many studies have shown that the HRQoL of patients with hypertension is lower than that of patients with normal blood pressure, regardless of physical health or mental health\(^1,^7^-^10\).

High Blood Pressure-Health Literacy (HBP-HL) refers to the ability of hypertensive patients to acquire, understand, and deal with hypertension-related knowledge as well as the medical services needed to control diseases\(^11\). Previous studies have indicated HBP-HL as a powerful indicator for predicting the health status of people, which is highly correlated with morbidity, mortality, life expectancy, and HRQoL of people with hypertension\(^12\), especially in ethnic minorities\(^13^-^14\). Low health literacy usually leads to a series of negative health outcomes\(^15\). The existing literature has also demonstrated that HBP-HL is an independent predictor of blood pressure control\(^16^-^18\), and emphasized that health care providers should evaluate HBP-HL level when they meet the patients with hypertension for the first time in order to provide tailored interventions\(^19^-^20\). However, HBP-HL has not been introduced into the study of the HRQoL of patients with hypertension, especially among Kazakh hypertension patients in rural China.

Self-management is a dynamic process in which individuals actively apply cognitive and behavioral strategies to manage their own thoughts, emotions and behaviors\(^21\). Effective self-management can not only encourage patients to actively monitor their condition, and regulate their behavior and emotions, but also can improve their HRQoL\(^22^-^24\).

Medication adherence refers to patients' compliance with medical conventions and active adoption of health-promoting behaviors\(^25\). Studies have demonstrated that the medication adherence is typically higher among patients with acute illness, compared to those with chronic ones\(^26^-^27\). Poor medication adherence is strongly related to the uncontrolled blood pressure among hypertensive patients\(^28\). Mollaoglu found that a significant positive correlation between medication adherence, self-efficacy and HRQoL\(^29\). Hanus suggested that medication adherence can not predict HRQoL, although patients with high adherence scores had better HRQoL\(^30\).

Self-efficacy is an important determinant of intention and behavior. On the one hand, self-efficacy can predict HRQoL, and low self-efficacy usually leads to low HRQoL\(^31\). On the other hand, as a mediating variable, self-efficacy can promote the improvement of self-management level, and ultimately better the HRQoL in people suffering from chronic disease\(^32\). Evidence suggests that patients with high self-efficacy had better blood pressure control\(^33\).
An increasing number of studies demonstrate that social support is significantly related to self-efficacy, the interaction between the two factors can predict the HRQoL, and is one of the important mediating factors in determining the level of HL and self-management. For hypertension, social support not only can improve the medication adherence, help to control blood pressure, but also contribute to optimize the HRQoL in hypertensive patients.

The HRQoL of hypertensive patients are influenced by many objective and subjective factors acted together. Based on the above mentioned existing literatures, HBP-HL, self-management, medication adherence, self-efficacy, social support and HRQoL are related and have complex relationships. However, their synergistic effects on HRQoL and the potential mechanism remain unclear. This study aims to introduce the conception of HBP-HL, and to expound the status quo of HRQoL, HBP-HL, self-management, medication adherence, self-efficacy, and social support of Kazakh hypertension patients in rural Xinjiang. Eventually develop a structural equation model to explore the factors influencing the HRQoL of Kazakh hypertensive patients. Figure 1 shows the initial hypothesis model (M1) in this study.

**Methods**

**Research participants**

The Kazakh hypertension patients in the rural area of Xinjiang were recruited through random cluster sampling. First, based on the census data of Xinjiang, a list of the main Kazakh residence areas in Xinjiang was generated; one research site (from Urumqi counties) was randomly selected from this list. Second, five towns/townships were randomly selected from the selected Urumqi counties. In the selected towns, only Kazakh residents who were diagnosed with hypertension at the age of 18 years or older were eligible for this study. Finally, hypertensive patients diagnosed in Kazakh settlements in Baiyanggou, Toli Ranch, Gangou Township, Xiaquzi, and Sardanban Townships in Urumqi County, Xinjiang who met the following inclusion criteria were recruited: (1) 18 years old or older; (2) meeting the criteria for the diagnosis of essential hypertension (according to the Chinese guidelines for the prevention and treatment of hypertension in 2010), systolic blood pressure (SBP) ≥ 140 mmHg, and/or diastolic blood pressure (DBP) ≥ 90 mmHg; (3) Blood pressure (BP) levels that have not reached the above-mentioned diagnostic criteria but have a history of hypertension, and are currently taking antihypertensive drugs; (4) Normal cognitive ability, and the capability to independently (or through the investigator) read and fill in the required research questionnaire; and (5) Agreement by Kazakh patients to participate to this study and sign the inform consent. However, if the patients met any of the following criteria, they were excluded: (1) Mental disorder and/or mental retardation; (2) Serious social dysfunction (patients with an inability to communicate); (3) Participation in other research projects in the past one month; (4) Profession in medical field and/or relation to medical professionals; (5) Cancer patients who received radiotherapy or chemotherapy in the past six months; (6) Patients with various types of secondary hypertension.

**Data Collection**
The one-on-one household interviews were conducted by Kazakh investigators. The questionnaires were further checked for missing data. If any missing information was identified, further information was collected via phone call to the numbers provided by the participants or one more visit to the participants' house. However, a group of participants have missing data; they were unreachable later on.

The survey collected general information (including sociodemographic characteristics, such as gender, age, education level, marital status, occupation, and annual family income) from the participants. HBP-HL, HRQoL, self-management, medication adherence, self-efficacy, and social support were also measured. All these scales were assembled into one questionnaire; the majority of them have been validated and used in previous studies. The following paragraphs describe each of them.

**Questionnaires**

Chinese-High Blood Pressure-Health Literacy Scale (C-HBP-HLS) \(^{39}\): consists of 15 items in 5 dimensions. According to the Test of Functional Health Literacy in Adults (TOFHLA) scoring system \(^{40}\), the final scale ranged from 0 to 60 points, and a higher score reflects higher the HBP-HL level. In addition, according to the TOFHLA classification criteria \(^{41}\), the patients were further categorized into three HBP-HL levels: lack (< 32 points), medium (32 to 40 points), and sufficient (≥ 40 points). The scale-level content validity index was 0.85. Cronbach's alpha of the overall scale was 0.78, and the test-retest reliability was 0.96.

HRQOL Instruments for Chronic Disease-Hypertension (QLICD-HY) \(^{42}\): consists of 30 items in 5 dimensions. The score for each patient was calculated with the specific formula: standardized score = (Raw Score-minimum) × 100/(Max-Min). A higher score reflects better HRQoL.

Hypertension Patients Self-Management Behavior Rating Scale (HPSMBRS) \(^{43}\): consists of 33 items in 6 dimensions. A higher score reflects better Self-management levels. Cronbach's alpha of the overall scale was 0.914.

Medication Adherence Scale for Hypertensive Patients (MASHP) \(^{44}\): consists of 25 items in 4 dimensions, which is used to assess the compliance of hypertension patients in recent months. A higher score means better medication adherence. Cronbach's alpha of the overall scale was 0.86, and the test-retest reliability was 0.96.

Self-efficacy of Chronic Diseases Scale \(^{45}\): It has been widely used in many countries and has good reliability and validity \(^{46}\). It was composed of 6 items in 2 dimensions, and a total scale is the sum of the average score of each item. A higher score reflects better self-efficacy. According to the total score, the self-efficacy was divided into three levels: low (< 4.0 points), medium (4.0 to 7.9 points), and high (≥ 8.0 points).

Social Support Rating Scale (SSRS) \(^{47}\): 10 items with 3 dimensions and the total score is the sum of each item. It has been used widely in China and has good reliability and validity. A higher score reflects
better social support. The social support was categorized into four groups based on the total score, which were: low (< 20 points), medium (20 to 30 points), high (30 to 40 points), very high (≥ 40 points). The retest reliability is 0.92; the consistency of each item is 0.89-0.94[48].

All original scale scores were standardized to make the scores comparable standardized score = (factor per capita value/the full number of each item) × 100, with the exception of QLICD-HY.

**Blood pressure measure**

The AU-621 (A & D Medical Life source, Japan) electronic sphygmomanometer [Ande Electronics (Shenzhen) Co., Ltd.] was used to measure the blood pressure of the right upper limb of the patient. The AU-621 was calibrated every 6 months. Before the measurement, the participants were asked to rest for at least 5 minutes. The sphygmomanometer’s cuff was placed on the right upper limb elbow of the patient two consecutive times, at least 30 seconds apart, and averaged.

**Data analysis**

All statistical analysis was performed using SPSS18.0 and AMOS18.0 software. The continuous variables were reported as mean ± standard deviation. The categorical variables were reported in percentage or composition ratio. The path analysis model was used to create the structural equation model for predicting the HRQoL of Kazakh hypertension patients with hypertension (a = 0.05 for entry into the model, and a = 0.10 for excluding from the model). \( P \leq 0.05 \) indicates statistical significance.

**Results**

The study was conducted in 2015. Overall, 540 patients who met the eligibility criteria, in the selected townships from the rural area of Xinjiang. Among them, 24 invalid questionnaires (with incomplete data) were excluded; 516 questionnaires were valid, with a return rate of 95.6%.

**Social demographic characteristics and BP level of the participants**

Among the 516 included Kazakh hypertension patients in the rural area, 239 were male (46.3%), and 277 were female (53.7%). The mean age of the participants was 58.14 ± 12.05 years old. About half of the participants were farmers and herdsmen (48.4%); the majority of the participants were married (83.5%). In addition, around 70% participants only attended junior high school or below, and about two-thirds of the participants have an annual family income of less than RMB 10,000 yuan (75.6%). The average SBP was 156.26 ± 24.40 mmHg, and the average DBP was 87.55 ± 14.73 mmHg for the participants.

**HRQOL, HBP-HL, self-management behavior, medication adherence, self-efficacy, and social support**
The standardized HRQoL score of Kazakh hypertension patients in rural areas was 63.5 points. The standardization scores of each dimension of QLICD-HY from high to low were: the psychological function (68.7 points), the social function (66.1 points), the hypertension specific module (61.5 points), and the physical function (57.2 points). The standardized HBP-HL score was 24.2 points. Overall, 487 patients (94.4%) lacked HBP-HL, 7 patients (1.4%) had a medium level of HBP-HL, and only 22 patients (4.2%) were considered to be sufficient in HBP-HL. The standardized scores of self-management behavior and medication adherence were 66.2 points and 64.4 points, respectively. The standardized score of self-efficacy was 64.0 points, including 20 cases (3.9%) with low self-efficacy, 422 cases (81.8%) with medium self-efficacy, and 74 cases with high self-efficacy (14.3%). The standardized social support score was 76.0 points, including 1 case (0.2%) with low social support, 8 cases (1.6%) with medium social support, 172 cases (33.3%) with high social support, and 335 cases (64.9%) with very high social support (Table 1).

### Table 1

| Variable                      | Min | Max | Mean ± SD     | Standardized Score | 95%CI      |
|-------------------------------|-----|-----|---------------|--------------------|-----------|
| Score of HRQoL                | 76  | 210 | 166.41 ± 22.21 | 63.52              | 164.49—168.33 |
| Psychological function        | 16  | 55  | 41.23 ± 8.45   | 68.70              | 40.05—41.96  |
| Social function               | 19  | 49  | 40.07 ± 4.43   | 66.07              | 39.69—40.45  |
| Hypertension specific module  | 24  | 79  | 58.82 ± 9.52   | 61.50              | 58.00—59.65  |
| Physical function             | 11  | 39  | 26.29 ± 4.92   | 57.16              | 25.87—26.72  |
| HBP-HL                        | 5   | 58  | 14.51 ± 8.56   | 24.18              | 13.77—15.25  |
| Self-management Behavior      | 56  | 165 | 109.28 ± 19.75 | 66.23              | 107.57—110.99 |
| Medication Adherence          | 45  | 122 | 80.44 ± 17.32  | 64.35              | 78.94—81.93  |
| Self-efficacy                 | 1.25| 10  | 6.40 ± 1.40    | 64.00              | 6.29—6.52    |
| Social Support                | 19  | 54  | 41.04 ± 4.78   | 82.08              | 40.62—41.45  |

Construction and testing of structural equation model of HRQoL

Based on the results mentioned above, and the literature, the initial hypothesis model (M1) of HRQoL, HBP-HL, self-management behavior, medication adherence, self-efficacy, and social support of Kazakh hypertension patients in rural areas were constructed (Fig. 2).
Next, the maximum likelihood method was used for parameter estimation. According to the revised index, standardized regression coefficient (path coefficient) and literature data, the paths that did not reach a significant level and were unreasonable, were deleted. For example, the paths between social support and self-management behavior, social support and self-efficacy, HBP-HL and self-management behavior, HBP-HL and medication adherence, and medication adherence and HRQoL, were deleted. After optimization, the HRQoL impact factor model (M2) had a better fitting index than the hypothesis model (M1). The optimized model is shown in Fig. 3; it composed of 5 modules and 16 dimensions.

We further evaluated the fitting effect of the path analysis model for HRQoL. When a sample size of 500 was amassed, the model reached the standard, and the fitting indicators met the requirements; this means the model fits well. The specific fitting indicators were shown in Table 2.

Table 2
Goodness-of-fit indices of the structural equation model for health-related quality of life among Kazakh hypertension patients in the low-income rural area of Xinjiang, China.

|        | χ²/df | RMSEA | GFI | AGFI | IFI | CFI |
|--------|-------|-------|-----|------|----|-----|
| M2     | 2.078 | 0.046 | 0.968 | 0.944 | 0.949 | 0.947 |
| Evaluation Criterion | 3.000 | 0.080 | 0.90 | 0.90 | 0.90 | 0.90 |

The testing of the modified model showed that all the paths were statistically significant (P<0.05, C.R.>1.96) and meaningful (Table 3, Path analysis results of HRQoL). Among the paths, HBP-HL had the biggest direct effect on HRQoL (0.350), followed by self-management behavior (0.257), social support (0.190), and self-efficacy (0.183). The model also indicated that self-efficacy could impact HRQoL through self-management behavior.

Table 3
Path analysis results of health-related quality of life among Kazakh hypertension patients in the low-income rural area of Xinjiang, China.

| Regression path            | Standardized Estimate* | S.E.  | C. R. | P    |
|----------------------------|------------------------|-------|-------|------|
| Self-management—Self-efficacy | 0.198                  | 0.069 | 3.371 | 0.001 |
| Quality of Life—HBP-HL     | 0.350                  | 31.991| 2.119 | 0.034 |
| Quality of Life—Self-management | 0.257                  | 0.856 | 4.059 | 0.001 |
| Quality of Life—Self-efficacy | 0.183                  | 0.650 | 4.457 | 0.001 |
| Quality of Life—Social Support | 0.190                  | 0.187 | 4.714 | 0.001 |

Discussion
The results of this study indicate that HRQoL, HBP-HL, and self-management behavior of Kazakh hypertension patients in rural areas are suboptimal, but their self-efficacy and social support status are high. The standardized HRQoL score was 63.30 points, which was at a low level. This result is lower than those of Dai people(79.19 points) in Yunnan, China\textsuperscript{[49]}. Among all the dimensions, the physical function was the worst. This result is similar to a study conducted among hypertension patients in Anuradhapura District in North Central Province, Sri Lanka\textsuperscript{[50]}. Tailored interventions should be implemented to improve the HRQoL of Kazakh hypertension patients, especially their physical functions.

Our results showed that the majority of the patients, up to 94% of them, lack HBP-HL. They are unable to read or understand the instructions of the prescription drugs, or can't communicate effectively with doctors. Research discussed that patients with high health literacy have better hypertension control and better HRQoL. The low health literacy causes a 10-year increased risk of cardiovascular disease\textsuperscript{[51]}. Furthermore, Halladay J R et al. demonstrated that health literacy intervention may equally lower SBP in patients with low and higher health literacy\textsuperscript{[52]}. All of these findings indicate the importance of assessing HBP-HL among hypertension patients.

The standardized score of self-management behavior among the Kazakh hypertension patients was at a medium-low level (66.23 points), and it was much lower than the score among hypertension patients in Guangdong, China (86.01points)\textsuperscript{[53]}. Potential reasons for the lower self-management behavior among Kazakh hypertension patients include these factors that all patients in this study living in the remote rural area, and having poor economic situations and education. In addition, since Kazakh is the patients' main communication language\textsuperscript{[54]}, and their Chinese reading and communication ability are relatively low, it creates difficulties in access knowledge and influences their ability to manage the diseases by themselves. Moreover, the patients live in a more dispersed area and often moved to different areas during different seasons, which makes it difficult to assemble the patients and their families, to carry out health educational activities. Mackey L M et al. discussed that low Health Literacy affects the development of self-management skills\textsuperscript{[55]}.

Extensive research indicates that health literacy plays an important role in promoting the HRQoL\textsuperscript{[56–58]}. One study conducted in rural western China found that enhancing the level of health literacy and raising self-management might improve the HRQoL of patients with hypertension\textsuperscript{[59]}. Another study conducted in Tehran, Iran, concluded that health literacy and HRQoL had a significantly positive correlation and suggested that nursing officials and policymakers take measures to promote patients’ HRQoL by improving patients’ health literacy levels\textsuperscript{[60]}. Thus, it seems essential to improve the level of HBP-HL among Kazakh hypertension patients.

The indexes of the model reached the adaptation criteria, and the fitting was good. The effects of HBP-HL, social support, self-efficacy, and self-management behavior on HRQoL were positive and statistically significant. HBP-HL has the biggest direct effect on HRQoL. The results of this study are consistent with worldwide results. For example, Tartavouille study shows that social support has a positive effect on the
The study by Lee et al. demonstrates that there is a positive effect of self-efficacy on HRQoL. Also, a study among patients with type 2 diabetes showed that self-management, disease-related knowledge, and attitude are the decisive factors that affect the HRQoL. One study conducted by Osborn et al. also found that the health literacy level and health knowledge path of hypertension patients were statistically significant and that health knowledge further affected patients’ self-efficacy and health status. Recent studies strongly suggest that the higher the level of health literacy, the better the HRQoL. These studies do not only support these correlations but further indicate the feasibility of our model.

**Conclusion**

HRQoL, HBP-HL, and self-management behavior of Kazakh hypertension patients in rural areas are poor. The structural equation model of HRQoL works well. HBP-HL has the largest impact on the HRQoL in the model. Further policies and interventions, focus on improving the HBP-HL level among the Kazakh hypertension patients in rural areas in Xinjiang, are needed. In addition, comprehensive interventions aimed to improve HBP-HL, social support, and self-efficacy together are essential for improving the HRQoL of patients with hypertension.

**Abbreviations**

HRQoL
Health-Related Quality of Life; HBP-HL:High Blood Pressure-Health Literacy;
C-HBP-HLS
Chinese-High Blood Pressure-Health Literacy Scale; QLICD-HY:HRQoL Instruments for Chronic Disease-Hypertension; HPSMBRS:Hypertension Patients Self-Management Behavior Rating Scale;
MASHP:Medication Adherence Scale for Hypertensive Patients; SSRS:Social Support Rating Scale;
RMSEA:Root Mean Square Error of Approximation; GFI:Goodness-of-fit Index; AGFI:Adjusted Goodness-of-fit Index;IFI:Incremental fit Index; CFI:Comparative fit Index.

**Declarations**

**Ethics approval and consent to participate**

This study was approved by the Ethics Committee of the First Affiliated Hospital of Xinjiang Medical University (approval number: 20130216-134). Written informed consent was obtained from each participant.

**Consent for publication**

Not applicable.
Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors contributions

Study Design: Qinghua Zhang, Jingping Zhang. Data Collection and Analysis: Qinghua Zhang, Lei Zhang. Manuscript Writing: Qinghua Zhang, Feifei Huang, Shasha Li.

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Figures

![Initial Hypothesis Model of HRQoL among Kazakh hypertension patients in the low-income rural area of Xinjiang, China. (M1)](image)

Figure 1 Initial Hypothesis Model of HRQoL among Kazakh hypertension patients in the low-income rural area of Xinjiang, China. (M1)
Figure 2 Structural Equation Model of HRQoL among Kazakh hypertension patients in the low-income rural area of Xinjiang, China. (M2)

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