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Development and evaluation of the psychometric properties of a hypertension self-care questionnaire

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Original Article

Abstract

BACKGROUND: There are a number of tools to assess self-care in hypertension (HTN), but they do not cover all the dimensions of self-care and do not have a good reliability and validity. This study was conducted to develop and evaluate the psychometric properties of a tool for self-care assessment in HTN.

METHODS: This cross-sectional, methodological study was conducted in Isfahan, Iran. An expert panel was held to assess the qualitative face validity of the tool. The content validity ratio (CVR) and content validity index (CVI) were measured. The questionnaire was distributed among 20 patients to measure its internal reliability. After 14 days, it was re-distributed among the same patients, as a measure of external reliability. The questionnaire was completed by 203 patients with HTN and an exploratory factor analysis was performed in order to assess the construct validity of the tool.

RESULTS: The items of the self-care tool were confirmed with a CVR ≥ 0.5, Kappa ≥ 0.71, I-CVI = 0.69, and intraclass correlation coefficient (ICC) = 0.952. The factor analysis showed that the 16-item questionnaire has 5 dimensions, including follow-up [3 items; factor loadings (FL) = 0.619 to 0.869, and Cronbach's alpha (α) = 0.737], healthy lifestyle (5 items; FL = 0.709 to 0.846, α = 0.703), promoting qualifications (4 items; FL = 0.610 to 0.791, α = 0.594), medication therapy (2 items; FL = 0.699 and 0.740, α = 0.717), and following recommendations (2 items, FL = 0.577 and 0.744, α = 0.701). These 5 dimensions explained 62.686% of the variance. The Cronbach's alpha coefficient of the final self-care assessment questionnaire was 0.833.

CONCLUSION: The developed questionnaire proved to have appropriate psychometric properties for measuring self-care in patients with HTN.

Keywords: Blood Pressure, Chronic Disease, Hypertension, Self-Care

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Introduction

The prevalence of hypertension (HTN) is high in developed and developing countries. Globally, 40% of people over the age of 25 years have high blood pressure, and the number of people with elevated blood pressure has increased from 600 million in 1980 to a billion in 2008.[1] HTN is a controllable risk factor for cardiac diseases, cerebrovascular diseases, kidney failure, and peripheral vascular diseases. The failure to manage this condition results in serious damage to the vital organs and premature death,[2] and is a cause of about 16.5% of all deaths.[3]

This disease is poorly managed around the world, particularly in low-income and middle-income countries.[4]

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Blood pressure control is possible and can lead to a significant reduction in the costs related to advanced medical care.[5]

The failure to prevent and control HTN is still a medical and social problem in most countries.[6] In Iran, 23% of those aged 30 to 55 years and 50% of those over 55 years of age have HTN.[7] In addition, according to some studies, suitable HTN control is missing in this area, and only about 16% of the cases have their blood pressure under control.[8]

Self-care is an essential step in the management of chronic illnesses such as HTN and is performed in both healthy and ill states. The results of clinical trials suggest that self-care is crucial to the management of blood pressure.[9]

Self-care is defined as "the ability of individuals, families and communities to promote health, prevent diseases and maintain health for fighting disease and disability with or without the support of a physician".[10] The theory of self-care emphasizes activities performed or initiated by each individual to sustain life, health, and well-being. Orem's self-care model is one of the most complete models of self-care; it recommends the offering of clinical guidance for planning and administrating self-care among patients.[11]

The patients' adherence to treatment is a key factor in blood pressure control; however, 50% of patients with HTN do not reach their goals for the control and management of this disease. Offering encouragement and helping patients change their lifestyle toward a healthier one can be effective in this regard.[12,13] Moreover, non-compliance with a healthy lifestyle, lack of regular consumption of the prescribed medications, and non-compliance with self-care behaviors contribute to stroke and premature death due to HTN.[11]

As the incidence of HTN, as a chronic disease, is increasing, greater emphasis is being placed on the role of self-care in its management in order to reduce the global burden of the disease. In addition, self-care may improve personal performances and promote independence and the quality of disease management.[9] Self-care reduces physician visits and emergency referrals.[14] For this reason, self-care should be adequately supported to transform the passive role of patients in their care process into a more aware and active role; therefore, it is important to plan for the active participation of patients in their process of disease control, accountability, and motivation.[15]

A number of tools are available for assessing self-care in hypertensive patients, but they do not cover all the areas of self-care, have poor reliability and validity, and have often been developed without a clear theoretical framework. Most tools used in HTN self-care research, such as the Morisky Medication Adherence Scale (MMAS) and Hill-Bone Compliance to High Blood Pressure Therapy Scale (HB-HBP), are not comprehensive, and are often related exclusively to medication adherence or have inappropriate theoretical frameworks and insufficient psychometric quality.[16] Relevant comprehensive tools are therefore necessary to assess all the aspects of self-care in these patients. Due to the above reasons and the lack of a tool to cover all the mentioned areas with valid psychometric properties to assess self-care in hypertensive patients, the present study was conducted to develop a hypertension self-care questionnaire and determine its psychometric properties.

Materials and Methods

This cross-sectional, methodological study was implemented in over 13 months from 2014 to 2015 in Isfahan, Iran, through the following steps.

1. The process of designing and developing the questionnaire and its items

First, the researcher developed 25 items on self-care with the help of experts on HTN and through the available clinical guidelines, a review of literature, the existing validated HTN self-care instruments [such as the HB-HBP, MMAS, and European Heart Failure Self-care Behavior Scale (EHFScBS)], and qualitative studies on hypertensive patients. The qualitative face validity of the tool and its quantitative validity were assessed using the content validity ratio (CVR) and content validity index (CVI).

- *Face Validity:* Specialist meetings were held with 11 experts (3 cardiologists, 1 psychiatrist, 2 nutritionists with a master's degree, 2 nurses with a master's degree, and 3 statisticians with a master's degree and PhD). Their views on the compatibility between the content of the questionnaire and the research objectives were used in order to determine whether the content of the questionnaire was fit for measuring the research objectives and whether the tool could measure the properties that it was initially designed to examine, and to evaluate the tool's validity.

During these sessions, the questionnaire was presented to the experts and they were asked to give their suggestions for enhancing the face validity of the items, which resulted in simpler, and more comprehensible and relevant items. In addition, items with duplicate or common concepts were

discarded or merged (3 items). The final version of the questionnaire consisted of 22 items. The dimensions of this questionnaire included nutrition and weight control (3 items), physical activity, sleep, and rest (3 items), lack of smoking and alcohol consumption (1 item), stress (3 items), medication therapy (2 items), improved knowledge (2 items), use of sources of support (2 items), seeking care and follow-up (4 items), and blood pressure measurement and satisfaction with blood pressure control (2 items). The questionnaire was ultimately approved by all the experts.

- *Content validity ratio:* The CVR of the tool was calculated to determine its ability to measure all the aspects of self-care. For this purpose, 25 experts and specialists gave their opinions and were asked to comment on each item based on a 3-point scale of 'essential', 'important but not essential', and 'not essential'. Given that the panel consisted of 25 members, the content validity of each item was confirmed if the calculated CVR exceeded 0.44.[17]

- *Content validity index:* To calculate the CVI, the self-care questionnaire was given to 17 specialists and experts (4 cardiologists, 4 general practitioners, 6 nursing PhDs, 2 nurses with master's degree, and 1 nurse with bachelor's degree), and they were asked to rate the relevance, simplicity, and clarity of the questionnaire items with a score of 1 to 4. The number of people who gave an item a score of 3 or 4 was divided by the total number of people, and the mean of all the items was defined as the CVI of the tool. Cohen's Kappa coefficient has been recommended as a measure of content validity. Cohen's Kappa is a consensus index of inter-rater agreement that adjusts for chance agreement. A Kappa value of over 0.74, 0.60-0.74, and 0.40-0.59 is considered as "excellent", "good", and "fair", respectively.[18,19] The present study used Kappa values of above 0.71. Any item with an item-level content validity index (I-CVI) of greater than 0.78 is considered as "excellent", and items with an I-CVI between 0.69 and 0.77 are candidates for revision. Those with very low I-CVI values are candidates for elimination.[18]

2. The initial reliability of the questionnaire

- *Internal reliability:* To evaluate the internal reliability of the questionnaire, it was distributed among 20 patients with HTN (who were part of the statistical population) to complete with responses based on a 5-point Likert scale (from 'strongly agree' to 'strongly disagree'). A Cronbach's alpha of > 0.9, > 0.8, > 0.7, > 0.6, > 0.5, and < 0.5 was considered as excellent, good, acceptable, questionable, poor, and unacceptable.[20]

- *External reliability:* To evaluate the external reliability of the questionnaire, it was distributed among the same people after 14 days for a re-test and the intraclass correlation coefficient (ICC) of the tool was calculated. An ICC ≥ 0.75, $0.4 \leq$ ICC < 0.75, and ICC < 0.4 was taken to indicate excellent reliability, fair to good reliability, and poor reliability, respectively.[21] One-way random effect model and average measurement were used to determine ICC and its significance for determining absolute agreement.

- *The pre-final version of the questionnaire:* After performing these steps, 9 items were excluded from the initial questionnaire and 16 items remained for the next steps (final validity and reliability assessment).

3. Validity assessment

A cross-sectional study was designed and implemented to assess the validity of the questionnaire. Studies have revealed that adequate sampling is partly determined by the nature of the data. A larger sample can help determine whether the factor structure and individual items are valid or not.[22] To evaluate the construct validity, exploratory factor analysis was conducted to extract the possible dimensions of the developed instrument. In this regard, 203 patients with HTN were recruited based on the following criteria. The inclusion criteria consisted of age of over 18 years, residing in urban areas of Isfahan, and history of HTN for at least 1 year based on the patient's self-report. The exclusion criterion was unwillingness to complete the questionnaire. Ethical considerations were observed by obtaining consent from subjects for participation in the study and assuring them of the confidentiality of their data and their anonymity (i.e., no names and addresses were requested).

The orthogonal equamax rotation was used to facilitate the interpretability of the factors and the Kaiser-Meyer-Olkin (KMO) test was used to evaluate the sample adequacy. A KMO value of greater than 0.5 was considered as illustrative of an adequate sample size. Bartlett's test of sphericity was used to ensure that the correlation between the questionnaire items was not 0, and its significant value was a confirmation for feasibility of factor analysis.[23] The amount of variance of each dimension and the cumulative variance of the dimensions was also determined.

4. The reliability of the final questionnaire

The Cronbach's alpha coefficient was calculated for each dimension and for the entire 16-item questionnaire in order to assess the final reliability

of the questionnaire. The corrected item-total correlation (CITC) was also measured for each item, and CITC values larger than 0.3 were considered as acceptable.[24] Items with a CITC of higher than 0.4, between 0.21 and 0.4, and less than 0.2 were considered as highly discriminative, somewhat discriminative, and poorly discriminative, respectively.[25] Data were analyzed in SPSS software (version 19, SPSS Inc., Chicago, IL, USA).

Results

The questionnaire was evaluated by 25 experts and specialists [7 cardiologists (28%), 8 nurses with a PhD (32%), 3 general practitioners (12%), 2 nutritionists with a master's degree (8%), 2 statisticians with a master's degree (8%), 1 statistician with a PhD (4%), 1 pharmacist with a PhD (4%), and 1 MBA-holder (4%)].

According to Lawshe's table and the study done by Ayre and Scally,[17] items with a CVR ≥ 0.5 were selected and a total of 3 items were eliminated from the questionnaire. In calculating the CVI based on the Cohen's Kappa coefficient, questionnaire items with a K ≥ 0.71 and an I-CVI ≥ 0.69 were selected and only 1 item was removed from the questionnaire. Table 1 presents the CVR and I-CVI of the items. Minor revisions were made to the items as per the CVI results at the researchers' discretion.

Table 1. Assessing the content validity of the self-care questionnaire using the content validity ratio and content validity index

Number of Items	N	CVR	Lawshe's Result	Colin Ayre Result	I-CVI	Kappa	Modified Kappa	I-CVI Main Group
1	22	0.76	1	1	0.88	0.88	Excellent; very relevant	appropriate
2	20	0.60	1	1	0.76	0.76	Excellent; very relevant	needs some revision
3	19	0.52	1	1	0.69	0.71	Good; relevant, but needs minor revision	needs some revision
4	20	0.60	1	1	0.82	0.82	Excellent; very relevant	appropriate
5	23	0.84	1	1	1.00	1.00	Excellent; very relevant	appropriate
6	19	0.52	1	1	0.69	0.71	Good; relevant, but needs minor revision	needs some revision
7	18	0.50	1	1	0.69	0.71	Good; relevant, but needs minor revision	needs some revision
8	21	0.68	1	1	0.88	0.88	Excellent; very relevant	appropriate
9	20	0.60	1	1	0.82	0.82	Excellent; very relevant	appropriate
10	21	0.68	1	1	0.69	0.71	Good; relevant, but needs minor revision	needs some revision
11	19	0.52	1	1	0.69	0.71	Good; relevant, but need minor revision	needs some revision
12	21	0.75	1	1	0.82	0.82	Excellent; very relevant	appropriate
13	21	0.68	1	1	0.82	0.82	Excellent; very relevant	appropriate
14	23	0.84	1	1	1.00	1.00	Excellent; very relevant	appropriate
15	19	0.52	1	1	0.74	0.75	Excellent; very relevant	needs some revision
16	21	0.68	1	1	0.88	0.88	Excellent; very relevant	appropriate

CVR: content validity ratio; I-CVI: Item-level content validity index

In calculating the internal reliability of the questionnaire with Cronbach's alpha using the SPSS software (version 18, SPSS Inc., Chicago, IL, USA), 2 items were removed from the questionnaire. The Cronbach's alpha coefficient of the initial self-care questionnaire was calculated as 0.703. The ICC of the questionnaire was 0.952 (range: 0.880-0.981).

After assessing the face validity, content validity, and internal and external reliability of the questionnaire, this 16-item tool was presented for a construct validity assessment using exploratory factor analysis.

In the cross-sectional study implemented for the exploratory factor analysis, 203 patients with HTN completed the questionnaire of whom 101 (49.8%) were women with a mean age of 62.72 ± 10.48 years and 102 were men with a mean age of 64 ± 8.98 years. The patients had a minimum age of 37 years and a maximum of 82 years. The KMO value of 0.829 and Bartlett's test of sphericity value ($P < 0.001$) for the questionnaire showed that factor analysis could be used for the data. The results of the factor analysis of the 16-item self-care questionnaire using orthogonal equamax rotation[25] revealed 5 dimensions for the questionnaire, which included follow-up (3 items), healthy lifestyle (5 items), promoting qualifications (4 items), medication therapy (2 items), and following recommendations (2 items).

The factor loadings of the items ranged from 0.577 to 0.869 and all of them were statistically significant.

Table 2. Dimensions, factor loadings, Cronbach's alpha, and variance and cumulative variance of the self-care questionnaire

Dimension	Item	Factor Loading	Cronbach's Alpha	Variance (%)	Cumulative variance (%)
Follow-up	I visit the physician and medical team on time to continue the treatment.	0. 869	0.737	8.704	62.686
	I visit the physician or the medical team every one to two months to have my blood pressure measured.	0.868			
	I take the necessary blood pressure tests on time as per the medical team's recommendations.	0.619			
Healthy lifestyle	I follow a low-salt diet.	0.846	0.703	32.492	
	I follow the medical team's recommendations for a healthy diet.	0.812			
	I have reached my optimal weight as per the medical team's recommendations.	0.712			
	I avoid stress and psychological tension.	0.804			
	I follow the medical team's recommendations for keeping active and performing physical exercise.	0.709			
Promoting qualifications	I have enough knowledge on hypertension and its treatment, and have sought to promote it further.	0.691	0.594	6.439	
	I rely on the support from my family and the medical team and I benefit from them.	0.669			
	I am familiar with referral and support centers for hypertensive patients in the city.	0.610			
	I ask my questions from the health personnel (physicians, nurses, etc.) to better understand the disease and the medical recommendations.	0.791			
Medication therapy	I follow the physician's and medical team's recommendations about the time, dose, and appropriate storage of my prescribed medications.	0.699	0.717	8.912	
	I buy my medicines on time.	0.740			
Following recommendations	I follow the medical team's recommendations about quitting/not smoking and drinking and avoiding second-hand smoke.	0.744	0.701	6.139	
	I actively try to maintain my blood pressure below 140/90 (as recommended by the physician).	0.577			

Table 3. The Corrected Item–Total Correlations for the items of the self-care questionnaire

Number	Item	CITC
1	I follow the physician's and medical team's recommendations about the time, dose, and appropriate storage of my prescribed medications.	0.528
2	I buy my medicines on time.	0.371
3	I have enough information about hypertension and its treatment and have sought to promote it.	0.419
4	I visit the physician and medical team on time to continue the treatment.	0.661
5	I take the necessary blood pressure tests on time as per the medical team's recommendations.	0.557
6	I visit the physician or the medical team every one to two months to have my blood pressure measured.	0.439
7	I rely on the support from my family and the medical team, and I benefit from them.	0.431
8	I follow a low-salt diet.	0.608
9	I follow the medical team's recommendations for a healthy diet.	0.666
10	I actively try to maintain my blood pressure below 140/90 (as recommended by the physician).	0.593
11	I am familiar with referral and support centers for hypertensive patients in the city.	0.433
12	I have reached my optimal weight as per the medical team's recommendations.	0.384
13	I follow the medical team's recommendations about quitting/not smoking and drinking, and avoiding second-hand smoke.	0.125
14	I ask my questions from the health personnel (physicians, nurses, etc.) to better understand the disease and the medical recommendations.	0.365
15	I avoid stress and psychological tension.	0.383
16	I follow the medical team's recommendations for keeping active and performing physical exercise.	0.452

CITC: Corrected item-total correlation

The 5 dimensions of the questionnaire explained 62.686% of the total variance. The Cronbach's alpha coefficient of the final version of the questionnaire was 0.833. The dimensions, factor loadings of each item, Cronbach's alpha of each dimension, variance of each dimension, and cumulative variance of the dimensions are presented in table 2. The CITC of each item ranged from 0.365 to 0.666, except for 1 item that had a CITC of 0.125. Table 3 presents the CITC of the items of the self-care questionnaire.

Confirmatory factor analysis: In order to assess the factor structure and determine the construct validity of the questionnaire using confirmatory factor analysis, 400 patients with HTN were randomly selected to complete the questionnaire. Chi-square ratio of was lower than 3 (2.85) which shows suitable structure. The normed fit index (NFI), incremental fit index (IFI), comparative fit index (CFI), tucker-lewis index (TLI), and root mean square error of approximation (RMSE) were, respectively, 0.85, 0.89, 0.89, 0.86, and 0.068, and thus, confirmed the model (Figure 1).

Discussion

Self-care is a set of voluntary and acquired health behaviors and the selection of a suitable lifestyle that prevents disease, or in the case of a disease, helps the individual seek effective treatment with knowledge and awareness.

In the present study, a valid and reliable questionnaire was developed for examining self-care in patients with HTN. The Cronbach's alpha of this questionnaire exceeded 0.8, which shows the high reliability of the tool. The self-care questionnaire developed by Han et al. with an alpha of 0.7 was also acceptable.[16] The ICC of the self-care questionnaire developed in the present study was 0.952, suggesting the excellent reliability of the tool.

The CITC of each item in this self-care questionnaire ranged from 0.365 to 0.666, except for 1 item. In the HTN self-care questionnaire developed by Han et al., the CITC of each item ranged from 0.2 to 0.63 .[16] In the self-care assessment tool developed by Sidani and Doran, a CITC exceeding 0.3 was deemed acceptable for all the items.[24] In another study examining an acceptance of HTN questionnaire, the CITC of all the items ranged from 0.32 to 0.67.[25] In a study by Erkoc et al., the CITC of the questionnaire items ranged from 0.27 to 0.5.[26]

Factor analysis showed that the 16-item self-care questionnaire developed in this study has 5 dimensions.

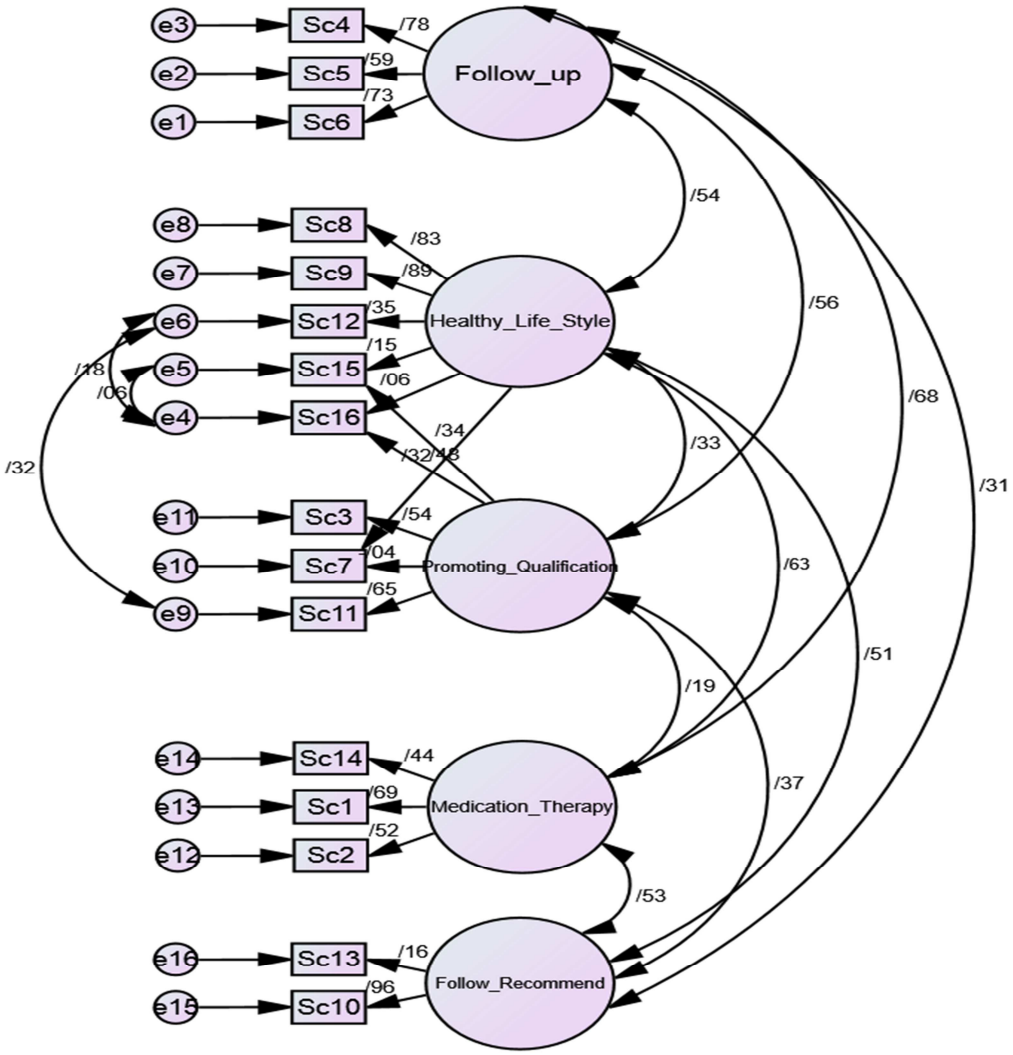

Figure 1. Standardized coefficients for the five-factor model for self-care based on confirmatory factor analysis with AMOS 21.0. (NFI = 0.85, CFI = 0.90, RMSEA = 0.068)
AMOS: Analysis of moment structures; NFI: Normed fit index; CFI: Comparative fit index; RMSEA: Root mean square error of approximation

The dimension of follow-up consisted of regular visits to the physician, undergoing the recommended tests, and having one's blood pressure regularly measured. The dimension of healthy lifestyle consisted of following a healthy low-salt diet, weight control, physical exercise, and avoiding stress. The dimension of promoting qualifications consisted of improving one's knowledge about HTN and its treatment, asking questions to better understand the disease and the medical recommendations, benefiting from the support of the family and the medical team, and familiarity with referral and support centers for hypertensive patients. The dimension of medication therapy consisted of the timely procurement of one's medicines, and adherence to the recommendations of the physician and medical team about the time, dose, and appropriate storage of the medications. The last dimension consisted of following the medical team's recommendations regarding quitting/not smoking and drinking, avoiding second-hand smoke, and maintaining one's blood pressure below 140/90 as recommended by the physician.

This questionnaire can thus be said to cover the most important areas of self-care, including medication administration and adherence, blood pressure self-monitoring, regular physician visits, stress reduction, adaptation to a new lifestyle of weight management, low-sodium and low-fat diet, physical activity, non-smoking, and moderation in alcohol consumption. Moreover, the subscales of

the Hypertension Self-Care Activity Level Effects (H-SCALE) questionnaire include medication, weight management, physical activity, tobacco exposure, alcohol intake, and healthy diet.[27] In their development and validation of the Hypertension Self-Care Profile with 20 items, Han et al.[16] examined HTN medication therapy (2 items), lifestyle factors such as physical exercise and a low-salt and low-fat diet (10 items), weight control, reduction of alcohol consumption, avoiding/quitting smoking, blood-pressure self-measurement, regular visits to the physician (1 item for each), and stress reduction (2 items).

The strength of this study is that several steps were taken for the development and psychometric assessment of the self-care questionnaire and that all the dimensions of self-care were taken into account in its design.

One limitation of this study is that the study subjects examined for the development and validation of the tool all resided in cities; however, it is necessary to examine patients with HTN living in rural areas. Due to the high prevalence of HTN in the community and the importance of self-care, it is recommended that future studies investigate the validity and reliability of this tool in larger samples, in urban and rural areas, and in hypertensive patients with different age ranges, genders, and cultural and ethnic backgrounds so as to achieve a valid and simple HTN self-care assessment tool for patients.

Additional studies for the comparison of this scale with other validated self-care questionnaires is necessary.

Conclusion

The developed questionnaire proved to have suitable psychometric properties for measuring self-care in patients with HTN. The administration of this questionnaire to patients with HTN by researchers and clinical staff can provide a more accurate assessment of their self-care and additional insight into the patients' self-care. The patients' adherence to treatment, which is a key factor in the management of blood pressure, can thus be improved and a reduction in physician visits and emergency referrals may be accomplished.

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Conflict of Interests

Authors have no conflict of interests.

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