ORIGINAL RESEARCH

Development and Psychometric Validation of the Hypertension Beliefs Assessment Tool Among Adult Population in Northwest Ethiopia

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Background: In Ethiopia, the majority of hypertension cases remain undiagnosed, untreated, and uncontrolled. Beliefs about hypertension and its complications play an important role in hypertension management behaviors. Accurate assessment of individuals' beliefs towards the disease is of paramount importance in the design of hypertension education. This study aimed to develop and validate a hypertension belief assessment tool based on the Health Belief Model for the general population among rural adults in northwest Ethiopia.

Methods: The study included item construction, face and content validation, factor analysis, and establishment of reliability and validity of the tool. A total of 308 rural adults participated in the study. Inter-item and item-to-total correlations were used to examine the items assessed with the same content on a scale. Principal component analysis with promax rotation was used to extract the factors. Internal consistency reliability was assessed using Cronbach's alpha coefficient. Convergent and discriminant validity were assessed using average variance extraction and maximum shared variance.

Results: The median age of the participants was 41 (IQR: 31–55) years. Of the participants, 175 (56.8%) were female and 287 (93.2%) were farmers. Kaiser-Meyer-Olkin test value of 0.84 and significant Bartlett's test of sphericity (p=0.000) revealed that the data were suitable for exploratory factor analysis. The principal component analysis identified 6 factors, which explained 70.06% of the variation of the hypertension belief. Cronbach's alpha was 0.85 for the entire scale, ranging from 0.74 to 0.92 for the sub-domains. The average variance extracted was above 0.5 for all factors, indicating convergent validity. The maximum shared variance between the two constructs was lower than the average variance extracted from each factor, indicating that discriminating validity had been established.

Conclusion: The hypertension belief assessment tool was found to be valid and reliable, which can be used to measure the health beliefs on hypertension for the rural adult population.

Keywords: hypertension, belief, validation, exploratory factor analysis

Background

Hypertension, also known as high blood pressure,[1] is one of the major global public health problems.[2–7] An estimated 1.13 billion adult people worldwide had hypertension with most (two-thirds) living in low and middle-income countries.[8] Hypertension affects nearly 1 in 4 Ethiopian adults and becomes a major public health problem.[9] Literature showed that the pooled prevalence of hypertension was 21.8%[10] and ranged from 13.2%[11] in southwest Ethiopia to 31.9% in Dabat northwest Ethiopia.[12]

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Hypertension, if left untreated and uncontrolled, might lead to cardiovascular disease morbidity, disability, and mortality.[5] Estimated 10.7 million deaths[13] and 162 million years of life lost[14] were attributed to hypertension in 2017. In Ethiopia, it accounted for 62.3% of cardiovascular diseases,[15] 37% to 41.1% of coronary heart disease,[16,17] and 36.3% to 69.3% of stroke cases.[18–22]

Lowering or controlling high blood pressure is associated with a decreased risk of cardiovascular disease morbidity, as well as overall mortality.[23] For instance, if systolic blood pressure was managed to be lowered by 10 mmHg, the risk of dying of coronary heart disease and stroke would be decreased by 22–25% and 27–41%, respectively.[24–26] Moreover, if blood pressure were optimally controlled, the incidence of heart failure and stroke would be reduced by 50% and 35–40%, respectively.[27]

Although medical and lifestyle interventions are effective in managing hypertension,[28,29] a large proportion of patients with hypertension in Ethiopia remain undiagnosed, untreated, and uncontrolled.[12,30–33] Studies conducted in different settings suggested that individuals' beliefs about hypertension and its complications play an important role in hypertension management behaviors.[34,35] Poor health beliefs, such as low perceived susceptibility and perceived severity of hypertension, could lead to less optimal blood pressure control indirectly through lower rates of hypertension screening and diagnosis,[36] poor clinical linkage and treatment,[37] less engagement in healthy lifestyle practices,[38] and medication non-adherence.[39]

Individuals' perceived benefit, barrier, and self-efficacy to take action also directly affect hypertension prevention and management.[40] A study in Kenya showed poor beliefs in treatment effectiveness had been linked to poor adherence to care, treatment, and blood pressure control.[41] However, patients who had a strong belief that their medicines are effective in protecting them from the effect of hypertension were found to be more adherent.[42] Patients with hypertension who have had fewer perceived barriers to adherence[43] and greater self-efficacy to take action were positively and significantly associated with better medication adherence[43–45] and blood pressure reduction.[46]

Accurate assessment of individuals' health beliefs about hypertension and its complication is an important first step to identifying individuals in need of hypertension education intervention. The Health Belief Model (HBM) is the most common health behavior theory used to explore one's health belief.[47] It was introduced in the 1950s by social psychologists to help understand the reasoning of individuals who participated in health programs, such as health check-ups and immunization.[48] It has also been used by many researchers to determine health protective and promotive behaviors, such as cardiovascular disease,[49] breast cancer,[50–53] testicular cancer,[54] osteoporosis,[55] arthritis,[56] diabetes,[57,58] and patients with hypertension.[5,59] However, there is no valid, reliable, and easy-to-use instrument to assess the health beliefs of the general population towards hypertension. Hence, this study aimed to develop and validate a hypertension belief assessment tool (HBAT) based on the HBM for the general population among rural adults in northwest Ethiopia.

Methods
Domain Identification
The hypothesized theoretical HBM with sub-domains of perceived susceptibility, perceived severity, perceived benefits of taking action, perceived barriers, and perceived self-efficacy to take action was used to develop the items.[60] Perceived susceptibility is defined as a person's subjective perception of the risk of acquiring a disease. Perceived severity is defined as person's feelings on the seriousness of contracting a disease. The perceived benefit of taking action is defined as a person's perception of the effectiveness of various actions available to reduce the threat of the disease. A perceived barrier to taking action is defined as a person's feelings on the obstacles to performing a recommended health action. Self-efficacy is defined as the level of a person's confidence in his or her ability to successfully perform a behavior.[61]

Item Construction
Existing scientific literatures regarding the health beliefs towards hypertension,[62] Health Belief Model Scale for Breast Self-Examination,[50,51] Health Belief Scale (HBS) for testicular cancer,[54] Champion Health Belief Model Scale (CHBMS) for Breast Cancer Screening,[63] Champion Health Belief Model Questionnaire,[64] Health Belief Model Scale for diabetic patients[57] shown to be reliable and valid were reviewed to develop the initial items. Moreover, experts in the subject area were consulted on the various dimensions of health beliefs to generate the initial items. First, a total of 25 items were generated in the form of positive sentences to measure an individual's health beliefs. The construct addresses 5 domains under the tenets of the HBM, including perceived susceptibility to hypertension, perceived severity of hypertension, perceived benefits of

taking action, perceived barriers to taking action, and self-efficacy to prevent hypertension. Each item of the scale/tool was assessed using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Face and Content Validation

First, seven Ethiopian experts from different disciplines (1 internal medicine specialist, 1 Ph.D. in nutrition, 1 public health expert, 3 Epidemiologist, and 1 MSc in Medical Nursing) who are content experts, and each has more than 10 years of work experience in the field evaluated the initial items for face validity. Experts commented on the items for clarity, conciseness, and alternative wordings. Then, a panel of experts evaluated the items, and items were revised as per the experts' suggestion. Accordingly, 3 items that do not work for the general adult population (If I had hypertension, I cannot support my family; having hypertension causes additional time; and, taking anti-hypertensive medication causes sexual dysfunction) were removed from the item list. One item was also added (Early detection of hypertension makes prevention of complications easier) from the item list making a total of 23 items.

Secondly, a total of 9 content experts were invited from different departments to evaluate the tool for content validity. The initial items pool was provided for the experts to rate each item of the health belief for relevance as "very relevant", "relevant", "somewhat relevant", and "not relevant". The content validity index for the individual items and the overall scale and Kappa coefficient of agreement were used to determine the relevance of the items. The content validity index for the individual items ≥0.78 and the content validity index for the overall scale ≥0.90 have been taken as the minimum acceptable indices. Kappa values >0.81 are considered excellent, between 0.60 and 0.80 good and 0.40 to 0.59 fair.

Description of the HBAT

The developed and validated tool to assess the health beliefs of the adult population towards hypertensive disease in this study is called the Hypertension Beliefs Assessment Tool (Appendix A). The tool was developed in the English version and translated forward to Amharic. The first translator was an Epidemiologist who knew the content area of the constructs of the tool. The second translator was an English language expert who did not have any knowledge about medical terminology and the construct of the tool. Two translated versions of the tool were generated (FT1 and FT2).

A panel of discussion was held with the presence of 2 forward translators and the research team. The two translated Amharic versions were compared with the original version regarding format, wording, the grammatical structure of the sentences, similarity in meaning, and relevance. Ambiguities and discrepancies of words, sentences, and meanings were resolved. A preliminary initial Amharic version (FT12) was developed from these two translations.

The initial translation (FT12) was back-translated into English by the independent bilingual English language and clinical experts. Two back-translated versions of the research tool were produced (BT1 and BT2). An expert panel of all the bilingual translators and the research team was also held. The instruction, items, and response format of the two back-translations were compared with its original English version regarding the format, wording, grammatical structure of the sentences, similarity in meaning, and relevance. Any ambiguities and discrepancies in words, sentences, and meanings were discussed and resolved through consensus. Finally, a pre-final Amharic version of the tool was produced (Appendix B).

Pilot-Testing

The pre-final Amharic version of the research tool was administered to a convenient sample of the target population. A total of 20 rural adult populations were recruited aimed at evaluating the instructions, items, and response format of the pre-final Amharic version of their clarity and suggestions for rewording considered.

Psychometric Validation of HBAT
Study Settings and Population

A cross-sectional study design was used to collect data in rural districts (Dabat and Gondar Zuria) in northwest Ethiopia from May to June 2020. Adults aged ≥18 years who lived in the catchment area for at least 6 months were eligible to be part of the study. Pregnant women and individuals with cognitive dysfunction were excluded. However, we did not get any of the individuals with the aforementioned exclusion criteria during data collection.

Sample Size and Sampling Procedures

In this study, the sample size for the psychometric analysis was performed according to Hair and Anderson's recommendation,[65] with a subjects-to-item ratio of 12:1 and 10% non-response rate. Therefore, a total of 308 rural adults participated in the study to validate the construct. First, 10 kebeles from each district were selected using

a simple random sampling technique. Then, 12–18 households were selected using a systematic random sampling method, and one participant per household was selected using lottery method from residents living in the selected kebeles.

Data Collection Procedures

A structured questionnaire including socio-demographic characteristics, medical histories, and beliefs towards hypertension was used to collect the data. Three data collectors trained for 2 days visited participants' homes and collected the data using an interviewer-administered questionnaire. The data collectors read aloud the instructions and each of the questions/items for the study participants to respond. Blood pressures were measured from each participant twice, 30 minutes apart,[66,67] using an aneroid sphygmomanometer and stethoscope. The questionnaire took 20 to 25 minutes to complete.

Statistical Analysis

All the data were entered using Epidata version 4.6 and analyzed using Statistical Package for Social Sciences (SPSS) version 25. Descriptive statistics such as mean with standard deviation, frequency, and percentages were used to describe variables.

Inter-Item and Item-Total Correlations

Inter-item correlations examine the extent to which a score on one item is related to scores on other items at a scale. An inter-items correlation of ≥0.30 in absolute value for each item was considered desirable to conduct factor analysis.[68,69] Item-total (item to rest) correlations, defined as the correlation between the item score and the rest of the score, were also carried out to assess the extent to which an item was correlated to the overall scale. The Pearson correlation coefficient values of the corrected item-total correlation ≥0.20 were considered satisfactory[70] and included in the scale, while an item-total correlation value of less than 0.20 indicated that the item did not correlate very well with the overall scale.[71]

Exploratory Factor Analysis

Exploratory factor analysis (EFA) is a statistical procedure used to reduce a large number of observed variables to a small number of factors and identify the underlying structures.[72] In EFA, the correlations among a group of observed variables were identified and transformed into a small number of related factors. The requirements to conduct EFA such as multivariate normality,[73] linearity, and sampling adequacy were checked.[74]

Preliminary analysis regarding inter-item correlation,[68,69] Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy,[75,76] and Bartlett's test of Sphercity[77] were carried out to decide the factorability of the instrument. The KMO measure of sampling adequacy with the recommended value ≥.50 for the overall items was applied to measure sampling adequacy and appropriateness of the data for EFA.[75,76] Bartlett's test of sphericity was also used to assess the correlation or relationship among a set of items and multivariate normality of a set of distributions.[77] A significant value of less than 0.05 indicates that the data do not produce an identity matrix and are acceptable for further analysis.[78]

Exploratory factor analysis with the Principal Component Analysis method was used to extract the data. The communalities of each item and the proportion of the item variance that was explained by the combination of items that had been extracted were set at a minimum value of 0.3 to retain an item. Factors with Eigenvalue ≥1 and a scree plot were used to determine the optimal number of underlying factors to be extracted. The factor loading criterion was set at ≥0.30 and considered appropriate to retain an item in each factor structure.[79] Factors obtained during factor extraction were rotated using oblique varimax rotation procedure with Kaiser Normalization. Inter-factors correlation (IFC), the strength of correlation between factors, was checked by observing the component correlation matrix. The IFC > 0.30 in absolute value was considered to choose the oblique rotation method.

Reliability Assessment

In this study, Cronbach's alpha coefficient was used to check the internal consistency reliability of the overall tool and the sub-domains. Cronbach's alpha coefficient measures how closely related a set of items are as a group, with ≥0.70 was accepted as evidence of good internal consistency for the tool.[80]

Construct Validity of the Tool

Construct validity is the extent to which an instrument measures the construct that was intended to measure.[81] Convergent and discriminant validity were used to explore the construct validity of the tool. Convergent validity is the assessment to measure the level of correlation of multiple indicators of the same construct that are in agreement. The average variance extracted (AVE),

a measure of the amount of variance that is captured by a construct in relation to the amount of variance due to measurement error, was used to assess the convergent validity of the construct. An AVE of >0.50 was considered to confirm that the items were converged in the same factor.[82,83] Discriminant validity (divergent validity), which tests constructs that should have no relationship, in fact, do not have any relationship, was assessed by comparing the AVE of one construct with the maximum shared variance (the squared of the IFC) of another construct. Thus, the levels of the AVE for each construct should be greater than the squared correlation involving the constructs.[82]

Ethical Consideration

This study has been approved by the Institutional Review Board of the University of Gondar (reference number R/T/T/C/Eng./327/02/2019). Permission letter was obtained from respective health departments. An information sheet including the purpose and importance of the study, confidentiality of the participants' response, and study benefits and risks was prepared and explained to the study participants. Since the majority of the study participants were unable to read and write, the informed consent was read by the data collectors to them and put their fingerprint on the consent form of their agreement. Confidentiality of data was guaranteed by using identification numbers rather than names and limiting access to the data. Finally, the study was conducted per the declaration of Helsinki.

Results

Participant Characteristics

The median age of the participants was 41 (IQR=31–55) years, ranging from 19 to 90 years. Of the total participants, 175 (56.8%) were female and 254 (82.5%) were married. Of the total participants, 287 (93.2%) were farmers and 207 (67.2%) were unable to read and write (Table 1).

Content Validity

In this study, the content validation showed the content validity index for the individual items ranged from 0.78 to 1, content validity index of the overall scale (0.96), and kappa coefficient of agreement ranged from 0.8 to 1.

Item Analysis

The overall mean of health beliefs towards hypertension was 3.35, ranging from 2.36 to 4.2. The low item mean

Table 1 Sociodemographic Characteristics of Participants in Rural Districts of Northwest Ethiopia (n = 308)

Variables	Category	Number (Percent)
Age, in years	18–24 25–34 35–44 45–54 55–64 ≥65	15(4.9) 74(24.0) 76(24.7) 64(20.8) 39(12.7) 40(13.0)
Sex	Male Female	133(43.2) 175(56.8)
Religion	Orthodox Muslim	304(98.7) 4(1.3)
Marital status	Single Married Divorced Widowed	22(7.1) 254(82.5) 11(3.6) 21(6.8)
Educational status	Unable to read and write Able to read and write Primary school High school College/University	207(67.2) 52(16.9) 29(9.4) 13(4.2) 7(2.3)
Occupational status	Farmer Merchant Student Others	287(93.2) 2(0.7) 13(4.2) 6(1.9)
Personal history of HTN	Yes No	9(2.9) 299(97.1)

(2.36) was "I am more likely to catch hypertension than other people", indicating that most participants had poor belief in the perceived susceptibility to hypertensive disease. The high item mean (4.22) was "hypertension is a serious disease", indicating that the majority of the participants were perceived hypertensive disease as highly dangerous (Table 2).

Exploratory Factor Analysis

The correlation matrix showed the inter-item correlations were above the cut-off value ranging from 0.36 to 0.80. The KMO measure of sampling adequacy was 0.84, which revealed that the sample size was adequate for factor analysis. The measure of sampling adequacies ranging from 0.74 ("I follow health information about

Table 2 Item Analysis of the Health Belief Assessment Tool

Sub Domain	Items	Mean	SD
Perceived Susceptibility	Item 1	2.54	1.11
	Item 2	2.48	1.12
	Item 3	2.58	1.12
	Item 4	2.36	1.04
Perceived health-related severity	Item 5	4.22	0.95
	Item 6	3.18	1.13
	Item 7	3.88	0.88
	Item 8	4.20	0.95
	Item 9	3.93	0.85
Perceived socio-economic-related severity	Item 10	3.45	0.90
	Item 11	3.39	0.89
	Item 12	3.25	0.81
	Item 13	3.57	0.90
Perceived benefit	Item 14	3.81	0.80
	Item 15	3.87	0.75
	Item 16	3.77	0.76
Perceived barrier	Item 17	3.39	0.94
	Item 18	3.57	0.96
	Item 19	3.54	0.95
	Item 20	3.63	0.90
Self-efficacy	Item 21	2.88	1.08
	Item 22	2.98	1.04
	Item 23	2.67	1.14

hypertension") to 0.89 ("hypertension is a serious disease") were also above the cut-off value of 0.50. Bartlett's test of sphericity, which tests the null hypothesis that the original correlation matrix is an identity matrix, was statistically significant (χ^2= 3756.48, df = 253, p=0.000). The communality values for all the items were above the cut-off value (0.30) and ranged from 0.41 to 0.88. All these indicated that the data were suitable for EFA and can be grouped into a smaller number of underlying factors.

Factor Extraction

The principal component analysis identified and retained 6 factors with an eigenvalue of >1 for further analysis. The scree plot also verified the existence of 6 factors above an eigenvalue of 1. The first factor explained 26.2% of the total variance of hypertension belief in the data set. The second factor explained 15.2% of the total variance in the data set. Factors three, four, five, and six explained 10.7%, 6.8%, 5.7%, and 5.5% of the total variance of hypertension belief in the data set, respectively. Overall,

items loaded on the 6 factors for the HBAT explained 70.06% of the variation in hypertension belief in the data set (Table 3).

Factor Rotation

The rotated component matrix showed that items 1 to 4 strongly loaded on factor 1 with factor loadings ranging from 0.88 to 0.94, items 5 to 9 loaded on factor 2 with factor loadings ranging from 0.56 to 0.87, items 21 to 23 loaded on factor 3 with factor loadings ranging from 0.89 to 0.90, items 17 to 20 loaded on factor 4 with factor loading ranging from 0.48 to 0.90, items 10 to 13 loaded on factor 5 with factor loading ranging from 0.69 to 0.80, and items 14 to 16 strongly loaded on factor 6 with factor loading ranging from 0.81 to 0.84 (Table 4).

Labeling of Factors

Items within each factor of the pattern matrix were examined to label the factors. Factor 1 included four items to measure the health beliefs of participants regarding their susceptibility towards hypertension and labeled them as "perceived susceptibility". Factor 2 included 5 items to measure participants' health perception towards the health-related severity of hypertension and labeled as "perceived health-related severity of the disease". Factor 3 represented 3 items to measure participants' self-efficacy to prevent hypertension and labeled as "perceived self-efficacy". Factor 4 included 4 items to measure the health beliefs of participants about possible barriers to taking an appropriate measure and labeled as "perceived barriers to take action". Factor 5 labeled as "perceived socio-economic-related severity", participants' belief towards socio-economic consequences of the disease. Factor 6 included 3 items to measure the health belief of participants about the benefits of taking measure and labeled as "perceived benefits of taking action". The factors extracted were in agreement with the hypothesized theoretical groupings of the HBM. However, the EFA divided the perceived severity into two distinct sub-domains (perceived health-related and socio-economic-related severity).

Inter-Factor Correlations

The oblique promax rotation revealed that there was moderate correlation among factors, such as factor 2 with 4 (IFC = 0.328), factor 2 with 5 (IFC = 0.407), factor 2 with 6 (IFC = 0.431), factor 3 with 5 (IFC = 0.329), factor 4

Table 3 Total Variance Explained of the Health Belief Assessment Tool

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.037	26.247	26.247	6.037	26.247	26.247
2	3.490	15.172	41.420	3.490	15.172	41.420
3	2.469	10.736	52.156	2.469	10.736	52.156
4	1.557	6.771	58.927	1.557	6.771	58.927
5	1.307	5.684	64.610	1.307	5.684	64.610
6	1.254	5.451	70.061	1.254	5.451	70.061
7	0.845	3.672	73.733			
8	0.769	3.344	77.077			
9	0.711	3.090	80.167			
10	0.567	2.464	82.631			
11	0.504	2.191	84.822			
12	0.437	1.902	86.724			
13	0.424	1.845	88.568			
14	0.406	1.766	90.335			
15	0.343	1.493	91.828			
16	0.305	1.326	93.154			
17	0.290	1.262	94.417			
18	0.272	1.184	95.601			
19	0.250	1.087	96.687			
20	0.231	1.005	97.693			
21	0.196	0.853	98.546			
22	0.186	0.807	99.353			
23	0.149	0.647	100.000			
Extraction Method: Principal Component Analysis.						

with 5 (IFC = 0.442), factor 4 with 6 (IFC = 0.339), and factor 5 with 6 (IFC = 0.375).

Reliability Analysis
Inter-Item and Item-Total Correlations
The inter-item correlations ranged from 0.69 to 0.80 for perceived susceptibility of hypertensive disease; 0.37 to 0.64 for perceived health-related severity; 0.39 to 0.52 for perceived socio-economic related severity of the disease; 0.59 to 0.71 for the perceived benefit to take action; 0.43 to 0.67 for perceived barriers to take action; and 0.71 to 0.76 for perceived self-efficacy to take action. The corrected item-total correlations were all positive and ranged from 0.28 to 0.57, which means that the items were sufficiently related and contributed to scale measurement.

Internal Consistency Reliability
The Cronbach's α were calculated for the entire scale and the six sub-domains of the HBAT and found to be an appropriate tool to measure an individual's belief towards hypertension. The Cronbach's alpha coefficient was 0.85 for the entire scale. It was 0.92 for the perceived susceptibility; 0.78 for perceived health-related severity; 0.74 for perceived socio-economic-related severity; 0.86 for the perceived benefit of taking action; 0.81 for perceived barriers to take action; and 0.89 for self-efficacy to take action. There is no improvement in Cronbach's alpha coefficient if any of the items are deleted from the scale. Therefore, we would not want to remove any of the items (Table 5).

Construct Validity
In this study, the AVEs were above the cut-off value of 0.5 for all factors, ranging from 0.55 to 0.82. Hence, convergent validity had been established. The maximum shared variance, the squared of the inter-factor correlation, in any correlations between the two constructs were lower than the AVE in each factor indicated that discriminate validity

Table 4 Pattern Matrix Showing Factor Loadings for the Health Belief Assessment Tool

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Item 2	0.938					
Item 1	0.895					
Item 3	0.884					
Item 4	0.881					
Item 8		0.865				
Item 7		0.797				
Item 5		0.752				
Item 9		0.599				
Item 6		0.558				
Item 23			0.920			
Item 21			0.914			
Item 22			0.885			
Item 20				0.900		
Item 19				0.874		
Item 18				0.804		
Item 17				0.481		
Item 11					0.797	
Item 10					0.777	
Item 13					0.709	
Item 12					0.693	
Item 15						0.843
Item 16						0.840
Item 14						0.806

had been established. The correlations among the factors ranged from −0.038 to 0.442, which are less than 0.85 indicated factors, are distinct from each other (no multi-collinearity between the items). These indicators revealed that HBAT had good discriminant validity for all six factors.

Discussion

This validation study explored the health beliefs of the adult population towards hypertension in rural districts, northwest Ethiopia. The study revealed strong inter-items and item-to-total correlations within the sub-domains of the scale. The KMO sampling adequacy value (0.84) was found to be good. This was in agreement with the HBS for patients with hypertension (KMO = 0.78),[59] the Spanish version of CHBMS for breast cancer screening (KMO = 0.81),[63] the Mexican version of Health Belief Model Scale for breast self-examination (KMO = 0.84),[50] and Malaysian version of CHBMS for breast cancer screening (KMO = 0.87).[84] But, it was higher than the Chennai hypertension screening tool (KMO = 0.67)[62] and the Health Belief Model Questionnaire for promoting Breast Self-Examination (KMO = 0.69%),[51] which had fair sampling adequacy.

The EFA identified six sub-domains, namely Perceived susceptibility, Perceived health-related severity, Perceived socio-economic-related severity, Perceived benefit, Perceived barriers, and Self efficacy with excellent factor loadings except for item 17 (0.48) ("Lack of health information can prevent getting healthcare services"). The factor loadings ranged from 0.48 to 0.93, indicating that all items represented the same construct. It was consistent with the HBS for hypertensive patients (0.67–0.87)[59] and HBS for testicular cancer self-examination (0.37–0.89).[54] The absence of cross-loading items and the high loading of each item in each factor indicated that each item was strongly correlated with its corresponding factor.

The EFA also revealed that all the sub-domains in the scale explained 70.06% of the total variance in the data set. This finding was in agreement with the HBS for hypertensive patients (TVE = 72%)[59] and Health Belief Model Questionnaire for promoting Breast Self-Examination (TVE = 74.2%).[51] However, the TVE in this study was far better than validation studies conducted in Chennai urban community (TVE = 42.4%),[62] HBS for testicular cancer self-examination (TVE = 53.8%),[54] and the Spanish version CHBMS for breast cancer screening (TVE = 50.4%).[63]

Table 5 Internal Consistency Reliability of the Health Belief Assessment Tool

Sub Domain	Items	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha
Perceived Susceptibility	Item 1	0.304	0.851	0.92
	Item 2	0.300	0.852	
	Item 3	0.323	0.851	
	Item 4	0.278	0.852	
Perceived health-related severity	Item 5	0.429	0.846	0.78
	Item 6	0.373	0.849	
	Item 7	0.445	0.846	
	Item 8	0.361	0.849	
	Item 9	0.492	0.844	
Perceived socio-economic-related severity	Item 10	0.514	0.843	0.74
	Item 11	0.473	0.845	
	Item 12	0.334	0.849	
	Item 13	0.566	0.841	
Perceived benefit	Item 14	0.440	0.846	0.86
	Item 15	0.508	0.844	
	Item 16	0.424	0.847	
Perceived barrier	Item 17	0.475	0.845	0.81
	Item 18	0.522	0.843	
	Item 19	0.491	0.844	
	Item 20	0.433	0.846	
Self-efficacy	Item 21	0.394	0.848	0.89
	Item 22	0.410	0.847	
	Item 23	0.402	0.847	

The positive and significant correlations between some factors or constructs indicated a synergistic relationship between the sub-domains. Perceived health-related severity of hypertensive disease was positively correlated with the perceived barriers and benefits of taking action. Those individuals who have had positive beliefs about the health-related severity of the disease tend to have lower barriers to taking preventive action and higher perceived benefits of taking preventive action. There was also a positive correlation between the perceived socio-economic-related severity of the disease with the perceived barrier, benefit, and self-efficacy of taking action. Those individuals who have had positive beliefs towards the socio-economic-related severity of hypertensive disease tend to have lower barriers to taking preventive action, high perception of the benefits of taking preventive action, and high self-efficacy in performing hypertension screening.

The internal consistency reliability of the overall scale was found to be good with Cronbach's alpha value of 0.85.

This finding was in agreement with the HBS for hypertensive patients (Cronbach's α=0.79)[59] and the various versions of the CHBMS.[51,52,63,84–86] The internal consistency reliability for each sub-domain also showed good to excellent reliability (Cronbach's α= 0.74 to 0.92). This finding was also in agreement with the Greek Version of CHBMS (Cronbach's α=0.66 to 0.88),[52] the Indian version of CHBMS for breast self-examination (Cronbach's α=0.67 to 0.87),[53] the Malaysian version of CHBMS for breast cancer screening (Cronbach's α=0.716 to 0.879),[84] Iranian version (Cronbach's α=0.72 to 0.82),[86] Spanish version (Cronbach's α= 0.69, 0.83),[63] and HBS for Testicular Cancer Self-Examination (Cronbach's α=0.64–0.88).[54] However, it was higher than the HBS for hypertensive patients (Cronbach's α=0.52 to 0.69).[59] This might be due to the current validation study dividing the perceived severity of the disease into two distinct categories (perceived health-related and socio-economic-related severity).

Limitations of the Study

The study included only the rural population, and it was difficult to generalize to the urban adult population.

Conclusions

This study is the first to explore an individual's belief towards hypertension based on the HBM in rural settings of northwest Ethiopia. The HBAT found a valid and reliable instrument to evaluate the health beliefs related to hypertension for the general rural adult population. It is recommended that researchers can use this tool to measure the health beliefs of the adult population in rural settings. Healthcare providers can also use this tool to assess an individual's health beliefs towards hypertension and provide education and the support needed, based on the HBM for rural adults in Ethiopia. Further, a validation study is needed to evaluate the HBAT in the urban setting of the general population of the country.

Abbreviations

AVE, Average Variance Extracted; CHBMS, Champion's Health Belief Model Scale; HBAT, Hypertension Belief Assessment Tool; HBM, Health Belief Model; HBS Health Belief Scale; KMO, Kaiser– Meyer – Olkin Test; TVE, Total Variance Extracted.

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Author Contributions

All authors contributed significantly to the work reported, that is in the conception, study design, data collection, data analysis, and drafting or revising the article. The authors have agreed on the journal to which the article was submitted, gave final approval for the version to be published, and agreed to be accountable for all aspects of the work.

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