



Hypertension knowledge and its associated factors among hypertensive patients in primary care settings in Central Vietnam: A cross-sectional study

[Conocimiento de la hipertensión y sus factores asociados entre pacientes hipertensos en entornos de atención primaria en el centro de Vietnam: Un estudio transversal]

Ho Anh Hien^{1,2}, Nguyen Minh Tam¹, Dirk Devroey², Stefan Heytens³, Vo Tam⁴, Tran Binh Thang⁵, Vo Nu Hong Duc⁵, Dang Thi Thanh Nha⁵, Doan Pham Phuoc Long⁴, Nguyen Vu Phong⁶, Huynh Van Minh⁴, Hoang Anh Tien^{4,6*}

¹Department of Family Medicine, University of Medicine and Pharmacy, Hue University, Hue, Vietnam.

²Department of Family Medicine and Chronic Care, Faculty of Medicine and Pharmacy, Vrije Universiteit Brussel, Brussels, Belgium.

³Department of Public Health and Primary Care, Faculty of Medicine and Health Sciences, Ghent University, Ghent, Belgium.

⁴Department of Internal Medicine, University of Medicine and Pharmacy, Hue University, Hue, Vietnam.

⁵Faculty of Public Health, University of Medicine and Pharmacy, Hue University, Hue, Vietnam.

⁶Cardiovascular Center, Hue University of Medicine and Pharmacy Hospital, Hue, Vietnam.

*E-mail: hatien@hueuni.edu.vn

Abstract

Context: Hypertension is highly prevalent in Vietnam, yet the rate of controlled hypertension remains low. Knowledge about hypertension is linked to patient beliefs and medication adherence. However, there's limited data on hypertension knowledge among primary care patients in Vietnam.

Aims: To evaluate the knowledge of hypertension among hypertensive patients in primary care settings in Central Vietnam and identify factors affecting their knowledge.

Methods: A cross-sectional study was conducted, and a thorough examination was performed to assess hypertension knowledge and its related factors. Utilizing the Hypertension Knowledge Level Scale and Medication Adherence Report Scale, hypertension knowledge and medication adherence were evaluated. Additionally, demographic, clinical, lifestyle, and patient belief data were gathered. Statistical analyses and logistic regression models were applied to pinpoint key factors associated with hypertension knowledge.

Results: In the study involving 761 participants (55.7% male), the average hypertension knowledge score was 15.0 (SD = 4.6), with only 45.3% demonstrating a high level of knowledge. Significant correlations were observed between hypertension knowledge and variables such as education level, ethnicity, home blood pressure monitoring, patient beliefs, and medication adherence. Logistic regression analysis indicated that higher education levels and belonging to the majority ethnicity were linked to enhanced hypertension knowledge. Notably, individuals with better hypertension knowledge tended to recognize the necessity of their prescribed medications.

Conclusions: Hypertension knowledge among primary care patients in Central Vietnam is suboptimal, with approximately half having a high knowledge level. These findings emphasize the importance of hypertension knowledge in shaping patient beliefs, perceptions, and medication adherence. Tailored educational interventions are crucial, especially for those with lower education and minority backgrounds, to enhance hypertension management.

Keywords: blood pressure; hypertension knowledge; medication adherence.

Resumen

Contexto: La hipertensión tiene una alta prevalencia en Vietnam, pero la tasa de hipertensión controlada sigue siendo baja. El conocimiento sobre la hipertensión está vinculado a las creencias del paciente y la adherencia a la medicación. Sin embargo, hay datos limitados sobre el conocimiento de la hipertensión entre los pacientes de atención primaria en Vietnam.

Objetivos: Evaluar el conocimiento sobre la hipertensión entre pacientes hipertensos en entornos de atención primaria en el centro de Vietnam e identificar factores que afectan su conocimiento.

Métodos: Se realizó un estudio transversal y un examen exhaustivo para evaluar el conocimiento sobre la hipertensión y sus factores relacionados. Utilizando la Escala de Nivel de Conocimiento sobre Hipertensión y la Escala de Informe de Adherencia a la Medicación, se evaluaron el conocimiento sobre hipertensión y la adherencia a la medicación. Además, se recopilaron datos demográficos, clínicos, de estilo de vida y de creencias de los pacientes. Se aplicaron análisis estadísticos y modelos de regresión logística para identificar factores clave asociados con el conocimiento sobre la hipertensión.

Resultados: En el estudio que involucró a 761 participantes (55,7% hombres), la puntuación promedio de conocimiento sobre hipertensión fue de 15,0 (DE = 4,6), y solo el 45,3% demostró un alto nivel de conocimiento. Se observaron correlaciones significativas entre el conocimiento sobre la hipertensión y variables como el nivel educativo, el origen étnico, el control de la presión arterial en el hogar, las creencias de los pacientes y la adherencia a la medicación. El análisis de regresión logística indicó que los niveles de educación más altos y la pertenencia a la etnia mayoritaria estaban relacionados con un mayor conocimiento sobre la hipertensión. En particular, las personas con mejores conocimientos sobre hipertensión tendían a reconocer la necesidad de los medicamentos recetados.

Conclusiones: El conocimiento sobre hipertensión entre los pacientes de atención primaria en el centro de Vietnam es subóptimo, y aproximadamente la mitad tiene un alto nivel de conocimiento. Estos hallazgos enfatizan la importancia del conocimiento sobre la hipertensión a la hora de moldear las creencias, percepciones y la adherencia a la medicación de los pacientes. Las intervenciones educativas personalizadas son cruciales, especialmente para aquellos con menor educación y antecedentes minoritarios, para mejorar el manejo de la hipertensión.

Palabras Clave: adherencia a la medicación; conocimientos sobre hipertensión; presión arterial.

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AUTHOR INFO

ORCID: [0000-0002-9780-5328](https://orcid.org/0000-0002-9780-5328) (HAH)

[0000-0002-7406-9604](https://orcid.org/0000-0002-7406-9604) (HAT)

[0000-0002-8505-677X](https://orcid.org/0000-0002-8505-677X) (NMT)

[0000-0003-1097-4987](https://orcid.org/0000-0003-1097-4987) (SH)

[0000-0002-6083-2998](https://orcid.org/0000-0002-6083-2998) (DD)

[0000-0002-8179-4927](https://orcid.org/0000-0002-8179-4927) (TBT)

[0000-0002-8218-5197](https://orcid.org/0000-0002-8218-5197) (VNHD)

INTRODUCTION

Cardiovascular diseases (CVDs) have emerged as a substantial health burden in Vietnam, imposing an escalating challenge on the nation's healthcare system. Rapid urbanization, shifting lifestyles, and dietary habits have contributed to an increasing prevalence of cardiovascular risk factors, including hypertension, obesity, and diabetes. Consequently, the incidence of heart disease and stroke in Vietnam has been steadily on the rise. Cardiovascular diseases were estimated to account for a staggering 33% of all deaths (World Health Organization, 2014), with stroke emerging as the leading cause of mortality (Hoa et al., 2012). This concerning trend underscores the pressing need for heightened awareness, prevention strategies, and enhanced healthcare services to address the cardiovascular health crisis in Vietnam.

Hypertension stands as a critical and preventable contributor to cardiovascular diseases. Elevated blood pressure (BP) exerts sustained strain on the heart and blood vessels, significantly amplifying the risk of various cardiovascular conditions such as heart disease, stroke, and heart failure. It is worth noting that more than 1.13 billion people globally are afflicted by hypertension, rendering it a paramount global health concern (World Health Organization, 2013). Extensive research has repeatedly affirmed the strong association between hypertension and cardiovascular diseases, as exemplified by seminal studies like the Framingham Heart Study (Bitton and Gaziano, 2010). In Vietnam, the prevalence of hypertension has surged from 25.1% in 2008 to 33.8% in 2019 (Minh et al., 2021; Son et al., 2012). Despite this surge, the control of hypertension remains disconcertingly low, with adherence rates of 12.2% among all hypertensive individuals and 36.8% among those under treatment in 2015 (Hien et al., 2018). This emphasizes the imperative need for effective hypertension management and control, primarily through lifestyle modifications and appropriate medication usage, to alleviate the burden of preventable cardiovascular diseases.

Hypertension knowledge plays a pivotal role in medication adherence, as it equips patients to make informed decisions regarding their health. Understanding the risks associated with uncontrolled high BP, comprehending the benefits of prescribed medications, and being aware of potential side effects significantly increase the likelihood of patients adhering to their treatment regimens. A compelling study found that hypertensive patients with higher levels of knowledge regarding their condition demonstrated significantly improved compliance with their prescribed medications (Andrew et al., 2022; Jankowska-

Polańska et al., 2016). This link between knowledge and adherence is reinforced by the work of those who demonstrated that patients with limited health literacy and scant knowledge about hypertension exhibited lower rates of adherence. Furthermore, interventions designed to enhance patients' comprehension of hypertension, such as educational programs and counseling, have proven effective in boosting medication adherence. Collectively, the existing literature underscores the pivotal role of patient education and awareness in enhancing medication adherence among individuals with hypertension (Andrew et al., 2022; Cross et al., 2020).

However, limited information is available regarding the knowledge level among hypertensive patients in Vietnam, especially within primary care settings. Gaining a comprehensive understanding of this subject is crucial for healthcare providers, researchers, health planners, and policymakers. It provides valuable insights for developing interventional programs, guiding future research efforts, and implementing practical solutions in routine healthcare practices. The objective of this study is to assess the hypertension knowledge level among hypertensive patients in primary care settings in Central Vietnam and to identify associated risk factors.

MATERIAL AND METHODS

Study design and population

A cross-sectional study was designed to assess hypertension knowledge among hypertensive patients in Central Vietnam's primary care settings and identify associated risk factors. The research involved the use of data gathered from community health centers (CHCs) situated in three different provinces, namely, Lam Dong, Khanh Hoa, and Thua Thien Hue. This dataset was chosen to provide a representative sample of the overall patient population in Central Vietnam for the year 2022 (Vietnam Ministry of Health, 2023).

In each province, researchers designated one urban area and one rural area for inclusion in the study, ensuring a comprehensive representation of the province's demographic diversity. Furthermore, within these districts, two to four CHCs were randomly chosen to ensure an adequate pool of participants. The selection of potential participants, ranging from 50 to 70 individuals, was carried out using a random process, with individuals chosen at intervals of 5 from lists of hypertensive patients at these CHCs. The selection adhered to specific inclusion criteria. Eligible participants were individuals between the ages of 40

and 75 who had been diagnosed with primary hypertension. They represented diverse ethnic backgrounds and had been receiving treatment at the study site for a minimum of six months. Exclusion criteria were applied to exclude individuals with secondary hypertension, hypertension related to pregnancy, acute symptoms, or those with intellectual or cognitive impairments.

Sample size calculation

The data used in this study were derived from a previous study that examined medication adherence among hypertensive patients receiving care at CHCs in Central Vietnam. To determine the required sample size, reference was made to another study in Vietnam that reported a medication adherence rate of 49.8% (Nguyen et al., 2017). The sample size calculation aimed for a 5% margin of error and a study power of 99%. Based on these criteria, a sample of 660 eligible subjects was deemed necessary. To account for potential non-response, 792 patients were initially invited to participate. Ultimately, data analysis was conducted on a sample of 761 participants, resulting in a participation rate of 96.1%. The collected data was then utilized to analyze another objective of the study, which is to evaluate hypertension knowledge among hypertensive patients and identify associated risk factors influencing patients' knowledge.

Data collection

Selected participants were invited to visit their local CHCs in the morning. Each invitation letter provided precise information regarding the visit, including the schedule, location, and any dietary restrictions to be observed. Data collection was conducted through the administration of a semistructured questionnaire. Firstly, participants were asked about their demographic characteristics, including age, gender, residence, ethnicity, educational level, occupation, history of CVD, family history of CVD, number of antihypertensive medications, home BP monitor, health insurance status, time since hypertension diagnosis and personal behaviors such as smoking, dietary habits (salty and healthy diet), alcohol use, and physical activity. Subsequently, participants were interviewed regarding their knowledge of hypertension, beliefs about medication, perception of hypertension, and adherence to hypertension treatment. Secondly, anthropometric measurements such as height, weight, and BP levels were recorded. Lastly, blood cholesterol levels were collected for analysis.

Variables measurements

Demographic information, personal and family medical history related to hypertension, and patient behaviors were comprehensively documented during the data collection process. Age was classified into two groups (40-59 and ≥ 60). The residences of participants were in urban and rural areas. Education levels were categorized into three tiers: (1) low, indicating less than six years of formal schooling; (2) middle, representing individuals with six to nine years of schooling; and (3) high, indicating more than nine years of formal education. Current smokers were defined as individuals who were actively using tobacco products or had quit smoking for less than 12 months (World Health Organization, 2005). Excessive alcohol consumption was identified as men who consumed more than 14 standard units per week and women who consumed more than seven standard units per week (World Health Organization, 2005). Assessment of a salty diet relied on patients' self-perception, determined through the question: "Do you believe that you consume a higher amount of salty food compared to others in your community?". Adequate intake of fruits and vegetables (healthy diet) was characterized by the consumption of a minimum of five servings each day, while physical inactivity was attributed to individuals engaging in less than 600 MET/min/week of physical activity (World Health Organization, 2005). Body Mass Index (BMI) was computed as the ratio of weight (in kilograms) to the square of height (in meters), classified according to the Asia-Pacific standard (World Health Organization, 2000). For physical measurements of the patients, we employed specific tools and procedures. Body weight was recorded using a digital scale, which provided measurements to the nearest 0.1 kg. Height measurements were taken using a Telescopic Measuring Rod, ensuring precision to the nearest 0.1 cm. All height measurements were conducted with participants in a standing position to maintain consistency and accuracy across measurements. BP measurements were taken on three occasions, with a minimum interval of 3 minutes, while participants were seated and in a resting state. This was carried out using automatic sphygmomanometers (OMRON HEM 9210T, Omron Healthcare, Tokyo, Japan) equipped with appropriately sized cuffs, following a standardized measurement protocol. The analysis relied on calculating the average of the last two measurements (Van Minh et al., 2022).

Hypertension knowledge

The Hypertension Knowledge Level Scale (HK-LS) (Erkoc et al., 2012) was employed to assess patients' knowledge of hypertension. This instrument consists

of 22 items distributed across six subdimensions. Thirteen items contained correct statements (Items 1, 2, 3, 5, 12, 13, 15, 16, 18, 19, 20, 21, 22). Participants received one point for each correct answer, while incorrect statements were scored inversely on the other items. The total scale had a maximum score of 22, with subdimension scores of 2 for "definition," 4 for "medical treatment," 4 for "drug compliance," 5 for "lifestyle," 2 for "diet," and 5 for "complications," respectively. The lowest possible score was zero for the entire scale and each subdimension. Higher scores indicated a greater level of hypertension knowledge. The median of this score is 16, so a cut-off point of 16 was used to separate two groups: the low knowledge group from 0 to 16 and the high knowledge group from 17 to 22. This tool has demonstrated high validity and reliability in previous studies (Zinat Motlagh et al., 2015).

Medication adherence

The primary focus of this study was to assess patient medication adherence, which was evaluated using the 5-item version of the self-report Medication Adherence Report Scale (MARS-5) (Chan et al., 2020; Stone et al., 2021). The study's primary outcome variable was derived from the total score on the MARS-5. In this study, scores ranging from 5 to 23 were considered indicative of non-adherence, while scores of 24 to 25 were classified as adherent.

Patient's beliefs about medicines

Patients' beliefs regarding hypertension medications were assessed using the Beliefs About Medicines Questionnaire (BMQ), specifically the adapted Vietnamese version (Horne et al., 1999; Nguyen et al., 2019). The BMQ comprises eighteen items, further organized into two distinct sections: the BMQ-Specific, aimed at gauging patients' beliefs concerning the medication prescribed for their personal use, and the BMQ-General, which delves into broader beliefs about medication in general. The BMQ-Specific consists of two subscales: Necessity and Concern, each containing five questions. In contrast, the BMQ-General is divided into two subscales: Overuse and Harm, with each encompassing four questions.

Patient's perception of hypertension

Patients' perceptions of their hypertension were assessed using the Brief Illness Perception Questionnaire, specifically the adapted Vietnamese version (B-IPQ) (Broadbent et al., 2006; Nguyen et al., 2019). The B-IPQ comprises eight distinct items that provide valuable insights into patients' perceptions of their condition, including Consequences, Timeline, Personal control, Treatment control, Identity, Illness concern,

Understanding, Emotional response. Each of these items is scored on a scale ranging from 0 to 10, enabling a comprehensive evaluation of patients' perceptions and attitudes towards their hypertension. In our study, the Cronbach's alpha coefficient for the B-IPQ (total score) was calculated to be 0.87.

The translation process for the HK-LS, BMQ, B-IPQ, and MARS-5 questionnaires adhered to the five-stage guideline established by Beaton et al. (2000). Two bilingual individuals and two medical doctors conducted both forward and backward translations of the questionnaires. They independently translated the original English measures into Vietnamese and subsequently merged these translations into a unified Vietnamese version. Following this, two additional bilingual translators performed a backward translation, converting the Vietnamese version back into English for validation. To assess the clarity and comprehensiveness of the final Vietnamese translations, a pilot trial was conducted involving 30 candidates. The results from this pilot study demonstrated that all questionnaires were clear and easily understood by the participants. Furthermore, the Cronbach's alpha coefficient for the HK-LS in this study was calculated to be 0.83. The Cronbach's alpha coefficient for the MARS-5 and B-IPQ was also calculated to be 0.87. Additionally, the Cronbach's alpha coefficients for the BMQ-Specific scales (Necessity and Concern) were 0.85 and 0.77, respectively, while for the BMQ-General scales (Overuse and Harm), the Cronbach's alpha coefficients were 0.63 and 0.68, respectively.

Survey teams were composed of both medical professionals and medical students at the University of Medicine and Pharmacy, Hue University, in collaboration with local primary healthcare personnel. All members of the research team, comprising principal investigators and supporting staff, underwent comprehensive training, which familiarized them with the precise objectives of the study and equipped them with the requisite tools and research methodologies. The survey was conducted over a period of four months, spanning from March to June in the year 2023.

Ethical approval

Medical ethics for this research was granted by the University of Medicine and Pharmacy, Hue University, with reference number H2023/027. Additionally, approvals were secured from the health departments of the three respective provinces: Thua-Thien Hue, Khanh Hoa, and Lam Dong. In adherence to ethical norms, the study's objectives and procedures were thoroughly explained to all potential participants, and their written informed consent was obtained before their involvement in the research.

Statistical analysis

A series of statistical analyses were conducted to evaluate the level of hypertension knowledge and associated risk factors in hypertensive patients with CHCs in Central Vietnam. All analyses followed a two-sided approach, with statistical significance defined as $p < 0.05$. Continuous variables were compared using either the t-test or the Mann-Whitney U test, depending on the ordinal assumptions of the data. Categorical variables underwent assessment using the chi-square test. Additionally, multivariate logistic regression analysis was performed to delve into the factors influencing patients' knowledge. The variables under examination included gender, age, ethnicity, insurance coverage, home BP monitoring, occupation, education level, duration of hypertension since diagnosis, and beliefs assessed through BMQ. These variables had previously shown significant associations in the univariate analysis, with p values less than 0.05.

Data collection was conducted using Epidata entry software (version 3.1, Epidata Association, Denmark) to ensure accuracy. For descriptive, analytical, and multivariate logistic regression analyses, SPSS 27.0 (SPSS Inc., Chicago, IL, USA) was employed. Internal

consistency within the BMQ, MARS-5, and HK-LS was assessed using Cronbach's α , with an α value exceeding 0.7, indicating strong intercorrelation within the respective subscales.

RESULTS

Table 1 offers a comprehensive overview of the demographic and clinical characteristics of patients, categorized based on their level of hypertension knowledge. Notably, only 45.3% of patients demonstrated a high level of knowledge regarding hypertension. Within the high knowledge level group, there was a higher prevalence in urban areas (51.9% vs. 44.0%, $p=0.03$). Similar patterns were observed among patients belonging to the ethnic majority, those with a high level of education, individuals conducting home BP monitoring, and those with coronary heart disease, diabetes, or a family history of CVDs. Importantly, patients with a high level of hypertension knowledge exhibited greater adherence to treatment regimens. Conversely, no significant differences were detected in terms of age group, gender, occupation, number or class of antihypertensive medications, or patient behaviors across the various knowledge levels in this study.

Table 1. Demographic and clinical characteristics of patients stratified by hypertension knowledge level.

Characteristics	Hypertension knowledge level			p-value
	Total n (%)	Low n (%)	High n (%)	
	761 (100)	416 (54.7)	345 (45.3)	
Age group				
40-59	242 (31.8)	129 (31.0)	133 (32.8)	0.61
≥60	519 (68.2)	287 (69.0)	232 (67.2)	
Gender				
Man	337 (44.3)	187 (45.0)	150 (43.5)	0.68
Woman	424 (55.7)	229 (55.0)	195 (56.5)	
Residence				
Urban	362 (47.6)	183 (44.0)	179 (51.9)	0.03
Rural	399 (52.4)	233 (66.0)	166 (48.1)	
Ethnicity				
Ethnic Majority (Kinh)	704 (92.5)	369 (88.7)	335 (97.1)	<0.001
Ethnic Minorities	57 (7.5)	47 (11.3)	10 (2.9)	
Educational level				
Primary school or under	240 (31.5)	176 (42.3)	64 (18.6)	<0.001
Middle or High school	227 (29.8)	110 (26.4)	117 (33.9)	
College or University	294 (38.6)	130 (31.3)	164 (47.5)	

Table 1. Demographic and clinical characteristics of patients stratified by hypertension knowledge level (continued...)

Characteristics	Hypertension knowledge level			p-value
	Total n (%)	Low n (%)	High n (%)	
	761 (100)	416 (54.7)	345 (45.3)	
Occupation				
Manual Worker	510 (67.0)	277 (66.6)	233 (67.5)	0.07
Governmental Staff	47 (6.2)	19 (4.6)	28 (8.1)	
Retired People	204 (26.8)	120 (28.8)	84 (24.3)	
Body mass index				
Underweight	33 (4.3)	26 (6.3)	7 (2.0)	0.024
Normal Weight	393 (51.6)	218 (52.4)	175 (50.7)	
Overweight	167 (21.9)	87 (23.3)	80 (21.9)	
Obesity	168 (22.1)	85 (20.4)	83 (24.1)	
History of stroke				
Yes	57 (7.5)	30 (7.2)	27 (7.8)	<0.001
No	680 (89.4)	364 (87.5)	316 (91.6)	
Unknown	24 (3.2)	22 (5.3)	2 (0.6)	
History of coronary heart diseases				
Yes	64 (8.4)	28 (6.7)	36 (10.4)	0.009
No	540 (71.0)	287 (69.0)	253 (73.3)	
Unknown	157 (20.6)	101 (24.3)	56 (16.2)	
History of diabetes				
Yes	110 (14.5)	44 (10.6)	66 (19.1)	<0.001
No	544 (71.5)	301 (72.4)	243 (70.4)	
Unknown	107 (14.1)	71 (17.1)	36 (10.4)	
Family history of cardiovascular diseases				
Yes	336 (44.2)	158 (38.0)	178 (51.6)	<0.001
No	365 (48.0)	209 (50.2)	156 (45.2)	
Unknown	60 (7.9)	49 (11.8)	11 (3.2)	
Numbers of antihypertensive medication				
1	607 (79.8)	343 (82.5)	264 (76.5)	0.11
2	139 (18.3)	65 (15.6)	74 (21.4)	
3	15 (2.0)	8 (1.9)	7 (2.0)	
Home BP monitor (Yes)	351 (46.1)	156 (37.5)	195 (56.5)	<0.001
Health insurance (Yes)	732 (96.2)	389 (93.5)	343 (99.4)	<0.001
Smoking (Yes)	176 (23.1)	104 (25.0)	72 (20.9)	0.08
Salty diet (Yes)	207 (27.2)	107 (25.7)	100 (29.0)	0.31
Healthy diet (Yes)	479 (62.9)	256 (61.5)	223 (47.9)	0.37
Excessive alcohol use (Yes)	21 (2.8)	13 (3.1)	8 (2.3)	0.49
Physical inactivity (Yes)	467 (61.4)	250 (60.1)	217 (62.9)	0.43
Medication adherence (Yes)	383 (50.3)	180 (43.3)	203 (58.8)	<0.001
Time since diagnosis (Years, Mean \pm SD)	5.8 (5.1)	5.3 \pm 4.7	6.5 \pm 5.5	0.001

Table 2. Number (proportions) of correct answers to HK-LS items in the two hypertension knowledge level groups.

Items	Hypertension knowledge level			p-value
	Total n (%)	Low n (%)	High n (%)	
1. Increased diastolic BP also indicates increased BP.	259 (34.0)	88 (21.2)	171 (49.6)	<0.001
2. High diastolic or systolic BP indicates increased BP.	337 (44.3)	126 (30.3)	211 (61.2)	<0.001
3. Drugs for increased BP must be taken every day.	679 (89.2)	336 (80.8)	334 (99.4)	<0.001
4. Individuals with increased BP must take their medication only when they feel ill.	465 (61.1)	180 (43.3)	285 (82.6)	<0.001
5. Individuals with increased BP must take their medication throughout their life.	620 (81.5)	285 (68.5)	335 (97.1)	<0.001
6. Individuals with increased BP must take their medication in a manner that makes them feel good.	104 (13.7)	61 (14.7)	43 (12.5)	0.38
7. If the medication for increased BP can control BP, there is no need to change lifestyle.	358 (47.0)	113 (30.8)	230 (66.7)	<0.001
8. Increased BP is the result of aging, so treatment is unnecessary.	522 (68.6)	209 (40.2)	313 (90.7)	<0.001
9. If individuals with increased BP change their lifestyles, there is no need for treatment.	460 (60.4)	162 (38.9)	298 (86.4)	<0.001
10. Individuals with increased BP can eat salty foods as long as they take their drugs regularly.	568 (74.6)	240 (57.7)	328 (95.1)	<0.001
11. Individuals with increased BP can drink alcoholic beverages.	596 (78.3)	279 (67.1)	317 (91.9)	<0.001
12. Individuals with increased BP must not smoke.	477 (62.7)	228 (54.8)	249 (72.9)	<0.001
13. Individuals with increased BP must eat fruits and vegetables frequently.	685 (90.0)	348 (83.7)	337 (97.7)	<0.001
14. For individuals with increased BP, the best cooking method is frying.	587 (77.1)	258 (62.0)	329 (95.4)	<0.001
15. For individuals with increased BP, the best cooking method is boiling or grilling.	640 (84.1)	308 (74.0)	332 (96.2)	<0.001
16. The best type of meat for individuals with increased BP is white meat.	501 (65.8)	206 (49.5)	295 (85.5)	<0.001
17. The best type of meat for individuals with increased BP is red meat.	461 (60.6)	190 (45.7)	271 (78.6)	<0.001
18. Increased BP can cause premature death if left untreated.	642 (84.4)	304 (73.1)	338 (98.0)	<0.001
19. Increased BP can cause heart diseases, such as heart attack, if left untreated.	635 (83.4)	294 (70.7)	341 (98.8)	<0.001
20. Increased BP can cause strokes if left untreated.	663 (87.1)	320 (76.9)	343 (99.4)	<0.001
21. Increased BP can cause kidney failure if left untreated.	554 (72.8)	235 (56.5)	319 (92.5)	<0.001
22. Increased BP can cause visual disturbances, if left untreated.	552 (72.5)	228 (54.8)	424 (93.9)	<0.001

Table 2 provides a breakdown of the proportion of correct responses to each item within the HK-LS questionnaire. Notably, only seven out of the twenty-two items (items 3, 5, 13, 15, 18, 19, and 20) garnered more than 80% correct responses. It was worth highlighting that patient with a high level of knowledge consistently provided correct answers significantly more frequently than their counterparts with a low knowledge level ($p < 0.001$). Conversely, item 6 stood out with the lowest proportion of correct responses at 13.7%, and interestingly, no significant difference was

observed in the proportion of correct answers between the two knowledge groups ($p = 0.38$).

The mean total score of hypertension knowledge was found to be relatively modest, with an average of 15.0 and a standard deviation of 4.6. Notably, the mean score in the group characterized by high knowledge significantly exceeded that of the group with low knowledge ($p < 0.001$). This observed trend was consistent across all six domains of hypertension knowledge as assessed by the HK-LS instrument. Specifically, the definition domain exhibited the low-

est score, while the domains pertaining to medical treatment and drug compliance displayed scores notably above the overall average. Remarkably, the lifestyle and complication domains yielded the highest scores, as explained in Table 3.

Table 4 showed the potential impact of hypertension knowledge on individuals' perceptions of medication (BMQ specific and BMQ general) that indicating that all factors were significantly associated with the level of knowledge. Table 4 also highlighted the significant influence of hypertension knowledge on multiple dimensions of participants' perceptions,

encompassing their understanding of consequences, timeline, personal control, treatment control, illness concerns, and understanding regarding hypertension except for identity and emotional response ($p > 0.05$).

In the logistic regression analysis, Table 5 presented the influence of various predictor variables on hypertension knowledge. Notably, women exhibited 1.47 times higher odds of possessing hypertension knowledge compared to men with 95%CI (1.04-2.08). The majority ethnic group displayed 2.60 times higher odds of hypertension knowledge in comparison to minority ethnic groups with 95%CI (1.19-5.67).

Table 3. Mean and standard of correct answers to HK-LS domains in the two hypertension knowledge level groups.

HK-LS questionnaire domains	Total (Mean \pm SD)	Low knowledge (Mean \pm SD)	High knowledge (Mean \pm SD)	p-value
Definition (0-2)	0.8 \pm 0.9	0.5 \pm 0.7	1.1 \pm 0.8	<0.001
Medical treatment (0-4)	2.4 \pm 1.0	2.0 \pm 1.0	2.9 \pm 0.5	<0.001
Drug compliance (0-4)	2.5 \pm 1.3	1.7 \pm 1.2	3.4 \pm 0.7	<0.001
Lifestyle (0-5)	3.9 \pm 1.3	3.4 \pm 1.4	4.5 \pm 0.6	<0.001
Diet (0-2)	1.3 \pm 0.8	0.9 \pm 0.8	1.6 \pm 0.5	<0.001
Complication (0-5)	4.0 \pm 1.6	3.3 \pm 1.8	4.8 \pm 0.5	<0.001
Total (0-22)	15.0 \pm 4.6	12.0 \pm 3.9	18.4 \pm 1.2	<0.001

Table 4. Patient beliefs and illness perception by hypertension knowledge level.

Items/Domain	Hypertension knowledge level			p-value
	Total (Mean \pm SD)	Low (Mean \pm SD)	High (Mean \pm SD)	
BMQ specific				
<i>Necessity</i> (5-25)	18.3 \pm 3.8	17.4 \pm 4.1	19.5 \pm 3.1	<0.001
<i>Concern</i> (5-25)	14.4 \pm 3.8	14.8 \pm 3.8	13.9 \pm 3.8	0.001
BMQ general				
<i>Overuse</i> (4-16)	10.8 \pm 2.6	11.1 \pm 2.7	10.4 \pm 2.5	0.001
<i>Harm</i> (4-16)	9.9 \pm 2.8	10.3 \pm 2.8	9.5 \pm 2.9	<0.001
Brief IPQ (0-80)				
<i>B-IPQ1. Consequences</i>	6.7 \pm 2.7	6.2 \pm 2.6	7.3 \pm 2.6	<0.001
<i>B-IPQ2. Timeline</i>	8.3 \pm 2.3	7.9 \pm 2.4	8.9 \pm 1.9	<0.001
<i>B-IPQ3. Personal control</i>	6.9 \pm 2.3	6.5 \pm 2.3	7.4 \pm 2.3	<0.001
<i>B-IPQ4. Treatment control</i>	8.2 \pm 1.9	7.7 \pm 2.1	8.7 \pm 1.6	<0.001
<i>B-IPQ5. Identity</i>	5.6 \pm 2.6	5.6 \pm 2.5	5.7 \pm 2.7	0.36
<i>B-IPQ 6. Illness concern</i>	8.3 \pm 2.1	7.2 \pm 2.5	8.5 \pm 1.6	<0.001
<i>B-IPQ 7. Understanding</i>	7.0 \pm 2.5	6.3 \pm 2.6	7.8 \pm 2.0	<0.001
<i>B-IPQ 8. Emotional response</i>	5.8 \pm 2.9	5.6 \pm 2.7	6.0 \pm 3.0	0.09

Table 5. Factors associated with hypertension knowledge. Logistic regression analysis results for patients.

Predictor variable	Odds ratio	95% Confidence interval (CI)	p-value	
Gender (Women vs. Men)	1.47	1.04 - 2.08	0.029	
Ethnicity (Majority vs. Minority)	2.60	1.19 - 5.67	0.016	
Age group (≥ 60 vs. < 60)	0.83	0.57 - 1.20	0.33	
Health Insurance (Yes vs. No)	4.33	0.96 - 19.5	0.87	
Home BP monitoring (Yes vs. No)	1.12	0.60 - 2.09	0.72	
History of stroke	Yes (Ref)			
	No	1.26	0.66 - 2.04	0.48
	Unknown	0.40	0.07 - 2.20	0.29
History of CHDs	Yes (Ref)			
	No	0.96	0.51 - 1.82	0.91
	Unknown	0.86	0.41 - 1.81	0.69
History of diabetes	Yes (Ref)			
	No	0.70	0.43 - 1.14	0.15
	Unknown	0.71	0.35 - 1.44	0.34
Family history of CVDs	Yes (Ref)			
	No	1.02	0.72 - 1.46	0.89
	Unknown	1.12	0.14 - 0.70	0.005
Educational level	Low level (Ref)			
	Middle level	2.60	1.65 - 4.08	< 0.001
	High level	3.60	2.30 - 5.65	< 0.001
Time of diagnosis	1.02	0.99 - 1.05	0.22	
BMQ-Specific necessity	1.18	1.12 - 1.24	< 0.001	
BMQ-Specific concern	0.94	0.90 - 0.99	0.023	
BMQ-General overuse	1.00	0.92 - 1.05	0.98	
BMQ-General harm	0.99	0.92 - 1.06	0.71	

Additionally, higher educational levels (middle and high level) were linked to significantly greater odds of outcome when contrasted with lower educational levels (Low) with odds ratio and 95%CI: 2.60 (1.65-4.08), and 3.60 (2.30-5.65), respectively. Moreover, "BMQ-Specific necessity" and "BMQ-Specific concern" both endeavored significant effects on the outcome ($p < 0.001$ and $p = 0.023$, respectively). Specifically, elevated scores in the "necessity" domain increase the odds of achieving the desired outcome, whereas higher scores in the "Concern" domain reduce these odds.

DISCUSSION

Hypertension knowledge level

This research investigates hypertension knowledge among hypertensive patients in CHCs and explores its associations with various influencing factors among 761 participants in Central Vietnam,

offering significant information for healthcare practice and management. The mean hypertension knowledge score assessed by HK-LS was relatively low, with a mean of 15 ± 4.6 . Notably, the High Knowledge group (18.4 ± 1.2) displayed significantly higher knowledge levels compared to the Low Knowledge group (12.0 ± 3.9), with a $p < 0.001$. This outcome aligns with findings from a study involving Polish hypertensive patients, where the High Knowledge group scored 19.1 ± 1.1 and the Low Knowledge group scored 13.7 ± 3.7 (Jankowska-Polańska et al., 2016).

Furthermore, the specific domains of the HK-LS revealed interesting insights. The mean scores for the Complication and Lifestyle domains were relatively high, standing at 4.0 ± 1.6 and 3.9 ± 1.3 , respectively. However, the mean scores for the Definition, Treatment, and Drug Compliance domains were notably lower at 0.8, 2.4, and 2.5, respectively. This discrepancy can be attributed to particular misconceptions and misunderstandings among hypertensive patients. For

instance, some participants were not aware that an increase in diastolic BP also indicates elevated overall BP. Additionally, certain individuals believed that taking their medication only when it made them feel good was sufficient. Moreover, there were mistaken opinions, such as the belief that if medication effectively controls increased BP, there is no need to make lifestyle changes, or that altering one's lifestyle negates the necessity for treatment. Addressing these misconceptions and emphasizing these critical points is essential in daily practice to ensure that hypertensive patients have a clearer understanding of the condition and its management.

In this study, nearly 55% of individuals demonstrated a high level of hypertension knowledge. This proportion was higher than that observed in Polish (36.9%) and Irian (25.1%) hypertensive patients (Janowska-Polańska et al., 2016; Zinat Motlagh et al., 2015). However, it's important to note that a cutoff point of 16 was used to distinguish between the two knowledge groups in this study, whereas the previous study utilized a cutoff point of 17. The prevalence of low hypertension knowledge among hypertensive patients is not limited to developing countries; it's also prevalent in developed countries. This underscores the significance of addressing this issue as a long-term strategy to enhance the quality of care for hypertensive patients.

Factors associated with hypertension knowledge

Patients from the Kinh ethnic group exhibited markedly higher levels of hypertension knowledge compared to those from minority groups. Furthermore, patients with a higher level of education displayed significantly elevated levels of hypertension knowledge. This relationship can be attributed to the advantages that higher education affords individuals, equipping them with the skills, resources, and knowledge necessary for comprehending and managing their health, particularly regarding conditions like hypertension. Higher education fosters health literacy, enhances critical thinking abilities, and bolsters the capacity to access and effectively utilize health information. Conversely, minority populations in Vietnam, comprising approximately 15% of the population, equivalent to roughly 15 million individuals, remain in disadvantageous circumstances marked by low socioeconomic conditions and limited access to healthcare resources (General Statistics Office of Vietnam, 2019). This emphasizes the pressing need for sustainable solutions to enhance hypertension management within this population.

In the High Knowledge group, a significantly larger proportion of hypertensive patients had access to BP monitor equipment and engaged in home BP mon-

itoring when compared to the Low Knowledge group, with a $p < 0.001$. This observation suggests that home BP monitoring is linked to increased hypertension knowledge. The practice of home BP monitoring encourages individuals to actively participate in their healthcare, motivating them to seek out information and fostering regular interactions with healthcare providers. These interactions contribute to an improved understanding of hypertension and its management. Many hypertension associations have recommended the use of home BP monitoring to enhance medication adherence and achieve better BP control (Ihm et al., 2022; Van Minh et al., 2022). This underscores the importance of raising awareness about the benefits of home BP monitoring for effective hypertension management.

The prevalence of medication adherence, as measured by MARS-5, was found to be 50.3% in this study. Notably, within the High Knowledge group, the proportion was significantly higher at 58.8%, as opposed to the Low Knowledge group, where it was 43.3%, with a $p < 0.001$. These results once again underscore the strong association between hypertension knowledge and medication adherence, aligning with previous research. Numerous studies have shown that when patients possess a solid understanding of hypertension, encompassing its causes and potential complications, they are more inclined to appreciate the critical nature of managing their BP. This heightened awareness serves as a motivating factor for adhering to their prescribed medication regimen. Moreover, enhancing hypertensive patients' knowledge not only bolsters their comprehension of the condition and its treatment but also reinforces the significance of medication adherence (Dhar et al., 2017; Náfrádi et al., 2017). This improved understanding empowers patients to adopt a proactive stance toward their health, minimizing misconceptions and promoting collaborative efforts with healthcare providers. Consequently, this collaborative approach yields better control of BP and overall health outcomes.

The impact of hypertension knowledge on patient beliefs and perceptions

The relationship between hypertension knowledge and patient beliefs, as measured by the BMQ, is closely intertwined. This study demonstrates that participants in the High Knowledge group consistently achieve significantly higher mean BMQ scores than those in the Low Knowledge group. Notably, the Low Knowledge group exhibits a slightly higher mean BMQ-S Concern score in comparison to the High Knowledge group. Hypertension knowledge is instrumental in guiding patient beliefs and behaviors. When patients possess a strong grasp of hyperten-

sion, including its causes and potential complications, they are better equipped to comprehend the critical importance of BP control through medication. This heightened understanding reinforces their belief in the necessity of adhering to their prescribed medications (Świątoniowska-Lonc et al., 2021; Thomson et al., 2020).

Conversely, patients with lower hypertension knowledge may harbor more concerns or questions about their medication. Insufficient comprehension can breed doubt and apprehension about potential side effects or harm linked to their medication, as reflected in the BMQ-Specific Concern domain. Additionally, patients with lower hypertension knowledge may express heightened concerns about overusing their medication, possibly due to misconceptions about its purpose and a fear of dependency. Enhancing hypertension knowledge can have a positive ripple effect on patients' beliefs, potentially leading to improved medication adherence and better BP control (Świątoniowska-Lonc et al., 2021; Thomson et al., 2020). It is paramount for healthcare providers to address patients' concerns and provide education to bolster their understanding of hypertension and its treatment.

Moreover, hypertension knowledge exerts a substantial influence on patients' perceptions of their condition, as assessed by B-IPQ. These findings underscore that hypertensive patients with higher knowledge levels tend to score significantly higher on various aspects of the B-IPQ, particularly in the domains of Consequences, Timeline, Personal Control, Treatment Control, and understanding regarding hypertension. Patients equipped with a deeper understanding of hypertension perceive it as a serious yet manageable condition. They are more inclined to believe in their capacity to control it through the judicious use of medication, lifestyle adjustments, and diligent monitoring. Healthcare providers assume a pivotal role in educating patients to enhance their hypertension knowledge, thereby fostering more informed, positive, and empowered perceptions of the condition (Thomson et al., 2020). This, in turn, influences their overall approach to managing hypertension and optimizing health outcomes.

Limitations and implications

This study's limitations should be considered when interpreting the results. Participants in this study were recruited from the community health center, and while they represent a specific segment of the population, they may not fully reflect the broader population. This potential selection bias could arise if individuals with varying levels of hypertension knowledge were more or less inclined to participate.

The cross-sectional nature of the study provides a snapshot of the population at a single point in time. Consequently, establishing a direct causality between hypertension knowledge and outcomes such as patients' beliefs, perceptions, or adherence can be challenging. Furthermore, self-reporting by participants may introduce recall bias. To mitigate these limitations, several strategies were implemented. The data collection team received thorough training to ensure consistent and accurate data collection. Efforts were made to create a comfortable and non-judgmental environment for participants during the survey. Additionally, the random sampling method was employed, selecting individuals at regular intervals from lists of hypertensive patients. As a result, the study achieved a high response rate of 96.1%, enhancing the representativeness of the sample and reducing the potential for selection bias.

Despite these limitations, this study provides valuable insights into hypertension knowledge among hypertensive patients in primary care settings. It emphasizes the need for tailored educational interventions, particularly for individuals with lower educational levels and from minority backgrounds. Healthcare providers should promote home BP monitoring to enhance self-management. Employing a patient-centered approach can bridge the knowledge-belief gap by addressing patients' concerns and misconceptions about hypertension and its treatment, ultimately improving health outcomes. Given the high prevalence of low hypertension knowledge, a long-term strategy is imperative to enhance patient understanding. Public health authorities and healthcare organizations should contemplate implementing public awareness campaigns and educational initiatives to enhance overall hypertension knowledge at the community level. These findings suggest practical implications for healthcare providers, policy-makers, and researchers in addressing low hypertension knowledge to enhance medication adherence and hypertension management.

CONCLUSION

Hypertension knowledge among hypertensive patients in primary care settings in Central Vietnam is suboptimal, with nearly half classified as having a High Knowledge level. This study has revealed significant associations between hypertension knowledge and various factors, including educational level, ethnicity, home BP monitoring, patient beliefs, and medication adherence. These findings emphasize the vital role of hypertension knowledge in shaping patient beliefs, perceptions, and medication adherence. To enhance hypertension management in primary care settings, it is imperative to implement tailored educa-

tional interventions, with a focus on individuals with lower educational levels and from minority backgrounds. Additionally, promoting home BP monitoring and adopting a patient-centered approach are crucial steps toward improving patient outcomes and ultimately elevating the quality of hypertension care.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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AUTHOR CONTRIBUTION:

Contribution	Hien HA	Tam NM	Devroey D	Heytens S	Tam V	Thang TB	Duc VNH	Nha DTT	Long DDP	Phong NV	Minh HV	Tien HA
Concepts or ideas	x	x	x	x	x	x					x	x
Design	x	x	x	x	x	x					x	x
Definition of intellectual content	x	x	x	x	x	x	x	x	x	x	x	x
Literature search	x	x	x	x	x	x	x	x	x	x	x	x
Experimental studies	x	x				x	x	x	x	x		x
Data acquisition	x					x	x	x	x	x		x
Data analysis	x	x				x					x	x
Statistical analysis	x	x				x					x	x
Manuscript preparation	x	x										x
Manuscript editing			x	x	x						x	
Manuscript review	x	x	x	x	x	x	x	x	x	x	x	x

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