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Research Article

Health Seeking Behavior and Medication Adherence of Hypertensive Patients in Erbil City: A Cross-Sectional Study

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Abstract

Background: Hypertension is a serious public health problem globally. Many patients don't adhere to the treatment plan, even though treatment is freely available. ***Objective***: To assess health-seeking behavior and drug adherence of a group of hypertensive patients. ***Methods***: 400 hypertensive patients participated in a cross-sectional study done in Erbil, Kurdistan region, Iraq. Data were gathered through face-to-face interviews using a structured questionnaire that encompassed demographic variables, health-seeking behavior, medication adherence, barriers, and social support. ***Results***: Most of the patients were males (82%), urban residents (74.25%), and aged ≥70 years. Obesity (42.75%) and overweight (41%) were common. 44.5% had high socioeconomic status. Overall, 74.5% adhered to medication regimens. No significant associations were found between adherence and demographic or socioeconomic factors. 66.3% used combination medication and lifestyle changes. Uncontrolled BP was prevalent (72%), and 25.5% were non-adherent, though non-adherence was not significantly associated with uncontrolled BP. Social support was common but did not significantly impact adherence. Among respondents, 125(31.3%) reported facing barriers to BP control. The most reported barriers were personal negligence (63.2%) and medication costs (43.2%). There is no exclusive barrier that has a significant association separately. ***Conclusions***: Despite treatment adherence, most participants had uncontrolled BP. Social support and demographic characteristics had no impact on adherence. Poor control was mainly due to the irregular pattern of blood pressure monitoring, the preference for home-based checks, expense, and personal neglect.

Keywords: Hypertension, Hypertensive patients, Health-seeking behavior, Medication adherence.

سلوك البحث عن الصحة والالتزام بالأدوية لمرضى ارتفاع ضغط الدم في مدينة أربيل: دراسة مقطعية

الخلاصة

الخلفية: ارتفاع ضغط الدم مشكلة صحية عامة خطيرة على مستوى العالم. لا يلتزم العديد من المرضى بخطة العلاج على الرغم من أن العلاج متاح مجانا. **الهدف**: تقييم سلوك البحث عن الصحة والالتزام بالأدوية لمجموعة من مرضى ارتفاع ضغط الدم. **الطرائق**: شارك 400 مريض يعانون من ارتفاع ضغط الدم في دراسة مقطعية أجريت في أربيل، إقليم كردستان، العراق. تم جمع البيانات من خلال المقابلات وجها لوجه باستخدام استبيان منظم شمل المتغيرات الديموغرافية وسلوك البحث عن الصحة والالتزام بالأدوية والحواجز والدعم الاجتماعي. **النتائج:** كان معظم المرضى من الذكور (82٪)، وسكان الحضر (74.25٪)، وتتراوح أعمارهم بين ≤70 عاما. كانت السمنة (42.75٪) وزيادة الوزن (41٪) شائعة. 44.5٪ كانوا في وضع اجتماعي واقتصادي مرتفع. بشكل عام ، التزم 74.5٪ بأنظمة الأدوية. لم يتم العثور على ارتباطات يعتد بها بين الالتزام والعوامل الديموغرافية أو الاجتماعية والاقتصادية. 66.3٪ استخدموا الأدوية المركبة وتغيير نمط الحياة. كان ضغط الدم غير المنضبط سائدا (72٪)، و 25.5٪ كانوا غير ملتزمين، على الرغم من أن عدم الالتزام لم يكن مرتبطا بشكل يعتد به بضغط الدم غير المنضبط. كان الدعم الاجتماعي شائعا ولكنه لم يؤثر بشكل يعتد به على الالتزام. من بين المستجيبين، أفاد 31.3٪ بأنهم يواجهون حواجز أمام السيطرة على ضغط الدم. كانت العوائق الأكثر الإبلاغ عنها هي الإهمال الشخصي (63.2٪) وتكاليف الأدوية (43.2٪). لا يوجد حاجز حصري له ارتباط كبير بشكل منفصل. **الاستنتاجات**: على الرغم من الالتزام بالعلاج، كان لدى معظم المشاركين ضغط الدم غير المنضبط. لم يكن للدعم الاجتماعي والخصائص الديموغرافية أي تأثير على الالتزام. كان ضعف التحكم يرجع بشكل أساسي إلى النمط غير المنتظم لمراقبة ضغط الدم، وتفضيل الفحوصات المنزلية، والنفقات، والإهمال الشخصي.

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INTRODUCTION

Hypertension (HTN), defined as a systolic blood pressure (SBP) ≥140 mmHg or diastolic blood pressure (DBP) ≥90 mmHg, is a major public health issue globally and a leading contributor to cardiovascular diseases and premature death. It places significant strain on healthcare systems and economies. According to the WHO, one-third of adults are hypertensive, with four out of five having poor blood pressure control [1]. Improved management of hypertension can result in significant savings on the approximately $320 billion annual cost of cardiovascular disease in the United States [2]. Though age and sex are recognized non-modifiable risk factors, evidence regarding gender differences in blood pressure control is mixed [3]. Gestational hypertension affects approximately 6–8% of pregnancies and is part of a broader group of hypertensive disorders in pregnancy [4]. Hypertension prevalence increases with age, with estimates reaching 61.24% for those over 60 years [5]. In Erbil City, Iraq,

the prevalence is 54.7% [6], significantly higher than earlier rates in Nasiriyah (26.5%) and other national reports [7]. Across the Middle East, prevalence ranges from 26.1% in Saudi Arabia to 44% in Turkey [8]. A disproportionate amount of the burden falls on populations in low- and middle-income countries (LMICs), and estimates indicate that, as a result of changing lifestyles, inadequate healthcare systems, and socioeconomic disparities, three-quarters of hypertensive patients will live in these nations within ten years [9]. When it comes to controlling chronic conditions like hypertension, health-seeking behavior is essential. It includes the steps people take to preserve or regain their health, such as consulting a doctor, following their treatment plan, or occasionally forgoing care entirely [10]. Research identifies three key behavioral patterns in response to hypertension: biomedical action (seeking formal treatment), self-regulation (personal strategies), and medical inaction (neglect or misinformation). Factors influencing health-seeking behavior include individual personality, stress levels, gender, socioeconomic status, culture, disease perception, and the influence of family or peer networks [11]. Access to healthcare services and effective health education campaigns also play vital roles in shaping responses to chronic illness [12]. Theoretical frameworks such as the Health Belief Model and Bandura's self-efficacy theory help explain health behaviors. These models highlight the importance of perceived disease severity, expected outcomes, and confidence in one's ability to manage health. Self-efficacy, in particular, is a strong predictor of health behaviors, particularly in the context of chronic disease management [11]. Adherence to antihypertensive medication is essential for effective blood pressure control and reducing cardiovascular complications [13]. However, up to 50% of patients globally fail to take their medications as prescribed, contributing to approximately 125,000 deaths and $289 billion in healthcare costs annually in the U.S. alone [14]. Adherence is influenced by several factors, including complex treatment regimen, side effects, personal beliefs, age, emotional and psychological health (e.g., stress, depression), financial challenges, and the presence of social support. People are more likely to adhere when they perceive the disease as serious, receive social and cultural support, are middle-aged, and have high levels of conscientiousness [11]. Involving patients in treatment decisions also leads to better adherence and improved outcomes [15]. While individual traits may affect adherence, no fixed "nonadherent personality" has been identified [11]. This study aims to assess health-seeking behavior and drug adherence among hypertensive patients in Erbil City, Iraq.

METHODS

Study design and setting

Four hundred hypertensive patients participated in a cross-sectional study done in Erbil City, Kurdistan region, Iraq. Patients aged 18 years or older were interviewed in various public settings to gather data.

Sampling method and sample size calculation

A convenience sampling method was used to collect the estimated sample size. The EpiInfo7 computer program was used for sample size calculation, where the following information was entered into the program: The population was entered as 2,000,000; the level of significance was set at 0.05; the expected prevalence was set at 50% (as it gives the highest sample size); the degree of precision was set at 0.05. Accordingly, the estimated sample size was 384, but 400 participants were recruited to account for anticipated problems with missing data or refusal to participate. The researchers believed that the following indoor venues of Erbil, such as the General Traffic Directorate, the General Education Directorate, and schools, were preferred due to the harsh winter weather during the data collection period (late November 2024 to early February 2025). However, on rare sunny days, interviews and data collection were conducted in outdoor areas such as the Qala bazaar and Parky Shar (a well-known park for retirees), where a significant portion of the population visits daily. This approach ensured data collection from individuals with diverse demographic characteristics.

Data collection

A questionnaire designed by researchers was used to collect the data for this study. There were five primary sections of the questionnaire. Section one: Demographic information that includes participants' age, gender, residency, marital status, BMI, education, income, and socioeconomic status. Section two: Health-Seeking and Treatment Practices that explored how participants managed their hypertension. It includes questions about the pattern of checking their blood pressure and whether they owned a BP measuring device. Participants were also asked about non-drug interventions such as healthy eating, exercise, stress management, and sleeping habits. Treatment approaches were categorized into medication-only, lifestyle changes-only, herbal remedies, or combinations of these approaches. Section three: Medication Adherence Assessment that describes participants' adherence to their prescribed regimens was evaluated using the Medication Adherence Report Scale (MARS-5). This tool includes five questions about forgetfulness, missing doses, and switching or stopping medications. A 5-point rating system was used for each item; higher ratings suggest greater commitment. High adherence was defined as having a total score of ≥ 20, while non-adherence was defined as collecting less than 20 [16]. Section four: Social Support that assessed whether participants received any support in managing their condition and who provided it (family members, friends, healthcare providers, or support groups). Section five: Barriers to adherence in which

participants were asked about common challenges they faced in following their treatment plans, including side effects, forgetfulness, cost of medication, number of daily pills, personal beliefs, and negligence. Four hundred patients (previously diagnosed with hypertension) were included in the study (Table 1).

Table 1: Medication adherence by demographic characteristics

Variables	Adherent	Not-adherent	Total	*p*-value
Age groups (year)				
< 50	30(61.2)	19(38.8)	49(12.25)	
50-59	64 (72.7)	24 (27.3)	88 (22.0)	0.098*
60-69	95 (76.0)	30 (24.0)	125 (31.25)	
70 ≥	109 (79.0)	29 (21.0)	138 (34.5)	
Gender				
Male	243 (74.1)	85 (25.9)	328 (82.0)	0.685**
Female	55 (76.4)	17 (23.6)	72 (18.0)	
Residency				
Urban	222 (74.7)	75 (25.3)	297 (74.25)	0.847**
Rural	76 (73.8)	27 (26.2)	103 (25.75)	
Marital Status				
Single	12 (70.6)	5 (29.4)	17 (4.25)	
Married	250 (73.1)	92 (26.9)	342 (85.5)	0.167*
Widowed	32 (88.9)	4 (11.1)	36 (9.0)	
Divorced	4 (80.0)	1 (20.0)	5 (1.25)	
Educational level				
Illiterate	27 (75.0)	9 (25.0)	36 (9.0)	
Read and write primary	70 (79.5)	18 (20.5)	88 (22.0)	
Intermediate	37 (74.0)	13 (26.0)	50 (12.5)	0.701*
Secondary	42 (76.4)	13 (23.6)	55 (13.75)	
College and above	122 (71.3)	49 (28.7)	171 (42.75)	
BMI (kg/m^2)				
< 25	50 (76.9)	15 (23.1)	65 (16.25)	
25-29	125 (76.2)	39 (23.8)	164 (41.0)	0.591*
30 ≥	123 (71.9)	48 (28.1)	171 (42.75)	
Income				
Not sufficient	278 (74.9)	93 (25.1)	371 (92.75)	0.478**
Sufficient	20 (69.0)	9 (31.0)	29 (7.25)	
Socioeconomic status				
Low (< 5)	40 (75.5)	13 (24.5)	53 (13.25)	
Medium (5-8)	126 (74.6)	43 (25.4)	169 (42.25)	0.981*
High (9-12)	132 (74.2)	46 (25.8)	178 (44.5)	
Total	298 (74.5)	102 (25.5)	400 (100.0)	

Values are expressed as frequency and percentage. * Pearson's chi-square test. ** Fisher's exact test.

Instrument development and validation

The questionnaire was created based on a review of existing research. It was reviewed by experts in medicine, sociology, and health education to ensure that it was clear, relevant, and valid. To clarify the questions, a pilot study was also conducted involving 40 patients with hypertension to examine the internal consistency of the questionnaire. The results showed Cronbach's alpha score of 0.919, indicating strong reliability. In addition to the questionnaire, participants' weights were measured using an Eufy smart scale, known for its accuracy [17]. Height was measured by a special tool. The BMI was calculated by dividing weight (kg) by height (m) squared**.** A sphygmomanometer manufactured by the Japanese company AKA was used to assess blood pressure. Measurements were taken twice, approximately five minutes apart, while the participant was at rest. The average of these readings was recorded following established hypertension measurement guidelines. WHO defines hypertension as a BP measurement of ≥140/90 mmHg. The typical management goal is to drop BP below 140/90 mmHg (considered as controlled) [18].

Ethical considerations

The protocol of this research was reviewed and approved by the council of the College of Medicine and approved by the ethics committee of the College of Medicine, Hawler Medical University on April 12, 2024 (certificate number 24 on December 4, 2024). The study complied with the ethical guidelines outlined in the Declaration of Helsinki and other relevant institutional and national research ethics frameworks. An official letter has been submitted from the College of Medicine to the General Education Directorate, the General Traffic Directorate, and the General Security Directorate of Erbil to obtain facilitation and cooperation. All participants received a thorough description of the study's goals, methodology, potential risks, and benefits before their involvement. Informed consent was obtained to ensure that participants were aware of their rights, including the voluntary nature of their participation.

Data analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS, version 26). The chi-square test of association was used to compare the

proportions of two or more groups. Fisher's exact test was used instead of the chi-square test when the expected frequencies of the table's cells were less than 5. A *p*-value of < 0.05 was considered statistically significant.

RESULTS

As shown in Table 1, more than one-third of the patients (34.5%) were aged ≥ 70, and 31.25% were aged 60-69. The majority (82.0%) were males, and 18.0% were females. The majority (74.25%) were living in urban areas, and the rest (25.75%) were living in rural areas. The greater portion (85.5%) were married, and 42.75% of them were college graduates (or higher level), while 9% and 22% of them were illiterate or read and write, respectively. The prevalence of obesity was 42.75%, and overweight was 41.0%. Almost all (92.75%) of the patients mentioned that their income was not sufficient, while 44.5% of the patients were of high socioeconomic status. Overall, 74.5% of the participants were adherent to their medication regimens. Adherence increased with age, ranging from 61.2% in those under 50 years to 79.0% in individuals aged 70 and above, and with rising socioeconomic status level; however, this trend did not reach statistical significance (*p*= 0.098). No significant association was found between adherence and the following variables: gender (*p*= 0.685), residency (*p*= 0.847), marital status (*p*= 0.167), educational level (*p*= 0.701), BMI (*p*= 0.591), income (*p*= 0.478), and socioeconomic status (*p*= 0.981). More details are presented in Table 1. Out of 400 participants, 386 (96.5%) reported checking their blood pressure (BP), but only 37.3% did so regularly, while 62.7% reported irregular or no checking. Places of BP checking varied, with many using multiple locations. The most common place was at home (62.7%), followed by clinics run by supportive healthcare staff (39.6%). Clinics, pharmacies, and primary healthcare centers were less frequently utilized, each comprising around 11% of responses. This highlights a strong preference for home-based monitoring, which offers convenience but may lack professional oversight (Table 2).

Table 2: Pattern of BP checking by patients

Variables	n(%)
Checking BP (n= 400)	386(96.5)
Regularity of BP checking (n= 386)	
Regular monitoring of BP	144(37.3)
Irregular or none	242(62.7)
Place of checking BP* (n = 386)	
At the physician's clinic	37(9.6)
Private pharmacy	43(11.1)
Primary healthcare center	42(10.9)
Supportive healthcare staff's clinic	153(39.6)
At home	242(62.7)

* Patients may choose more than one location to check their blood pressure.

Nearly all participants (95.5%) reported adhering to some form of management practice. The most common approach was a combination of medication and lifestyle changes, utilized by 66.3% of respondents. In contrast, 19.1% relied solely on medication. Additionally, a small percentage of individuals used alternative methods, such as herbs, either alone or in conjunction with conventional treatments (Table 3).

Table 3: Current practices for managing hypertension

Variables	n(%)
Having a BP management practice (plan)	382(95.5)
Type of practice (n=377)*	
Combination of medication and lifestyle changes	265(66.3)
Just medicine	72(19.1)
Combination of medicine and herbs	19(5.0)
Lifestyle changes only	13(3.5)
Combination of lifestyle changes, medicine, and herbs	9(2.4)
Combination of herbal and lifestyle changes	4(1.1)

* A participant may have more than one practice.

The prevalence of uncontrolled BP was 72% (Figure 1), and the prevalence of non-adherence was 25.5% (Figure 2).

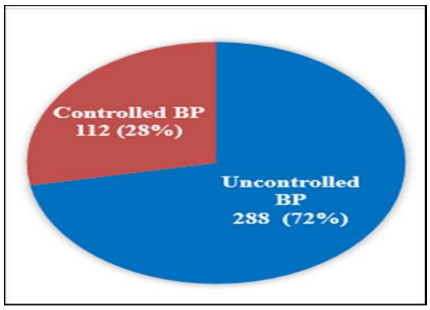

Figure 1: Prevalence of hypertension BP among the samples studied.

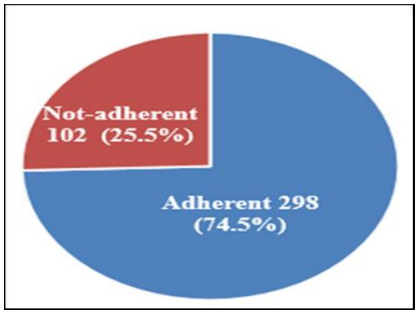

Figure 2: Drug adherence among the samples studied.

The relation between BP control and adherence was presented in Table 4 that showed non-significant differences between controlled and non-controlled patients (*p*= 0.363).

Table 4: The relation between BP control and adherence

Variable	Uncontrolled BP	Controlled BP	Total	*p*-value
Adherence to antihypertensive drugs				
Adherent	211(70.8)	87(29.2)	298(100)	
Not-adherent	77(75.5)	25(24.5)	102(100)	0.363*
Total	288(72)	112(28)	400(100)	

Values are expressed as frequency and percentage. * Pearson chi-square test.

Participants with social support had a 73.8% adherence rate, compared to 80.5% for those without it. The presence or absence of social support, whether from family, friends, healthcare providers, or support

groups, did not significantly affect adherence rates (p> 0.05). Support from family and friends was most common, but their presence did not significantly influence outcomes (Table 5).

Table 5: Effect of social support on drug adherence

Variables	Adherent	Not-adherent	Total	*p*-value*
Having an asocial support system				
Yes	265(73.8)	94(26.2)	359(100)	0.353
No	33(80.5)	8(19.5)	41(100)	
Type of social support providers				
Family members				
Yes	261(74.8)	88(25.2)	349(100)	0.732
No	37(72.5)	14(27.5)	51(100)	
Friends				
Yes	117(77)	35(23)	152(100)	0.374
No	181(73)	67(27)	248(100)	
Healthcare provider				
Yes	11(73.3)	4(26.7)	15(100)	1.00
No	287(74.5)	98(25.5)	385(100)	
Support groups				
Yes	6(60)	4(40)	10(100)	0.284
No	292(74.9)	98(25.1)	390(100)	
Total	298(74.5)	102(25.5)	400(100)	

Values are expressed as frequency and percentage. * Fisher's exact test.

Only 125 (31.3%) of the respondents said they had difficulties or obstacles in controlling their hypertension, whereas 275 (68.8%) said they had no such problems. Personal negligence was the most frequent obstacle among those who encountered difficulties (n= 125), followed by the expense of medications (43.2%), the quantity of prescription tablets (13.6%), forgetfulness (12.8%), adverse drug reactions (12.0%), and false health beliefs (12.0%). It was possible for participants to report multiple challenges (Table 6).

Table 6: Challenges or barriers to the management of hypertension

Variables	n(%)
Are you facing Challenges or barriers?	
Yes	125(31.3)
No	275(68.8)
Type of Challenges or barriers (n=125)*	
Own negligence	79(63)
Medication costs	54(43)
Number of Pills	17(13.6)
Forgetfulness	16(12.8)
Medication side effects	15(12)
Wrong beliefs	15(12)

* Participants may have more than one challenge or barrier.

Around half (44.0%) of the 125 people who reported difficulties have utilized their medications as instructed, and 56.0% did not. This association was statistically significant (p< 0.001), implying a strong correlation between lower adherence rates and obstacles or difficulties. The main barriers or challenges for non-adherence, as mentioned by the patients, were negligence (63.2%) and medication costs (43.2%). No significant associations were detected between adherence and the following barriers: medication side effects (p= 0.226), wrong beliefs (p = 0.226), pill number (0.776), medication cost (p= 0.206), and own negligence (p= 0.092) (Table 7).

Table 7: Medication adherence by barriers or challenges

Barriers/challenges	Adherent	Not-adherent	Total	*p*-value*
Facing challenges or barriers	55 (44)	70 (56)	125(100)	<0.001
Type of challenge (n=125) ††				
Medication side effects	9(60)	6(40)	15(12)	0.226
Wrong beliefs	9(60)	6(40)	15(12)	0.226
Forgetfulness	11(68.8)	5(31.2)	16(12.8)	0.556
Pills number	12(70.6)	5(29.4)	17(13.6)	0.776
Medication costs	44(81.5)	10(18.5)	54(43.2)	0.206
Own negligence	53(67.1)	26(32.9)	79(63.2)	0.092

Values are expressed as frequency and percentage. * Fisher's exact test. †† A participant may have more than one barrier.

DISCUSSION

Hypertension is considered a public health problem in Erbil, as more than half of the population has hypertension [6], and the majority of them have uncontrolled BP (according to the results of the current study). This study aimed to explore health-seeking behavior and medication adherence of a group of hypertensive patients in Erbil, Kurdistan Region, Iraq. Accurate blood pressure readings are crucial for effectively managing hypertension, both at home and in the doctor's office [19]. Only 37.3% checked their blood pressure regularly, while 62.7% did not. A cross-sectional survey conducted among healthcare professionals from eleven Asian countries (between November 2019 and June 2021) showed that fewer than half of their patients are monitored regularly [20]. Around **t**wo-thirds of hypertensive patients (62.7%) were checking their BP at home. As part of patient-centered care, the International Society of Hypertension recommends home blood pressure monitoring to enhance adherence, control blood pressure, evaluate the efficacy of treatment, and promote self-monitoring and shared decision-making [21]. More than 60% of home-monitoring patients did not follow at least one core guideline, such as the recommended 5-minute rest period before measurement and taking multiple readings over a few days, according to a 2023 study by Tucker *et al*. [22]. There's no statistical significance between demographic status and adherence, as all p-values were more than 0.05. The results are consistent with a study that looked at follow-up practices among patients with chest pain in the United States and found no correlation between social determinants (education, income, and trust) and follow-up compliance, indicating that demographic factors by themselves weren't dependable indicators of care-seeking [23]. Studies on a variety of noncommunicable diseases and in different regions

(Europe, Asia, and the Middle East) have often found no correlation between medication adherence and SES (income, education, and occupation). Although some research may only reveal tenuous connections [24,25]. The results show that the participants have a minimum visiting frequency of 10.9% to primary health care centers for checking their BP. Despite their accessibility, primary healthcare clinics might not be enough because of the quality of their services or the connections between patients and clinicians. The therapist-patient interaction is very important. Patient-centered outcomes are increasingly being measured and linked to the direct interpersonal quality of care. It has now been established that basic aspects of patient experience and trust are influenced by nonverbal clues, such as a clinician's posture [26,27]. Almost all of the participants, 95.5%, had a BP management practice (plan). The most common method was a mix of medication and lifestyle adjustments, used by 66.3% of respondents. The International Society of Hypertension's 2020 global hypertension practice guidelines state that a well-known strategy that complies with accepted hypertension treatment criteria is the combination of medication and lifestyle modifications [28]. The findings revealed that a significant proportion, 19.1%, practiced just medication taking. This is a quarter of the results that were shown by a 2020 cross-sectional study conducted in Turkey, which evaluated adherence behaviors among hypertensive patients and revealed that 78% adhered to prescribed medications, indicating that pharmacological treatment was prioritized over non-pharmacological strategies [29]. The 2024 ESC guidelines explicitly note that lifestyle modifications, though critical, are frequently neglected, leaving medication as the primary management strategy [30]. Some participants, 4.5%, also had no practice, which is much less than reported in a cross-sectional study, 15.0%, conducted in a hospital setting of Iraqi adults diagnosed with primary hypertension in Iraq [31]. And a community-based cross-sectional survey based on household visits conducted in Erbil City, Kurdistan, Iraq, from April to June 2017 (6.1%), not taking their treatment, respectively [6], and a few of the respondents, 2.4%, had inconsistent treatment, such as a combination of medicine and herbs. While 1.1% had practiced a combination of herbal and lifestyle changes. These results point out the need for public health interventions that enhance patient education, address common misconceptions, and improve access to affordable hypertension care. Respondents had good adherence levels (74.5%). This coincides with recent assessments that indicate that a majority of hypertensive patients adhere well to pharmacological regimens. For example, a 2022 Iranian study in Shahrekord reported that 63.3% of participants had sufficient adherence [32]. Similarly, in a cross-sectional study at Debre Tabor General Hospital, northwest Ethiopia, three-quarters (75.1%) of the participants were found to be adherent to their medication therapy. The relation between BP control and adherence in the current study was nonsignificant. A 2020 study conducted at a specialized outpatient clinic in Brazil evaluated the link between self-reported medication adherence and BP control. There was a high frequency of patients with satisfactory adherence to antihypertensive drug treatment. Blood pressure control was less frequent. In addition, in a 2019 cohort study of adults with resistant hypertension in the U.S., researchers found that despite a high average medication adherence rate (median 85%), there was no significant association between adherence and 1-year BP control**.** Instead, achieving control was more strongly linked to treatment intensification rather than adherence alone [33]. This indicates that there is a significant gap in adherence to routine BP monitoring despite widespread behavior. Adherence to critical procedural standards, such as taking multiple readings, observing appropriate rest periods before measurement, and positioning the arm and body correctly, remains limited. In this study, social support, whether from family, friends, healthcare providers, or support groups, did not significantly impact adherence rates, with all $p > 0.05$. This result is similar to the studies done in Jordan, which indicate that while social support may be beneficial in many health contexts, its mere presence does not reliably enhance medication adherence in people with hypertension [34]. A systematic review published in the Journal of the American Heart Association identified 1155 articles; 14 articles met the inclusion criteria. Statistically significant positive associations between medication adherence and social support were found in only nine studies ($p < 0.05$) [35]. Medication adherence can be successfully improved through patient-centered care, professional and non-judgmental communication skills, and the patient's trust in the clinician's expertise. A low percentage of clinician burnout and quality-based compensation may improve individual health outcomes and aspects of the health system [36]. WHO showed that 21% of hypertensive people had controlled BP [8], which coincides with the results of our study, where 28% had controlled BP. In this study, 31.3% of hypertensive patients reported facing challenges or barriers to antihypertension medication adherence, most notably personal negligence (63%), medication costs (43%), pill burden (13.6%), forgetfulness (12.8%), side effects (12%), and incorrect beliefs (12%). Patients experiencing any barrier were significantly less likely to adhere to their antihypertensive regimen (44% adherent, 56% non-adherent), underscoring the overall impact of barriers on adherence ($p < 0.001$). These results align with the World Health Organization’s multidimensional framework, which posits that patient-level factors (e.g., negligence, forgetfulness), therapy-related factors (e.g., side effects, pill burden), and socioeconomic barriers (e.g., cost) converge to impact adherence [33]. A systematic review highlights similar challenges: medication costs, insufficient health literacy, and high pill burden consistently impede adherence [29]. Negligence was the most cited barrier (63%), closely echoing findings from qualitative studies in Iran and Tanzania, where

lifestyle discordance, forgetfulness, and unintentional non-adherence (e.g., negligence) emerged as central themes. Further, wrong beliefs present in 12% of participants align with other studies noting that misunderstanding the disease's seriousness or treatment relevance undermines adherence [34]. A meta-analysis of data from more than 34,000 adults in Sub-Saharan Africa with hypertension revealed that patients with a good understanding of hypertension were 3 to 9 times as likely to be adherent to their medication compared with those who had a poor understanding of the condition [35]. Medication cost was identified by 43% of the respondents as a known economic barrier to hypertension management, but without a significant relationship to medication adherence. Cost was not significantly associated with adherence, suggesting that cost alone may not fully explain adherence unless combined with other factors. In the systematic literature review published in JAMA Health Forum, which assesses the association between economic policies and hypertension management and control in the US, prior economic evaluations indicate that increased copayments correlate with reduced antihypertensive adherence [15]. A cross-sectional study in India, the International Journal of Noncommunicable Diseases, showed a non-significant link to adherence or BP control, even though adverse effects (12.0%) and pill load (13.6%) were less common; they nevertheless significantly contribute to non-adherence. Although not statistically significant in this case, side effects are well-known obstacles to adherence, and pill burden literature has repeatedly found that a high drug count is a risk factor for non-adherence due to cognitive fatigue and regimen complexity. The aforementioned resources demonstrated a correlation between non-adherence and the quantity of tablets taken as well as adverse effects [37]. Current data show that any barrier significantly predicts non-adherence, whereas no single barrier does so independently. This multifactorial nature of non-adherence aligns with recent meta-analyses that highlight the limited effectiveness of interventions targeting only single factors compared to multicomponent strategies.

Study limitations

For a cross-sectional study, convenience sampling can be helpful for quick and accessible data collection, but it has significant limitations in terms of representativeness. The researchers tried their best to collect the sample from different areas of Erbil, making the sample more representative. The females participated in a small number, maybe because of religious and tribal customs and the harsh winter weather during the data collection period; accordingly, they refused to take off their clothes to check their BP.

Conclusions

Although a comparatively high percentage of drug adherence was noted in this research of hypertensive patients, most of the patients still had uncontrolled blood pressure. Social support and demographic characteristics had no discernible impact on adherence, underscoring their poor predictive power. Suboptimal control outcomes were primarily attributed to inconsistent blood pressure monitoring, a tendency towards home-based checks, and several reported challenges, including financial cost and lack of attention. These results highlight the necessity of a thorough, multifaceted strategy for managing hypertension that extends beyond medication adherence and incorporates improved clinician practices, patient education, behavior modification assistance, and easily accessible, reasonably priced care systems.

Recommendation

These findings highlight the need for comprehensive intervention models: medication cost relief, simplified regimens, generic comorbidity strategies, patient education and empowerment, incorporating strategies to correct misconceptions, enhancing awareness, increasing perceived benefits of adherence, reminders, side-effect management, monitoring, and proactively adjusting therapy to improve tolerance and reduce discontinuation risk.

Conflict of interests

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Data sharing statement

Supplementary data can be shared with the corresponding author upon reasonable request.

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