Patient Preference and Adherence

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ORIGINAL RESEARCH

Factors Affecting the Level of Adherence to Hypertension Medications: A Cross-Sectional Study Using the Hill-Bone Questionnaire

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Background: The adherence to antihypertensive therapy plays a significant role in determining the clinical outcomes of hypertension. We aim to evaluate the level of adherence to antihypertensive medications among patients and to assess the effect of different sociodemographic factors on the level of adherence using the Hill-Bone scale for indirect assessment.

Methodology: In this cross-sectional study, we utilized a validated, face-to-face interview questionnaire to collect data on socio-demographic characteristics, participants' attitudes, and disease knowledge. The Hill-Bone questionnaire was employed to assess treatment adherence. The statistical analysis was conducted using SPSS version 28.0, where mean, standard deviation, and range were utilized for variability analysis.

Results: A total of 390 patients were included in this study. The sample comprised 56.9% of females and 56.4% of participants aged 60 years or older. Approximately 80% of participants were currently married, and 46.7% had a higher education level. The average Hill-Bone CHBPTS score was 21.23± 4.95 and indicated good adherence in 63.8% of participants. The findings showed that several factors were significantly associated with higher adherence rates, including older age (COR = 3.41, 95% CI = 1.10–10.54, p = 0.03), higher educational level (COR = 1.72, 95% CI = 1.05–2.83, p = 0.03), regular blood pressure monitoring (COR = 1.90, 95% CI = 1.10–3.30, p = 0.03), and knowledge about their medications (COR = 2.12, 95% CI = 1.14–3.94, p = 0.02).

Conclusion: The medication adherence within our population falls below the desired level. Enhanced counselling and further research are necessary to identify additional factors influencing adherence and develop effective strategies for promoting adherence to antihypertensive medications.

Keywords: elderly patients, hypertension, hill-bone scale, medication adherence, socioeconomic factors

Background

Hypertension poses a global health challenge, emerging as a leading yet preventable cause of morbidity and mortality. The World Health Organization (WHO) reports that over 1.3 billion individuals worldwide suffer from hypertension, contributing to more than 7 million annual deaths.[1] Alarming projections anticipate a 30% surge in global hypertension prevalence by 2025, particularly affecting low- and middle-income countries.[2] In Jordan, classified as a lower-middle-income country by the World Bank,[3] a study revealed a significant prevalence of hypertension, reaching 41.4% among men and 28.3% among women, underscoring the urgency of addressing this health concern.[4]

Controlling hypertension primarily relies on medication treatment coupled with lifestyle modifications. However, the asymptomatic nature of hypertension poses a challenge, as patients may underestimate the importance of adhering to their prescribed therapy. Non-adherence becomes a critical factor contributing to uncontrolled hypertension, prompting an exploration of the multifaceted reasons behind medication non-compliance.[5]

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Studies investigating medication non-adherence among hypertensive patients consistently highlight the role of education and sociodemographic status. Higher education levels and income are associated with improved adherence.[6–8] Research findings indicate a direct correlation between patients' educational levels and their medication knowledge. A study conducted in Saudi Arabia specifically revealed a significant association between patients' education levels and all facets of medication knowledge, encompassing medication recognition, understanding medication indications, dosage schedules, and awareness of potential side effects. The study concluded that higher education levels, intertwined with enhanced medication knowledge, play a pivotal role in fostering medication adherence among patients.[9]

Additionally, age emerges as a significant factor, with younger patients exhibiting higher adherence rates.[7,10] Beyond individual factors, healthcare-team-related issues, such as communication gaps and prolonged waiting times during appointments, have been linked to poorer medication adherence.[11]

Efforts to enhance medication adherence among hypertensive patients have led to various strategies. Simplifying drug regimens has proven effective,[11] with studies revealing that patients using one or two antihypertensive pills demonstrate greater adherence compared to those with more complex regimens.[5,6,10] In Egypt, a study identified a positive correlation between simplified dosing schedules and improved adherence.[7]

The assessment of medication adherence involves both direct and indirect methods. The Hill-Bone Compliance to High Blood Pressure Therapy scale (Hill-Bone CHBTS) stands out as one of the most widely used indirect measures. This scale evaluates adherence in three behavioral domains: appointment-keeping, diet, and medication adherence.[12]

While numerous studies have explored factors influencing medication adherence in hypertensive patients, few have focused on low- and middle-income countries, with none conducted in Jordan. Therefore, this study aims to be the first to evaluate the level of adherence to antihypertensive medications among patients in Jordan. By addressing this gap, the study seeks to contribute valuable insights that may inform targeted campaigns to improve patient compliance with their prescribed medications. Additionally, the research aims to assess the impact of different sociodemographic factors on the level of adherence, further refining our understanding of the complexities surrounding hypertension management in this specific context.

Methodology

Study Design and Population

This is a cross-sectional study conducted using data that was collected between January 2022 to June 2022 through face-to-face interviews. Participants were recruited by simple random sampling from patients visiting the cardiology, nephrology, and family medicine clinics at Jordan University Hospital (JUH) located in the northwest of the capital Amman. As a tertiary medical center, JUH provides health care services to approximately half a million patients annually from various regions across the country.

The study included patients who are 18 years or older who were diagnosed with hypertension according to the American Heart Association (AHA) guidelines[13] and/or those treated pharmacologically with at least one anti-hypertensive medication for at least 6 months.

Excluded patients were those diagnosed with secondary hypertension, those who had undergone major changes in their medication regimen within the past 6 months, individuals with a history of kidney transplant or end-stage renal disease, and those with mental health conditions that could impact their ability to adhere to prescribed medications. Additionally, individuals unable to provide informed consent, as well as pregnant or breastfeeding women, were also excluded.

Study Questionnaire

Data were collected via a questionnaire designed to capture the sociodemographic characteristics, the participants' attitude towards BP measurement and their approach to managing specific medication-related situations, in addition to the participants' knowledge of normal BP readings and their own prescribed medications. Moreover, adherence to treatment was measured using The Hill-Bone scale after performing a comprehensive and accepted method of translation to eliminate language barriers.

The translation process employed the back translation technique developed by Brislin in 1970, which is a widely used method of translating research instruments in cross-cultural research where the language of the target population is different from the original language of the instrument.[14]

Questions in the scale were forward translated (1) by two members of the team producing two independent translations (TL1, TL2). Then, another two members of the team performed back translation (1) on TL1 and TL2 producing BT1 and BT2. After comparing the translated versions in terms of linguistic and cultural equivalents and taking expert reviews, we produced TL3. After that, we performed back translation (2) on TL3 producing two independent back translations (BT3 and BT4). Finally, after comparing it with the original version, we produced the final version.

A pilot study of 10 participants was conducted following expert review by bilingual professionals who assessed the translated questionnaire for linguistic clarity, accuracy and cultural appropriateness.

Finally, subsequent psychometric analysis, including tests for internal consistency, and test-retest reliability were done to provide evidence of the questionnaire's reliability and validity.

The Hill-Bone CHBPTS has 14 items grouped into 3 sub-scales: nine items measure the frequency of behaviors related to taking medications, two items are related to appointment keeping, and three items are related to salt intake. Each item is assessed using a four-point Likert scale: 1=none of the time, 2= some of the time, 3= most of the time, and 4= all the time. The minimum and maximum possible scores are 15 and 56, respectively. A lower score means a higher degree of adherence and a higher score means a lower degree of adherence to treatment regimens. Item 6 has been reversed coded. We defined good adherence as a score that is less than the group mean Hill-Bone score and poor adherence as a score that is equal to or greater than the group mean score.

Responses from 400 participants were collected, however 390 were included in this study as 10 participants had missed or incomplete data. The minimum required sample size was calculated using Fisher's formula: N= z-score^2*stDev*(1-stDev)/confidence interval^2.[15] Where N indicates the sample size, and (z) indicates the level of confidence. According to the standard normal distribution (for a level of confidence of 95%, z=1.96), the minimum sample size is 385.

This study received approval from Jordan University Hospital (JUH) and Institutional Review Board (IRB) at the University of Jordan Number (414/2021). The researchers obtained verbal consent from all patients before conducting face-to-face interviews and administering the questionnaire. Verbal consent, which involves obtaining permission directly through spoken communication instead of relying on written documentation, is acceptable and approved by the Jordan University Hospital ethics committee. Permission to use the Hill-bone scale was obtained by submitting an online permission request form.

Statistical Analysis

SPSS version 28.0 (Chicago, USA) was used for statistical analysis. Variability analysis in the form of the mean (standard deviation) and the range were used to describe data. The sociodemographic factors were provided as frequencies (percentages) using standard descriptive statistical parameters. The normality of the distribution of variables was examined using the Shapiro–Wilk test. Pearson Chi-square or Fisher's exact test were utilized to investigate the association between the Hill-bone CHBPTS adherence groups and other categorical variables at a 95% confidence interval. A p-value < 0.05 was considered statistically significant.

Results

Sociodemographic Factors and the Hill-Bone CHBPTS

The analysis encompassed a total of 390 patients meeting the inclusion criteria. Among them, 249 individuals demonstrated good adherence (63.8%), while 141 patients exhibited poor adherence (36.2%). The mean age of participants was 61.9 $\pm$ 10.8 year, and slightly more than half of the patients were female (56.9%) and were 61 years or older (56.4%). The majority were married (80%), had a BMI of 25.0 or higher (86%), and resided in central Jordan (92.6%). In addition, almost half of the patients had completed a bachelor's degree or higher (46.7%), and just over half reported a family

monthly income of less than 700 US dollars (54%). The majority of patients in this study were non-smokers (82.8%). Regarding comorbidities, around half of the patients had diabetes (49%). Notably, close to a quarter of the patients (28.2%) were taking three or more antihypertensive medications.

Significant associations with better medication adherence were observed in older patients, specifically those in the age groups 40-59 (COR = 3.21, 95% CI= 1.03-10.06, p = 0.04) and 60 years or older (COR = 3. 41, 95% CI= 1.10-10.54, p = 0.03), as well as those who had completed higher education (COR= 1.72, 95% CI=1.05-2.83, p = 0.03). Table 1 further outlines the sociodemographic characteristics of the patients.

Table 1 Sociodemographic and Adherence-Related Characteristics of Participants

Variables	Median (IQR) or n (%)	Hill-Bone Score		COR (95% CI)	*p* value
		Poor Adherence	Good Adherence		
Age groups					
18–39	14 (3.6)	9 (64.3)	5 (35.7)	Ref	
40–59	156 (40)	56 (35.9)	100 (64.1)	3.21 (1.03–10.06)	0.04*
≥60	220 (56.4)	76 (34.5)	144 (65.5)	3.41 (1.10–10.54)	0.03*
BMI					
<25.0	55 (14)	22 (40.0)	33 (60.0)	Ref	
≥25.0	335 (86)	119 (35.5)	216 (64.5)	1.21 (0.68–2.10)	0.52
Gender					
Female	222 (56.9)	79 (35.6)	143 (64.4)	Ref	
Male	168 (43.1)	62 (36.9)	106 (63.1)	0.95 (0.62–1.43)	0.83
Area of residence					
Central	361 (92.6)	130 (36.0)	231 (64.0)	Ref	
Peripheral	29 (7.4)	11 (37.9)	18 (62.1)	0.92 (0.42–2.01)	0.84
Level of education					
Illiterate/Primary school	111 (28.5)	46 (41.4)	55 (58.6)	Ref	
Secondary School	97 (24.9)	42 (43.3)	55 (56.7)	0.93 (0.53–1.61)	0.79
Higher Education	182 (46.7)	53 (29.1)	129 (70.9)	1.72 (1.05–2.83)	0.03*
Marital status					
Single	78 (20)	33 (42.3)	45 (57.7)	Ref	
Married	312 (80)	108 (34.6)	204 (65.4)	1.39 (0.84–2.30)	0.21
Family monthly income (JOD)					
Less than 500	211 (54)	81 (38.4)	130 (61.6)	Ref	
≥ 500	179 (46)	60 (33.5)	119 (66.5)	1.24 (0.82–1.87)	0.32
Smoker					
No	323 (82.8)	112 (34.7)	211 (65.3)	Ref	
Yes	67 (17.2)	29 (43.3)	38 (56.7)	0.70 (0.41–1.19)	0.21
Diabetes					
No	199 (51)	71 (35.7)	128 (64.3)	Ref	
Yes	191 (49)	70 (36.6)	121 (63.4)	0.96 (0.55–1.65)	0.87
Number of HTN medications					
≤2	280 (71.8)	101 (36.1)	179 (63.9)	Ref	
3 or more	110 (28.2)	40 (36.4)	70 (63.6)	0.98 (0.62–1.56)	0.95

Notes: *Statically significant. Monthly household income in JOD = Jordanian Dinar; 1 JOD = 1.41 USD.
Abbreviations: COR, crude odds ratio; CI, confidence interval; BMI, body mass index; HTN, hypertension.

Attitudes and the Hill-Bone CHBPTS

Patients' attitudes and their Hill-Bone CHBPTS scores are presented in Table 2. Patients who measured their blood pressure periodically (COR = 1.86, 95% CI 1.23-2.83, p = 0.004), those who measured their blood pressure regularly twice daily compared to patients who measured randomly throughout the day (COR = 1.64, 95% CI 1.03-2.60, p = 0.03), those who measure their blood pressure at home (COR = 1.90, 95% CI 1.10-3.30, p = 0.03), and those who knew that their medications were effective and had a role in maintaining their health (COR = 2.12, 95% CI 1.14-3.94, p = 0.02) had increased odds of having good adherence. On the other hand, patients who changed their dose of medication or stopped taking their medication without consulting their doctor (COR = 0.54, 95% CI 0.39-0.96, p = 0.04) and (COR = 0.081,

Table 2 Participants' Attitudes and Practices Toward High Blood Pressure Management Related to Adherence as Measured by Hill-Bone CHBPT Scale

Statements	Total n (%)	Hill-Bone Score		COR (95% CI)	*p* value
		Poor Adherence	Good Adherence		
Measure BP periodically					
No	164 (42.1)	73 (44.5)	91 (55.5)	Ref	
Yes	226 (57.9)	68 (30.1)	158 (69.9)	1.86 (1.23–2.83)	0.004*
Time of BP measurement					
Random	234 (60.5)	90 (38.5)	144 (61.5)	Ref	
Regularly twice daily	134 (34.6)	37 (27.6)	97 (72.4)	1.64 (1.03–2.60)	0.03*
I do not measure it	19 (4.9)	12 (63.2)	7 (36.8)	0.37 (0.14–0.96)	0.04*
Location of BP measurement					
Outside	61 (15.6)	30 (49.2)	31 (50.8)	Ref	
Home	329 (84.4)	111 (33.7)	218 (66.3)	1.90 (1.10–3.30)	0.03*
Change dose of your medication without consulting a doctor					
No	337 (86.4)	115 (34.1)	222 (65.9)	Ref	
Yes	53 (13.6)	26 (49.1)	27 (50.9)	0.54 (0.39–0.96)	0.04*
Stop taking your BP medication because your BP is normal, or you do not feel symptoms					
No	341 (87.4)	100 (29.3)	241 (70.7)	Ref	
Yes	49 (12.6)	41 (83.7)	8 (16.3)	0.081 (0.037–0.18)	< 0.001*
Forget to take your medicines when traveling or leaving home					
No	260 (66.7)	85 (32.7)	175 (67.3)	Ref	
Yes	130 (33.3)	56 (43.1)	74 (56.9)	0.64 (0.42–1.00)	0.06
Use a medication regulator					
No	310 (79.5)	119 (38.4)	191 (61.6)	Ref	
Yes	80 (20.5)	22 (27.5)	58 (72.5)	1.64 (0.96–2.82)	0.09
Ever felt unwilling to take the treatment					
No	261 (66.9)	78 (29.9)	183 (70.1)	Ref	
Yes	129 (33.1)	63 (48.8)	66 (51.2)	0.45 (0.29–0.69)	< 0.001*
My medications are effective and have a role in maintaining my health.					
No	46 (11.8)	24 (52.2)	22 (47.8)	Ref	
Yes	344 (88.2)	117 (34)	227 (66)	2.12 (1.14–3.94)	0.02*

Note: * statically significant.
Abbreviations: COR, crude odds ratio; CI, confidence interval; BP, blood pressure.

95% CI 0.037-0.18, p < 0.001), respectively, and patients that had ever felt unwilling to take their treatment (COR = 0.45, 95% CI 0.29-0.69, p < 0.001) were more likely to have poor adherence.

Knowledge and the Hill-Bone CHBPTS

The patients' knowledge of hypertension along with their medications and their Hill-Bone CHBPTS scores are displayed in Table 3. Patients who knew the names of all their medications were significantly associated with having good adherence (COR = 1.87, 95% CI 1.15-3.06, p = 0.01). Notably, no other variables demonstrated a significant association with either improved or worse adherence.

Hill-Bone CHBPTS Questionnaire

The mean Hill-Bone CHBPTS score was 21.23 ± 4.95, the minimum recorded score was 14, and the maximum was 47. The Hill-Bone CHBPTS is comprised of multiple subscales, Specifically, the first three questions, presented in Supplemental Table 1, contribute to the reduced sodium intake subscale, exhibiting a mean (SD) of 5.28 ± 1.87. The subsequent two questions pertain to the appointment-keeping subscale, with a mean (SD) of 3.58 ± 1.43. Finally, the last nine questions form the medicine-taking

Table 3 Knowledge and Belief of Participants About Blood Pressure Management Related to Adherence as Measured by Hill-Bone CHBPT Scale

Statements	Total n (%)	Hill-Bone Score		COR (95% CI)	*p* value
		Poor Adherence	Good Adherence		
What is normal upper blood pressure?					
≤ 120	265 (68)	100 (37.7)	165 (62.3)	Ref	
>120	91 (23)	26 (28.6)	65 (71.4)	1.52 (0.90–2.54)	0.12
I do not know	34 (8.7)	15 (44.1)	19 (55.9)	0.77 (0.37–1.58)	0.47
What is a normal lower blood pressure?					
≤ 80	312 (80)	106 (34.0)	206 (66.0)	Ref	
>80–89	44 (11)	20 (45.5)	24 (54.5)	0.62 (0.33–1.17)	0.14
I do not know	34 (8.7)	15 (44.1)	19 (55.9)	0.65 (0.32–1.33)	0.24
Know names of medications					
No	230 (59)	96 (41.7)	134 (58.3)	Ref	
Yes	112 (28.7)	31 (27.7)	81 (72.3)	1.87 (1.15–3.06)	0.01*
Yes, but not all of them	48 (12.3)	14 (29.2)	34 (70.8)	1.74 (0.89–3.42)	0.11
Do you know the side effects of your medications?					
No	261 (66.9)	99 (37.9)	162 (62.1)	Ref	
Yes	129 (33.1)	42 (32.6)	87 (67.4)	1.27 (0.81–1.98)	0.32
Distinguish between my medications**					–
Name	233 (60)	73 (31.3)	160 (68.7)		
Color/Shape/Size	201 (51.5)	77 (38.3)	124 (61.7)		
Dose	28 (7.2)	13 (46.4)	15 (53.6)		
I cannot tell them apart	22 (5.6)	12 (54.5)	10 (45.5)		
Source of information**					–
Medical doctor	317 (81.3)	105 (33.1)	212 (66.9)		
Google	191 (49)	71 (37.2)	120 (62.8)		
Friends and relatives	69 (17.7)	24 (34.8)	45 (65.2)		
Pharmacist	54 (13.8)	17 (31.5)	37 (68.5)		

Notes: *Statically significant, **The sum of responses is greater than 100% because participants could select more than one response.
Abbreviations: COR, crude odds ratio; CI, confidence interval; BP, blood pressure.

Table 4 Hill-Bone CHBPTS Scores for Home Blood Pressure Medication Adherence Summary Statistics

	None of the Time	Some of the Time	Most of the Time	All of the Time	Mean ± SD
Reduced sodium intake					
Eat salty food	146 (37.4)	156 (40)	62 (15.9)	26 (6.7)	1.92 ± 0.89
Shake salt on your food before you eat it	244 (62.6)	80 (20.5)	46 (11.8)	20 (5.1)	1.59 ± 0.89
Eat fast food? (fat cook, chips, burgers)	154 (39.5)	185 (47.4)	40 (10.3)	11 (2.8)	1.76 ± 0.75
Appointment keeping					
Get the next appointment before you leave the clinic	74 (19)	42 (10.8)	74 (19)	200 (51.3)	1.97 ± 1.18
Miss scheduled appointments.	227 (58.2)	107 (27.4)	37 (9.5)	19 (4.9)	1.61 ± 0.85
Medicine taking					
Forget to take your HBP medicine	196 (50.3)	133 (34.1)	49 (12.6)	12 (3.1)	1.68 ± 0.81
Decide not to take your HBP medicine	277 (71)	67 (17.2)	35 (9)	11 (2.8)	1.44 ± 0.77
Forget to get prescriptions filled	318 (81.5)	42 (10.8)	14 (3.6)	16 (4.1)	1.30 ± 0.73
Run out of HBP pills	290 (74.4)	67 (17.2)	27 (6.9)	6 (1.5)	1.36 ± 0.68
Skip your HBP medicine before you go to the clinic	305 (78.2)	36 (9.2)	21 (5.4)	28 (7.2)	1.42 ± 0.89
Miss taking your HBP pills when you feel better.	326 (83.6)	20 (5.1)	16 (4.1)	28 (7.2)	1.35 ± 0.86
Miss taking your HBP pills when you feel sick	322 (82.6)	34 (8.7)	22 (5.6)	12 (3.1)	1.29 ± 0.71
Take someone else's HBP pills	348 (89.2)	28 (7.2)	10 (2.6)	4 (1)	1.15 ± 0.49
Miss taking your HBP pills when you careless	292 (74.9)	59 (15.1)	29 (7.4)	10 (2.6)	1.38 ± 0.73

Abbreviation: HBP, home blood pressure.

subscale of the Hill-Bone CHBPTS score, demonstrating a mean (SD) of 12.37 ± 1.37. The individual questions that make up the Hill-Bone CHBPTS with their results are displayed in Table 4.

Discussion

This study aimed to assess the adherence of patients to antihypertensive medication in our population. According to the WHO, inadequate adherence is identified as the primary factor contributing to uncontrolled blood pressure.[16] Sustained and consistent adherence to medication over the long term is essential for managing and sustaining control over this chronic condition.[17] In hypertensive patients, suboptimal drug adherence is a key factor associated with inadequate blood pressure control, contributing substantially to a growing and noteworthy public health challenge.[18] And the non-adherence to medications carries both human and economic implications, with estimates suggesting that adhering to treatment recommendations could potentially save around 8% of global overall health costs.[19]

The findings of this study revealed that 63.8% of the sample exhibited commendable adherence to their antihypertensive medications, while 36.2% demonstrated subpar adherence, which indicates relatively a better adherence to hypertensive medications compared to other studies. This finding surpassed a study conducted in the Middle East, where only 55.9% of patients adhered to their antihypertensive medication.[20] Similarly, a study in Malaysia reported a lower adherence rate of 53.4% among participants.[21] Our results also outperformed two previous Jordanian studies[22,23] and a Lebanese study that employed comparable methods, utilizing the validated 8-item Modified Morisky Medication Adherence Scale (MMMAS). The Lebanese study found that out of 210 patients, 50.5% demonstrated good adherence to medicine, 27.1% had medium adherence, and 22.4% had low adherence.[24]

However, our study's adherence rate was lower than those reported in developed countries such as the United States and Scotland, where adherence rates reached up to 91% for each.[19,25] This difference could be attributed to the fact that the latter research used a subjective method to assess adherence levels, which may have inflated the results.

Our findings revealed that older patients exhibited a higher level of medication adherence compared to their younger counterparts, particularly among patients aged 40–59 and above 60 years. This observation aligns with the results of a retrospective cohort study involving approximately 950,000 patients, which assessed the persistence with antihypertensive drugs over 10 years and concluded that older patients demonstrated greater persistence than their younger counterparts.[26] Several other studies have also reported a positive correlation between age and medication adherence.[27,28] It is theorized that this trend may be attributed to the fact that older patients often experience a higher severity of illness compared to their younger counterparts, leading to increased awareness of their health status, which, in turn, positively influences adherence.[29] We hypothesized that older patients exhibit higher rates of medication adherence due to specific factors. Firstly, their possession of more established and consistent daily routines facilitates the seamless incorporation of medication-taking into their daily activities.[30] Moreover, the extensive social networks commonly found among older individuals, which often include family members or caregivers, play a crucial role in providing support. This support system proves instrumental in reminding and assisting with medication adherence.[31]

We contend that younger patients exhibit a lower adherence rate to their medications for several reasons. Firstly, a sense of invincibility prevalent among younger individuals may lead them to underestimate the potential consequences of non-adherence, fostering a lax attitude toward medication adherence.[32] Furthermore, the dynamic and fast-paced lifestyles common among younger individuals contribute to forgetfulness in regularly taking their medications, particularly when routines change due to travel or irregular work hours.[33,34] Side effects or concerns about medication that the younger patients may be more sensitive to potential side effects or have concerns about the long-term effects of medications, leading to lower adherence rates.[35]

Furthermore, this study showed that patients with higher level of education exhibited a greater level of adherence to their medications. This finding aligns with a study conducted in South Korea which aimed to identify factors linked to self-reported non-adherence to antihypertensive regimens and found that patients with lower educational level had higher rates of non-adherence.[36] Similarly, a study in the USA showed that individuals with higher levels of education demonstrated higher rates of medication adherence.[37] The rationale behind this correlation between education and medication adherence lies in an information-seeking attitude, suggesting that higher education is linked to receiving more advice and information from healthcare providers.[38]

Our study illustrated that patients who monitored their blood pressure regularly, specifically those who checked their blood pressure twice daily, and individuals who measured their blood pressure at home, had higher odds of maintaining good medication adherence. This observation aligns with a separate study conducted in Jordan, where 85% of participants reported monitoring their blood pressure, and nearly 79% maintained a record of their blood pressure at home.[23] The similarity in findings between the two studies may be attributed to the fact that participants in both research endeavors shared similar cultural and educational backgrounds.

Monitoring blood pressure at home is of significant importance for various reasons and brings numerous advantages to individuals dealing with hypertension or other cardiovascular conditions. One key factor underlining the significance of home blood pressure monitoring is its ability to provide an accurate assessment of blood pressure in a familiar and relaxed environment. This helps mitigate the "white coat syndrome", ensuring a more precise reflection of an individual's typical blood pressure.[39]

Furthermore, home monitoring enables healthcare providers to compile a more comprehensive and personalized dataset on a patient's blood pressure patterns. This wealth of information assists in tailoring treatment plans to address the specific needs of each individual, taking into account factors such as time-of-day variations and responses to medications.[40]

In addition, home monitoring facilitates the assessment of the effectiveness of prescribed interventions by allowing both patients and healthcare providers to observe the direct impact of lifestyle changes or medications on blood pressure. This firsthand insight can serve as a powerful motivator, encouraging individuals to adhere more consistently to their treatment plans.[41]

Our findings indicated that patients who adjusted their medication dosage or discontinued their medication without consulting their doctor, as well as those who expressed reluctance to take their medications, were more likely to exhibit poor adherence. There is a growing body of evidence emphasizing the importance of the patient-clinician relationship in this context. Practices that prioritize patient-centered care, exhibit professional and non-judgmental communication skills, and foster patients' trust and confidence in the clinician's knowledge have been shown to effectively enhance medication adherence.[42] A focus on quality-based payment systems and maintaining low clinician burnout rates could contribute to improvements in health system-related factors and individual health outcomes.[43,44]

This study also indicated a significant association between patients who could correctly identify the names of all their medications and exhibiting good adherence. A study conducted in Ethiopia yielded similar findings, where 60% of patients with low adherence faced difficulties remembering their medications.[45] Other studies have identified low education as a risk factor for inadequate medication-related knowledge.[9,46] Logistic regression analyses revealed that patients with comprehensive knowledge were ten times more likely to demonstrate high medication adherence. Specifically, patients who were knowledgeable about their medication names, administration instructions, what to do in case of a missed dose, and how to address potential side effects exhibited a significant association with improved medication adherence.[45]

The strength points of this research paper lie in its robust methodology, notably the inclusion of a substantial number of patients and the utilization of a reliable scale for assessment. The study benefits from a large and diverse patient sample, enhancing the generalizability of the findings and bolstering the statistical power of the analyses. Furthermore, the use of a validated and reliable scale ensures the accuracy and consistency of the measurements, contributing to the overall reliability of the study. Additionally, the research is conducted in a tertiary medical center renowned for its specialization and role as a referral center. This aspect adds a layer of credibility to the study, as the hospital's expertise and patient population make the findings more representative and applicable to broader clinical contexts. The combination of a robust methodology, a significant number of patients, and the study setting in a tertiary medical center reinforces the strength and reliability of the research outcomes.

This study encountered certain limitations. Firstly, the cross-sectional study design offers indications of associations but does not permit conclusive statements about causation. Additionally, there is a potential for selection bias that arises from recruiting participants from tertiary care hospitals instead of the broader community, which may limit the generalizability of our findings. Secondly, relying on self-reported data introduces the possibility of social desirability bias, where patients may underreport socially undesirable activities. Considering these factors, the reported level of adherence among participants may be inflated.

Conclusion

This study indicated that 66% of the population demonstrated good adherence to their antihypertensive medication as assessed by the Hill-Bone questionnaire. Factors such as older age, higher educational level, regular blood pressure monitoring, and knowledge about their medications were significantly associated with higher adherence rates. However, additional research is necessary to investigate deeper into the factors that influence medication adherence in these patients and to identify strategies that healthcare providers can employ to address these factors and enhance adherence to antihypertensive medications.

Data Sharing Statement

All data generated or analysed during this study are included in this publication article. Raw datasets are available from corresponding author and can be provided upon reasonable request.

Ethical Approval

This study was approved by the institutional review boards of Jordan University Hospital in Amman, Jordan. All procedures performed during this research were in accordance with the ethical principles outlined in the World Medical Association's revised Declaration of Helsinki.

Consent for Publication

Informed verbal consent was obtained from all of the patients. The researchers obtained verbal consent from all patients before conducting face-to-face interviews and administering the questionnaire. Verbal consent involves obtaining permission directly through spoken communication instead of relying on written documentation. This approach ensures that participants are fully informed about the study and voluntarily agree to participate. Permission to use the Hill-bone scale was obtained by submitting an online permission request form.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no conflicts of interest in this work.

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