Evaluation of medication adherence in Lebanese hypertensive patients

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Abstract Controlling hypertension is essential in cardiovascular diseases. Poor medication adherence is associated with poor disease outcomes, waste of healthcare resources, and contributes to reduced blood pressure control. This study evaluates treatment adherence to antihypertensive therapy in Lebanese hypertensive patients by estimating the proportion of adherent hypertensive patients using a validated tool and investigates what factors predict this behavior. A questionnaire-based cross-sectional study was conducted on a random sample of 210 hypertensive outpatients selected from clinics located in tertiary-care hospitals and from private cardiology clinics located in Beirut. Adherence level was measured using a validated 8-item Modified Morisky Medication Adherence Scale (MMMAS). Among 210 patients, 50.5% showed high adherence, 27.1% medium adherence, and 22.4% low adherence to medication. Mean MMMAS score was 6.59 ± 2.0. In bivariate analyses, having controlled blood pressure ($p = 0.003$) and taking a combination drug ($p = 0.023$) were predictors of high adherence. Forgetfulness ($p < 0.01$), complicated drug regimen ($p = 0.001$), and side effects ($p = 0.006$) were predictors of low adherence after multiple liner regression. Logistic regression results showed that calcium channel blockers ($p = 0.030$) were associated with increased adherence levels. In conclusion, developing multidisciplinary intervention programs to address the factors identified, in addition to educational strategies targeting healthcare providers, are necessary to enhance patient adherence.
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1. Introduction

Hypertension is a worldwide epidemic causing 7.1 million premature deaths each year and accounting for 13% of all deaths globally [1]. Kearney et al. [2] reported that overall prevalence of hypertension in 2000 was estimated to be 26.4% of the world population and predicted that the burden of hypertension would increase by 60% to approximately 1.56 billion in the year 2025. Also, hypertension results in an economic burden of $47.5 billion annually in direct medical expenses and $3.5 billion each year in lost productivity [3].

According to the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7), hypertension is defined as a systolic blood pressure (SBP) of 140 mmHg or higher, or a diastolic blood pressure (DBP) of 90 mmHg or higher [1].

Hypertension is reported to be the leading cause of cardiovascular disease worldwide [4]. Additionally, uncontrolled blood pressure (BP) increases the risk of ischemic heart disease three- to fourfold [5] and overall cardiovascular risk by two-to threefold [6].

Among hypertensive patients who have poor BP control, poor drug adherence is one of the causes and accounts for an increasingly significant and substantial public health burden [7]. Only 29% of hypertensive patients in the United States achieve adequate control and even fewer have been reported in Canada and Europe (17% and ⩽10%, respectively) [8].

The term ''adherence'' is defined by the World Health Organization (WHO) as the extent to which a person's behavior taking medication, following a diet, and/or executing lifestyle change corresponds with agreed recommendations from a health care provider [9]. The WHO describes poor adherence as the most important cause of uncontrolled blood pressure [9] and estimates that 50−70% of people do not take their antihypertensive medication as prescribed [10].

In a meta-analysis of literature on medication nonadherence rates in the elderly, it was shown that from 29% to 59% of outpatients do not take medications as prescribed [11]. In another study done on hypertensive patients in primary health care centers and hospitals in Saudi Arabia, 53% were found to be adherent and, consequently, the mean SBP and DSB were found to be significantly lower in adherent patients relative to those nonadherent [12].

Numerous factors influence treatment adherence, including demographic characteristics (gender, age, education, etc.), psychosocial factors (quality of life), socioeconomic status and disease severity, class of drug prescribed, patient understanding of disease and importance of treatment, co-morbid medical conditions, patient−healthcare provider relationship, drug cost, forgetfulness, and presence of psychological problems, specifically depression [13−16].

Based on this, our study objective is to evaluate treatment adherence to antihypertensive therapy in Lebanese hypertensive patients by estimating the proportion of adherent hypertensive patients using a validated tool and to investigate what factors predict this behavior.

2. Methods

2.1. Patients and methods

A cross-sectional design utilizing a convenient sample and a well-designed questionnaire was adopted to address the study objective. Patients recruited for this study were randomly selected from those visiting the external (outpatient) clinics located in tertiary care hospitals and from private cardiology clinics located in Beirut. In fact, interviewers visited the location on randomly selected dates and recruited all patients present in these clinics.

An oral informed consent was obtained from each patient. All patients interviewed agreed to participate in this study. The Institutional Review Board of the Lebanese University stated that approval was not necessary, since the study was an observational one and not experimental, clinical, or interventional.

2.2. Inclusion and exclusion criteria

Eligible patients were Lebanese adult outpatients (⩾18 years). They were diagnosed with essential (primary) hypertension by a cardiovascular physician and taking at least one antihypertensive medication. Patients with co-existing medical conditions were also included. Excluded subjects were those with secondary hypertension, pregnant women, or taking other drugs that could increase BP. Hypertensive patients taking no medication were also excluded.

2.3. Sample size

We used the following formula for sample size calculation: $n = \frac{Z^2 . p(1-p)}{d^2}$, where Z is a standard normal variate ($Z = 1.96$ when the confidence interval is 95%), p is the expected proportion of outcome in

population based on other studies, and d is the absolute accuracy or precision [17]. Based on a previous study where 16% of the population were highly adherent (Morisky score of 8) [18], we calculated a minimal sample size of 207 that would be required to give a 95% probability of measuring the prevalence of high adherence with 5% accuracy.

2.4. Data collection

Data were collected using a structured questionnaire composed of different sections chosen and organized based on a thorough review of similar literature. The questionnaire was administered by trained interviewers in the Arabic language for ease of patient comprehension. The tool was pilot tested on 30 patients who were not included in the final study sample.

The questionnaire extracted information regarding sociodemographic characteristics, lifestyle characteristics, patient healthcare behaviors, patient disease status, patient—healthcare provider relationship, and patient medication adherence using an 8-item modified Morisky Medication Adherence Scale (8-MMMAS).

Trained investigators measured BP using aneroid sphygmomanometers and stethoscopes in all patients after they were in the resting state for 10 min and in a seated position with the right arm placed at the level of the heart. Controlled hypertension was defined as a BP reading <140 systolic or <90 diastolic mmHg at the time of data collection irrespective of measurements at other times. BP

Table 1 Sociodemographic characteristics (n = 210).

Variables	Mean ± SD/n (%)
Age	59.33 ± 12.201
Gender	
Males	85 (40.5)
Females	125 (59.5)
Body mass index	
Normal weight	51 (24.3)
Overweight	103 (49)
Obese	56 (26.7)
Marital status	
Single	11 (5.2)
Married	170 (81)
Divorced/widowed	29 (13.8)
Education level	
Illiterate	30 (14.3)
Elementary	66 (31.4)
Intermediate	55 (26.2)
Secondary	23 (11)
University	36 (17.1)
Employment status	
Unemployed	132 (62.9)
Employed/Self-employed	57 (27.1)
Retired	21 (10)
Monthly income	
500,000—1,000,000	95(45.2)
1,000,000—2,000,000	85 (40.5)
>2,000,000	30 (14.3)
Working hours	
3—7	22 (10.5)
8—16	35 (16.7)
Having care provider at home	173 (82.4)
Having medical insurance	132 (62.9)

SD = standard deviation.

readings $\geqslant 140$ systolic or $\geqslant 90$ diastolic mmHg are referred to as uncontrolled hypertension [18].

2.5. The 8-MMMAS

The original 8-MMMAS was tested by Morisky et al. [18] on a sample of hypertensive patients, and the scale was reliable with good predictive validity and sensitivity. Sensitivity and specificity of the 8-item scale were 93% and 53%, respectively [18]. The scale is a widely used and validated method for assessing patient adherence/nonadherence to a drug regimen. Highly adherent patients were identified with a score of 8 on the scale, medium adherers with a score of 6 or <8, and low adherers with a score of <6 [18]. Using a cutoff of 6, its sensitivity in identifying low versus high adherers was estimated to be 93% and the specificity was 53% [18].

2.6. Statistical analysis

All data were analyzed using SPSS version 20 (IBM, Corp., Atlanta, GA, USA). Bivariate and multivariate (linear and logistic regressions) analyses were undertaken. The dependent variable for linear regression was the medication adherence score, which is a continuous variable ranging from 0 to 8, while for logistic regression it was the dichotomized adherence score (based on a cutoff point = 6). Only variables having $p < 0.2$ in bivariate analysis were included in multivariate analysis. We considered a 95% confidence interval and a value of $p < 0.05$ to be statistically significant.

3. Results

3.1. Socio-demographic and lifestyle characteristics

Two hundred and ten patients were approached, agreed to participate (100%), and were included in this study. Forty percent were males, with no significant ($p = 0.199$) age difference between males (60.65 ± 12.34) and females (58.44 ± 12.07). The majority of the study population was married (81%) and only 27.1% of the sample population is employed (Table 1). Forty percent are smokers and 69% of patients regularly measure their blood pressure (Table 2).

Table 2 Lifestyle characteristics.

Variables	Mean ± SD/n (%)
Smoking status	
Nonsmoker	102 (48.6)
Smoker	84 (40)
Ex-smoker	24 (11.4)
Number of cigarettes/d	9.904 ± 15.506
Regular sport	
Yes	67 (31.9)
No	143 (68.1)
Frequency of practicing sport/wk	
1—3	31 (14.8)
4—7	36 (17.1)
Doctor recommended a certain diet?	
Yes	197 (93.8)
No	13 (6.2)
Do you follow this diet?	
No/sometimes	92 (43.8)
Yes	118 (56.2)
Do you eat a lot of salt?	
No	137 (65.2)
Some	34 (16.2)
Yes	39 (18.6)
Do you regularly measure your BP?	
Yes	145 (69)
No	65 (31)

BP = blood pressure; SD = standard deviation.

3.2. Health status and medication-related characteristics

The mean duration of hypertension was 7.65 ± 6.61 years and it was accompanied with other comorbidities in 71.9% of cases. The mean DBP was 82.92 ± 9.41 mmHg, the mean SBP was 139.40 ± 18.56 mmHg, and 62.9% of the cases were classified as having controlled BP. The average number of medications taken by patients was approximately four different medications/day (4.28 ± 2.71) and, specifically, the mean number of antihypertensive medications prescribed was 1.45 ± 0.68.

Regarding pharmacological classes, the most widely prescribed type of antihypertensive medications was beta-blockers (BB) at 62.9% (Table 3).

3.3. Relationship with healthcare provider

When asked, 36.7% of patients admitted that they postpone physician appointments. Also, results showed that a high percentage (89.5%) of hypertensive patients know the normal BP reading (120/80 mmHg) and that the most commonly reported cause of stopping medication was forgetfulness at 21.4% (Table 4).

Table 3 Health status and medication-related characteristics.

Variables	Mean ± SD/n (%)
Systolic blood pressure	139.404 ± 18.560
Diastolic blood pressure	82.928 ± 9.414
Duration of hypertension (y)	7.650 ± 6.617
Uncontrolled BP	78 (37.1)
Controlled BP	132 (62.9)
Family history of hypertension	
Yes	185 (88.1)
No	25 (11.9)
Presence of comorbidities	
Yes	185 (88.1)
No	59 (28.1)
Number of comorbidities	1.28 ± 1.077
Total number of medications	4.285 ± 2.711
Number of antihypertensive medications	1.457 ± 0.685
Pharmacological category of antihypertensive medications	
Beta-blockers	132 (62.9)
Calcium channel blockers	48 (22.9)
ACEi/ARBs	78 (37.1)
Diuretics	36 (17.1)
Combination drug	63 (30)
Dosing frequency/d	
Once daily	77 (36.7)
Twice daily	82 (39)
Three times daily	51 (24.3)
Do you experience any side effects related to antihypertensive medications?	
Yes	28(13,3)
No	182(86,7)
Do you experience any complications related to hypertension?	
Yes	67(31.9)
No	143(68.1)
Do you take any OTC medications?	
Yes	77 (36.7)
No	133 (63.3)

ACEi = angiotensin-converting-enzyme inhibitor; ARB = angiotensin II receptor blockers; BP = blood pressure; OTC = over-the-counter; SD = standard deviation.

3.4. Adherence patterns

The mean 8-MMMAS score was 6.59 ± 2.0, with minimum and maximum scores of 0 and 8, respectively. Following classification, 50.5% showed high adherence, 27.1% medium adherence, and 22.4% low adherence. These results were modified to 77.6% high adherence and 22.4% low adherence following dichotomization based on a cutoff point <6 (Table 5).

3.5. Factors associated with antihypertensive medication adherence

The association of different variables with adherence status was investigated using both bivariate and multivariate analyses. Variables that showed significant association in the bivariate analysis included following a recommended diet, adding salt to food, having a controlled/uncontrolled BP, taking BBs as an antihypertensive medication, taking any over-the-counter (OTC) medications, postponing medical appointments, understanding how to take medications, knowing normal BP value,

facing different reasons to stop taking medications, value of SBP and DBP, and number of cigarettes/day (Table 6).

Linear regression results indicated that stopping medications due to forgetfulness has the greatest impact on adherence score (standardized $\beta = 0.481$), decreasing it by approximately 2 points ($p < 0.01$). Similarly, stopping medication due to feeling that the disease is under control ($p < 0.01$), the drug regimen is too complicated ($p < 0.01$), experiencing side effects ($p < 0.01$), or drug cost ($p < 0.01$) were associated with a decrease in adherence score by a range of approximately 1—3 points. Only understanding how to take medications ($p < 0.01$) and having a combination drug ($p < 0.023$) were shown to improve adherence score (Table 7). Results of logistic regression showed that patients taking calcium channel blockers (CCB) or knowing the normal BP value were three to five times more adherent than those taking other types of medication or not knowing the normal BP value (ORa = 3.08, 95% confidence interval [1.12; 8.50], $p = 0.030$ and ORa = 4.95, 95%

Table 4 Relationship with healthcare provider.	
Variables	Mean ± SD/n (%)
Do you consult a physician about your disease/treatment?	
No	27 (12.9)
Yes	183 (87.1)
Frequency of physician visit (mo)	6.490 ± 7.744
Do you postpone your doctor appointment?	
No	133 (63.3)
Yes	77 (36.7)
Does the doctor explain how to take medications?	
No	6 (2.9)
Yes	204 (97.1)
Do you understand how to take your medication?	
No	9 (4.3)
Yes	201 (95.7)
Does the doctor explain your disease?	
No	17 (8.1)
Yes	193 (91.9)
Do you know the normal BP value?	
No	22 (10.5)
Yes	188 (89.5)
Reason for stopping medication	
Did not stop	140 (66.7)
Forget	45 (21.4)
Drug cost	11 (5.2)
Complicated regimen	3 (1.4)
Side effects	3 (1.4)
Controlled BP	8 (3.8)
BP = blood pressure; SD = standard deviation.	

Table 5 Percentages of 8-MMMAS answers and adherence scores.

Question	Yes (%)	No (%)
1- Do you sometimes forget to take your pills?	30.5	69.5
2- People sometimes miss taking their medication for reasons other than forgetting. Thinking over the past two weeks, were there any days when you did not take your medicine?	16.7	83.3
3- Have you ever cut back or stopped taking your medication without telling your doctor, because you felt worse when you took it?	11	89
4- When you travel or leave home, do you sometimes forget to bring along your medication?	23.8	76.2
5- Did you take your medication yesterday?	91.4	8.6
6- When you feel like your disease is under control, do you sometimes stop taking your medicine?	11	89
7- Taking medication every day is a real inconvenience for some people. Do you ever feel hassled about sticking to your treatment plan?	12.9	87.1
	Sometimes/often/always	**Never/rarely**
8- How often do you have difficulty remembering to take all of your medication?	26.2	73.8
	Mean	**SD**	**Median**	**Range** (min—max)
8-MMMAS Score	6.595	2.005	8	0—8
	High adherence (=8)	**Medium adherence (6—7)**		**Low adherence (0—5)**
8-MMMAS Classes (%)	50.5	27.1		22.4
	Adherent	**Nonadherent**		
Dichotomous 8-MMMAS (%)	77.6	22.4		

8-MMMAS = 8-items modified Morisky medication adherence scale; SD = standard deviation.

Table 6   Variables associated with adherence score.

Variables	Mean 8-MMMAS	p
Do you follow the recommended diet?		
No/sometimes	6.119	0.003
Yes	6.966	
Do you eat a lot of salt?		
No	6.875	<0.001
Some	7.294	
Yes	5	
Controlled BP		
Uncontrolled	6.115	0.011
Controlled	6.878	
Taking beta-blockers	6.348	0.011
Taking combination drug	7	0.023
Do you take any OTC medications?		
No	6.842	0.019
Yes	6.168	
Do you postpone your doctor appointment?		
No	7.037	<0.001
Yes	5.831	
Do you understand explanation about your medication provided by your doctor?		
No	4.222	0.034
Yes	6.701	
Do you know the normal BP value?		
No	5.727	0.032
Yes	6.696	
Reason for stopping taking the medications		
Did not stop	7.471	<0.001
Forget	4.777	
Drug cost	5.818	
Complicated regimen	4	
Side effects	5.666	
Controlled BP	3.875	
Number of cigarettes/day	—	0.005
Systolic blood pressure	—	0.006
Diastolic blood pressure	—	<0.001

8-MMMAS = 8-items modified Morisky medication adherence scale; BP = blood pressure; OTC = over-the-counter.

confidence interval [1.52; 16.13], $p = 0.008$, respectively) (Table 8).

4. Discussion

The objective of our study was to estimate the prevalence of nonadherence to antihypertensive medication in Lebanese hypertensive patients and to evaluate what factors predict and constitute a barrier toward good medication adherence. The overall percentage of adherent hypertensive patients was 77.6%, greater than that reported by the WHO for other developing countries, such as Gambia (27%) [19], as well as Saudi Arabia (53%) [12] and China (65.1%) [7]. However, it is slightly greater than the adherence rate (71.6%) of patients in the Unites States according to 8-MMMAS [20]. Cultural factors, such as cultural health perception of hypertension, self-care behaviors, and social support, could explain variations in adherence rates among different populations.

Sociodemographic factors were not associated with any variation in adherence levels. This is similar to findings from a study from Brazil [21], while other studies have shown different results. Younger patients and males [22] were found to be less adherent, while another study showed the opposite [12]. Additionally, poor socioeconomic status,

Table 7 Multivariate analysis and linear regression model.

Variables	Unstandardized β	95% CI	p
Forgot to take drugs[a]	−2.346	−2.852; −1.841	<0.001
Feeling BP is controlled[a]	−3.338	−4.378; −2.299	<0.001
DBP	−0.033	−0.055; −0.012	0.003
High drug cost[a]	−1.308	−2.223; −0.394	0.005
Complicated drug regimen[a]	−2.852	−4.530; −1.174	0.001
Understand how to take medications	1.536	0.541; 2.531	0.003
1,000,000−2,000,000	0.547	0.137; 0.957	0.009
Stop due to SE[a]	−2.386	−4.068; −0.705	0.006
Postpone physician appointments	−0.525	−0952; −0.098	0.016
Combination drug	0.514	0.073; 0.956	0.023

BP = blood pressure; CI = confidence interval; DBP = diastolic blood pressure. Dependent variable: Morisky score.
Model statistics: adjusted R^2 = 0.513/p-value of the model ANOVA < 0.001.
[a] Reasons to stop medications (categorical variable).

Table 8 Multivariate analyses and logistic regression model.

Variables	Adjusted odds ratio (Exp β)	95% CI	p
Duration of cigarette smoking	0.968	0.944; 0.992	0.010
Salt (1)[a]	2.282	0.593; 8.787	0.230
Salt (2)[a]	0.118	0.047; 0.297	<0.001
Taking CCB	3.080	1.116; 8.501	0.030
Postpone physician visits	0.245	0.110; 0.543	0.001
Know normal BP value	4.948	1.517; 16.134	0.008

BP = blood pressure; CCB = calcium channel blockers; CI = confidence interval; DBP = diastolic blood pressure. Dependent variable: dichotomized Morisky score. Omnibus test p-value < 0.001/Hosmer−Lemeshow test p-value = 0.986.
Nagelkerke R^2 = 0.362/Overall predicted percentage = 83.7%.
[a] Salt amount (categorical variable)/reference group: no salt added.

illiteracy, and unemployment were estimated to be important risk factors for poor adherence [23].

Following a physician-recommended diet reflects an aspect of a management plan that all adherers complied with, in addition to taking medication. This perhaps indicates a level of awareness that hypertension management is an integrated plan, wherein pharmacological treatment is complementary to the nonpharmacological.

Several studies show a strong linkage between medication adherence and BP control. Controlled levels of SBP and DBP were most prominent among adherent patients according to studies done in Brazil [21] and the United States [18,20]. Our findings match these, wherein association between adherence levels and controlled BP and inverse correlation between adherence scores and both SBP and DBP affirm the cited results. This can be attributed to the mutual association between better outcomes of the treatment offering the patient satisfaction and creating strong motivation toward treatment and bad outcomes (uncontrolled BP) making the patient hopeless and lowering satisfaction, resulting in treatment termination. Better adherence to medication can consequently lead to improved clinical outcomes, one of which is controlled BP.

Surprisingly, the number of antihypertensive medications was not related to adherence behaviors. This is consistent with findings from China [7] and contrary to a study undertaken in France [24]. Our study demonstrated that taking a combination of antihypertensive drugs rather than multiple single drugs may improve adherence levels. However, the opposite is true when taking many OTC medications concurrently with hypertension medications. As a result, complicated drug regimens, commonly accepted as a reason for poor adherence [25,26], should be simplified by fewer daily doses of antihypertensive drugs, monotherapies (preferably combination dosages), and fewer changes in antihypertensive medications for better adherence outcomes.

In crude analyses, only patients on BBs were less adherent than others, possibly attributed to the fact that in Lebanon, most BBs are available in a single form and not in combinations. This is in addition to side effects associated with BBs, specifically hypotension and sexual impotence.

After adjustment for other factors in multivariate analyses, CCBs were found to improve adherence in hypertensive patients, similar to a study carried out in the Unites States using 8-MMMAS

[27]. Patients for whom CCBs are recommended are generally at high risk of coronary disease, diabetes, or have higher BP levels [1]. Thus, patients taking these drugs may have a more severe disease and comorbidities reinforcing the importance of medication adherence. Furthermore, significant improvements of depressive symptoms in patients randomized for dosages of verapamil versus atenolol suggest positive mood-related effects associated with this CCB [28], which may impact adherence. Finally, the reduced variation in SBP observed in patients taking CCBs [29] may result in more controlled BP levels over time and thus better adherence.

A good relationship between patients and their healthcare providers, as well as proper counseling, can affect adherence levels in hypertensive patients [18,20]. One of the aspects of a good patient—healthcare provider relationship is adhering to physician appointments and understanding counseling regarding treatment and disease, which can improve adherence outcomes. For example, our study demonstrated a strong association between adherence scores and patient knowledge of normal BP values, understanding physician explanations regarding treatment, and postponing physician visits. Patients attending medical appointments may positively impact drug treatment adherence, given that frequent patient attendance at the clinic may offer reduced BP levels by providing motivation and improving attitudes that contribute to reduction of arterial hypertension, better pressure-level monitoring, and increased access to information related to treatment and disease.

Forgetting to take drugs and drug cost were the most commonly reported barriers to medication adherence. Our findings are in line with those of a study from Pakistan [16]. Appropriate measures should be taken to enhance patient memory, including planning to take medications in conjunction with certain activities, such as eating meals, and recommending the use of pill boxes that organize the process of medication intake. Physicians can also prescribe generic medications when drug cost is a barrier to adherence.

To our knowledge, this is the first study carried out in Lebanon analyzing adherence to antihypertensive medications among Lebanese hypertensive patients. Many factors have been identified as possible barriers to adherence leading to poor treatment outcomes.

Several limitations to our study can be addressed here. As mentioned, given that patients having co-existing illnesses were not included, some of our results may not be purely indicative of the characteristics of all hypertensive patients. Hence, the extent of generalization is limited. Self-reporting was used as the only method of measuring adherence, which has potential disadvantages concerning recall bias and eliciting only socially-acceptable responses. Given these possibilities, adherence levels among participants may be overestimated. Additionally, single BP readings were used to classify patients into controlled and uncontrolled hypertension groups, which may increase classification bias. Also, we did not account for the ''white-coat'' effect while making these classifications. This implies that a subject demonstrating ''normal'' BP levels when measured outside of a physician office may exhibit levels in the hypertensive range when levels are measured within a physician office [30]. Similarly, we did not account for ''white-coat'' adherence, which is defined as improving medication-taking behavior shortly before and after an appointment with a healthcare provider [13]. Multiple comparisons may give rise to ''false'' positive associations so that a more skeptical assessment of the obtained associations is needed.

5. Conclusion

Our study highlights several factors that may impact adherence levels in Lebanese hypertensive patients either by improving adherence though understanding how to take medications, knowing normal BP value, or taking CCBs, or decreasing adherence through high drug costs, forgetfulness, or complicated drug regimens.

We recommended implementing educational campaigns to increase awareness about hypertension risk factors, complications, and treatment. Patient—healthcare provider factors, such as patient education and counseling, developing a good healthcare provider—patient relationship, and innovating new ways to help patients remember to take their medications should be emphasized.

Conflicts of interest

There are no conflicts of interest to disclose.

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