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Patient activation, adherence to hypertension treatment plans and blood pressure control in Saudi Arabia: a cross-sectional study

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ABSTRACT

Objectives To explore the relationship between patient activation, adherence to hypertension treatment plans, blood pressure control and other important demographic factors.

Design A cross-sectional study.

Setting Primary healthcare centres in Riyadh province, Saudi Arabia.

Participants A total of 114 adults with hypertension, including 68 men and 46 women.

Outcome measurements Blood pressure control is achieved if (a) patients under 80 years of age with treated hypertension have blood pressure under 140/90 mm Hg or (b) patients aged 80 years or over with treated hypertension have blood pressure under 150/90 mm Hg. Secondary outcomes included patient activation, adherence to hypertension treatment plans and demographic factors (age, gender, education, income and comorbidity). Data were analysed using Pearson's correlation and multiple regression models.

Results 57% (n=66) of participants did not achieve the ideal blood pressure target. Perfect adherence to hypertension treatment plans was significantly associated with lower systolic (r=−0.38, p<0.01) and diastolic blood pressure (r=−0.50, p<0.01). Age was significantly correlated with patient activation (r=−0.20, p<0.05) and diastolic blood pressure (r=−0.33, p<0.01). There was no statistically significant association between Patient Activation Measure, systolic blood pressure and diastolic blood pressure. In the hierarchical regression analysis, adherence to hypertension treatment plans was found to be a significant predictor and explained 15% of the variance in systolic blood pressure (β=−0.36, p<0.001) and 26% of the variance in diastolic blood pressure (β=−0.51, p<0.001).

Conclusion The individual and family self-management theory can serve as an effective theory for understanding the key factors in achieving ideal blood pressure target. The majority of patients with hypertension reported lower levels of activation and poor blood pressure control. Inadequate adherence to treatment plans was related to poor blood pressure control. This work is pivotal in devising self-management interventions to assist patients in the management of hypertension disease, especially in Saudi Arabia.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ A strength is application of the individual and family and self-management theory to guide the study.
⇒ Adherence to hypertension treatment plans was a prerequisite for patients with hypertension in order to successfully manage their disease condition.
⇒ Patient Activation Measure scale has not been used for Middle Eastern patients and requires further investigation.
⇒ As this is a cross-sectional study, the findings are less generalisable to the general population of patients with hypertension.

INTRODUCTION

Hypertension is a significant burden to both patients and the healthcare system as a whole. The number of people diagnosed with hypertension has reached 1.13 billion globally.[1] In Saudi Arabia, 31.4% of the population has been diagnosed with hypertension,[2] and more than half (57.8%) were reportedly not aware of their health condition.[3] Hypertension self-management has become a significant factor across the prevention spectrum (primary, secondary and tertiary). To ensure successful self-management of this disease, healthcare providers must move beyond the focus on health education and treatment to subjective factors (eg, adherence to hypertension treatment plans and patient activation) that have a significant impact on hypertension disease self-management.

An integral element to engaging in hypertension self-management behaviours is patient activation. A common finding across studies regarding chronic disease self-management is that patients vary in the extent to which they are disposed to changing their attitudes and lifestyles to conform to healthcare providers' recommendations.[4] In 2004, the term patient activation was first theoretically defined as the ability and willingness to take an active role in

managing a health condition.[5] Hendriks and Rademakers suggest there are four progressive levels of patient activation.[6] At stage 1, individuals tend to be unprepared and disengaged, they are more likely to be passive recipients of care. At stage 2, people lack knowledge of and confidence in self-management. At stage 3, people are taking necessary actions but may still lack the confidence and skills to support new behaviours. At stage 4, people have the ability to adopt adequate behaviours but may not be able to maintain them in the face of stress.[6]

Some studies have found that patient activation is associated with better blood pressure (BP) measurements and hypertension control. For example, based on activation theory, Young *et al* examined the effect of a home-based activation intervention on adherence to treatment plans in 100 patients with heart failure.[7] The result of this study revealed that participants in the intervention group showed significantly improvement in behavioural skills (eg, weight management, low-sodium diet, medication adherence and regular physical activity) compared with usual care at 3 and 6 months after discharge. This study demonstrated that higher levels of activation were associated with patient-reported self-management adherence.

Another important component of hypertension self-management is adherence to treatment plans. In the context of chronic disease self-management, adherence refers to the extent to which a person actively participates in the plan of care, collaboration and maintenance of health-promoting behaviours.[8] Lifestyle modifications also have a significant role to play in managing BP, as patients with hypertension can avoid the risk factors of this disease by adopting health-promoting behaviours. Adherence to hypertension treatment plans as recommended by the Eighth Joint National Committee for the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure included adhering to antihypertensive drug therapy, engaging in regular physical activity, maintaining a healthy weight, following a Dietary Approach to Stop Hypertension eating plan, managing stress and smoking cessation.[8 9]

Research among ambulatory and primary care patients has showed a significant association between adherence to treatment regimens and BP control. In a cross-sectional evaluation of 5116 patients with hypertension, Li *et al* found that adherence to standardised hypertension management had a positive impact on BP control.[10] Additionally, Piercefield *et al* demonstrated that participants who adhered to medications had greater tendency to achieve ideal BP compared with those who considered as non-adherent.[8] In line with the findings of previous studies, a cross-sectional study conducted in Saudi Arabia among 204 patients also reported that participants with high levels of medication adherence were about five times more likely to achieve optimal BP compared with those with inadequate medication adherence.[11] On the contrary, other researchers found that patients who adopted sedentary lifestyles (weight gain, lack of physical activity, high salt intake) experienced inadequate BP.[12] The findings of previous research indicated that to achieve ideal BP targets, healthcare providers should encourage patients to adopt necessary lifestyle modifications, in addition to prescribing antihypertensive drugs and home BP self-mentoring.[8 10–12]

The individual and family and self-management theory (IFSMT) was used to guide the application of this study.[13] Based on IFSMT, self-management is a multifaceted and dynamic process that considers the influence of three main dimensions: context, process and outcomes. The components of contextual and process dimensions of IFSMT are antecedent to proximal and distal outcomes.[13]

As highlighted by Ryan and Sawin, the contextual dimension of the IFSMT converges into three risk and protective factors.[13] These include (a) condition-specific factors, such as the disease or treatment complexity, (b) physical and social environments, such as access to care and culture, and (c) individual and family factors, including literacy, capacity to self-manage and developmental stages. Another dimension of the IFSMT is the process. The main components of the process dimension of self-management include knowledge and beliefs, self-regulation skills and abilities, and social facilitation aspects.[13] The last dimension of the IFSMT is the outcome, which includes proximal and distal outcomes. Proximal outcomes are associated with the acquisition of self-management behaviours for a specific health condition, whereas distal outcomes refer to attaining better health outcomes.[13]

The IFSMT is often used as an orienting framework because it provides perspective on the idea of engagement in self-management behaviours. For this study, the IFSMT was used to examine how the main study variables influence self-management and BP control in Saudi patients with hypertension. In addition, three variables were derived from the four concepts of IFSMT: adherence to hypertension treatment plans and patient activation based on self-management behaviours, and BP control based on health status (see figure 1).

In terms of hypertension self-management in Saudi Arabia, few studies have tested the important factors

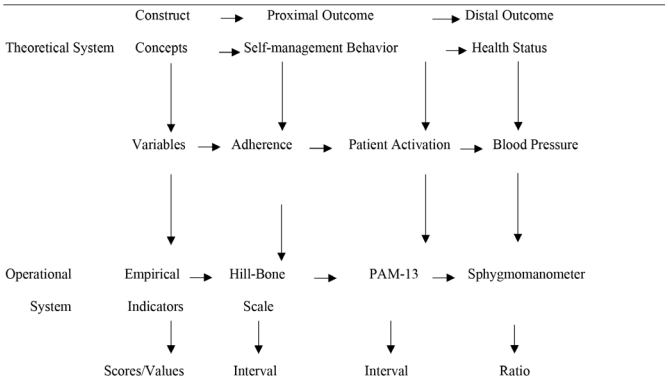

Figure 1 A theoretical substruction of the individual and family and self-management theory. PAM, Patient Activation Measure.

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including adherence to hypertension treatment plans, which play a significant role in chronic disease control.[14 15] Approaches to self-management skills are vitally important for patients to make decisions and take actions to live well with one or more chronic diseases. In terms of health promotion and disease prevention, the Ministry of Health must investigate factors that predict successful self-management of chronic diseases. Thus, a need exists for correlational descriptive studies of factors, such as patient activation and adherence to hypertension treatment plans, aimed at improving hypertension self-management among Saudi adults. To address this gap, we aimed to (a) determine the association between patient activation, adherence to hypertension treatment plans and BP control, (b) examine the influence of patient activation and adherence to hypertension treatment plans on BP control while controlling for social demographic factors (age, gender, educational levels and income) and (c) determine the relationship between individuals' characteristics and main variables.

MATERIALS AND METHODS

Subjects and settings

The study employed a cross-sectional descriptive correlational design. Due to the restrictions and lockdown measures in response to COVID-19, the data collection took more than a year. This study was conducted from January 2020 to August 2021 at primary healthcare (PHC) centres in Riyadh province, Saudi Arabia. PHC centres were appropriate settings for this study given their patient volume and the likelihood that a significant portion of the patients with follow-up appointments would present with chronic diseases.

Data collection procedure

Individuals who were aged 18 years or above and diagnosed with hypertension were included in the study. Exclusion criteria were as follows: newly diagnosed hypertension, active cancer treatment, active hepatitis C treatment, end-stage renal disease and dementia. Those patients were excluded from this study due to the status of disease condition and inability to carry out research activities without discomfort. The participants were instructed to put their completed questionnaires in an envelope, seal them and return the sealed envelope to the investigator. The information pack contained written instructions to help the participant answer the questionnaires and to return them to the investigator.

Given that Riyadh comprises over 130 city districts, we identified and recruited from only four urban primary care centres. Two additional primary care centres were selected from Riyadh region to enhance the sample size. These PHC centres receive patients with different chronic diseases. However, our data were specific to participants living with hypertension or hypertension and other chronic diseases.

According to the guidelines for power analysis set forth by Cohen, a sample size of 103 was sufficient for this study.[16] Convenience sampling was used to identify a sample of 103 patients with hypertension to achieve a power of 0.80 with seven predictors (two independent variables, five covariates), alpha of 0.05 and an effect size of 0.15 on the F-test for multiple regression.[16] A sample of 103 participants was needed to examine the seven predictors, including independent variables (ie, adherence to hypertension treatment plans and patient activation) and covariates (ie, age, gender, income, level of education and comorbidity), and their relationship with the dependent variable—BP control—with a 5% risk of a type I error and 20% risk of a type II error.

A total of 139 individuals were approached to participate in the study, of which 119 consented (response rate=86%). Five individuals were found to be ineligible because they were either not diagnosed with hypertension or were newly diagnosed with hypertension. The remaining 114 participants completed the study surveys (participation rate=96%). The majority of participants were recruited from primary care centres located in Riyadh, the capital city of Saudi Arabia, and 13.3% of the participants were recruited from primary care centres in rural areas.

Patient and public involvement

No patient was involved.

Instruments

Data were collected from 139 patients attending PHC centres in Riyadh, Saudi Arabia. Collected data were restricted to participants' demographics, adherence to hypertension treatment plans and patient activation. Two instruments were used in addition to a demographic questionnaire and BP measurements. First, BP readings were taken using an electronic BP monitor. Following this, the participant was administered a battery of assessment scales, beginning with the Hill-Bone Compliance to High Blood Pressure Therapy (Hill-Bone) Scale. This instrument measures adherence to hypertension treatment plans.[17] This was followed by the 13-item Patient Activation Measure (PAM), which was used to evaluate participants' levels of activation.[5] Demographic characteristics included gender, age, income, educational level, marital and employment status, and comorbidity (hypertension, or hypertension and other chronic diseases).

Adherence to hypertension treatment plans

The Hill-Bone Scale, developed by Kim *et al*, was used to evaluate patients' adherence to hypertension treatment plans.[17] This instrument involved 14 questions across three subscales: nine items were related to medication taking, two items measured appointment making and attendance and three items measured sodium intake. The Hill-Bone instrument used a 4-point Likert-like scale with anchors ranging from 1 (none of the time) to 4 (all of the time). Scores ranged from 14 (minimum)

to 54 (maximum) for the 14 items that were related to three behavioural domains (ie, medication adherence, follow-up appointments and sodium intake).[17] According to previous studies, adherence to hypertension treatment plans includes three levels: poor adherence, indicated by a score <70; moderate adherence, indicated by a score 70–80; and perfect adherence, indicated by a score >80.[18 19] For this study, we used the Arabic version of Hill-Bone Scale.[19]

Kim *et al* have reported on the psychometric properties for the Hill-Bone Scale. Cronbach's alpha, which measures the internal consistency or reliability of the 14 items, was reported at 0.84.[17] The average correlation between items was 0.28. This scale also demonstrated construct and predictive validity. The Hill-Bone Scale has been validated for patients of different ethnicities, such as African American, Poles, Germans, Turks and Arabs. Alsolami *et al* performed a study of an Arabic adaptation of the Hill-Bone Scale to validate the instrument using a sample of 110 hypertensive Arabic-speaking patients.[20] The authors used only one subscale (medication-taking subscale). As a result, the internal consistency of the 9-item Arabic adaptation of the Hill-Bone Scale was found to be 0.76. The findings of this study indicate that the Arabic translation of the Hill-Bone Scale has sufficient internal consistency and factorial construct validity in terms of the medication-taking subscale.[20] For this study, the Cronbach's alpha was 0.75.

Patient activation

Patient activation was measured using the 13-item PAM scale.[5] This instrument measures individual self-reported knowledge, motivation and skills for self-management. Items were measured using a 4-point Likert scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). A raw score was calculated by summing the responses to the 13 items, mapping the sum onto a scale of 0–100. Therefore, scores were converted to a PAM level (1–4) using the PAM scoring spreadsheet by Insignia Health. PAM includes four stages: stage 1 (disengaged and unprepared), indicated by a score of 0–47; stage 2 (being aware, but struggling), indicated by a score of 47.1–55.1; stage 3 (taking necessary actions), indicated by a score of 55.2–72.4; and stage 4 (maintaining a behaviour), indicated by a score of 72.5–100. For this study, we used the Arabic version of PAM provided by Insignia Health.[21]

PAM-13 has demonstrated construct and predictive validity.[5] Several studies using PAM have shown that higher levels of patient activation were associated with better health outcomes, including the demonstration of healthy behaviours, better adherence to treatment plans and lower healthcare utilisation.[5 22] PAM has been reported to be a reliable measure with good internal consistency (α=0.87) among adults with chronic illnesses.[5 23] In this study, Cronbach's alpha for PAM-13 in Arabic was 0.85, indicating that this instrument is reliable.

BP control

BP was measured using an electronic BP monitor. Three BP readings were taken, after which average systolic BP and diastolic BP were computed. According to the National Institute for Health and Care Excellence (2019), BP is considered to be controlled if (a) patients under 80 years of age with treated hypertension have BP under 140/90 mm Hg or (b) patients aged 80 years or over with treated hypertension have BP under 150/90 mm Hg.

Ethical considerations

The informed consent was obtained from each participant. The researcher distributed a recruitment statement to each participant that included the purpose of the study, risks and benefits, confidentiality and autonomy. Participants were informed that they had the right to withdraw from the study at any time without any consequences. The data were reported in aggregate form to maintain participants' confidentiality.

Data analysis

The Statistical Package for the Social Sciences software (V.28) was used for data analysis. Data analysis procedures involved descriptive statistics, Pearson product–moment correlation coefficient (r) and hierarchical linear regression. All statistical tests were conducted using bidirectional tests, and statistical significance was determined at p<0.05. The assumptions of inferential statistics (ie, adequate variance in the independent and dependent variables, absence of influential cases, linearity, constant error variance, normality of residuals, absence of either multicollinearity or autocorrelation) were met.

RESULTS

Description of participant characteristics

Table 1 describes the characteristics of the 114 patients who participated in this study. Patients ranged in age from 21 to 80 years, less than half being between 52 and 62 years old (41.4%). The distribution of participants by gender was somewhat imbalanced. In this study, more than half of the participants were diagnosed with two chronic diseases. The majority of participants were married, had less than 7th grade education and retired.

Description of the measurement results for main study variables

Hill-Bone Scale

Table 2 describes participants' adherence to hypertension treatment plans as measured by the Hill-Bone Scale. In this study, 77.2% (n=88) of participants reported perfect adherence to hypertension treatment plans, while 14.9% (n=17) reported moderate adherence, and 7.9% (n=9) of the sample scored below 70, which reflected poor adherence to hypertension treatment plans.

Patient Activation Measure

Table 2 describes the results of PAM-13 that measures patient activation. Approximately 38% of participants

Table 1 Descriptive statistics—individual characteristics of patients with HTN (n=114)

Variable	N	%
Age		
21–30	4	3.5
31–40	8	7
41–50	26	22.8
≥51	76	66.7
Comorbidity		
Patients living with only hypertension	29	25.4
Patients living with two chronic diseases	60	52.6
Patients living with more than two chronic diseases	25	22
Education		
Less than 7th grade	34	29.8
Intermediate	26	22.8
Some high school	2	1.8
High school	30	26.3
Associate degree	10	8.8
Baccalaureate degree	8	7
Some college	3	2.6
Master's degree	1	0.9
Gender		
Male	68	59.6
Female	46	40.4
Marital status		
Single	5	4.4
Married	95	83.3
Divorced	7	6.1
Widowed	7	6.1
Personal monthly income		
≤$1066	40	35.1
$1067–$2666	41	36
$2667–$3999	20	17.5
$4000–$5333	12	10.5
>$5333	1	0.9
Employment		
Employed	29	25.4
Unemployed	35	30.7
Retired	50	43.9

HTN, hypertension.

were at level 2 of activation, while 30% were found to be at level 1, with both these levels indicating low levels of activation. However, quite a few participants were at level 3, indicating that they were taking the necessary actions to manage their chronic condition. Also, a small number of participants reported being at level 4, indicating that they were maintaining the necessary behaviours to manage their chronic illness successfully.

Blood pressure

Table 2 describes participants' BP as measured by an electronic BP monitor. In this study, 55.3% of the participants had a systolic BP of 140 mm Hg or greater, which was above target. Approximately 65% had a diastolic BP of less than 90, which was regarded as controlled. Accordingly, 66 (57%) of the participants in this study did not achieve the ideal BP target (<140/90 mm Hg),

Table 2 Patient activation, adherence to hypertension treatment plans and blood pressure control (n=114)

Variables	Total score		N	%
Adherence to hypertension treatment plans	<70	Poor adherence	9	7.9
	70–80	Moderate adherence	17	14.9
	>80	Perfect adherence	88	77.2
Patient activation level	0.0–47.0	Level 1 (disengaged and unprepared)	34	30
	47.1–55.1	Level 2 (being aware, but struggling)	43	38
	55.2–72.4	Level 3 (taking necessary actions)	22	19
	72.5–100	Level 4 (maintaining a behaviour)	15	13
Blood pressure control	≥140	Systolic blood pressure	63	55.3
	<140	Systolic blood pressure	50	43.9
	≥90	Diastolic blood pressure	40	35.1
	<90	Diastolic blood pressure	72	64.9
	<140/90	Achieved ideal blood pressure target	48	42.1

whereas 42.1% kept their BP within the recommended range.

Association between patient activation, adherence to hypertension treatment plans, BP control and individual characteristics

As shown in table 3, there was a low and negative correlation between participant ages and patient activation (r=−0.20, p<0.05). The younger the participants, the more activated they were in the practice of recommended self-management tasks. There were significant positive and moderate correlations between age and adherence to hypertension treatment plans (r=0.38, p<0.01). The older the participants, the higher their level of adherence to their hypertension treatment plan.

Systolic and diastolic BP were moderately and negatively correlated with adherence to hypertension treatment plans (r=−0.38 and r=−0.50, respectively, p<0.01). Participants with high scores on the Hill-Bone Scale reported lower systolic and diastolic BP readings. The other main variable, patient activation, was not significantly correlated with systolic and diastolic BP.

Table 3 Correlation matrix for age, systolic BP, diastolic BP, adherence to hypertension treatment plans and PAM

Variable	1	2	3	4	5
1 Age	1				
2 Systolic BP	0.099	1			
3 Diastolic BP	−0.326**	0.620**	1		
4 Adherence	0.38**	−0.38**	−0.50**	1	
5 PAM	−0.203*	−0.185	0.087	0.14	1

Pearson's correlation was used. *P<0.05; **p<0.01.
BP, blood pressure; PAM, Patient Activation Measure.

Influence of patient activation and adherence to hypertension treatment plans on BP control

Systolic BP

The overall regression model for systolic BP was statistically significant (p<0.01). As shown in table 4 model A, perfect adherence to hypertension treatment plans was a statistically significant determinant of decreased systolic BP (p<0.001) and accounted for 15% of the variance. After all covariates (ie, age, gender, education, comorbidity and income) were included, the adjusted variance of the regression model (table 4 model B) did increase (adjusted R^2=18%). Model B became insignificant (p=0.12) after the covariates were included. Adherence

Table 4 Summary of regression analysis for blood pressure control, systolic blood pressure (n=113)

Predictor variable	Model A		Model B	
	B	β	B	β
Constant	211.56		196.20	
Adherence to hypertension treatment plans	−1.22	−0.36***	−1.56	−0.46***
Patient activation	−0.18	−0.14	−0.14	−0.11
Age			0.23	0.15
Gender			0.47	0.32
Comorbidity			0.60	0.01
Education			0.43	0.05
Income			0.49	0.03
R^2	0.16		0.23	
Adjusted R^2	0.15		0.18	
F	10.62***		1.78	

***P<0.001.

Table 5 Summary of regression analysis for blood pressure control, diastolic blood pressure (n=113)

Predictor variable	Model A		Model B	
	B	β	B	β
Constant	123.07		120.26	
Adherence to hypertension treatment plans	−0.92	−0.51***	−0.77	−0.43***
Patient activation	0.11	0.16	0.03	0.05
Age			−0.05	−0.06
Gender			3.38	0.18
Comorbidity			−0.56	−0.03
Education			0.30	0.07
Income			0.16	0.02
R^2	0.27		0.30	
Adjusted R^2	0.26		0.26	
F	20.31***		1.04	

***P<0.001.

to hypertension treatment plans continued to be a significant variable (p<0.001). One covariate added to the explained variance in the regression model: age (p<0.01).

Diastolic BP

The overall regression model for diastolic BP was statistically significant (*F*=20.30, p<0.001). Adherence to hypertension treatment plans influenced diastolic BP (p<0.001) and accounted for 26% of variance. After all covariates were included, the adjusted variance of the regression model (table 5 model B) did not increase. The F-test overall significance in table 5 model B was not significant (p=0.40). Adherence to hypertension treatment plans was also found to be a significant variable.

DISCUSSION

This study was conducted to explore the relationship between patient activation, adherence to hypertension treatment plans, BP control and demographic factors. In this study, correlational analysis revealed that patient activation had a significant negative correlation with age; the younger the participant the more activated in the practice of required self-management activities. Interestingly, no statistically significant associations were found between patient activation and the main study variables, such as adherence to hypertension treatment plans and BP control. This finding is contrary to previous studies conducted in western countries.[7 24] Although prior research studies show that improved activation is associated with improved patient outcomes, it may be challenging to achieve better BP control among patients with comorbidities and low levels of education and income.[7 25–27] These barriers impede patients' understanding of how active engagement in healthy promoting behaviours may lead to lower BP.

In addition, there is limited evidence on the effects of self-management interventions on patient activation in adults with hypertension. Thus, it is difficult to explain the reasons for the findings found in this study. Innab and Kerari conducted a systematic review and meta-analysis aimed to evaluate how self-management strategies affect changes in activation levels in adults with hypertension.[28] As a result, the authors only found four randomised controlled trials that assessed the effects of self-management interventions on patient activation in adults with hypertension. Self-management interventions (ie, community-based self-management programmes, motivational interviewing strategies) were associated with better PAM scores and BP control than usual care.[28] More research needs to be conducted aimed at evaluating the impact of patient activation on chronic disease self-management in Middle Eastern countries. In the context of hypertension disease, targeted strategies tailored to individual levels of activation are needed to improve self-management skills.

Adherence to hypertension plans was the sole predictor of systolic and diastolic BP. Better adherence to hypertension treatments was related to decreased systolic and diastolic BP. The study results regarding the impact of adherence to hypertension treatment plans on BP control are consistent with past studies.[8 10 11] Literature regarding chronic disease self-management has focused on the importance of adherence to treatment regimens. Patients maintaining the practice of required health behaviours are more likely to achieve better health outcomes.[29–31]

In areas of primary care settings, healthcare professionals should play an important role in improving patients' knowledge, motivation and self-management skills to ensure better adherence to hypertension treatment plans. Some of the strategies to increase patients' adherence include instructing patients to record medication taking in a diary and encouraging the use of home BP monitoring. In addition, healthcare providers can provide an annual review of care to their patients, which could help in increasing their adherence rate and BP control.

In addition, the results of this study affirm the writings of Obro *et al* and Warner *et al*, where engaging in treatment regimens is one of the factors contributing to successful chronic disease self-management and control.[32 33] Thus, patients need to understand the importance of behavioural skills adherence to treatment plans in managing hypertension disease. In areas of primary care settings, healthcare providers can use the Hill-Bone instrument to evaluate patients' adherence levels to hypertension treatment plans. As demonstrated in this cross-sectional study, this instrument serves as a valuable tool for measuring adherence to hypertension treatment plans in the Saudi population.

Limitations

This study faced some limitations. First, the representativeness of the sample is a major concern when employing a convenience sampling method. Thus, the findings of the study may be less generalisable to the general population of patients with hypertension. Recruitment from several primary care centres located in different regions of Saudi Arabia that provide healthcare services to a larger population of patients with chronic diseases would have added to the diversity in terms of participant characteristics (ie, education, income, comorbidity). Second, the study design was cross-sectional and so causality cannot be examined. Furthermore, most of the main variables were self-reported, which may increase the risk of social desirability bias.

CONCLUSION

In this study, perfect adherence to hypertension treatment plans was significantly associated with decreased systolic and diastolic BP. Yet, greater work is needed to educate patients on adopting healthy behaviours, building confidence and improving BP control. Patient activation was not a significant predictor of BP control. These findings are important as the use of PAM-13 scale has not been widely used in the Middle Eastern countries and requires further investigation. The IFSMT can serve as an effective theory for understanding factors contributing to improved BP control in Saudi Arabia. Improved research designs and sampling techniques may help assess for significant relationships between these variables in future studies.

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Patient consent for publication Not applicable.

Ethics approval This study involves human participants and before the commencement of data collection, institutional review board approvals were obtained from the Ministry of Health (Ref No: H-01-R-012) and OHRP/NIN, USA (IRB 0010471). The study was performed following the Declaration of Helsinki. Participants gave informed consent to participate in the study before taking part.

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