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Health Beliefs and Medication Adherence in Omanis with Hypertension

Huda Al Noumani, PhD,

College of Nursing, Sultan Qaboos University, Muscat, Oman.

Jia-Rong Wu, PhD,

School of Nursing, University of North Carolina at Chapel Hill, Chapel Hill, USA.

Debra Barksdale, PhD,

School of Nursing, Virginia Commonwealth University, Virginia, USA.

George Knafl, PhD,

School of Nursing, University of North Carolina at Chapel Hill, Chapel Hill, USA.

Esra AlKhasawneh, PhD, and

College of Nursing, Sultan Qaboos University, Muscat, Oman.

Gwen Sherwood, PhD

School of Nursing, University of North Carolina at Chapel Hill, Chapel Hill, USA.

Hypertension (HTN) is prevalent, affecting about 40% of adults globally.¹ Oman, a developing country in the Middle East, is a modern society classified as a high-income country. The health system in Oman is well developed and all citizens have equal access to medical care. In Oman, the prevalence of HTN is 40.3%² and it is the leading cause of hospitalization.³ Globally, HTN is responsible for approximately 50% of cardio- and cerebrovascular events.¹ Though medication is key to managing HTN^{4–6}, adherence to antihypertensive medication worldwide and in the Middle-East remains poor.^{7,8}

Various factors contribute to poor medication adherence^{9,10}, such as patients' beliefs^{9,11}, purposely skipping medication, forgetfulness, poor patient-provider communication, or access to care issues¹². The health beliefs model (HBM) supports that a decision to take a health action (i.e., medication adherence) is influenced by patients' beliefs about the disease, effectiveness of medications and self-efficacy.^{13,14} Therefore, investigators commonly use the HBM to understand how patients' perceptions of severity, benefits, barriers, and self-efficacy affect medication adherence.^{15–18}

Literature related to hypertension^{15,19,20} and literature among Arabs^{21–23} have also reported that adherence is related to beliefs about medication necessity and concern. For instance, in Islamic culture, all Muslims believe in the central role of God in healing, which may

Corresponding author at: Huda Al Noumani, hudasn@squ.edu.om, Tel: +968 9211 6739, Fax: +968 2441 3536.

Permanent address: Sultan Qaboos University, College of Nursing, P.O. Box 66, P.C. 123, Alkhoud, Muscat, Oman

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influence their behavior toward managing illness. Accordingly, some Muslims may take medications, while others may not because they believe that illness is God's wish and only religious practices will heal them.²⁴ Oman is similar to other Arab/Muslim countries where people believe that illness and/or healing is connected to God.²⁵

In Oman, although several investigators have examined HTN prevalence and risk factors^{26–28}, in only one study in 2005 was adherence to antihypertensive medications examined.²⁹ However, to date, no investigators have examined medication adherence in relation to patients' beliefs nor have they used the HBM as a framework. Hence, guided by the HBM, this study was conducted to examine (a) patients' beliefs about HTN, medication, self-efficacy, and adherence to antihypertensive medication; (b) the relationship between patients' beliefs and medication adherence; and between medication adherence and blood pressure (BP) control (Figure 1). Findings from this study will enhance identification of factors related to poor adherence among Omanis as compared to other population; thus, revealing challenges and opportunities to improve medication adherence and BP control.

Method

Design and setting

This descriptive cross-sectional study was conducted in Oman. Subjects with HTN were recruited from primary healthcare settings (e.g. health centers) around Oman. Those primary healthcare settings have on-site HTN clinics, which are operated at least once a week. Participants were recruited from various Clinics of Ad Dhakhliyah, North Ash Sharqiyah, Muscat, Ad Dhahirah, North and South AlBatinah Governorates. The Omani government primarily finances healthcare system while the Ministry of Health is the main healthcare provider and regulator.

Sample Size

In our previously published pilot study³⁰, the smallest correlation between medication adherence and patient's beliefs was $r = .25$; this would have required a sample size of 117 to have 80% power to detect a relationship at .05 two sided significance. To be more conservative, we considered a smaller correlation of $r = .22$, which would have required a sample size of 156 to have 80% power to detect a relationship at 0.05 two-sided significance. We over-recruited participants to raise the total sample to 215 and thereby allowing for as much as 27% missing data.

Inclusion and Exclusion Criteria

Inclusion criteria were Omanis diagnosed with HTN for at least 3 months, aged ≥ 21 years, and taking at least one antihypertensive medication. Ethical approval was obtained from the Omani Ministry of Health.

Participants attending clinic were screened for eligibility using a patient list obtained through electronic medical records. Eligible participants were initially approached by a nurse about participation. Willing participants were then contacted by the principal investigator (PI) who informed them about the study's purpose and asked them to sign an

informed consent form. Participants were assured that participation was voluntary and refusal to participate would not affect their treatment. Participants completed a demographic sheet and self-reported questionnaires on medication adherence and beliefs. For participants with reading limitation, the study purpose and procedure were explained by the PI and participants were asked to write "X" if they could not sign and then they were interviewed by the PI. Data related to current BP, past BP readings during five previous clinic visits, 3 months apart, and comorbidity burden were obtained through medical records. Data were collected from 25 health centers, representing 14 districts in six governorates, from October 2015 to January 2016. Permission to use all questionnaires described below was obtained from main developers.

Instruments

Morisky Medication Adherence Scale-8 items (MMAS-8)—We used the Arabic version of MMAS-8 to measure medication adherence. The MMAS-8 is a reliable and valid scale³¹ and has been adopted in several languages, including Arabic.^{22,23,32–37} MMAS-8 comprises eight items; seven items with yes/no response whereas the remaining item is rated on a five-point Likert scale (4 = never to 0 = all the time). All items are summed, with the last item weighted by 1/4, giving a total sum MMAS-8 score ranging from 0–8 with higher scores reflecting higher adherence. A total score of 6 indicates high adherence³¹. In this study, Cronbach's alpha was .64, which was below the acceptable value of .70. Item 7 (i.e., feeling hassled about sticking to medications) had the lowest corrected item-total correlation ($r = .28$). This item was retained because when it was deleted, the alpha coefficient decreased to .62.

Beliefs about Medicines Questionnaire- specific (BMQ)—We used the Arabic version of BMQ-specific to measure participants' beliefs about medication. It comprised BMQ-necessity scale (BMQ-N) to assess beliefs about medications' necessity, and BMQ-concern scale (BMQ-C) to assess participants' concerns about medication. BMQ-N and BMQ-C had adequate reliability and validity³⁸ including the Arabic version.^{22,39–42} Subscales were rated on a five-point Likert scale (5= strongly agree to 1= strongly disagree) with a mean score ranging from 1–5; a higher score represented stronger beliefs about the necessity or concerns. In our study, Cronbach's alphas for BMQ-N and BMQ-C were .84 and .70, respectively.

Brief Illness Perception Questionnaire (BIPQ)—We used the BIPQ to measure beliefs about HTN severity. The BIPQ comprised eight items and had adequate reliability and validity⁴³. BIPQ was translated to Arabic according to international guidelines^{44–46}. In our study, Cronbach's alpha was .52, indicating low internal consistency. Consequently, we deleted item 7, which had a low item-total correlation and increased the alpha coefficient to .66. Therefore we used the seven-item BIPQ for the analysis. Each item of the BIPQ was rated from 0–10 with total summated score ranged from 0–70 and higher score indicated strong beliefs about HTN severity.

Medication Adherence Self-Efficacy Scale- Revised (MASES-R)—We used MASES-R to assess the degree of participants' confidence in taking medication under

certain circumstances. MASES-R, comprising 13 items, was translated to Arabic following international guidelines.^{44–46} MASES-R is reliable and valid⁴⁷ and is rated on four-point responses (1 = not at all sure, 4 = extremely sure) with a mean score ranged from 1–4 (higher score indicating higher self-efficacy).⁴⁷ In this study, the MASES-R Cronbach's alpha was 0.93.

Systolic (SBP), diastolic blood pressure (DBP), and Charlson Comorbidity Index (CCI)—The SBP, DBP, and CCI to collect data on comorbidities^{48,49} were obtained from electronic medical records. BP is considered controlled if systolic < 140 mmHg and diastolic < 90 mmHg.⁵ The CCI score was calculated by summing the total weights assigned, with a higher score indicating a higher comorbidity burden. Patients' demographic data that were collected are illustrated in table 1.

Analysis

Data were analyzed using SPSS version 23 (IBM Corp., Armonk, NY). Descriptive statistics of means and standard deviations were used for continuous variables and frequency and percentages for categorical variables. Bivariate logistic regression was used to examine the relationships of demographics, CCI, and beliefs (BMQ-N, BMQ-C, BIPQ, MASES-R) with having high medication adherence (MMAS-8 = 6). Then, multivariate logistic regression analysis using backward elimination based on the likelihood ratio was used to examine the independent effect of beliefs on medication adherence. Demographic variables significantly related to MMAS-8 in the bivariate analysis were adjusted by multiple logistic regression analysis. Additionally, similar bivariate and multivariate logistic regression analyses were conducted to predict BP control and high medication adherence. A *p* value < .05, a 95% confidence interval, and odds ratios (OR) were used to report the statistical significance and estimates.

Results

A total of 215 participants were included in this study (mean age = 53.6 years, standard deviation (*SD*) = 13.1) (Table 1). The mean SBP and DBP were 140.8 mmHg (*SD* = 19.1) and 81.3 mmHg (*SD* = 11.3), respectively, and only 36% (*n* = 78) had their BP controlled. The comorbidity burden was 1.6 (*SD* = 0.98), with most participants (64%) having HTN only and the remaining having concurrent comorbidities (e.g., diabetes, myocardial infarction, heart failure, stroke).

The mean score of the MMAS was 6.4 (*SD* = 1.6) with 68% of participants having high adherence. Reasons for non-adherence as reported by participants who could select more than one reason, were: 1) feeling well and having controlled BP (17%), 2) feeling hassled about sticking to BP medication (22%), 3) forgetting BP medication when leaving home (24%), and 4) forgetting to take medication (30%).

The mean score of the BIPQ was 25.8 (*SD* = 12.2). The total score ranged from 0–56 with the 75th percentile at 39, indicating that a large majority of the participants had a lower perception regarding HTN severity. Overall, 76% of participants believed that HTN

minimally affects their life, 83% believed they have control over HTN, 77% experienced few or no symptoms from HTN and 74% had less concern about HTN.

The mean score of the BMQ-N was 3.7 ($SD = 0.86$). Participants agreed that their current health (70%) and future health (54%) depended on BP medication, that their lives would be impossible without BP medication (64%), and that BP medication protects their health from getting worse (85%).

The mean score of the BMQ-C was 2.4 ($SD = 0.8$). Most participants were not concerned about medication disrupting their life (86%), bothered by side effects (70%), worried to take BP medication (69%), nor feared dependency (59%). However, about 51% were worried about medication long-term side effects.

The mean score of the MASES-R was 3.4 ($SD = 0.71$). Most participants were confident to take their BP medication when they were busy at home (70%), did not have any symptoms (67%), took medication more than once a day (66%), and while traveling (65%). Only 58% and 48% of participants were confident to take medication in public and when medications bring about the urge to urinate while away from home, respectively.

Relationship between Medication Adherence, Beliefs, and BP control

The bivariate logistic analysis showed that increased age, higher self-efficacy, stronger beliefs about medication necessity, and being a widow had significantly high medication adherence ($OR = 1.07$, $OR = 3.39$, $OR = 1.82$, $OR = 6.75$, respectively). On the contrary, those with stronger beliefs about HTN severity and more concerns about medications were significantly less likely to have high adherence ($OR = 0.96$ and $OR = 0.30$, respectively). Additionally, educated participants were significantly more adherent than illiterates ($OR = 0.36$ and $OR = 0.24$, respectively).

The variables that were significantly related to high adherence in the bivariate analysis were entered into multiple regression analysis. Of all variables entered (MASES-R, BIPQ, BMQ-N, BMQ-C, age, education and marital status), only four variables (MASES-R, BMQ-N, BMQ-C, age) remained after backward elimination. This reduced model was statistically significant ($\chi^2(4) = 84.4$, $p < .001$, Table 2) and explained 48% of the variation in medication adherence level (Nagelkerke $R^2 = .48$). Self-efficacy, beliefs about medication necessity, and concern about medication explained about 37% of the variation in medication adherence (Nagelkerke $R^2 = .37$). The model revealed that a) participants with higher self-efficacy were two and a half times more likely to have high adherence ($OR = 2.59$, $p < .001$); b) those with stronger beliefs about medication necessity were twice as likely to have high adherence ($OR = 1.98$, $p = .006$); and c) those more concerned about their medication were about one-third as likely to have high adherence ($OR = 0.34$, $p < .001$). Additionally, high adherence is more likely to increase with age ($OR = 1.06$, $p < .001$).

The bivariate logistic analysis between study variables and BP control showed that participants were significantly less likely to have uncontrolled BP with high medication adherence ($OR = 0.50$, $p = .03$) more likely to have uncontrolled BP with more concern about medication ($OR = 1.50$), higher comorbidity burden (CCI) ($OR = 1.48$), and higher

past SBP ($OR = 1.05$) and DBP ($OR = 1.48$). When these variables entered in the multiple logistic regression, past SBP and medication adherence remained significant. After backward elimination, the model showed that participants with higher past SBP were more likely to have uncontrolled BP ($OR = 1.04$, $p < .001$), and those with high medication adherence were less likely to have uncontrolled BP ($OR = 0.48$, $p = .04$) and both variables explained 15% of the variation in BP control (Nagelkerke $R^2 = 0.15$) (Table 3).

Discussion

This study was conducted to examine the relationship between patients' beliefs and medication adherence among Omanis with HTN. The study found that Omani patients with HTN are more likely to have high medication adherence when they have stronger beliefs about medication necessity, stronger self-efficacy regarding medication adherence, and less concerns about medications. Additionally, patients with higher adherence are less likely to have their BP uncontrolled.

Higher adherence is reported among patients with stronger beliefs about medication necessity and less concern about medication. These findings are consistent with HTN studies^{15,19,20} and among Arabs.^{21–23} About 50% of participants reported concerns related to medications' side effects that could develop in the future. Therefore, it is essential for clinicians and scientists to assess patients' beliefs and concerns about medications to appropriately provide information emphasizing medications' benefits against future risks. As around 50% of our participants are unemployed/housewives and do not read or write, it is important to provide an effective and individualized health education to patients and their families. Accordingly, clinicians will be able to maximize positive medications' beliefs and minimize individual concerns to enhance adherence.^{50,51}

Our findings regarding the positive relationship between self-efficacy and medication adherence are consistent with other studies in HTN^{20,47,52}, glaucoma⁵³, HIV⁵⁴, and osteoporosis⁵⁵. These investigators reported the same positive association despite using different measures of adherence and self-efficacy. This is in line with Bandura's theory that supports self-efficacy as a central concept determining individuals' behaviors and how much effort they spend in adopting a healthy behavior.⁵⁶ This denotes the importance of incorporating self-efficacy into practice to increase patients' confidence in adopting management behavior, particularly medication adherence. Accordingly, individualized care to enhance self-efficacy could be planned.

In Islamic culture, Muslims trust and depend on God for healing, but at the same time they believe that health is a gift, and they are responsible for protecting their health and seeking treatment.^{57,58} Hence, they make a maximal effort to seek care and leave the outcome to God. This could explain why our participants who believed HTN minimally affected their life (76%) still felt that taking the medication was important to their current and future health (54%–70%). Understanding these certain beliefs is crucial for healthcare providers taking care of Muslim patients. Furthermore, our participants reported less confidence in taking medication when they were in public or when medications caused frequent urination while away from home. This response is not unusual because Omanis value confidentiality

and do not like to reveal their medical or personal issues to others, which could explain their lower confidence in taking medication under these circumstances.

Consistent with previous studies, participants with high medication adherence significantly exhibited more BP control.^{31,32,59,60} Behavioral and educational intervention studies have shown that improving patients' knowledge about HTN, its consequences, and medications' side effects improved medication adherence and BP outcomes.⁶¹ Hence, the public health agenda could embrace assessing and improving adherence to antihypertensive medication as a top priority, given the high prevalence of HTN and uncontrolled BP worldwide and in Oman.

In this study, 68% of subjects reported high adherence. Although this percentage is not optimal, it is higher compared to other countries in the Middle East. For instance, among Arabs, adherence ranged between 19% and 57%.^{15,22,23,35,62} The higher adherence rate in our study could be attributed to the fact that 75% of participants were 45 years or older and older age (e.g., >50 years) has been significantly related to higher adherence.^{22,35,60} Another explanation for higher adherence could be the fact that all Omanis have free access to medications and therefore cost would not be a barrier to adherence.

The findings of this study offered important implications for providers and researchers. Providers need to be aware that evaluating patients' beliefs is an important step toward improving medication adherence. Researchers should design interventions aiming to improve medication adherence through enhancing patients' awareness of medication necessity over medication concerns, and individualized self-efficacy, which could be achieved through patient education about HTN and medication. Future studies are needed to validate the BIPQ and MMAS-8 in the Omani population, and examine long-term medication adherence in Oman and in the Middle Eastern countries. Further studies could consider the effect of medication's class and dose and effect of other medications used to treat concurrent comorbidities on medication adherence.

Our findings should be interpreted in light of several limitations. First, this study is cross-sectional and cannot support a causal relationship. Second, we utilized a self-reporting measure of adherence, which may have introduced a recall bias. However, the MMAS-8 is reliable, valid, widely used across cultures and populations, and has been correlated with objective measures of medication adherence (i.e., pharmacy refills and electronic monitoring system).^{63,64} We used a convenience sample, which limited the generalizability of findings. Another limitation was the low reliability of BIPQ and MMAS-8 (Cronbach's alpha = .66 and .62, respectively). However, both BIPQ and MMAS-8 are widely used to measure perception of illness severity and medication adherence. Therefore, further studies to validate MMAS-8 and BIPQ among Omani population could be conducted.

In this study, we did not examine types or the actual dose of antihypertensive medications nor numbers and types of other medications taken to manage other concurrent comorbidities in relation to medication adherence. This could have influenced patients' beliefs about the necessity of and concerns regarding antihypertensive medications and medication adherence.

Conclusion

This study is the first to examine the relationship between beliefs and medication adherence in Oman using multiple cities and governorates. The study findings set new priorities for future research in Oman to incorporate patients' beliefs as a key aspect in providing health education and optimizing medication adherence among Arab patients.

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What's New?

- Higher adherence to antihypertensive medications is more likely with higher self-efficacy.
- Stronger beliefs about medications necessity and less medications' concern are related to higher medication adherence.
- Uncontrolled blood pressure is less likely with high medication adherers.

Figure 1.
Study Conceptual Framework Guided by Health Beliefs Model

Table 1**Characteristics of Study Participants**

Variable	n (%)	Mean (SD)	Range
Age (years)		53.6 (13.1)	21 – 86
Years with HTN		7.9 (7.4)	3m – 40y
Number of antihypertensive medications		1.8 (0.86)	1 – 5
Frequency of daily dose		1.5 (0.67)	1 – 4
SBP (mm Hg)		140.8 (19.1)	102 – 200
DBP (mm Hg)		81.3 (11.3)	49 – 110
CCI		1.6 (0.98)	1 – 7
Scales Scores			
BMQ-C		2.4 (0.80)	1 – 5
BMQ-N		3.7 (0.86)	1 – 5
BIPQ		25.8 (12.2)	0 – 56
MASES		3.4 (0.71)	1 – 4
MMAS-8		6.4 (1.6)	1.50 – 8
Governorate			
Ad Dhakhliyah	65 (30)		
Muscat	47 (22)		
Ad Dhahirah	44 (20)		
Ash Sharqiyah (North)	28 (13)		
Al Batinah (South)	19 (9)		
Al Batinah (North)	12 (6)		
Gender			
Male	74 (34.4)		
Female	141 (65.6)		
Marital Status			
MarriedWidowed	151 (70.2)		
Single	44 (20.5)		
Divorced	10 (4.7)		
	10 (4.7)		
Income (US dollar) is it OMR?			
No Income	77 (36.2)		
<150 (< \$ 390)	27 (12.7)		
150 – 499 (\$ 390 – \$ 1,299)	65 (26.3)		
500 – 999 (\$ 1,299 – \$ 2,601)	28 (13.1)		
1000 (\$ 2,604)	25 (11.7)		
Education Level			
Do not write or read	104 (48.8)		
Write and read only	24 (11.3)		
Primary or preparatory completed	31 (14.6)		
High school Completed	26 (12.2)		

Variable	n (%)	Mean (SD)	Range
University or more	28 (13.1)		
Employment Status			
Government sector	37 (17.5)		
Private sector	18 (8.5)		
Self-employed	4 (1.9)		
Unemployed/Housewife	127 (60.2)		
Retired	25 (11.8)		
Smoking			
No	207 (98.1)		
Yes	4 (1.9)		
Alcohol consumption			
No	209 (99.1)		
Yes	2 (0.90)		
Medication Adherence (MMAS-8)			
High	145 (67.8)		
Low	69 (32.2)		
BP control status			
Uncontrolled	133 (63)		
Controlled	78 (37)		

Note. CCI = Charlson Comorbidity Index; BIPQ = Brief Illness Perception Questionnaire; BMQ-C = Beliefs about Medicine Questionnaire-Concern; BMQ-N = Beliefs about Medicine Questionnaire-Necessity; DBP= Diastolic BP; HTN = Hypertension; m = month; MASES = Medication Adherence Self Efficacy Scale; MMAS-8 = Morisky Medication adherence scale-8 items; OMR = Omani Rials; SBP = Systolic BP; SD = Standard Deviation; y = year

Table 2
Summary of Multiple Logistic Regression Analysis for Variables Predicting Likelihood of High Medication Adherence *

Variable	B	SE	Wald	df	p-value	Odds Ratio	95% CI for Odds Ratio
MASES	.95	.27	12.80	1	< .001	2.59	1.54, 4.37
BMQ-N	.68	.25	7.48	1	.006	1.98	1.21, 3.23
BMQ-C	-1.09	.268	16.48	1	< .001	0.34	0.20, 0.57
Age	0.06	.02	15.44	1	< .001	1.06	1.03, 1.10

Note. B = -----; BMQ-C = Beliefs about Medicine Questionnaire-Concern; BMQ-N = Beliefs about Medicine Questionnaire-Necessity; CI = Confidence Interval; df = ----- MASES-R = Medication Adherence Self-Efficacy Scale-Revised; SE = Standard Error

* This model used backward elimination method and represents only the significant predictors of medication adherence among other variables included (Brief illness perception (BIPQ), education and marital status).

Table 3

Summary of Multiple Logistic Regression Analysis for Variables Predicting Likelihood of Uncontrolled Blood Pressure*

Variable	B	SE	Wald	df	p	Odds Ratio	95% CI for Odds Ratio
Past SBP [#]	0.04	.01	16.56	1	< .001	1.04	1.02, 1.06
High Medication Adherence	-.73	.35	4.47	1	.04	0.48	0.24, 0.95

Note. B = -----; CI = Confidence Interval; df = -----; SBP = Systolic BP; SE = -----

* This model used backward elimination method. Model included variables: Beliefs about medication concern (BMQ-C), Morisky medication adherence (MMAS-8), Charlson comorbidity index (CCI), past SBP and DBP.

[#] SBP of the previous visit