HEALTH BELIEFS AND ANTIHYPERTENSIVE MEDICATION ADHERENCE IN OMAN

Huda Al-Noumani

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Approved by:

Jia-Rong Wu

Debra Barksdale

Gwen Sherwood

George Knafl

Esra Al-Khasawneh

ABSTRACT

Huda Al-Noumani: Health Beliefs and Antihypertensive Medication Adherence in Oman
(Under the direction of Jia-Rong Wu)

Hypertension (HTN) is a serious health issue across the globe. Oman, an Arabic Muslim country located in the Middle East, has high prevalence of HTN and uncontrolled blood pressure (BP). Appropriate management of HTN and control of BP require adherence to antihypertensive medication to prevent HTN-related serious complications. Worldwide, proper adherence remains a challenge. Several factors contribute to medication adherence among patients with HTN. Patients' beliefs about HTN and medication are among the significant predictors of medication adherence. In Oman, studies that examined patients' health beliefs of patients with HTN as determinants of medication adherence are not available. Hence, this dissertation aimed to examine the relationship between beliefs about the necessity of and concerns about medication, beliefs about HTN, and self-efficacy and medication adherence among Omanis with HTN. The health beliefs model was used to guide this dissertation. Three manuscripts were produced to achieve the overall purpose of this dissertation. The first manuscript is a systematic review of available quantitative evidences on the relationship between patients' different health beliefs and medication adherence among patients with HTN. The second and third manuscripts constituted a pilot study and a main study, respectively, which reported findings on the relationship between patients' beliefs (HTN severity, medication necessity, medication concerns, and self-efficacy) and medication adherence among Omanis with HTN. The main finding of the three manuscripts were that patients with stronger beliefs about the necessity of antihypertensive medications,

fewer concerns regarding medication (e.g., side effects), and higher self-efficacy regarding medication adherence significantly associated with high adherence. Findings of this dissertation denote that patients' beliefs are important determinants of medication adherence and should be considered by clinicians and researchers to optimize adherence to antihypertensive medications.

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Who taught me to trust in Allah and to believe in myself. Thank you for making me who I am today. Without your unconditional love, inspiration, and prayers of days and nights, I would not get this success and honor.

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LIST OF ABBREVIATIONS

BP	Blood Pressure
HTN	Hypertension
HBM	Health Beliefs Model
MOH	Ministry of Health

CHAPTER 1: INTRODUCTION

Though considered a developing country, Oman is a modern society in the Middle East that is recognized as a high-income country. The health system in Oman is well developed and healthcare system and resources are equally distributed with free access to all citizens. The Omani government primarily finances healthcare system, and, the Ministry of Health (MOH) is the main healthcare provider and regulator. Since its inception, the healthcare sector has aimed to build a healthy Omani society, through improving quality of life, health promotion, and disease prevention. Hence, a majority of the healthcare sector's efforts have shifted to non-communicable disease prevention and wellness promotion. Hypertension (HTN) is a non-communicable disease that has been targeted by the government.

In Oman, HTN is the second leading cause of death (14.3%) after coronary heart diseases (28.5%) and Oman ranks 3rd in deaths due to HTN (111 /100,000 populations) (World Health Rankings, 2014). Data from Oman's Ministry of Health showed that HTN is leading cause of inpatient morbidity in females over 45 years of age and 2nd in males 45 - 60 years (Ministry of Health, 2014a). The Omani national health survey, conducted in 2008 as part of the world health survey by the World Health Organization and aimed to obtain baseline information about the health of Omani population, showed that 30% of included patients with HTN were newly diagnosed and 5 % have severe HTN (SBP≥180 or DBP ≥ 110 mmHg). This survey also showed that 75% of those who self-reported having HTN were not diagnosed at the time of the survey and 67% had uncontrolled BP (Al Riyami et al., 2012). In Oman, 52% of expenditures of the health system in Oman are due to non-communicable diseases that included cardiovascular

diseases and HTN (Al Riyami et al., 2012).

HTN is a major public health concern that is accountable for 45% of total mortality due to ischemic heart disease and 51% of total stroke deaths (World Health Organization, 2013). Additionally, mortality rates due to ischemic heart disease and stroke increase twofold with 20 mmHg systolic or 10 mmHg diastolic increase in blood pressure (BP) above the optimal range (Chobanian et al., 2003). These complications worsen when blood pressure (BP) is not controlled and in the presence of other comorbidities. For instance, patients with HTN who have concurrent diabetes have been found to have worse BP and blood sugar control, higher medication utilization, and lower physical function (Al-Mandhari, Al-Zakwani, Al-Hasni, & Al-Sumri, 2011). In the Eastern Mediterranean, the mortality rate due to HTN, cardiovascular diseases, and other non-communicable diseases is projected to increase by 20% between 2010 and 2020 (World Health Organization, 2013).

Antihypertensive medication is very important to manage HTN and control BP. High adherence results in better survival outcomes due to lower mortality and HTN-related complications than non-adherent (James et al., 2014; van Vark et al., 2012). Furthermore, adherence to cardiovascular medication including antihypertensive medication resulted in 10% reduction of the healthcare utilization and expenditure (Simon-Tuval, Triki, Chodick, & Greenberg, 2016). Despite antihypertensive medication effectiveness, adherence to antihypertensive medication remains poor. The World health Organization reported that the medication adherence is only 50% in developed countries and is lower in developing countries (World Health Organization, 2013). In the Middle East, medication adherence is also less than 50% (Al Qasem, Smith, & Clifford, 2011; Sulaiman, Alomar, & Strauch, 2009; World Health Organization, 2013).

Several reasons have been attributed to poor adherence with cardiovascular medications including antihypertensive medications, which are categorized differently. For instance these reasons are categorized as 1) intentional reasons (e.g., skipping medication on purpose) or unintentional reasons (e.g., forgetting to take medications) or as 2) predictors (e.g., age, gender, socioeconomic status) or barriers that are related to patients (e.g., patients' beliefs, attitude), providers (e.g., patient-provider communication), health system (e.g., Access to care) (Kronish & Ye, 2013). Patients-related barriers to a proper medication adherence such as their beliefs have been identified to significantly relate to medication adherence. Various theories (e.g., the health beliefs model and theory of planned behavior) propose that individuals' beliefs are strong predictors of their health behavior such as medication adherence (Ajzen, 1991; Rosenstock, Strecher, & Becker, 1988).

Over the past decades, adherence with antihypertensive medications has been correlated with patients' beliefs about HTN severity, beliefs about necessity of and concerns about antihypertensive medications, and self-efficacy (Bane, Hughe, & McElnay, 2006; Grégoire, Moisan, Guibert, Ciampi, & Milot, 2006; Horne et al., 2013; Vermeire, Hearnshaw, Van Royen, & Denekens, 2001). Similarly, in the Middle East, adherence to antihypertensive has been related to patients' beliefs about HTN and antihypertensive medications (Al Qasem et al., 2011). In Oman, although many studies examined epidemiology of HTN, only one by EL-Badawy has examined adherence to antihypertensive medications in 2005; however, this study has not examined patients' beliefs or the relationship between patients' beliefs and medication adherence (El-Badawy, Al-Kharusi, & Al-Ghanemy, 2005). To date, no published study that examined the relationship between patient's health beliefs and medication adherence in patients with HTN in Oman has been identified.

Purpose

This dissertation aimed to address patients' health beliefs and adherence to antihypertensive medications in Oman due to (a) the high prevalence of HTN and uncontrolled BP, (b) unavailability of evidence on Omani health beliefs in relation to antihypertensive medication adherence. The general *objective* of this dissertation was to examine the relationship between patients' health beliefs and medication adherence among Omanis with HTN. Hence, specifically, the dissertation research *aimed* to:

1) Describe patients' beliefs about HTN, beliefs about antihypertensive medications' necessity and concerns, and self-efficacy regarding medication adherence.
2) Describe patients' adherence to antihypertensive medication.
3) Examine dependence of antihypertensive medication adherence on patients' beliefs about HTN, beliefs about the necessity of and concerns related to antihypertensive medications, and self-efficacy.
4) Examine dependence of BP control on antihypertensive medication adherence.

The hypotheses were:

(a) Patients are more likely to have high adherence if they have:

1) Stronger beliefs that HTN is a severe disease, 2) stronger beliefs that antihypertensive medications are beneficial and necessary, (3) greater medication adherence self-efficacy, and (4) fewer concerns about antihypertensive medications.

(b) Patients with high medication adherence are more likely to have their BP controlled.

Conceptual Framework

This dissertation is based on the health belief model (HBM) (Figure 1.1). The HBM was developed to understand why people do not seek and engage in screening and preventive behavior (Becker et al., 1977; Cummings, Jette, & Rosenstock, 1987; Hochbaum, 1958). Later, the HBM was used to explain peoples' responses to a disease and adherence to treatment regimens (Janz & Becker, 1984). The HBM consists of the following major constructs (Janz & Becker, 1984; Rosenstock et al., 1988):

(a) Perceived susceptibility (beliefs of risk to contracting an illness or its complications).

(b) Perceived severity (beliefs that the disease is severe and has serious consequences).

(c) Perceived benefits (beliefs that taking a health behavior is beneficial to reduce or prevent disease threat).

(d) Perceived barriers (beliefs that potential factors might make it difficult to taking the behavior).

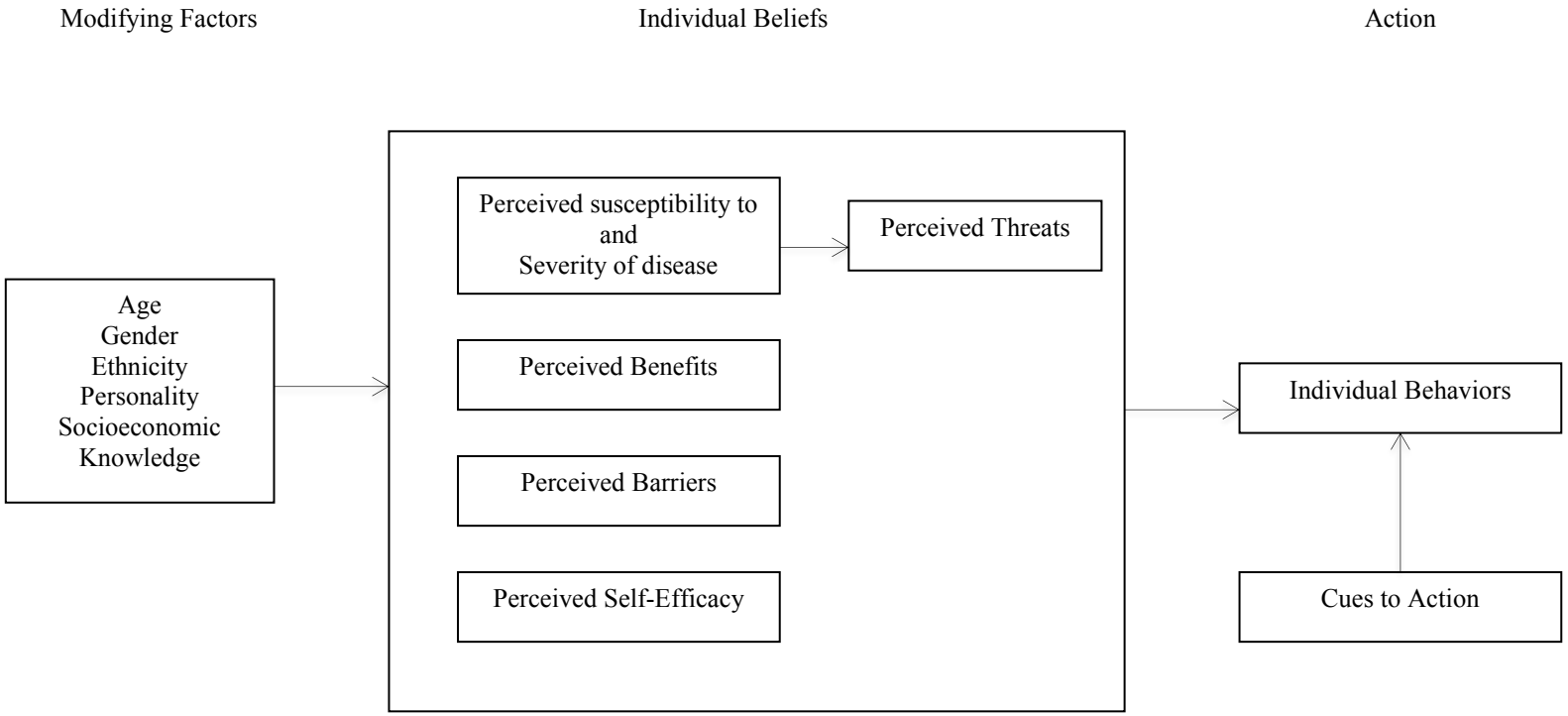
(e) Self-efficacy (beliefs in own ability to undertake certain behavior).

The HBM postulates that when an individual perceives that s/he is at risk of contracting a serious disease (threat), s/he will initiate a certain health behavior to prevent it. However, this health behavior will not be adopted unless the benefits of the behavior outweigh its barriers and consequences. Those beliefs are potentiated by triggers (cues to action), which are internal (e.g; disease symptoms) or external (e.g; bodily or environmental events) (Janz & Becker, 1984; Rosenstock et al., 1988). Additionally, the model proposes that some variables such as demographics (e.g; age, gender, ethnicity, and socioeconomics) affect an individual's beliefs;

thus, indirectly influence an individual's behavior (Champion & Skinner, 2008; Janz & Becker, 1984; Rimer & Glanz, 2005; Strecher & Rosenstock, 1997). In addition to individuals' beliefs of susceptibility, severity, benefits, and barriers, self-efficacy is an important facet influencing a health behavior. People are more likely to take behavior if they have high self-confidence and believe on their ability to take that behavior (Janz & Becker, 1984; Rosenstock et al., 1988).

Studies utilizing the HBM as a framework have demonstrated that patients' beliefs about severity and susceptibility of a disease, benefits of and barriers related to medications, and self-efficacy are related to a change in behavior such as adherence to medications (Bane et al., 2006; Grégoire et al., 2006; Horne, Weinman, & Hankins, 1999; Rajpura & Nayak, 2014; Vermeire et al., 2001). Therefore, the HBM is adopted to guide this study. Figure 1.2 displays the research conceptual framework that is based on HBM. Table 1.1 illustrates terms, definitions, and measures of the variables of the dissertation study.

Figure 1.1 The Health Beliefs Model



Source: Glanz K, Rimer BK, Viswanath K, eds. 2008. *Health Behavior and Health Education: Theory, Research, and Practice (4th ed)*. San Francisco: Jossey-Bass.

Figure 1.2 Study Conceptual Framework

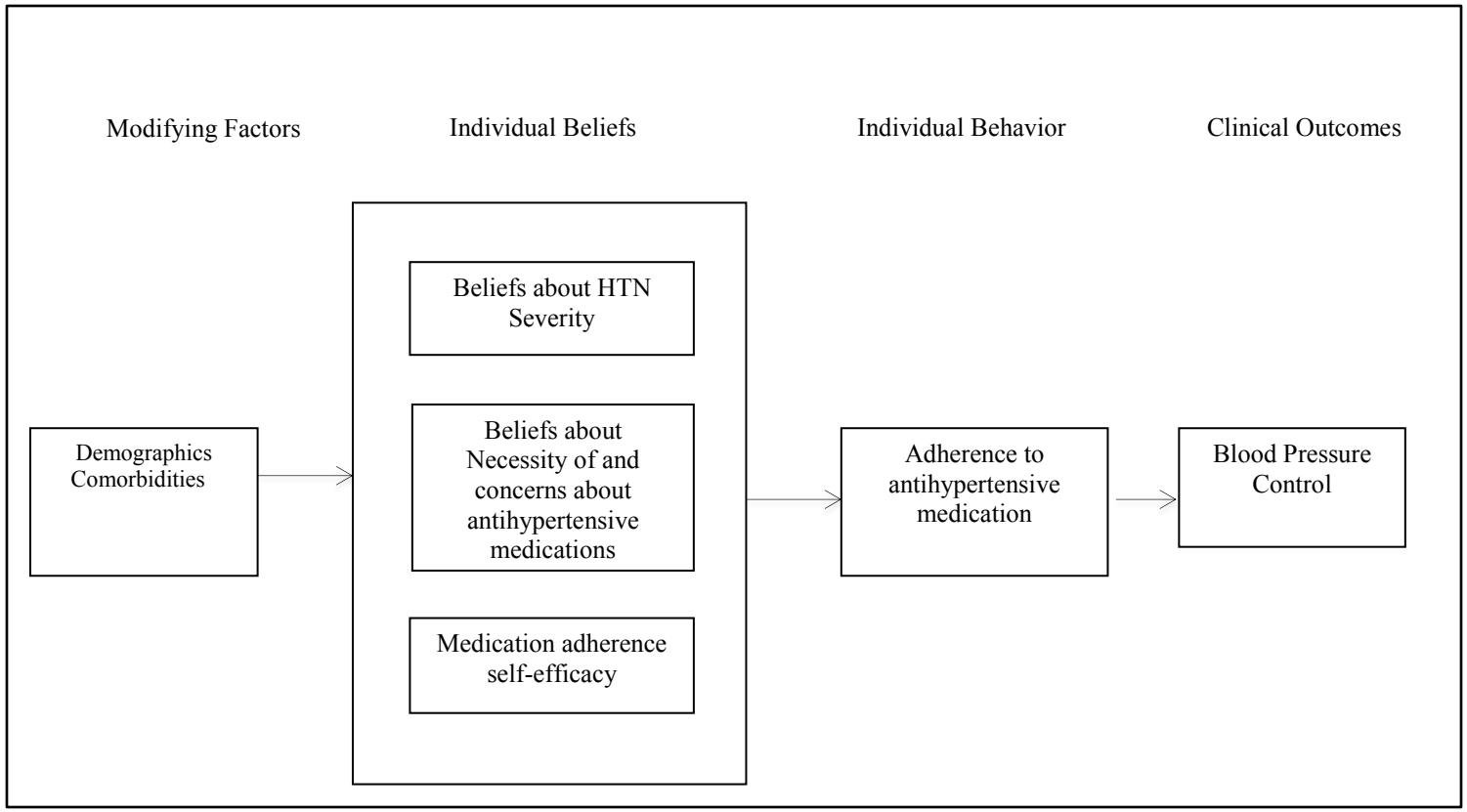


Table 1.1: Dissertation's Term Definitions and Measures

Variables	Definitions	Measures	Measures Description	Psychometrics
Beliefs about HTN	The degree to which patients believe that HTN is a threatening disease. They include beliefs about HTN consequences, control, chronicity, concerns, and emotional impact. Beliefs about HTN correspond to beliefs about severity of and susceptibility to consequences of a disease in the HBM.	Brief- Illness Perception Questionnaire (B-IPQ)	Nine-item scales with 8 items use a 0 to 10-response scale and one-item represent subjects' report of HTN causes. Scores range from 0-80 A higher score reflects a more threatening view of HTN.	α= 0.72. Test-retest reliability Concurrent, Predictive, discriminant validity
Perceived necessity	The degree to which patients believe that antihypertensive medications are effective in controlling BP and reducing HTN complications. They correspond to beliefs about benefits in the HBM.	Beliefs about Medication Questionnaire (BMQ)	Five--items scale of: Specific-Necessity (BMQ-N) and six-items scale of Specific-Concern (BMQ-C). Each has five –points Likert scale with (1) 'strongly disagree' and (5) 'strongly agree'. Scores of both subscales range from 1-5. Higher score indicates higher beliefs in concept of interest (Necessity or Concern).	α= 0.76 each subscale Test-retest reliability. Criterion-related and discriminant validity
Perceived concerns	The extent to which patients have concerns and barriers to antihypertensive medication intake. This includes concerns related to medications such as side effect, long-term effects, and dependence. They correspond to beliefs about barriers in the HBM.			
Self-Efficacy	The degree to which patients believe that they have the confidence to take antihypertensive medications in different situations such as when they are busy at home, in public, travelling, taking more than one medications,	Medication Adherence Self-Efficacy Scale-Revised (MASES-R)	13-items scale with 4-responses (1) not at all sure to (4) extremely sure. Scores range from 1-4. Higher score indicates higher	α=(0.90-0.92) Concurrent and predictive validity

	have no symptoms and are feeling well, and make taking medication part of the life routine. This corresponds to self-efficacy in HBM.		medication adherence self-efficacy	
Adherence to antihypertensive medication	The extent to which patients take medications as prescribed.	Morisky Medication Adherence Scale (MMAS-8)	Self- report 8- items with seven yes/no items and a one item with 5-response options. Scores range from 0-8. A higher score reflect higher adherence.	α= 0.83. Concurrent and predictive validity
BP	SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg is considered as uncontrolled	Electronic medical records	SBP < 140 and/or DBP < 90 will be considered as controlled.	Not Applicable
		Age, gender, marital status, Governorate, city, education, monthly income, number of antihypertensive medications, length being on medication, dose frequency per day, number of months/years with HTN, systolic BP (SBP), diastolic BP (DBP), and CCI.		

Note: α= Cronbach's alpha (Internal consistency)

Study Setting Overview

In Oman, the healthcare system is designed to provide primary-level healthcare through its primary health centers and polyclinics. These primary healthcare settings are spread all over the 11 governorates of Oman and only provide outpatient care. Moreover, each Governorate has one or more of the state reference hospitals that provide secondary–level curative and preventive healthcare services. These hospitals refer the complicated pathological cases to tertiary–level healthcare hospitals, which are situated in Muscat Governorate. Tertiary–level hospitals provide advanced specialties and sub–specialties services. In this research, subjects with HTN were recruited from multiple primary healthcare settings (e.g. health centers) around the country in order to obtain a heterogeneous sample. Those primary healthcare settings have on-site HTN clinics, which provide the researcher with the potential subjects. Those clinics are operated once or more a week. Each clinic sees a minimum of 5 patients with HTN per day. In this study, clinics from different Governorates of Ad Dhakhliyah, North Ash Sharqiyah, Muscat, Ad Dhahirah, North and South Al Batinah are utilized to recruit subjects.

Significance of the Study to Oman

This dissertation is in alignment with the research priorities of the Ministry of Health (MOH) in Oman, which focuses on reducing HTN prevalence, risk factors, and complications as well as improving screening, control, and treatment adherence. Additionally, it is in alignment with the MOH's Health Vision 2050 that emphasizes on patient-centered care to improve patients' involvement in their care and enhance treatment adherence and accordingly, making positive behavioral changes (Ministry of Health, 2014b). The results of this study will provide the foundation to examine beliefs in relation to antihypertensive medication adherence. Therefore, the results can (a) positively impact researchers and clinicians to develop effective

and culturally appropriate interventions that take patients' health beliefs into consideration to improve medication adherence among Omanis with HTN; (b) be the precursor for improving adherence to pharmacological and non-pharmacological management of HTN, and more significantly, (c) help in reducing the economic burden by preventing uncontrolled BP complications.

Dissertation Plan

Chapter 1 is the problem statement, conceptual framework, and significance of the study to Oman. Chapter 2, 3, and 4 of the dissertation are structured in three publishable manuscripts. **Chapter 2 (Manuscript 1),** titled **"**Beliefs and Medication Adherence in Patients with Hypertension: A systematic Review", presents a systematic review that identifies and compiles the current literature on HTN, beliefs, and medication adherence. The aim of this review is to examine the relationship between patients' health beliefs and antihypertensive medication adherence. **Chapter 3 (Manuscript 2),** titled "Relationship between Medication Adherence and Beliefs among Patients with Hypertension in Oman", presents results from the pilot study that was conducted in Oman to examine feasibility of the study, to test the study Arabic measures in Omani populations, and to obtain a preliminary data on the relationship between patients' health beliefs and medication adherence. **Chapter 4 (Manuscript 3),** titled "Medication Adherence and Health Beliefs among Omanis with Hypertension", presents findings from the proposed study that describes patients' beliefs about HTN, beliefs about medications, self-efficacy, and medication adherence among Omanis with HTN. Also, it presents findings on the relationship between beliefs and medication adherence, and the relationship between medication adherence and BP control. **Chapter 5** is an overall synthesis and discussion of the three manuscripts findings. This chapter provides implications for practice, future research, and policy.

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CHAPTER 2: BELIEFS AND MEDICATION ADHERENCE IN PATIENTS WITH HYPERTENSION: A SYSTEMATIC REVIEW

Introduction

Hypertension (HTN) is a prevalent health concern around the globe that affects about 40% of the world's population aged 25 years and older (Alwan, 2011). Effective HTN management, using antihypertensive medications, is vital and leads to substantial improvements in patients' health outcomes (e.g., blood pressure (BP) control, complications risk reduction) and in overall healthcare (e.g., cost reduction) (Blood Pressure Lowering Treatment Trialists' Collaboration et al., 2013; Matsumura et al., 2012; Simon-Tuval, Triki, Chodick, & Greenberg, 2016). Despite the guidelines regulating HTN management, control of BP remains a challenge for many patients with HTN. Proper adherence to antihypertensive medications is only 50% or less, which contributes to poor control of BP (World Health Organization, 2013).

Medication adherence is linked to several factors (Gellad, Grenard, & Marcum, 2011; Jackson, Clatworthy, Robinson, & Horne, 2010) that require understanding before implementation of strategies to improve adherence to antihypertensive medications (McDonald, Garg, & Haynes, 2002; Morrison, Wertheimer, & Berger, 2000; Schroeder, Fahey, & Ebrahim, 2004). Patients' beliefs about health, illness, and treatment are significant predictors of medication adherence in patients with various chronic illnesses including HTN (Broadbent, Donkin, & Stroh, 2011; Brown & Bussell, 2011; Gadkari & McHorney, 2012; Horne et al., 2013; Schüz et al., 2011; Van Den Bemt, Zwikker, & Van Den Ende, 2014). In treating HTN, understanding patient's beliefs in relation to medication adherence is fundamental because HTN

is silent and asymptomatic in nature. Thus, patients might have misperceptions about HTN, its severity, and the significance of its management (Center for Health Protection, 2016; Marshall, Wolfe, & McKevitt, 2012; World Health Organization, 2013), which could influence their adherence to antihypertensive medication.

After a thorough search of related literature, we found two reviews focused on barriers to antihypertensive medication adherence, but they included very limited studies concerning beliefs as possible barriers (AlGhurair, Hughes, Simpson, & Guirguis, 2012; Khatib et al., 2014). Another review focused on examining patients' beliefs on HTN and medication adherence (Marshall et al., 2012); however, this was a review of qualitative studies and excluded findings from quantitative studies. Over the past decades, several quantitative studies have found that various beliefs held by patients influence medication adherence (Ambaw, Alemie, Yohannes, & Mengesha, 2012; Bhandari, Sarma, & Thankappan KR, 2011; Cummings, Kirscht, Binder, & Godley, 1982; Forsyth, Schoenthaler, Chaplin, Ogedegbe, & Ravenell, 2014; Hashmi et al., 2007; Morrell, Park, Kidder, & Martin, 1997); nevertheless, we identified no reviews summarizing and synthesizing these studies' findings. Hence, this systematic review of quantitative studies was conducted to explicitly identify different HTN-related health beliefs and to examine the relationship between these beliefs and medication adherence. The examination of the relationship between different patients' beliefs and adherence to antihypertensive medications among patients with HTN will guide the development of effective strategies to enhance medication adherence by incorporating patients' specific beliefs and perspectives into patient-centered treatment plans.

Method

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines was used to guide the review (Moher, Liberati, Tetzlaff, & Altman, 2009). The search was done in collaboration with a librarian and included the following electronic databases: PubMed, CINHAL, EMBASE, and PsychInfo. To retrieve appropriate articles, the following Medical Subject Headings (Mesh) and text-words were used in PubMed: *adherence [tw] OR compliance [tw]) AND (attitude*[tw] OR belief*[tw] OR perception*[tw] OR perceiv*[tw] OR psychosocial [tw]) AND ("Antihypertensive Agents"[Mesh] OR "Antihypertensive Agents" [Pharmacological Action] OR antihypertensive agent*[tw] OR medication*[tw]) AND (hypertension [tw] OR hypertensive [tw]*. The same search strategy was used with other databases as well, with Mesh and text-words appropriately modified to fit each database. The search was restricted to English, peer-reviewed, and full text research articles. There were no limitations on geographical location, year of publication, or type of patients' beliefs because this review aimed to identify all possible beliefs and to include all possible studies matching the purpose of this review.

Eligibility Criteria

Studies were included in the review if they (a) were quantitative; (b) included participants with HTN taking at least one antihypertensive medication who were ≥18 years (because a majority of literature on HTN and medication adherence included participants with a minimum age of 18 years); (c) addressed patients' beliefs; and (d) measured medication adherence as an outcome variable. Studies were excluded if they (a) were qualitative, as a review of qualitative studies was already conducted (Marshall et al., 2012); (b) focused only on providers' beliefs; or (c) included subjects with concomitant morbidities in addition to HTN or had medications other

than antihypertensive medications because having concomitant morbidities will influence patients' perceived burdens and the severity of a disease and its management (Amr, El-Mogy, & El-Masry, 2013).

Review Process

All retrieved articles were organized and screened using a Microsoft Excel spread sheet and Refworks reference management software. After removing duplicates, articles' titles and abstracts were assessed for eligibility. Then, the full-text articles were screened and data of the eligible articles were extracted into a table. Extraction of the data was based on the following categories: authors, publication year, theory, sample size and population, mean age and gender, types of beliefs, adherence measure, and findings. Quality of the studies was evaluated using the Quality Assessment Tool for Systematic Review of Observational Studies (QATSO) checklist (Wong, Cheung, & Hart, 2008) , which was slightly modified to fit the review (See Appendix 2.1). The QATSO consists of items to assess external validity, bias and confounding, and measures' validity/reliability. Relevant articles were not excluded based on quality evaluation because the purpose of the review was to identify as many beliefs as possible.

Results

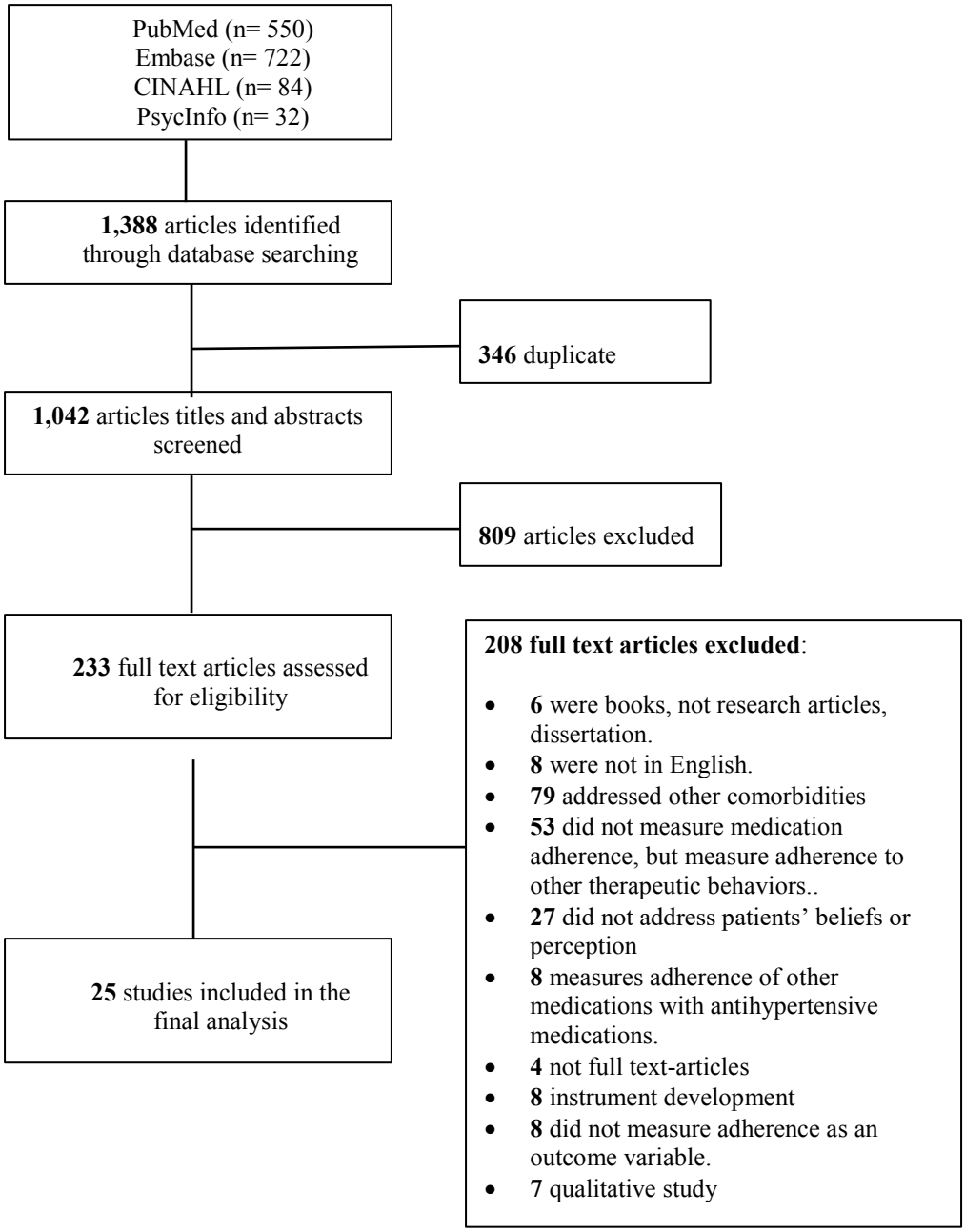
Selection of the Studies

The electronic search yielded 1,388 articles (Figure 2.1). After removing duplicates (n= 346), 1,042 articles remained. Of these, 809 articles were excluded after title and abstract screened applying inclusion and exclusion criteria. The remaining 233 full text articles were further screened for eligibility. Of these, 208 articles were excluded because these articles: (a) included subjects who had other comorbidities in addition to HTN (n=79); (b) did not address patients' beliefs (n=27); (c) did not measure medication adherence or measured adherence to

other therapeutic behaviors (e.g., diet and exercises) (n=53); (d) measured adherence of medications other than antihypertensive (n=8); (e) did not measure adherence as an outcome variable (n=8); or (f) were qualitative studies (n=7). The remaining 25 studies were included in the systematic review.

Methodological quality evaluation of the studies revealed that 80% (n=20) of the reviewed studies scored from satisfactory to good (Table 2.1). Although 84% (n=21) of the studies reported validity and reliability of the adherence measures, a majority of them used only self-reporting measures (n=19), and the remaining used either objective measure only, or both. However, self-report measures, such as Morisky Medication Adherence Scale (MMAS), have been correlated with other objective measures such as pharmacy refills and the Medical Events Monitoring System (MEMS) (Hamilton, 2003; Morisky, Ang, Krousel-Wood, & Ward, 2008). Moreover, a majority of studies used non-probability sampling (n=16), which could limit the studies' external validity.

Figure 2.1 Flow Diagram of the Selection Process of the Studies



Characteristics of the Studies

The 25 studies reviewed appeared from 1980−2016 (Table 2.2). The studies' sample sizes ranged from 45 to 1,367 participants with a total of 6,696 participants. The samples represented people from the following countries: Canada (n=1), Brazil (n=2), South Africa (n=1), Northern Ireland (n=1), Malaysia (n=1), the Netherlands (n=1), Taiwan (n=1), India (n=1), Peru (n=1), Iran (n=1), the United Kingdom (n=1), Australia (n=1), Nigeria (n=1), and the United States (n=11). Studies from the United States included the following ethnicities: White American, African American, Native American, Hispanic, Chinese American, and Caucasian. The mean age of participants included in the studies ranged from 42−75 years old. Both males and females were included in the studies, with the percentage of females ranging from 2−84%, except in the case of Haynes (1980) who included 100% no females.

Twenty-four studies, (96%), had cross-sectional designs, and only one study had a longitudinal design (Haynes et al., 1980). Of the 25 included studies, nine included a randomized sample (Brown & Segal, 1996; Dennis et al., 2011; Haynes et al., 1980; Hershey, Morton, Davis, & Reichgott, 1980; Hong, Oddone, Dudley, & Bosworth, 2006; Kamran, Ahari, Biria, Malepour, & Heydari, 2014; Morisky et al., 2008; Olowookere et al., 2015; Ungari & Fabbro, 2010). The majority of the studies used one measure to assess medication adherence, one study used three measures (i.e., medication event monitoring system, Morisky medication adherence scale, and the medication adherence report scale) (Alison Phillips, Leventhal, & Leventhal, 2013), and another study used four measures of medications adherence (i.e., pill counts, serum uric acid, urinary chlorthalidone, and self-reports) (Haynes et al., 1980). Self-report measures were used by 92% of studies (n= 23); of these, the Morisky Medication Adherence Scale was used in nine studies (36%). Thirty-six percent of studies (n= 9) used a theoretical model: the health beliefs

model (Brown & Segal, 1996; Hassan et al., 2006; Kamran et al., 2014; Peltzer, 2004), self-efficacy and the theory of planned behavior (Bane, Hughe, & McElnay, 2006), self-regulation model (Chen, Tsai, & Lee, 2009), medication adherence model (Hsu, Mao, & Wey, 2010), commonsense self-regulation model (Alison Phillips et al., 2013), and ecological system theory (Hall, Lee, Clark, & Perilla, 2014).

Table 2.1. Quality Assessment of the Studies Included in the Review

Authors / Pub Year	Sampling Method	Response Rate mentioned	Adherence Measure validity and Reliability	Adherence Measure (Objective, self-report,)	Control of Confounding factors	Total Percentage*	Quality Score**
Alison,et al. (2013)	Non-probability	No	Yes	Objective	Yes	60 %	Satisfactory
Bane et al., (2006)	Non-probability	No	Yes	Objective	Yes	60 %	Satisfactory
Brown & Segal (1996)	Probability	Yes	Yes	self-report	Yes	80 %	Good
Chen et al (2009)	Non-probability	No	Yes	Objective	Yes	60 %	Satisfactory
Daniel & Veiga (2013)	Non-probability	No	No	self-report	NA	0 %	Bad
Dennis et al (2011)	Probability	No	Yes	self-report	Yes	60 %	Satisfactory
Dijkstra et al (2008)	Non-probability	No	No	self-report	Yes	20 %	Bad
Fernandez-Arias et al (2014)	Non-probability	No	Yes	self-report	Yes	40 %	Satisfactory
Gilbert et al (1990)	Non-probability	Yes	Yes	Objective	NA	75 %	Good
Hall et al (2014)	Non-probability	No	Yes	self-report	Yes	40 %	Satisfactory
Hassan et al, (2006)	Non-probability	Yes	Yes	self-report	Yes	60 %	Satisfactory
Haynes et al, (1980)	Probability	Yes	Yes	Objective	No	80 %	Good

Hershey et al, (1980)	Probability	Yes	No	self-report	Yes	60 %	Satisfactory
Hong et al (2006)	Probability	No	Yes	self-report	Yes	60 %	Satisfactory
Hsu et at (2010)	Non-probability	No	Yes	self-report	NA	25 %	Bad
Kamran et al, (2014)	Probability	No	Yes	self-report	Yes	60 %	Satisfactory
Khan et al., (2014)	Non-probability	No	Yes	self-report	NA	25 %	Bad
Morisky et al, (2008)	Probability	Yes	Yes	self-report	Yes	80 %	Good
Okowookere et al, (2015)	Probability	No	Yes	Objective	NA	75 %	Good
Patel & Taylor (2002)	Non-probability	Yes	Yes	self-report	No	40 %	Satisfactory
Peltzer (2004)	Non-probability	No	Yes	self-report	No	20 %	Bad
Richardson et al, (1993)	Non-probability	No	Yes	self-report	Yes	40 %	Satisfactory
Trevino et al, (1990)	Non-probability	No	Yes	self-report	Yes	40 %	Satisfactory
Ungari & Fabbro (2010)	Probability	No	Yes	self-report	No	40 %	Satisfactory
Wong et al, (2005)	Non-probability	Yes	No	self-report	Yes	40 %	Satisfactory

Note: NA = Not Applicable.
*Scoring: Total score (0/1) divided by total number of items multiplied by 100
**Bad = 0 - 33%; Satisfactory = 34 - 66%; Good = 67 – 100%

Table 2.1. Characteristics of the Studies

Authors/Year	Theory Used	Design	Sample size (n) Population	Mean Age Gender	Beliefs Type	Medication Adherence Measure
Alison Phillips, et al. (2013)	Commonsense self-regulation model	Cross-sectional	n = 71 White, Africa-American, Asian, Native American, Hispanic	M=68 63% (F)	1. Necessity of medications	1. Medication Event Monitoring System* 2. Morisky Medication Adherence Scale * 3. Medication Adherence Report Scale *
Bane et al, (2006)	Self-efficacy Theory of planned behavior	Cross-sectional	n = 139 Northern Ireland	M= 52 50% (F),	1. Perception of self-efficacy 2. Perception of subjective norms	1. Self-report 2. Patient medication report*
Brown & Segal (1996)	HBM	Cross-sectional	n = 300 African-American/White Americans	M= 60 56% (F)	1. Perception of susceptibility 2. Perception of severity 3. Benefits of medication 4. Cost of medication 5. Side effects of medication	1. Self-report*
Chen et al, (2009)	Self-Regulation model	Cross-sectional	n = 277 Taiwanese	M=66 40% (F)	1. Illness perception 2. Self-efficacy (Treatment and personal control)	1. The Medication Adherence Inventory*

Daniel & Veiga (2013)	None	Cross-sectional	n = 69 Brazilian	M=64 67% (F)	1. Side effects of medication 2. Cost of medication 3. Doctor-patient communication	1. Self-report
Dennis et al (2011)	None	Cross sectional	n = 608 Urban Indian	M=58 49% (F)	1. Medication barriers - Cost	1. Brief Medication Questionnaire *
Dijkstra et al (2008)	None	Cross-sectional	n = 176 Netherlands	M= 62 52% (F)	1. HTN severity	1. Self-report (1-item)
Fernandez-Arias et al (2014)	None	Cross-sectional	n = 115 Peru	M=62 67% (F)	1. Medication harm 2. Medication Concern 3. Medication Necessity	1. Morisky Medication Adherence Scale (8-items)*
Gilbert et al (1990)	None	Cross-sectional	n = 110 Australian	M= 59 55% (F)	1. Self-efficacy	1. Prescription re-fill* 2. Self-report of consumption
Hall et al (2014)	Ecological System Theory	Cross-sectional	n = 45 Hispanic	28-60 56% (F)	1. Perceived stress	1. Morisky Medication Adherence Scale (8-items)*
Hassan et al (2006)	HBM	Cross-sectional	n = 240 Malaysian	M= 55 50% (F)	1. Severity of HTN 2. Susceptibility to HTN consequences 3. Barriers (complex regimen, cost)	1. Self-report*

Haynes et al (1980)	None	Longitudinal / 6 months follow-up	n = 134 Canadian	M= 42 100% (M)	1. Medication safety 2. Medication benefits 3. HTN seriousness	1. Pill count* 2. Serum Uric acid and potassium determination* 3. Urinary chlorthalidone and hydrochlorothiazide * 4. Self-report
Hershey et al (1980)	None	Cross-sectional	n = 132 92% Black and white Americans	M= 52 61% (F)	1. Susceptibility 2. Severity of HTN 3. Benefits of medications 4. Concerns about health 5. Control over HTN 6. Dependence on the provider 7. Barriers	1. Self-report
Hong et al (2006)	None	Cross-sectional	n = 588 White/African American	M= 63 2% (F)	1. Barriers (side-effects, complex regimen, forgetting) 2. Internal locus of control	1. Self-report (Morisky 4-items)*
Hsu et al. (2010)	Medication Adherence Model	Cross-sectional	n = 94 Chinese American	M= 75 63% (F)	1. Necessity and effectiveness of medication 2. Side-effects medication 3. Safety	1. Hill-Bone Compliance* 2. The Adherence Factor Questionnaire*
Kamran et al., (2014)	HBM	Cross-sectional	n = 671 Iran	>30 75% (F)	1. Severity of HTN 2. Susceptibility to HTN consequences 3. Benefits of medications 4. Barriers 5. Self-efficacy	1. Morisky Medication Adherence Scale (4-items)*

Khan et al., (2014)	None	Cross-sectional	n = 200 UK	>18 62% (F)	1. Side-effects	1. Morisky Medication Adherence Scale (4-items)*
Morisky et al., (2008)	None	Cross-sectional	n = 1367 American	M= 62 59% (F)	1. Health status 2. Social support 3. Stress	1. Self-report (Morisky 4-items, & 8-items)* 2. Blood pressure
Okowookere et al, (2015)	None	Cross-sectional	n = 420 Nigerian	M= 61 51% (F)	1. Family Support	1. Bill count*
Patel & Taylor (2002)	None	Cross-sectional	n = 102 80% white	M=59 60% (F)	1. Control over HTN	1. Self-report (Morisky 4-items)*
Peltzer, (2004)	HBM	Cross-sectional	n = 100 South African	M=61 67% (F)	1. Benefits of medication 2. Side effects & cost of medication 3. Severity of HTN 4. Susceptibility to HTN consequences	1. Self-report on adherence*
Richardson et al (1993)	None	Cross-sectional	n = 197 American	M= 54 68% (F)	1. Barriers	1. Self-report* 2. Provider interview
Trevino et al., (1990)	None	Cross-sectional	n = 109 American	M= 50 58% (F)	1. Marital adjustment and function	1. Self- report

Ungari & Fabbro, (2010)	None	Cross-sectional	n = 109 Brazilian	> 20 yrs 84% (F)	1. Trust in doctors	1. **Morisky Medication Adherence Scale (4-items)***
Wong et al., (2005)	None	Cross-sectional	n = 323 Hmong American	M=58. 60% (F)	1. HTN preventable 2. Side-effects	1. self-report

Note: HBM = Health Belief Model; M = Mean age; F = Female
* Reliability and validity reported

Relationship Between Beliefs and Medication Adherence

The systematic review revealed that some patients' beliefs were negatively related (e.g., medication concerns), some were positively related (e.g., severity of HTN), and other beliefs had no significant relationship with to antihypertensive medication adherence (Table 2.3). Findings of this review were categorized based on belief types: (a) beliefs about hypertension (e.g., severity of HTN); (b) beliefs about antihypertensive medications (e.g., barriers, effectiveness); and (c) other patient-related beliefs (e.g., self-efficacy, perceived patient-provider relationship, and perceived stress.

Beliefs About Hypertension. Nine studies (36%) examined beliefs about the severity of HTN and susceptibility to its complications in relation to antihypertensive medication adherence. Beliefs about severity of HTN, this is patients' perceptions about the seriousness of HTN, were reported in seven studies; three studies found that higher perception of HTN severity was significantly related to higher medication adherence (Haynes et al., 1980; Kamran et al., 2014; Wong, Mouanoutoua, Chen, Gray, & Tseng, 2005) whereas four studies reported no relationship (Brown & Segal, 1996; Hassan et al., 2006; Hershey et al., 1980; Peltzer, 2004).

Patients' beliefs regarding their susceptibility to HTN−related complications were reported in seven studies and revealed mixed results. Two studies reported that as beliefs about susceptibility to complications increased, the medication adherence increased significantly (Dijkstra, Okken, Niemeijer, & Cleophas, 2008; Kamran et al., 2014). One study found that as beliefs about susceptibility to complications increased, medication adherence decreased (Chen et al., 2009), and four studies reported no relationship (Brown & Segal, 1996; Hassan et al., 2006; Hershey et al., 1980; Peltzer, 2004).

Beliefs About Antihypertensive Medications. Sixteen studies (64%) reported beliefs about barriers to taking antihypertensive medications and beliefs about medications effectiveness/benefits, safety, and necessity. Perceived barriers to taking medications were reported by 13 studies; of these, 11 studies found that stronger beliefs in barriers to taking medications such as medications' side effects, high cost, bad taste, and harmful effects, were significantly associated with lower medication adherence (Brown & Segal, 1996; Daniel & Veiga, 2013; Fernandez-Arias, Acuna-Villaorduna, Miranda, Diez-Canseco, & Malaga, 2014; Hassan et al., 2006; Hershey et al., 1980; Hong et al., 2006; Kamran et al., 2014; Khan, Shah, & Hameed, 2014; Peltzer, 2004; Richardson, Simons-Morton, & Annegers, 1993; Wong et al., 2005). However, two studies reported no relationship between beliefs concerning side effects of medication and medication adherence (Hsu et al., 2010) or between medication cost and medication adherence (Dennis et al., 2011).

Additionally, of eight studies examining beliefs about effectiveness, necessity, and safety of medications, five examined the relationship between medications' effectiveness/benefits and medication adherence; of these, two studies reported that stronger beliefs about the effectiveness of antihypertensive medications were associated with higher medication adherence (Kamran et al., 2014; Peltzer, 2004) and three studies found no relationship (Brown & Segal, 1996; Haynes et al., 1980; Hershey et al., 1980). Three studies examining beliefs about medications' necessity and safety did not find a relationship between perceived medications' necessity and adherence (Alison Phillips et al., 2013; Fernandez-Arias et al., 2014; Hsu et al., 2010) or between medication safety and adherence (Hsu et al., 2010). Only one study found that stronger beliefs of medication safety were related to higher medication adherence (Haynes et al., 1980).

Other Patient-Related Beliefs. Eleven studies examined other beliefs in relation to antihypertensive medication adherence. These studies reported that higher adherence was related to (a) higher self-efficacy, patients' beliefs about their own capabilities to perform a certain behavior (Bane et al., 2006; Chen et al., 2009; Gilbert, Owen, Sansom, & Innes, 1990; Kamran et al., 2014); (b) higher internal locus of control (i.e., the degree to which people believe that their health status is influenced by their own behavior (Hong et al., 2006); (c) higher subjective norms (i.e., beliefs that taking medications is important because significant others believe it is important (Bane et al., 2006) ; (d) perceived good general health (Morisky et al., 2008); (e) perceived good relationship with healthcare providers (Hershey et al., 1980; Ungari & Fabbro, 2010) ; (f) perceived good relationship with spouses (i.e., marital function; (Trevino, Young, Groff, & Jono, 1990) ; (g) perceived good control over HTN (Hershey et al., 1980); and (h) perceived strong family support (Olowookere et al., 2015). However, medication adherence was lower with more perceived stress (Morisky et al., 2008) and control over HTN (Patel & Taylor, 2002). Other studies reported no relationship between perceived stress and adherence (Hall et al., 2014) or between general concerns about health and adherence (Hershey et al., 1980).

Table 2.2. Findings of the Studies

1. Beliefs about hypertension			
Severity	Haynes (1980) * Kamran (2014) *** Wong (2005) ***	Positive association	*Higher* perceived seriousness of HTN is related to *higher* medication adherence.
	Brown (1996) Hassan (2006) Hershey (1980) Peltzer (2004)	No association	Perceived seriousness of HTN *is not* related to medication adherence.
Susceptibility	Dijkstra (2008) * Kamran (2014) **	Positive association	*Higher* perceived susceptibility to HTN/ complications is related to *higher* medication adherence.
	Brown (1996) Hassan (2006) Hershey (1980) Peltzer (2004)	No association	Perceived susceptibility to HTN/ complications *is not* related to medication adherence.
	Chen (2009) *	Negative association	*Higher* perceived susceptibility to HTN/ complications is related to *lower* medication adherence.
2. Beliefs about Antihypertensive Medications			
Barriers: Side-effects Taste Cost Harm	Brown (1996) * Daniel (2013)# Fernandez-Arias (2014) ** Hassan (2006) ** Hershey (1980) * Hong (2006) *** Kamran (2014) *** Khan (2014)# Richardson (1993) * Peltzer (2004) *** Wong (2005) *	Negative association	*More* perceived barriers to taking medications are related to *lower* medication adherence.

	Dennis (2011) Hsu (2010)	No association	Perceived barriers to taking medications *are not* related to medication adherence.
Benefits/Effectiveness	Kamran (2014) ** Peltzer (2004) **	Positive association	*Higher* perceived effectiveness of antihypertensive medications is related to *higher* medication adherence.
	Brown (1996) Haynes (1980) Hershey (1980)	No association	Perceived medication effectiveness *is not* related to medication adherence.
Necessity	Alison (2013) Fernandez-Arias (2014) Hsu (2010)	No association	Perceived medication Necessity *is not* related to medication adherence.
Safety	Haynes (1980) *	Positive association	*Higher* perceived safety of medication is related to *higher* medication adherence.
	Hsu (2010)	No association	Perceived medication safety *is not* related to medication adherence.
		3. Other Beliefs	
Self-efficacy	Bane (2006) *** Chen (2009) ** Gilbert (1990)# Kamran (2014) ***	Positive association	*Higher* self-efficacy is related to *higher* medication adherence.
Internal locus of control	Hong (2006) *	Positive association	*Higher* Internal locus of control is related to *higher* medication adherence.
Patient- provider communication	Hershey (1980) * Ungari (2010) *	Positive association	*Higher* self-efficacy is related to *higher* medication adherence.
Control over HTN	Hershey (1980) *	Positive association	*Higher* perceived control over HTN is related to *higher* medication adherence.
	Patel (2002) **	Negative association	*Higher* perceived control over HTN is related to *Lower* medication adherence.
	Morisky (2008) *	Negative association	*Higher* perceived stress is related to *lower* medication

Stress			adherence.
	Hall (2014)	No association	Perceived stress *is not* related to medication adherence.
Marital Adjustment	Trevino (1990) **	Positive association	Perception of *good* marital relationship is related to *higher* medication adherence.
Family support	Olowookere (2015)***	Positive Association	*Stronger* perception of family support is related to *higher* medication adherence
Subjective Norms	Bane (2006) **	Positive association	Subjective norms are related to *higher* medication adherence.
General health status	Morisky (2008) *	Positive association	Perception of *good* general health status is related to *higher* medication adherence.
Concern about health	Hershey (1980)	No association	Perceived concern about health *is not* related to medication adherence.

Note: * *p*-value ≤ .05 ** *p*-value ≤ .01 *** *p*-value ≤ .001 # used only descriptive statistics

Discussion

This systematic review identified 25 quantitative studies examining the relationships between different patients' beliefs and medication adherence among patients with HTN. The review identified these common beliefs related to antihypertensive medication adherence: beliefs about medications (e.g., effectiveness and necessity and barriers), beliefs about HTN (e.g., severity and susceptibility to consequences), and self-efficacy.

A majority of the studies examining beliefs about medications (11 out of 13) found a negative association between barriers to taking medications and medication adherence; these findings are similar to those of other reviews conducted among patients with HTN and other chronic diseases (AlGhurair et al., 2012; Marshall et al., 2012; Van Den Bemt et al., 2014; Verbrugghe, Verhaeghe, Lauwaert, Beeckman, & Van Hecke, 2013). Additionally, our findings are consistent with those of studies included in the meta-analysis by Horne and colleagues (2013), who found that medication adherence was significantly higher in patients with fewer concerns regarding medications' side effects and safety. Findings from this review and others underline the importance of ssessing patients' perceived barriers to medication adherence (e.g., side effects) to identify the best strategies for enhancing medication adherence.

Four studies in this review reported a positive relationship between beliefs about severity of HTN and their susceptibility to its complications and medication adherence, which is consistent with the findings of other reviews examining barriers to medication adherence among patients with HTN (AlGhurair et al., 2012), patients with chronic conditions (Van Den Bemt et al., 2014), and elderly patients (Gellad et al., 2011), which found that medication adherence was less likely among patients who believed that HTN is not severe and that they were at low risk of developing HTN complications. Four other studies of our review reported no association and one

found a negative relationship. These mixed findings could be related to the influence of culture on how people view illness causality, severity, and susceptibility to complications, especially because HTN is silent in nature. In our review, studies that examined these beliefs represented people from different cultural backgrounds (e.g., Canada, Brazil, South Africa, Northern Ireland, Malaysia, the Netherlands, Taiwan, India, Peru, Iran, the United Kingdom, Australia, Nigeria, and the United States) that might perceive HTN differently. For instance, adherence to antihypertensive medications was lower among Americans who attributed HTN to bad deeds (Wong et al., 2005) and Chinese who attributed HTN to cultural causality (e.g., imbalance between internal and external environment (Chen et al., 2009). Accordingly, researchers need to explore and examine the cultural influence on beliefs regarding HTN causality and severity, and thus medication adherence.

In this review, higher self-efficacy was significantly related to higher medication adherence, as reported in four studies from Ireland, Australia, Taiwan, and Iran (Bane et al., 2006; Chen et al., 2009; Gilbert et al., 1990; Kamran et al., 2014). Our review is consistent with findings from current literature among patients with other chronic illness (e.g., diabetes, arthritis, and cancer; Sleath et al., 2016; Van Den Bemt et al., 2014; Verbrugghe et al., 2013). Within the context of HTN, higher self-efficacy is also associated with higher adherence to other self-care behaviors related to diet, exercise, weight, and smoking (Gao et al., 2013; Walker, Smalls, Hernandez-Tejada, Campbell, & Egede, 2014; Warren-Findlow, Seymour, & Huber, 2012). Several studies showed improved medication adherence and self-care activities when self-efficacy was incorporated as a key element in interventions such as mobile text message, health education, counseling, and motivational interviewing (Arora, Peters, Agy, & Menchine, 2012; Fisher, Hessler, Masharani, & Strycker, 2014; Moral et al., 2015; Pradier et al., 2015). This

indicates that self-efficacy is a critical element in behavioral changes and plays a significant role in medication adherence irrespective of different diseases or populations, signifying the necessity to empower self-efficacy across different populations to enhance adherence to antihypertensive medications (Easthall, Song, & Bhattacharya, 2013; Nokes et al., 2012; Pak et al., 2014).

The majority of studies (75%) in our review reported no relationship between beliefs about medication necessity, effectiveness, and safety and medication adherence; this finding is inconsistent with Horne and colleagues' (2013) report of a positive relationship in a majority of its included studies. The inconsistency in findings could be explained by: (a) variation in measures of beliefs about medications, as Horne's review included studies that only used the Beliefs About Medicine Questionnaire (BMQ), whereas the current review did not restrict studies a specific measure; (b) differences in symptoms experienced by patients, as their review included more than 22 different chronic conditions (e.g., cancer, diabetes, HIV, asthma, and depression) that have more evident and severe symptoms than HTN, which could influence patients' beliefs about disease and medication adherence; and (c) difference in total sample size included because Horne's review included a total sample size of 25,072 compared to 6,696 in the current review; therefore, Horne's review could had more power to detect a relationship between some beliefs and medication adherence.

Overall, studies included in this review showed that findings vary in addressing the relationship between different beliefs and medication adherence. While some studies found a positive or a negative relationship, others reported no relationship. This variation in findings could be explained by heterogeneity in (a) cultural backgrounds of populations from 14 countries that might hold different beliefs related to disease causality and treatment; (b) sample size, which ranged from 45 to 1,367 participants; (c) age, which represented a mean age ranging from 42

−75 years old; and (d) defining and measuring medication adherence because adherence was defined differently as numbers of pills taken per month using a patient report (Peltzer, 2004), as a total score ≥ 75% on a self-report questionnaire (Hassan et al., 2006), or as a total score of 4 using MMAS-4 (Kamran et al., 2014). Therefore, variations in findings suggest that beliefs might vary across age groups, populations, and cultures indicating the need to understand different beliefs and how these beliefs could influence medication adherence differently. Therefore researchers and clinicians need to consider these variations in beliefs to design successful interventions sensitive to age and culture to improve adherence.

Limitations

These findings should take into consideration the following limitations of the studies reviewed. First, the majority of the studies used cross-sectional design with non-probability sampling, which limits causal relationships and generalizability of the findings to populations with HTN. Additionally, a majority of studies used self-report measures of medication adherence, which could introduce recall bias and overestimation of medication adherence. These studies also used different defining criteria for medication adherence. Therefore, future studies need to measure and define medication adherence objectively and consistently.

This review is subject to several limitations inherent in systematic review. This review is at risk for selection and reporting bias due to the possibility of missing some relevant studies, as this review was limited to English full−text studies retrieved from four electronic databases. Therefore, non-English studies, books, dissertations, and studies obtained manually or through reference lists were not included. Furthermore, this review was limited to patients with HTN who did not have any concomitant comorbidity. Compared to those with significant findings, some studies with no association might not been published in the peer-reviewed journals included in

the databases' searches, leading to a publication bias. Finally, studies of poor quality were included in reporting this review's findings.

Implications for Clinical Practice and Future Research

The findings from this systematic review have several clinical and research implications. Clinically, healthcare providers should be aware of and assess beliefs about HTN and medications while caring for patients with HTN across different cultures and age groups. The majority of studies included in the analysis used a cross-sectional design and various measures of medication adherence, so future studies should focus on measuring adherence using more objective measures and a longitudinal design to assess long-term adherence behaviors and changes over time. Unlike some demographic factors (e.g., age, race, gender) that influence medication adherence among patients with HTN (van den Bemt et al., 2014), patients' health beliefs are modifiable and could be tailored to match individual preferences or cultures. This necessitates early identification and incorporation of beliefs in designing effective interventions to foster medication adherence through reducing barriers to taking medications and maximizing positive beliefs about HTN and medications benefits. More studies are needed to further examine the relationship between beliefs about HTN severity and susceptibility to consequences and medication adherence because our review showed mixed findings. Furthermore, in examining the relationship between beliefs and adherence, future reviews could include more articles published in other search databases and in non-English languages, including thesis and dissertations.

Conclusion

This review sought to systematically synthesize findings of quantitative studies examining the relationship between different health beliefs held by patients with HTN and antihypertensive medication adherence. Findings showed that fewer perceived barriers to taking medications (e.g., side effects) and higher self-efficacy, were related to higher medication adherence. Findings also showed mixed results concerning the relationships among beliefs about HTN severity and susceptibility to its complications and medication adherence. A majority of studies have not found a relationship between beliefs about medications' effectiveness, necessity, and safety and medication adherence. The findings of this review emphasize the importance of assessing different beliefs, particularly perceived barriers and self-efficacy, integrating them in the clinical practice, and designing strategies to improve medication adherence.

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CHAPTER 3: RELATIONSHIP BETWEEN MEDICATION ADHERENCE AND BELIEFS AMONG PATIENTS WITH HYPERTENSION IN OMAN

Introduction

Hypertension (HTN) prevalence is high globally and, in developing countries, HTN is projected to increase by 80% by 2025 (World Health Organization, 2013). Oman, a high-income developing country in the Middle East, also exhibits a high prevalence rate of HTN and 40% of Oman's population is affected by HTN. Among those with HTN, 17% have both high systolic and diastolic blood pressure (BP) and 5% had severe HTN (BP ≥180/≥110) (Al Riyami et al., 2012). Poor HTN management increases complications and related mortality and morbidity, (Alwan, 2011; Joffres et al., 2013) and healthcare expenditure (Gaziano, Bitton, Anand, Weinstein, & International Society of Hypertension, 2009). The use of antihypertensive medication is key to HTN management (James et al., 2014; van Vark et al., 2012), and expenditure reduction (Simon-Tuval, Triki, Chodick, & Greenberg, 2016); however, patient adherence to medications is inadequate (World Health Organization, 2013).

Several factors contribute to poor medication adherence (AlGhurair, Hughes, Simpson, & Guirguis, 2012; Kardas, Lewek, & Matyjaszczyk, 2013); one of which is the patients' beliefs about health and illness. Beliefs about disease severity, self-efficacy, and treatment benefits and concerns, as proposed by the health belief model (HBM), can drive, predict, and explain attitudes toward medication adherence (Janz & Becker, 1984; Rosenstock, Strecher, & Becker, 1988). With HTN, specifically, these beliefs have been linked to the lack of adherence to medication (Kamran, Ahari, Biria, Malpour, & Heydari, 2015; Pasma, van't Spijker, Hazes, Busschbach, & Luime, 2013).

Citizens of Oman, similar to those in other Arab countries, hold certain beliefs related to the causes of disease (e.g., evil eye or envy) and its treatment. It is probable that these same beliefs exist among patients with HTN, which could influence HTN management and medication adherence. In Oman, many studies have focused on understanding HTN risk factors and correlates (Al-Maqbali, Temple-Smith, Ferler, & Blackberry, 2013; Al-Mawali, 2015; El-Aty, Meky, Morsi, Al-Lawati, & El Sayed, 2015), but only one study examined antihypertensive medication adherence (El-Badawy, Al-Kharusi, & Al-Ghanemy, 2005). However, studies that specifically examined health beliefs and how beliefs affect antihypertensive medication adherence have not been identified; therefore, and because an Omani government is making an effort to expand its healthcare system to provide the best patient-centered care, it is important to understand the role of patients' beliefs in HTN management in such a rapidly developing Arabic Muslim country.

The purpose of this study was to investigate the relationship between the health beliefs of Omanis with HTN and medication adherence. Specifically, this study aimed to a) describe medication adherence and patients' beliefs regarding HTN, antihypertensive medication, and self-efficacy; and b) examine the relationship between these beliefs and medication adherence in Omani patients with HTN. Examining health beliefs in relation to antihypertensive medication adherence allows clinicians and researchers to better understand the role between health beliefs and the willingness to take medication in managing HTN, and to effectively design screening protocols and strategies to foster medication adherence and BP control.

Method

This descriptive cross-sectional study was conducted in Oman using four primary healthcare centers over a period of one month (July, 2015). Ethical approval to conduct the study was obtained from the University of North Carolina at Chapel Hill and the Ministry of Health (MOH) in Oman.

Subjects and Recruitment

Inclusion criteria were as follows: 1) ≥ 21 years old, 2) diagnosed with HTN for at least 1 year, 3) prescribed at least one antihypertensive medication, and 4) spoke and understood Arabic. Patients were excluded from participation if they had any coexisting morbidities, which would require more complex treatment and could confound the relationship between beliefs and medication adherence (Sweileh et al., 2014).

Patients with HTN were recruited from a total of four HTN clinics, which are weekly operated as a part of primary care clinics, and were screened for eligibility using a patients' list obtained from medical records. Eligible patients were approached by a nurse and asked to participate. Study aims and procedure were explained to each enrolled subject by the principal investigator. Each subject signed a written informed consent, which was approved by the MOH.

Data Collection and Measures

In the waiting area, each subjects was asked to complete a demographic sheet and four Arabic version questionnaires that took 15-40 minutes to complete. These questionnaires were used with permission from the developers of these questionnaires[1] (See Appendix 2).

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[1] Permission to use the Arabic versions of the Morisky Medication Adherence Scale (8-items) and Beliefs about Medicine Questionnaire was granted from the developers, Morisky and Horne. Permission to translate the Brief Illness Perception Questionnaire and Medication Adherence Self-Efficacy Scale-revised to Arabic was obtained from developers, Weinman and Ogedegbe.

Medication Adherence. A validated Arabic version of the Morisky medication adherence scale-8 items (MMAS-8) (Alhewiti, 2014; Sa'ed, Al-Jabi, Sweileh, & Morisky, 2013) was used to measure medication adherence. MMAS-8 is reliable and valid and consists of eight items; seven with a binary response (yes/no) and one with 5-responses (4 = *never*, 3 = *once in a while*, 2 = *sometimes*, 1 = *usually*, 0 = *all the time*). The items were summed, with the last item weighted by 1/4, giving a total sum MMAS-8 score with values between 0 and 8 (higher scores reflected higher adherence) (Morisky, Ang, Krousel- Wood, & Ward, 2008). In this study, Cronbach's alpha of the MMAS-8 was .72 and a score of ≥ 6 represented high adherence (Morisky et al., 2008).

Beliefs about Necessity of and Concerns about Medications. To measure beliefs about antihypertensive medication, we used a validated Arabic version of the Beliefs about Medicines Questionnaire-Specific (BMQ-Specific) (Jamous, Sweileh, Taha, Adham Saed El-Deen Abu, & Zyoud, 2014). The BMQ-Specific scale had adequate validity and reliability (Horne, Weinman, & Hankins, 1999) and contains two subscales that measures medication necessity (BMQ-N) and medication concerns (BMQ-C). The BMQ-N (five items) and BMQ-C (six items) are rated on a five-point Likert scale (5 = *strongly agree* to 1 = *strongly disagree*). The mean score of both scales ranges from 1-5; higher score reflects stronger beliefs about medication necessity or concerns. In our study, Cronbach's alpha of BMQ-N and BMQ-C were .78 and .70, respectively.

Beliefs about HTN Severity. The Brief Illness Perception Questionnaire (BIPQ) that was translated into Arabic for this study using international guidelines (Table 3.1) was used to assess beliefs about HTN severity (World Health Organization & World Health Organization, 2009). The BIPQ, which is reliable and valid, contains eight items that assess illness consequences, timeline, personal and treatment control, illness identity and comprehensibility,

concerns related to illness, and emotions (Broadbent, Petrie, Main, & Weinman, 2006). Each item is rated on a 0-10 response scale with a total score of the eight items ranging from 0-80; a higher score represents stronger beliefs about HTN severity. Cronbach's alpha of the BIPQ in this study was .68.

Self-efficacy Regarding Medication Adherence. The Medication Adherence Self-Efficacy Scale-Revised (MASES-R) was translated into Arabic for this study (Table 3.1) using international guidelines (World Health Organization & World Health Organization, 2009), and used to measure patients self-efficacy regarding adherence to antihypertensive medication. The MASES-R items (n=13) are rated on a four-point Likert scale (1 = *not at all sure* to 4 = *extremely sure*) with a mean score ranging from 1-4 (higher score reflects higher self-efficacy). The original MASES-R is valid and reliable (Fernandez, Chaplin, Schoenthaler, & Ogedegbe, 2008). In this study, the MASES-R Cronbach's alpha was .90.

Table 3.1. BIPQ and MASES-R Translation Process

1. Questionnaires were translated to Arabic by a professional bilingual native Arabic translator. 2. Arabic translation was reviewed by a professional bilingual Arabic Omani translator residing in Oman. 3. Arabic questionnaires were back translated to English by a professional bilingual native English translator. 4. Back-translated versions were checked against original English by a professional translation team. 5. Cognitive debriefing was conducted by testing the questionnaires on 10 Omani patients with HTN.
BIPQ= Brief Illness Perception Questionnaire; MASES-R=Medication Adherence Self-Efficacy Scale-Revised. * Translation was done according to the international guidelines

Data Analysis

Descriptive statistics of means, ranges, standard deviation (*SD*s), frequencies and percentages were used to describe study variables. Prior to analysis, data normality, linearity, and multi-collinearity were assured using descriptive statistics, skewedness and kurtosis, visual inspection of histograms, P-P plots, and variance inflation factor (VIF). Relationship between demographics, beliefs, and adherence was assessed using bivariate analyses of Pearson correlation for continuous variables (i.e., age, number of years with HTN, number of antihypertensive medications, frequency of daily dose, BMQ-N, BMQ-C, BIPQ, and MASES-R) and one-way analysis of variance (ANOVA) for categorical variables (i.e., gender, governorate, marital and employment status, income, education level, smoking, alcohol consumption). Multiple linear regression analysis was used to examine the independent influence of the four beliefs variables (i.e., BMQ-N, BMQ-C, BIPQ, and MASES-R) on medication adherence. Demographic variables with a *p*-value < .05 in the bivariate analysis were entered in the multiple regression analysis. We used enter method to insert variables into the regression analysis. In this study, a *p*-value of less than .05 was considered statistically significant. In this study, we analyzed data from 45 subjects. This sample size provides 80% power to identify an R^2 of 15.4% or more for bivariate regression analyses and 23% or more for multiple regression analyses based on four predictors. Consequently, regression analyses are only powered to identify relatively large effect sizes. Data were analyzed using SPSS version 23 (IBM Corp., Armonk, NY).

Results

Forty-five subjects with HTN, mean age 52 years (*SD* = 14.6), participated in the study (Table 3.2). The majority of the subjects were female (64.4%), residents of AL Dakhiliya Governorate (71.1%), married (62.2%), unemployed/housewives (57.8%), and did not smoke

(95.6%) or consume alcohol (97.8%). Subjects had HTN for an average of seven years and were prescribed two antihypertensive medications with an average of two doses per day.

Medication Adherence

The mean MMAS-8 score was 5.3 (*SD* = 2.0). Of the 45 subjects, 22 (48.9%) were high adherers (MMAS-8 ≥ 6). When we explored each MMAS-8 items, 95.6% of subjects reported that they had not missed taking medication for the last 2 weeks, 66.7% did not ever feel hassled about sticking to medications, 64.4% had never cut back or stopped taking medication without telling doctor, and 64.4% did not forget medication when they traveled. One half of the subjects had no difficulty remembering to take medication.

Beliefs about Necessity of Antihypertensive Medication(s)

The mean BMQ-N score was 3.8 (*SD* = 0.79). The majority of subjects strongly agreed (scored 5) or agreed (scored 4) to the following: their current (88.9%) and future health (55.5%) depend on medication, medication protects their health from becoming worse (84.4%), and without BP medicine they would be very ill (57.8%). Of the remaining subjects, 33.3% were uncertain (scored 3) whether their future health depends on medications and whether their lives would be impossible without BP medicine.

Concerns about Antihypertensive Medication(s)

The mean BMQ- C score was 2.7 (*SD* = 0.73). More than 50% of all subjects strongly disagreed (scored 1) or disagreed (scored 2) to the following concern statements: BP medicine disrupt my life (68.2%), having to take BP medicine worries me (57.8%), and BP medicine give me unpleasant side effects (51.1%). At the same time, these subjects strongly agreed or agreed to having some concerns about becoming too dependent on medication (44.4%) and that medication was a mystery to them (35.5%).

Beliefs about HTN Severity

The mean BIPQ score was 27 (SD = 12.2). Each item in the BIPQ is rated on a 0-10 response scale; a higher score represents higher beliefs about HTN severity. In this study, a response from 0 to 5 represents lower perceptions about HTN severity. Subjects who responded from 0 to 5 on each BIPQ item were as follows: 70% reported that HTN has no/minimal effect on their lives, 100% believed in having control over HTN, 66.7% believed in having no/minimal symptoms from HTN, and 72.7% reported no/minimal concern regarding HTN.

Self-Efficacy Regarding Medication Adherence

The mean MASES-R score was 3.2 (*SD* = 0.67). Subjects were extremely confident (scored 4) in their ability to take antihypertensive medication between meals (70.5%) or more than once a day (59.1%), when they were worried about taking medication for the rest of their lives (54.5%), when they did not have any symptoms (54.5%) or felt well (52.3%), and when they were busy at home (50.0%).

Relationship between Beliefs and Medication Adherence

In the bivariate analyses, we found that stronger beliefs about HTN severity were correlated with lower medication adherence (r = − .32, p = .03), while higher self-efficacy was correlated with higher adherence (r = .44, p = .003) (Table 3.3). We did not observe a significant correlation between the necessity of and concerns about medication (r = .25, p = .10 and r = − .28, p = .06, respectively) and medication adherence or between demographics and adherence. Therefore, only beliefs variables and not demographics were considered in multiple regression analysis. When beliefs variables (BMQ-N, BMQ-C, BIPQ, and MASES-R) were entered into the regression model, the model was significant (F (4, 39) = 4.89, p = .003) and explained about 33% of the variation in medication adherence. The model showed that self-efficacy *(B* = 1.07, p

= .012) and beliefs about medication necessity (B = .78, p = .028) were significantly and positively associated with medication adherence, and, together (i.e., self-efficacy and necessity) explained about 26% of the variation in medication adherence (Table 3.4).

Table 3.2. Characteristics of Subjects

Variable	n (%)	Mean (SD)	Range
Age (years)		52.1 (14.6)	23 - 84
Years with HTN		7.3 (6.9)	1 - 30
Number of antihypertensive medications		1.9 (1.1)	1 - 5
Frequency of daily dose		1.6 (0.80)	1 - 4
Scales Scores			
MMAS		5.3 (2.0)	0.75 – 8.0
BMQ-C		2.7 (0.73)	1.2 – 4.7
BMQ-N		3.8 (0.79)	2.0 – 5.0
BIPQ		27.0 (12.2)	1.0 – 56.0
MASES		3.2 (0.67)	1.6 – 4.0
Governorate			
AL Dakiliya	23 (71.1)		
Muscat	13 (28.9)		
Gender			
Men	16 (35.6)		
Women	29 (64.4)		
Marital Status			
Single	4 (8.9)		
Married	28 (62.2)		
Widowed	13 (28.9)		
Income (OMR)			
No Income	15 (33.3)		
<150	8 (17.8)		
150 – 499	9 (20.0)		
500 – 999	2 (4.4)		
>1000	9 (20.0)		
Education Level			
Do not write or read	19 (42.2)		
Write and read only	4 (8.9)		
Primary or preparatory completed	4 (8.9)		
High school Completed	12 (26.7)		
University or more	6 (13.3)		
Employment Status			
Government sector	7 (15.6)		
Private sector	4 (8.9)		
Self-employed	4 (8.9)		
Unemployed/Housewife	26 (57.8)		
Retired	3 (6.7)		
Smoking			
No	43 (95.6)		
Yes	2 (4.4)		

Alcohol consumption	
No	44 (97.8)
Yes	1 (2.2)

Note. Note. HTN = Hypertension; MMAS = Morisky Medication adherence scale; BMQ-C = Beliefs about Medicine Questionnaire-Concern; BMQ-N = Beliefs about Medicine Questionnaire-Necessity; BIPQ = Brief Illness Perception Questionnaire; MASES-R = Medication Adherence Self Efficacy Scale-Revised; OMR = Omani Rials

Table 3.3. Summary of Pearson Correlations between Beliefs and Medication Adherence

Measure	Correlation (r)
BMQ-C	−.28
BMQ-N	.25
BIPQ	−.32*
MASES-R	.44**

Note. MMAS = Morisky Medication adherence scale; BMQ-C = Beliefs about Medicine Questionnaire-Concern; BMQ-N = Beliefs about Medicine Questionnaire-Necessity; BIPQ = Brief Illness Perception Questionnaire; MASES-R = Medication Adherence Self Efficacy Scale-Revised.
* $p < .05$. ** $p < .01$.

Table 3.4. Summary of Multiple Linear Regression Analysis for Variables Predicting Medication Adherence

Variable	*B*	SE (*B*)	Beta	*t*	*p*-value	95% CI
BIPQ	− 0.034	− 0.024	− 0.211	−1.389	.173	−0.83 – 0.15
MASES-R	1.067	0.405	0.363	2.363	.012	0.25 – 1.89
BMQ-C	− 0.303	−0.402	− 0.112	− 0.755	.455	−1.12 – 0.51
BMQ-N	0.777	0.339	0.303	2.289	.028	0.09 – 1.46

Note. $R^2 = .33$
BIPQ = Brief Illness Perception Questionnaire; MASES-R = Medication Adherence Self-Efficacy Scale-Revised; BMQ-C = Beliefs about Medicine Questionnaire-Concern; BMQ-N = Beliefs about Medicine Questionnaire-Necessity.

Discussion

Poor medication adherence remains a challenge and beliefs are significant factors influencing medication adherence. In our study, high self-efficacy was associated with medication adherence, which is consistent with the current literature on HTN (Fernandez et al., 2008; Kamran et al., 2015; Schoenthaler, Butler, Chaplin, Tobin, & Ogedegbe, 2016; Warren-

Findlow, Seymour, & Huber, 2012). The relationship between self-efficacy and medication adherence exists regardless of the difference in measures of adherence (e.g., MMAS-4, MEMS, and other self-reports) and self-efficacy (original MASES, other self-reports) or in study designs and population (Middle-Eastern, African American) (Fernandez et al., 2008; Kamran et al., 2015; Schoenthaler et al., 2016; Warren-Findlow et al., 2012). Self-efficacy is key to completion/maintenance of health behaviors because patients need to feel empowered and to have confidence in performing a positive health behavior (e.g., medication adherence) (Lorig, Laurent, Plant, Krishnan, & Ritter, 2014). This highlights the importance of the following: 1) assessing self-efficacy as a central component that empowers medication adherence across cultures and populations and 2) designing effective and personalized strategies (e.g., action plan) to enhance self-efficacy to improve medication adherence and other self-care activities (Lorig et al., 2014).

We found that stronger beliefs about the necessity of antihypertensive medication were related to higher medication adherence, which is consistent with the results of other studies, including those on Arabs, that examined adherence among patients with HTN and particularly studies that used both MMAS-8 and MMAS-4 to measure medication adherence (Kamran et al., 2015; Rajpura & Nayak, 2014). Beliefs about medication necessity remain a key predictor of medication adherence for various illnesses and among populations from Europe, United States, Asia, and Australia, regardless of different study designs, sample sizes, or measures of medication adherence (Horne et al., 2013). Therefore, beliefs about medication necessity should be assessed and incorporated into clinical practice and, accordingly, the plan of care would be modified to match patients' needs. For instance, a study to improve medication adherence by using text-messaging intervention has reported higher medication adherence when the text

message was tailored based on a previous assessment of patients' beliefs about medication necessity (Petrie, Perry, Broadbent, & Weinman, 2012). Thus, health education and counseling could be used to facilitate the adoption of positive beliefs known to enhance adherence by increasing patients' sense of power over medications used to control the disease and prevent complications (Pradier et al., 2015).

We did not find a relationship between concerns about antihypertensive medication and medication adherence, which is inconsistent with the findings from other HTN studies (Horne, Clatworthy, Hankins, & ASCOT Investigators, 2010; Kamran et al., 2015; Rajpura & Nayak, 2014). Findings from those studies revealed a negative relationship between medication concerns and medication adherence. In our study, the relationship was also negative, but was not significant. Our different findings could be the result of our small sample size, which would result in having less power to detect a relationship or because other studies included patients with coexisting morbidities that required multiple medication, resulting in patients having more concerns about these medications. In our study, subjects reported having more concerns about becoming dependent on their medications. The low adherence level noted among patients with more concerns about medication could be improved by addressing these concerns in the clinical settings. Major concerns related to side effects, long-term effects, or dependency on antihypertensive medications should be clarified and discussed with patients. For instance, patients with HTN should be informed that, depending on the type of medication, some side effects could develop, but are manageable. Patients should also be aware that taking antihypertensive medication as prescribed is critical, safe, and well tolerated (Bramlage et al., 2014; Khan et al., 2014).

Although it is not significant (which is consistent with another study), the relationship between HTN severity and medication adherence was negative (Sansbury, Dasgupta, Guthrie, & Ward, 2014). We found that as beliefs about HTN severity increased, medication adherence decreased, which is inconsistent with the HBM's proposition and with the majority of studies that reported a positive relationship (Horne et al., 2010; Kamran et al., 2015; Rajpura & Nayak, 2014). One reason for the negative relationship found in our study could be the influence of unique Islamic cultural beliefs about disease (including HTN). For instance, some Omanis might believe that HTN is severe and uncontrollable, but it is God's will and fate (e.g., fatalistic beliefs); therefore, the patients assume a passive role, do not take medications, and rely on faith that the cure is in God's hands and that prayers are the only healing option (Al Abed, Davidson, & Hickman, 2014; Padela, Killawi, Forman, DeMonner, & Heisler, 2012; Ypinazar & Margolis, 2006). These beliefs are consistent with studies of Arab women, which have found that fatalistic beliefs present barriers for breast cancer screening (Alkhasawneh, 2007; Goldblatt, Cohen, Azaiza, & Manassa, 2013).

Based on our findings and those of other literature regarding the relationship between illness severity beliefs and adherence, it is necessary to consider HTN-related beliefs when planning strategies to improve medication adherence. Clinicians should be aware that counseling and health education regarding HTN is effective in counteracting HTN-related negative beliefs that hinder medication adherence (Pradier et al., 2015). Specific attention, using a qualitative inquiry must be paid to investigate why Omanis who believe that HTN is a severe condition also demonstrate lower adherence.

Study Limitations

As this study used a cross-sectional correlational design, a causal relationship and long-term adherence cannot be inferred. Additionally, the small sample size, use of convenience sampling to recruit subjects from only two governorates, and inclusion of subjects with only HTN and no coexisting morbidities limited the generalizability of findings to a larger Omani population and increased the likelihood of selection bias. Therefore, researchers and clinicians should be cautious when using these findings in a clinical setting. Furthermore, use of a self-report measure to examine medication adherence (MMAS-8) could introduce a recall bias and overestimation of adherence; therefore, additional studies should use an objective measure of medication adherence.

Study Implications

Limited evidence is available about the determinants of medication adherence among Omani patients with HTN. Therefore, this study contributes to the body of Omani literature related to HTN and medication adherence. Furthermore, our study was conducted in primary healthcare settings that are focal points for health prevention. Therefore, it is vital that clinicians and researchers be aware of how beliefs affect medication adherence, so they can assess medication adherence and related barriers in primary clinical settings. This is the first step toward improvement of HTN management and preventing HTN-related consequences.

Future studies are needed to 1) consider the influence of unique Islamic cultural beliefs about illness causality and medication on medication adherence (these beliefs were not the focus of this study); 2) design individualized interventions (e.g., socio-behavioral, counseling, and educational) involving health beliefs and patient needs (Nieuwlaat et al., 2014; Pradier et al., 2015), and 3) use a longitudinal design and a larger sample size selected randomly from different

sites across Oman to improve generalizability of findings and examine medication adherence over time.

Conclusion

In this study, we found that more than half of Omani patients with HTN exhibited poor adherence to medication and that patients' beliefs about medication necessity and self-efficacy were significantly associated with medication adherence among these patients. This study highlighted the importance of assessing medication adherence among patients with HTN and demonstrated that beliefs are important factors influencing adherence beyond the demographics; thus, gaining more insights on improving medication adherence.

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CHAPTER 4: MEDICATION ADHERENCE AND HEALTH BELIEFS AMONG OMANIS WITH HYPERTENSION

Introduction

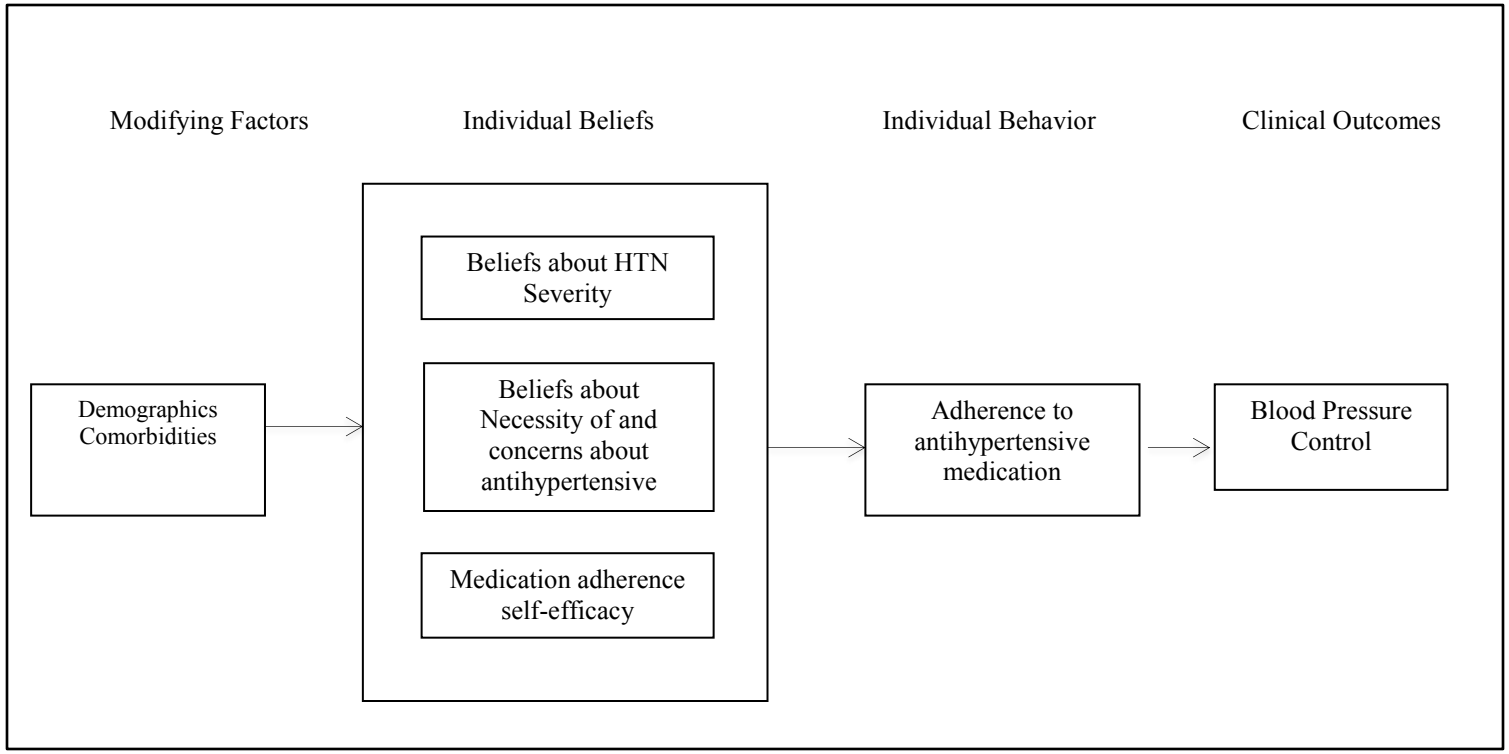
Hypertension (HTN) is prevalent in developed and developing countries with about 40% of adults having HTN globally (Alwan, 2011). In Oman, a Middle Eastern Arab developing country, HTN prevalence is 40.3% (Al Riyami et al., 2012) and is the leading cause of hospitalization (Ministry of Health, 2014). Globally, HTN is responsible for approximately 50% of cardiovascular and cerebrovascular events (Alwan, 2011). Though medication is key to managing HTN (Herttua, Tabak, Martikainen, Vahtera, & Kivimaki, 2013; James et al., 2014; World Health Organization, 2013), adherence to antihypertensive medication remains a challenge (Al Qasem, Smith, & Clifford, 2011; Chowdhury et al., 2013).

Various factors contribute to poor medication adherence (AlGhurair, Hughes, Simpson, & Guirguis, 2012; Lewis, 2012), such as patients' beliefs about illness, treatment, or the ability to manage health (AlGhurair et al., 2012; Khatib et al., 2014). The health beliefs model (HBM), which was used to guide our study, supports that a decision to take a health action (i.e., adherence to antihypertensive medication) is influenced by an individual's beliefs (a) about the condition's seriousness (i.e., hypertension) and his or her susceptibility to its consequences (e.g., stroke, cardiovascular diseases); (b) that the benefits gained from an action (e.g., blood pressure (BP) control) outweighs its harm (e.g., medication side effects); and c) beliefs about one's own ability to perform the behavior (i.e., medication adherence self-efficacy) (Rosenstock, Strecher, & Becker, 1988; Strecher, DeVellis, Becker, & Rosenstock, 1986).

Oman is similar to other Arab/Muslim countries in that, people believe that illness causality is connected to God (Hodges, 2015). Therefore, Omanis with HTN may hold certain beliefs about HTN and its treatment that could influence medication adherence. Several Omani studies have examined HTN prevalence and risk factors (Al Riyami & Afifi, 2002; Al-Maqbali, Temple-Smith, Ferler, & Blackberry, 2013; Al-Mawali, 2015), but no published studies to date have examined medication adherence in relation to beliefs among Omanis with HTN.

Hence this study was conducted to examine (a) patients beliefs about HTN, antihypertensive medication, and self-efficacy; (b) adherence to antihypertensive medication; (c) the relationship between patients' beliefs and medication adherence; and (d) the relationship between medication adherence and BP control (Figure 4.1). Findings from this study will be helpful in identifying factors related to medication adherence among the Omani population and thus revealing challenges and opportunities to improve medication adherence and HTN control.

Figure 4.1. Study Conceptual Framework



Method

Study Design, Setting, and Sample

This descriptive cross-sectional study was conducted in Oman and targeted patients with HTN who received HTN care in primary healthcare centers. These primary healthcare centers were chosen because they were convenient for and easily accessible by the principal investigator (PI). Inclusion criteria were Omanis diagnosed with HTN for at least 3 months, aged 21 years or older, and who were taking at least one antihypertensive medication. Participants were excluded if they did not read or understand Arabic. Ethical approval was obtained from the University of North Carolina at Chapel Hill and from the Ministry of Health in Oman.

Sample Size

In our pilot study, 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.

Procedure

Recruitment. Initially, the PI obtained HTN clinics' schedule of operation days and visited these clinics in every governorates on the days that the HTN clinic was operated. Participants visited these clinics in every governorates on the days that HTN clinic was operated. Participants who attended were screened for eligibility using a patient list obtained through electronic medical records. Eligible participants were initially approached by a nurse and asked to participate in the study; three participants refused to participate because they were busy and

could not stay longer. The PI then approached participants who had agreed to participate in the study and informed them about the study's purpose and their role. Participants were asked to sign an informed consent form before the study commenced; they were assured that participation was voluntary and that refusal to participate would not affect the care they received.

Data Collection and Measures. The principal investigator (PI) collected data from 25 health centers of 14 wilayah (districts) in six governorates (Ad Dhakhliyah, North Ash Sharqiyah, Muscat, Ad Dhahirah, North and South Al Batinah). Data were collected within four months period (October 2015−January 2016). In the waiting room, participants completed a demographic sheet and self-report Arabic questionnaires on medication adherence, beliefs about HTN, beliefs about antihypertensive medications, and self-efficacy; these took 15−40 minutes to complete. The PI interviewed participants who reported reading and writing limitation in a private room. The PI obtained data related to BP values and comorbidity burden from the medical records of each patient. Permission to use all questionnaires was obtained[2] (See Appendix 2).

Morisky Medication Adherence Scale-8 (MMAS-8) items. We used the Arabic version of MMAS-8, which measures medication adherence behavior and was validated among Arabs (Alhewiti, 2014; Ashur, Shah, Bosseri, Morisky, & Shamsuddin, 2016; Mayet, 2016; Sweileh et al., 2011; Sweileh et al., 2014) with a Cronbach's alpha ranging from .65−.80. The MMAS-8 is a reliable and valid scale (Morisky, Ang, Krousel- Wood, & Ward, 2008) and has been adopted in several languages (de Oliveira-Filho, Morisky, Neves, Costa, & de Lyra, 2014; Korb- Savoldelli et al., 2012; Moharamzad et al., 2014; Tandon, Chew, Eklu-Gadegbeku, Shermock, & Morisky,

[2] Permission to use the Arabic versions of the Morisky Medication Adherence Scale (8-items) and Beliefs about Medicine Questionnaire was granted from developers, Morisky and Horne. Permission to translate the Brief Illness Perception Questionnaire and Medication Adherence Self-Efficacy Scale-revised to Arabic was granted from developers, Weinman and Ogedegbe.

2015). MMAS-8 comprises eight items; seven items are reported as yes/no (1/0) response whereas the remaining item is rated on a five-point Likert scale (4 = never, 3 = once in a while, 2 = sometimes, 1 = usually, 0 = all the time). The items are summed, with the last item weighted by 1/4, giving a total sum MMAS-8 score with values between 0 and 8 and with higher scores reflecting higher adherence. In this study, a total score of ≥ 6 indicates high medication adherence (Morisky et al., 2008). In the current 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 (BMQ). We used the Arabic version of the BMQ- specific that was validated among Arabs with a Cronbach's alpha range from .70−.80 (Alhalaiqa, Masa'Deh, Batiha, & Deane, 2015; Alhewiti, 2014; Amr, El-Mogy, & El-Masry, 2013; Jamous, Sweileh, Taha, Adham Saed El-Deen Abu, & Zyoud, 2014; Jumah, Hassali, Qhatani, & Tahir, 2014) to measure participants' beliefs about medication. The BMQ-specific comprised two subscales; 1) the BMQ-necessity scale (BMQ-N) that comprised five items and assessed beliefs about antihypertensive medication necessity, and 2) the BMQ-concern scale (BMQ-C) that comprised six items and assessed participants' concerns related to medication's potential adverse effects. BMQ-N and BMQ-C had adequate reliability and validity (Horne, Weinman, & Hankins, 1999). Both subscales were rated on a five−point Likert scale (5= strongly agree to 1= strongly disagree) with a mean score ranged from 1–5; a higher mean score represented stronger beliefs about the necessity of or concerns about medication. In our study, Cronbach's alpha of BMQ-N and BMQ-C were .84 and .70, respectively.

Brief Illness Perception Questionnaire (BIPQ). We used the Arabic version of the BIPQ that was translated in the current study according to international guidelines (Figure 4.2) (Guillemin, Bombardier, & Beaton, 1993; Wild et al., 2005; World Health Organization & World Health Organization, 2009). The BIPQ comprised eight items, each assessing one dimension of a patient's perception of HTN. The BIPQ had adequate reliability (Cronbach's alpha = 0.72) and validity (Broadbent, Petrie, Main, & Weinman, 2006). 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, and the total summated score ranged from 0–70, where a higher score indicated strong beliefs about HTN severity.

Medication Adherence Self-Efficacy Scale- Revised (MASES-R). We used the Arabic version of the MASES-R to assess the degree of participants' confidence in taking their antihypertensive medication under certain circumstances (e.g., in public, while traveling, when having no symptoms). In this study, the MASES-R, comprising 13 items, was translated following international guidelines (Figure 4.2) (Guillemin et al., 1993; Wild et al., 2005; World Health Organization & World Health Organization, 2009). The MASES-R is reliable (Cronbach's alpha = 0.92) and valid (Fernandez, Chaplin, Schoenthaler, & Ogedegbe, 2008) and was rated on four-point responses (from 1 = not at all sure to 4 = extremely sure) with a mean score ranged from 1–4, with a higher score indicating higher self-efficacy regarding medication adherence (37). In this study, the MASES-R Cronbach's alpha was 0.93.

Blood Pressure (BP). The PI obtained Systolic blood pressure (SBP) and diastolic blood pressure (DBP) readings of the day of data collection and of participants' previous clinic visit

from participants' electronic medical records. BP is considered controlled if systolic < 140 mmHg and diastolic < 90 mmHg (James et al., 2014).

Charlson Comorbidity Index (CCI). We used a valid and commonly used CCI to collect data on comorbidities using electronic medical records (Charlson, Pompei, Ales, & MacKenzie, 1987; Charlson et al., 2008). The CCI score was calculated by summing the total weights assigned, with a higher score indicating a higher comorbidity burden.

Demographic Questionnaire. Participants self-reported their age, gender, marital status, governorate, wilayah, education, monthly individual income, number of antihypertensive medications they take, time since they started medication, dose frequency per day, and time since they were diagnosed with HTN.

Figure 4.2. Translation Process of the BIPQ and MASES-R Questionnaires*

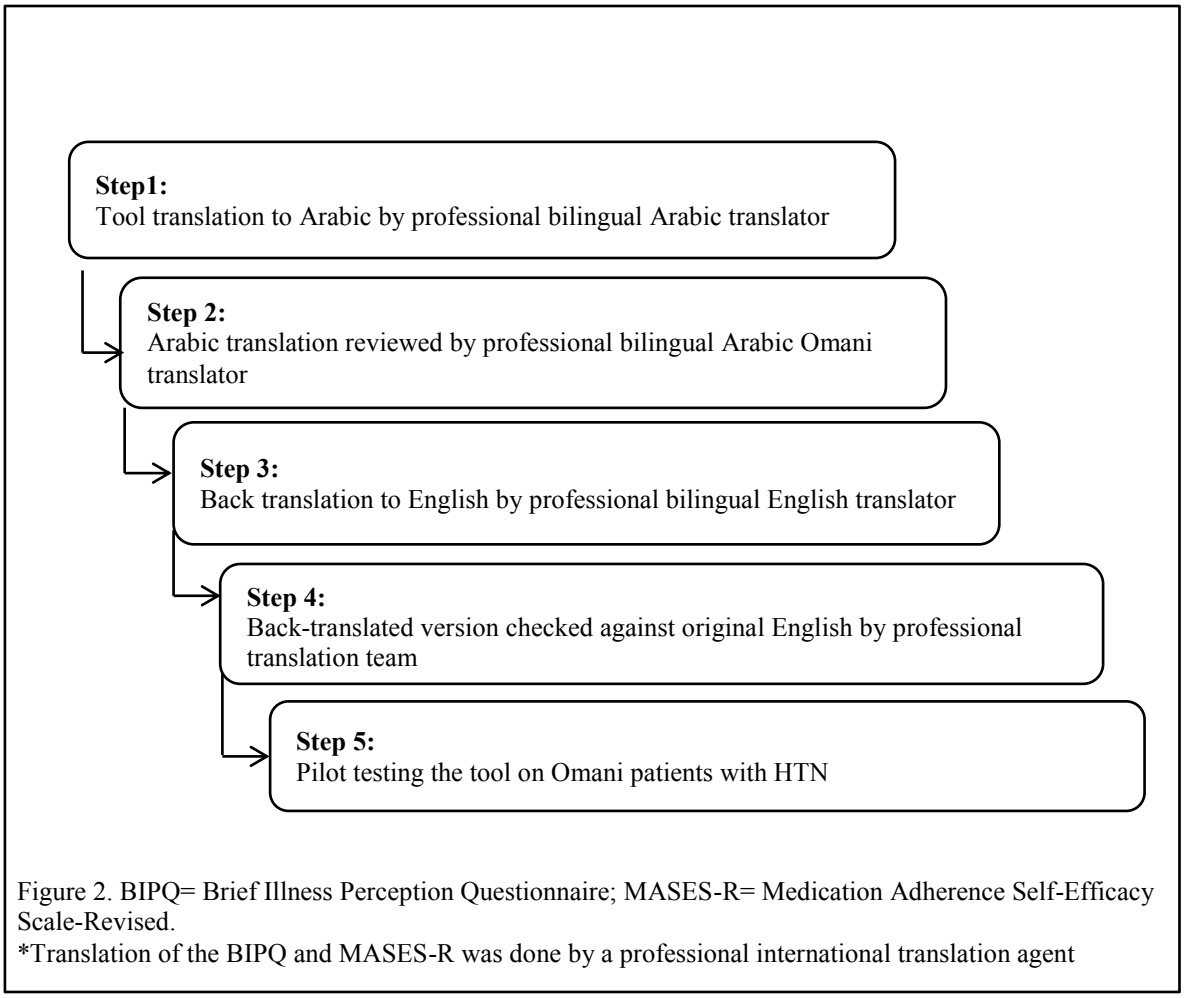


Figure 2. BIPQ= Brief Illness Perception Questionnaire; MASES-R= Medication Adherence Self-Efficacy Scale-Revised.
*Translation of the BIPQ and MASES-R was done by a professional international translation agent

Data Analysis

Data were analyzed using SPSS version 23 (IBM Corp., Armonk, NY). Data normality were assured using descriptive statistics of skewness, kurtosis, means, medians, and histograms. Descriptive statistics of means, standard deviations, minimum and maximum were used for continuous variables and of 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 $\geq$ 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 that significantly related to MMAS-8 in the bivariate analysis were adjusted for in the multiple logistic regression analysis. Additionally, similar bivariate and multivariate logistic regression analyses were conducted to predict BP control and, also considered high medication adherence as a possible predictor. 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 = 54 years, standard deviation (*SD*) = 13.1) (Table 4.1). Participants had HTN for an average of 8 years (*SD* = 7.4), ranging from 3 months to 40 years. The majority of participants were from Ad Dakhiliyah governorate (30%) followed by Muscat governorate (22%). Sixty-seven percent of participants were female, 70% were married, 48% were not able to read/write, 96% did not smoke, 97% did not consume alcohol, and 36% had no income. On the day of the survey, 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 (CCI) was 1.6 (*SD* = 1.0), with the majority of participants (64%) having HTN only and the remaining participants having concurrent comorbidities (e.g., diabetes, myocardial infarction, heart failure, stroke).

Table 4.1. 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 (OMR)			
No Income	77 (36.2)		
<150	27 (12.7)		
150 – 499	65 (26.3)		
500 – 999	28 (13.1)		
>1000	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)		
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)		

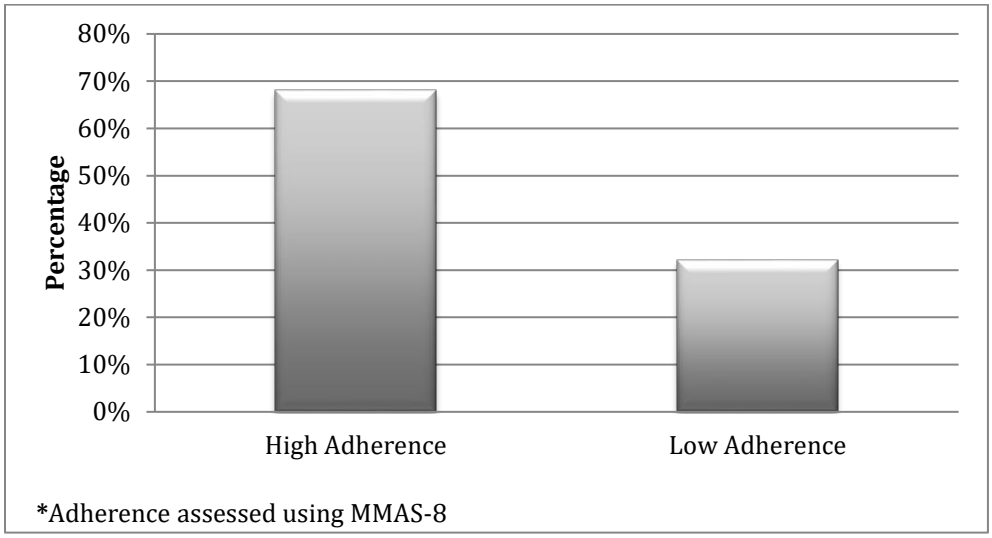
Alcohol consumption	
No	209 (99.1)
Yes	2 (0.90)
Medication Adherence (MMAS-8)	
High	145 (67.8)
Low	69 (32.2)
BP control status	
Uncontrolled	133 (63)
Controlled	78 (37)

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

Medication Adherence

The mean score of the MMAS-8 was 6.4 (*SD* = 1.6). Of 215 participants, 145 (68%) had high adherence (MMAS-8 ≥ 6) (Figure 4.3). To explore if participants took their medications as prescribed, 16% sometimes forgot to take medication over the past 2 weeks and 11% did not take their medication on the day before the study. Reasons for non-adherence as reported by participants were: 1) feeling well and having their BP controlled (17%), 2) feeling hassled about sticking to BP medication (22%), 3) forgetting BP medication when leaving home (24%), and 4) having difficulty remembering to take medication (30%).

Figure 4.2 Percentage of Medication Adherence Rate*



Beliefs about HTN Severity

The mean score of the BIPQ scale was 25.8 (*SD* = 12.2). The overall total score of the BIPQ scale ranged from 0–70. Participants' BIPQ 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. When each single item was examined, the majority of participants rated each item from 0–5 (perceived lower severity of HTN) for most of the BIPQ. For example, 76% believed that HTN does not affect or slightly affects their life, 83% believed they have some or total control over HTN, 77% experienced no or few symptoms from HTN, 74% had no or less concern about HTN, and 66% believed that HTN does not affect or has little effect on them emotionally. Only half of participants (55%) believed they understand HTN clearly.

Beliefs about Medication Necessity

The mean score of the BMQ-N scale was 3.7 (*SD* = 0.9). Participants strongly agreed or agreed (scored 4 or 5) that their current health (70%) and future health (54%) depended on BP medication, that their life would be impossible without BP medication (64%), and that BP medication protect their health from becoming worse (85%).

Concerns about Medications

The mean score of the BMQ-C scale was 2.4 (*SD* = 0.8). When airing their concerns regarding medication, the majority of participants strongly disagreed or disagreed with the following statements: medication disrupts my life (86%), having to take BP medication worries me (69%), medication gives me unpleasant side effects (70%), and I sometimes worry about becoming too dependent on BP medication (59%). However, about 51% worried about long-term side effects of BP medication.

Self-Efficacy Regarding Medication Adherence

The mean score of the MASES-R scale was 3.4 (*SD* = 0.7). The majority of participants were very confident in taking their BP medication when they were busy at home (70%), were worried about taking medication for the rest of their life (70%), did not have any symptoms (67%), took medication between meals (73%) or more than once a day (66%), and were traveling (65%). Only 58% and 48% were very confident in taking medication in public and when medication made them want to urinate while away from home, respectively.

Relationship Between Medication Adherence and Beliefs

The bivariate logistic analysis showed that those with increased age (OR = 1.07, $p < .01$), higher self-efficacy (OR = 3.39, $p < .001$), stronger beliefs about medication necessity (*OR* = 1.82, $p = .001$), and those who were widowed compared to single (*OR* = 6.75, $p = .01$) were

more likely to have high medication adherence. On the contrary, those with stronger beliefs about HTN severity (OR = 0.96, $p = .002$) and more concerns about medications ($OR = 0.30$, $p < .001$) were less likely to have high medication adherence. Additionally, compared to participants who do not read or write, participants who had completed high school only ($OR = 0.24$, $p = .002$) or had university education or more ($OR = 0.36$, $p = .02$) were less likely to have high adherence.

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 4.2) and explained 48% of the variation in medication adherence level (Nagelkerke $R^2 = .48$). Three beliefs (i.e., 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 1) participants with higher self-efficacy were two and a half times more likely to have high adherence ($OR = 2.59$, $p < .001$); 2) those with stronger beliefs about medication necessity were two times more likely to have high adherence ($OR = 1.98$, $p = .006$); and 3) those more concerned about their medication were about one-third as likely to have high adherence ($OR = 0.34$, $p < .001$). Additionally, the model revealed that high adherence is more likely with increased age ($OR = 1.06$, $p < .001$).

Relationship Between Medication Adherence and BP Control

The bivariate logistic analysis showed that participants with high medication adherence were less likely to have uncontrolled BP ($OR = 0.50$, $p = .03$) and medication adherence alone explained 3% of the variation in BP control (Nagelkerke $R^2 = .03$). Additionally, the bivariate analysis showed that participants were more likely to have uncontrolled BP if they had the

following: more concern about medication (*OR* = 1.50, *p* = .03), higher comorbidity burden (CCI) (*OR* = 1.48, *p* = .03), and higher past SBP (*OR* = 1.05, *p* < .001) and DBP (*OR* = 1.48, *p*= .01). In multiple logistic regression, past SBP and medication adherence remained significant after backward elimination and explained 15% of the variation in BP control (Nagelkerke R^2 = 0.15) (Table 4.3). This reduced model (past SBP and adherence) was statistically significant ($\chi^2(2) = 23.6$, $p < .001$). 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).

Table 4.2. 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. BMQ-C = Beliefs about Medicine Questionnaire-Concern; BMQ-N = Beliefs about Medicine Questionnaire-Necessity; MASES-R = Medication Adherence Self-Efficacy Scale-Revised.
*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 4.3. 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. SBP = Systolic BP.

* 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

Discussion

Understanding beliefs about illness, medication, and self-efficacy is critical to better achieving optimal medication adherence and HTN management. In this study, we found higher adherence is more likely in participants who have stronger beliefs about medication necessity and less concern about medication. These findings are in agreement with other findings among patients with HTN (Horne, Clatworthy, Hankins, & ASCOT Investigators, 2010; Kamran, Ahari, Biria, Malpour, & Heydari, 2015; Rajpura & Nayak, 2014) and among Arabs, where MMAS-8 and BMQ were used to measure adherence and beliefs about medications (Alhalaiqa, Deane, Nawafleh, Clark, & Gray, 2012; Alhewiti, 2014; Sweileh et al., 2014). About 50% of participants reported concerns related to medications' side effects that could develop in the future; therefore clinicians and scientists must assess patients' beliefs related to medication concerns and necessity and then provide patients with information to help them understand the necessity of medication (e.g., medications' effects and benefits against future risks) to maximize positive beliefs about medication and answer individual medication concerns (e.g., side effects) to both minimize these concerns and enhance adherence (Petrie, Perry, Broadbent, & Weinman, 2012; Pradier et al., 2015).

Current studies on HTN reported mixed results regarding the relationship between beliefs about HTN severity and medication adherence (Chen, Tsai, & Lee, 2009; Kamran et al., 2015; Lulebo et al., 2015; Morrison et al., 2015). In our study, though the relationship between beliefs about HTN severity and medication adherence was negative, this relationship was not significant, which is consistent with another study that used the same measures of adherence (MMAS-8) and HTN severity (BIPQ) (Meinema et al., 2015). These mixed findings might relate to different cultural backgrounds among different populations. In Islamic culture, for example, regardless of the perceived severity of illness, all Muslims believe in the central role of God (Allah) in healing. Their behavior toward managing illness may vary; while some Muslims take medications, others do not because they believe that illness is God's will and only religious practices and prayers will heal them (Padela, Killawi, Forman, DeMonner, & Heisler, 2012). This could explain the negative relationship between beliefs about HTN severity and medication adherence in this study. The mixed findings also indicate that clinicians should assess these beliefs and be aware that such variations could exist between cultures and within Islamic culture. Further, in our study, half of participants reported less understanding of HTN and its management, so an effort to increase HTN awareness and education in Oman's clinical and community settings is needed to improve medication adherence (Pradier et al., 2015).

Our findings regarding the positive relationship between self-efficacy and antihypertensive medication adherence are consistent with many other studies in HTN (Fernandez et al., 2008; Kamran et al., 2015; Ogedegbe, Mancuso, Allegrante, & Charlson, 2003), glaucoma (Sleath et al., 2015), HIV (Colbert, Sereika, & Erlen, 2013), and osteoporosis (Qi & Resnick, 2014); these studies reported the same positive association regardless of the different measures used for medication adherence or self-efficacy. Bandura's self-efficacy theory

supported the idea that self-efficacy is a central concept that determines individuals' behaviors and how much effort they spend in adopting the behavior (Bandura & Adams, 1977). This denotes the importance of incorporating self-efficacy into practice to increase patients' confidence of their self-management behavior, particularly medication adherence. Additionally, using a tool such as the MASES-R in clinical areas can enable providers to identify particular conditions that may inhibit patients' confidence in taking medications. Thus an individualized care/strategy to enhance self-efficacy should 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 (Hodge & Nadir, 2008; Yosef, 2008); they then make a maximal effort to seek care and leave the outcome to God. This could explain why the majority of our participants demonstrated self-efficacy. We further noted that participants reported less confidence in taking their medication when they were in public or when medications made them urinate while away from home. Compared to other cultures, this response is not unusual because Omanis are protective 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 (de Oliveira-Filho et al., 2014; Irvin et al., 2012; Morisky et al., 2008; Natarajan, Putnam, Van Aarsen, Beverley Lawson, & Burge, 2013). Intervention studies (e.g., behavioral and educational) have shown that improving patients' knowledge about HTN, its consequences, and medications' side effects improved medication adherence and BP outcomes (Gwadry-Sridhar et al., 2013). Hence, for favorable outcomes resulting from BP control, the public health agenda should embrace assessing and improving

adherence to antihypertensive medication as a top priority, especially given the high prevalence of HTN and uncontrolled BP worldwide and in Oman.

Findings on the relationship between age and medication adherence are currently mixed. Our study found that the likelihood of adherence increases significantly as age increases. Our findings are consistent with the majority of HTN literature (Ahmad, Ramli, Islahudin, & Paraidathathu, 2013; Cuffee et al., 2013; Korb- Savoldelli et al., 2012; Natarajan et al., 2013; Schoenthaler, Ogedegbe, & Allegrante, 2009) and with studies using MMAS-8 with a cutoff point of 6, specifically (Alhewiti, 2014; Lee et al., 2013). However, some studies have reported no relationship between age and medication adherence (Holt et al., 2013; Kamran et al., 2015; Sa'ed, Al-Jabi, Sweileh, & Morisky, 2013). Our findings, as supported by other literature findings, suggest the importance of understanding reasons for low adherence among those with younger ages; this is especially important as HTN prevalence is increasing among younger adults (Joffres et al., 2013; Nwankwo, Yoon, Burt, & Gu, 2013; Zhao et al., 2013). For example, in the United States, the prevalence of HTN among those 18–59 years old is 40% (Nwankwo et al., 2013). In Oman, unawareness of HTN also is greater among those 30–39 years old as compared to those who are 60 and older (El-Aty, Meky, Morsi, Al-Lawati, & El Sayed, 2015), indicating the need to raise awareness of HTN and treatment among young Omanis.

In this study, we found 68% of subjects had high adherence; though this percentage is not optimal, it is higher compared to other studies. For instance, studies among Arabs reported that high adherence ranges between 50% and 57% (Alhewiti, 2014; Sweileh et al., 2014); these studies used the MMAS-8 and defined high adherence as a score of ≥6. Other studies that used same or different measure of medication adherence, but different defining criteria reported an adherence rate that ranges from 19% to 46% (Mayet, 2016; Rajpura & Nayak, 2014; Sa'ed et

al., 2013). Higher adherence rate in our study compared to neighboring countries could be attributed to the fact that 75% of participants were 45 years or older because being older (e.g., >50 years) has been significantly related to higher adherence (Alhewiti, 2014; Mayet, 2016; Natarajan et al., 2013). Another explanation for higher adherence among our participants because all Omani patients have free access to care and medications, so cost of medication would not be a barrier to medication adherence.

Study Limitations

Our findings should be interpreted in light of several limitations. First, this study is cross-sectional, using correlation design, and cannot support a causal relationship. Second, we utilized the self-reporting measure of medication adherence, which may have introduced a recall bias and a social desirability. However, the MMAS-8 is reliable, valid, and widely used across cultures and populations, and has been correlated with objective measures of medication adherence (i.e., pharmacy refills and electronic monitoring system) (Arnet, Metaxas, Walter, Morisky, & Hersberger, 2015; Krousel-Wood et al., 2009). Furthermore, we used a convenience sample, which limited the generalizability of findings, though we used multiple primary care settings across Oman to obtain a heterogeneous sample. 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. In this study, we did not examine types or the actual dose of antihypertensive medications neither numbers and types of medications were taken to manage other concurrent comorbidities in relation to medication adherence, which could influence patients' beliefs about the necessity of and concerns regarding antihypertensive medications and medication adherence.

Implications

The findings of this study offered important implications for providers and researchers. Clinicians caring for patients with HTN should be aware that patients' beliefs could influence their medication adherence; therefore evaluating patients' beliefs is an important step toward improving medication adherence. Moreover, there is a need to design interventions aimed at improving medication adherence by increasing patients' understanding of medication necessity, reducing perceived concerns about medications (e.g., side effects), and enhancing patients' self-efficacy, all of which could be achieved through patient education about HTN and medication. Future studies are needed to 1) modify or validate the BIPQ and MMAS-8 in the Omani population, and 2) examine long-term medication adherence in Oman and in the Middle Eastern Arab countries. Further studies could consider the effect of antihypertensive medication's class and dose and of other medications taken by patients to treat concurrent comorbidities on medication adherence.

Conclusion

This study is the first to examine the relationship between beliefs and medication adherence in Oman using multiple cities and governorates. This study found that high medication adherence is more likely in people who have stronger beliefs about medication necessity, have fewer concerns about medications, have higher self-efficacy, and are advanced in age. Moreover, BP control is more likely among participants with higher adherence. The study findings set new priorities for future research and practice, to incorporate patients' beliefs as a key aspect in optimizing medication adherence.

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CHAPTER 5: FINDINGS SYNTHESIS AND IMPLICATIONS

First Manuscript (Chapter 2): "Beliefs and Medication Adherence in Patients with Hypertension: A systematic Review"

This manuscript is a review of the state of scientific quantitative evidences examining the relationship between different patients' beliefs and medication adherence for HTN. The review is based on the analysis of 25 quantitative studies that included patients who have HTN but do not have other comorbid conditions. This review represents the findings of studies from 14 countries around the world concerning common beliefs reported in relation to medication adherence were: beliefs about HTN's severity and susceptibility; beliefs about medications' effectiveness, necessity and barriers; and other patients–related beliefs (e.g., self–efficacy, patient–provider relationship, stress, family support, subjective norms). One major finding of this review was that high medication adherence was significantly related to (a) fewer perceived barriers and concerns related to antihypertensive medication (e.g., side-effects, high cost, and bad taste) and (b) high patients' self-efficacy. This review also revealed that (a) a majority of studies found no relationship between beliefs about the effectiveness and necessity of medication and medication adherence and (b) the findings were mixed concerning the relationship between beliefs about HTN severity and susceptibility and medication adherence. Although some studies showed a positive relationship between beliefs about HTN severity and susceptibility, others reported no relationship.

Second Manuscript (Chapter 3): "Relationship Between Medication Adherence and Beliefs Among Patients with Hypertension in Oman"

This manuscript, which was guided by the health beliefs model (HBM), is a report of findings from a pilot study aimed to examine the relationship between beliefs about HTN severity, beliefs about medications' necessity, medication concerns, and self-efficacy with medication adherence (Figure 5.1). In this study, multiple linear regression analysis was used to examine this relationship. The main findings were that stronger beliefs about medications' necessity and higher self-efficacy were associated with high medication adherence. Findings also showed no association between perceived medication concerns and beliefs about HTN severity, and medication adherence. Though beliefs about HTN severity were statistically negatively associated with medication adherence in the bivariate correlation, this relationship disappeared when other beliefs variables included in the model. In this study we also tested the reliability of the Arabic versions of the five beliefs questionnaires (MMAS-8, BMQ-N, BMQ-C, BIPQ, and MASES-R), by translating two questionnaires (BIPQ and MASES-R) into Arabic using international guidelines. Although this study was limited to 45 subjects and four healthcare centers, the correlation estimates findings were used to calculate the sample size required for the larger study, which is summarized in the following section of the third manuscript.

Third Manuscript (Chapter 4): "Medication Adherence and Health Beliefs Among Omanis with Hypertension"

This manuscript was a report of findings from the a larger study aimed to examine the relationship between beliefs about HTN severity, beliefs about necessity of and concerns related to antihypertensive medication, and self-efficacy with medication adherence. This study also aimed to examine the relationship between medication adherence and BP control (Figure 5.2). The main findings of this study indicated that patients with: (a) advanced age, (b) higher self-

efficacy, (c) stronger beliefs about the necessity of medication, and (d) fewer concerns about medications were all more likely to have high medication adherence. Additionally, findings showed that high medication adherence is related to less likelihood of having uncontrolled BP.

Synthesis of Findings from the Three Manuscripts

The main findings of the three manuscripts demonstrated that that patients with HTN showed high adherence to antihypertensive medication if they had (a) stronger beliefs about the necessity of antihypertensive medication to control BP and prevent complications, (b) higher self-efficacy regarding adherence to prescribed medication, and (c) fewer concerns about medication, both present and future medication side effects. These findings are consistent with the health beliefs model (Figure 5.3), which proposes that a health behavior is likely to be performed when an individual perceives more benefits (e.g., medications' necessity), fewer barriers (e.g., medication concerns), and higher self-efficacy. In the three manuscripts, high self–efficacy was found to be associated with high antihypertensive medication adherence, indicating the central role self-efficacy plays in improving medication adherence.

Dissertation findings also indicate that adherence to antihypertensive medications is lower among patients with stronger beliefs about HTN severity. This finding is inconsistent with the health belief model, which proposes a health behavior is more likely to be performed (i.e., medication adherence) when an individual perceives higher severity of a condition (i.e., HTN). Despite its inconsistency with the health beliefs model, this finding is consistent with another study conducted in Egypt, which is an Arab, Muslim country (Youssef & Moubarak, 2002). The negative relationship could be attributed to unique Islamic cultural beliefs regarding illness causality and treatment, which was not within the scope of this dissertation. This might indicate that beliefs about HTN severity vary across different cultures and populations.

Figure 5.1. Conceptual Framework of the Manuscript 2

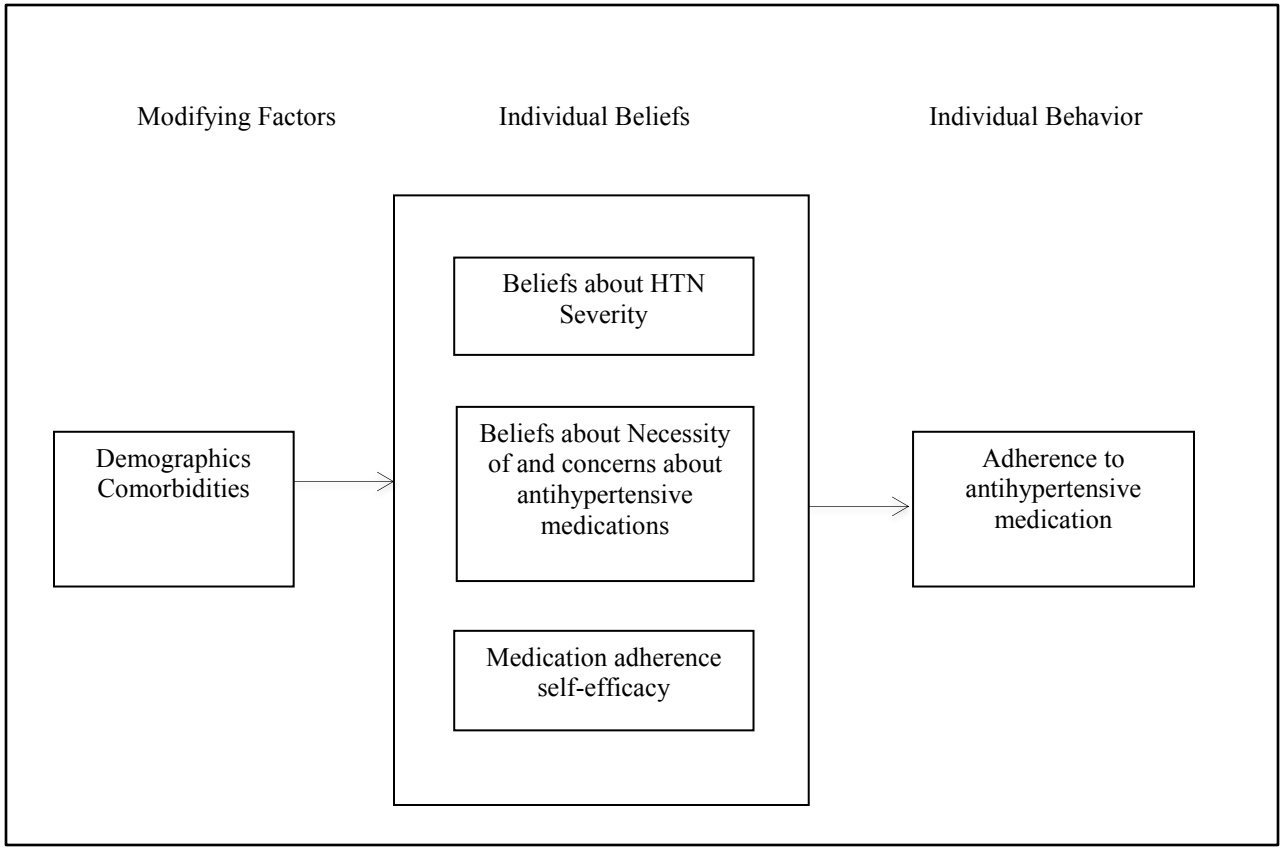


Figure 5.2. Study Conceptual Framework of the Manuscript 3

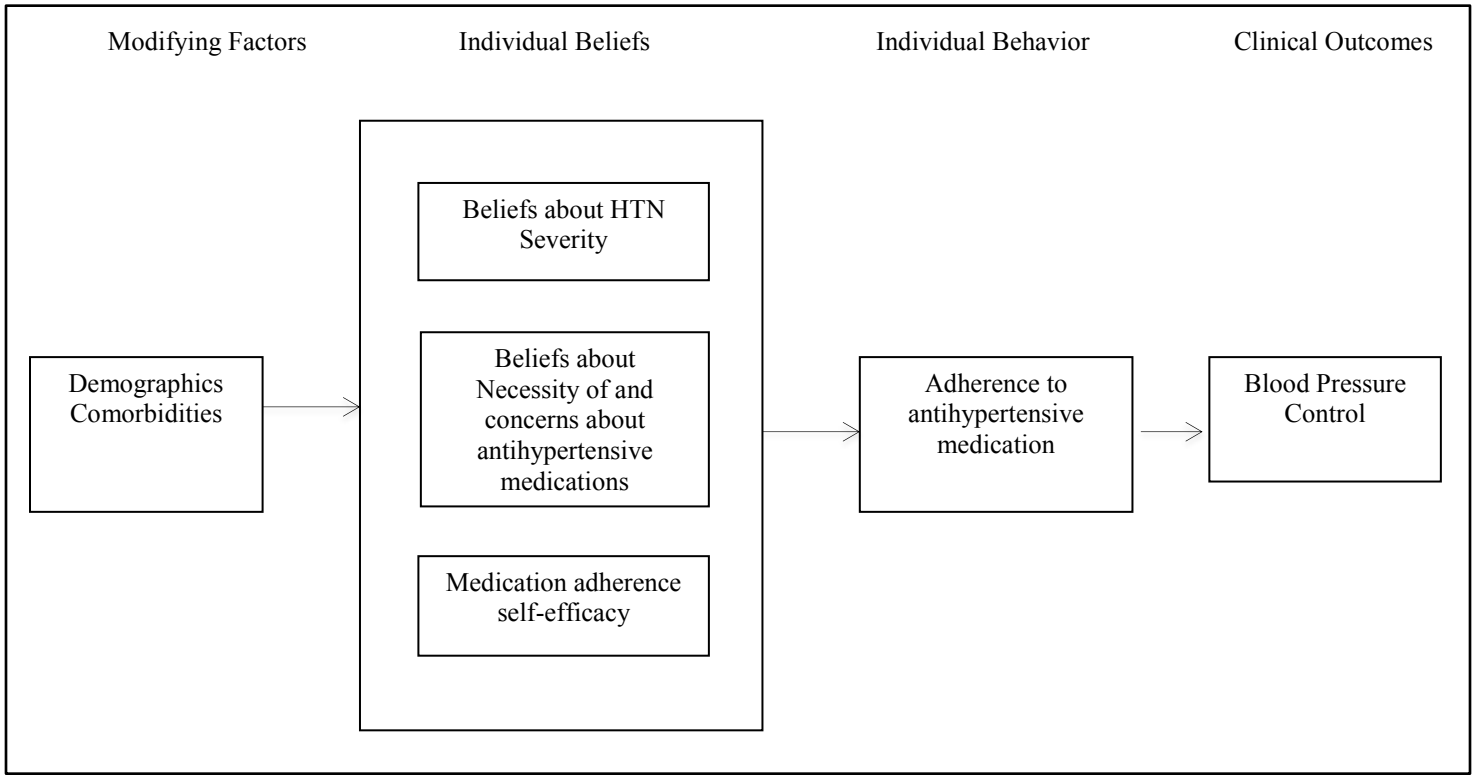
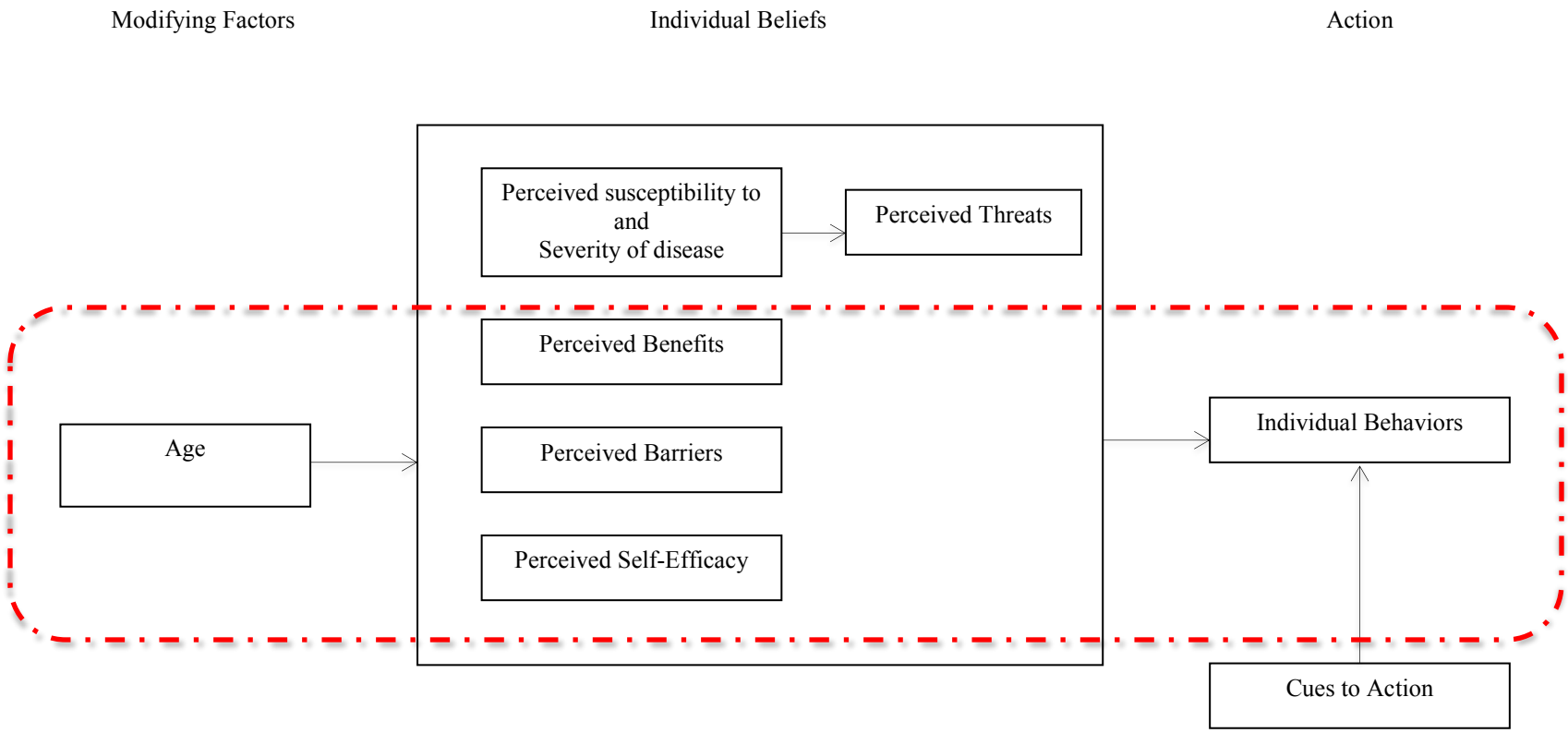


Figure 5.3. Summary of the Dissertation's Findings Applied to The Health Beliefs Model



Implications

Implications for Practice

The findings of this dissertation indicate several practical implications. In primary healthcare settings, clinicians should consider assessments of patients' health beliefs to be integral aspects of medication adherence and should incorporate them into practice. Clinicians need to assess and improve patients' self–efficacy, beliefs about medications' necessity, and concerns (e.g., side effects) to develop strategies personalized to patients' needs, which will enhance medication adherence. Moreover, clinicians should aim to maximize patients' positive beliefs about medications' necessity and self–efficacy and reduce concerns related to antihypertensive medication. Patients need to be aware that antihypertensive medications are safe, are easily tolerated, and offset side effects when taken properly. This could be achieved by designing appropriate education and counseling regarding HTN and the necessity of its medication. Education interventions should emphasize providing patients with written or visual education materials (e.g., leaflet, booklets) to accommodate patients' literacy level and fulfill their personal needs because our research showed that about 49% of participants do not read or write.

Implications for Future Research

The findings from this dissertation provide various recommendations for future research. Future studies should focus on investigating other possible beliefs that could influence medication adherence among patients with HTN, because in this dissertation, the focus was on beliefs from the health belief model. For example, in the second and third manuscripts, findings showed a negative relationship between beliefs about HTN severity and medication adherence, which was inconsistent with the findings from a majority of studies. This indicates that unique

Islamic cultural values or the influence of family and community beliefs might play a role in the relationship between medication adherence and beliefs about HTN severity. Therefore, qualitative studies are needed to accurately understand patients' beliefs about HTN severity and how these beliefs influence medication adherence.

Moreover, future studies using longitudinal designs and random sampling are necessary to optimize generalizability of findings and examine medication adherence over time and beliefs' causal relationship with medication adherence. Additionally, in collaboration with clinicians, researchers need to design and implement interventions (e.g., educational, behavioral, and technological), which are personalized to individual needs to improve medication adherence. These interventions should focus on assessing health beliefs, maximizing positive beliefs about HTN and its medications, and improving patients' self-efficacy. Finally, there is a need for future studies to validate the MMAS-8 and the BIPQ measures among Omanis because, in both studies, these measures' reliability was below the acceptable limit.

Implications for Policy

Researchers, clinicians, and stakeholders need to emphasize a collaborative effort to improve medication adherence. Limited data is available concerning medication adherence in Oman; therefore, the Ministry of Health needs to incorporate medication adherence statistics into annual health reports, national health surveys, and the healthcare databases. Using this data, the government's efforts to improve medication adherence can specifically monitored over time.

Further, there is a need to increase awareness related to HTN and its medications. This awareness will improve patient's beliefs and, thus, medication adherence. This can be achieved through increasing the number of community programs that are supported by the Ministry of Health. For instance, several successful community initiatives are available across Oman such as,

the Healthy Life Style program and the Healthy City Programs. These programs should be countrywide and focus not only on antihypertensive medication adherence, but rather adherence to other non-pharmacological therapeutic approaches including diet and life-style modifications to manage HTN and appropriately control the BP. The collaboration between stakeholders, scientists, and clinicians in these programs would facilitate early investigation, planning, and implementation of individualized and culturally appropriate strategies to improve antihypertensive medication adherence and management of HTN. In the Ministry of Health Vision 2050 (2014), it stated, "The health policy in the Sultanate of Oman considers primary healthcare, the most cost-effective healthcare, as the first and basic entry point for all levels of healthcare" (2014, p. 92), which supports the importance of examining and improving medication adherence in HTN and its determinants (e.g., beliefs) in primary healthcare settings.

Conclusion

To conclude, HTN remains a public health issue, and adherence to antihypertensive medication is not yet optimized. The results of this dissertation suggest that patients' beliefs are significant determinants of medication adherence among patients with HTN in Oman and globally. Therefore, implementing strategies examining and improving patients beliefs about the medications' necessity, medication-related concerns, and patients' self-efficacy regarding medication adherence are essential steps for clinicians, researchers, and stakeholders to achieve proper patient adherence to antihypertensive medication.

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Youssef, R., & Moubarak, I. (2002). Patterns and determinants of treatment compliance among hypertensive patients. *Eastern Mediterranean Health Journal*, 8 (4-5), 579-592.

APPENDIX 1: QUALITY ASSESSMENT TOOL OF STUDIES INCLUDED IN THE SYSTEMATIC REVIEW

	Assessment Questions	Score
1	Was the sampling method representative of the population intended to the study?	
	A. Non-probability sampling (including: purposive, quota, convenience and snowball sampling)	0
	B. Probability sampling (including: simple random, systematic, stratified g, cluster, two-stage and multi-stage sampling)	1
2	Was a response rate mentioned within the study? (Respond no if response rate is below 60)	
	A. No	0
	B. Yes	1
3	Was the measurement tool used valid and reliable?	
	A. No	0
	B. Yes	1
4	Was the measurement of adherence objective?	
	A. By Questionnaire (Self-reported)	0
	B. By Clinical records or lab tests	1
	C. Both	1
5	Did the investigator(s) control for confounding factors (e.g. stratification/ matching/ restriction/ adjustment) when analyzing the associations (if the study contains purely descriptive results, no association and prediction tests were conducted in the test, please select "Not applicable")?	
	A. No	0
	B. Yes	1
	C. Not Applicable	NA

Scoring: Total score divided by total number of items multiplied by 100

Methodological Appraisal Score

Bad	Satisfactory	Good
0 – 33%	34 - 66%	67 – 100%

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Name and contact information of Licensee: **Al Noumani, Huda Salim <alnouman@email.unc.edu> OR <hudasn@squ.edu.om**

Title of Study:
Health Beliefs and Medication Adherence Among Omanis with HTN

Number of Anticipated Administrations of the MMAS-8:

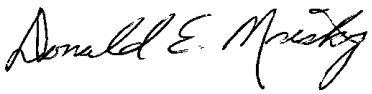
250 participants

Signature of Licensee:

Huda AL Noumani

Date:

February 12th, 2015



Signature of Developer/Owner:

Date: February 24, 2015

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4. The back-translation of the BMQ is approved by Professor Horne
5. All copies of the BMQ will have the legend: '© Professor Rob Horne' clearly indicated on them.
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8. A copy of the translated questionnaire is submitted to Prof Horne.

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I agree to the above conditions for translation of the BMQ:

Name of user	Huda Salim AL Noumani
Signature of user	Huda AL Noumani
Address for correspondence	1700 baity hill dr Chapel Hill, NC, 27514 USA
E-mail	hudasn@squ.edu.om OR alnouman@email.unc.edu
Telephone	+ (919)260-5945 OR (+968) 92116739
Date	February 12, 2015

Re: Brief Illness Perception Questionnaire Request

Weinman, John <john.weinman@kcl.ac.uk>

Mon 2/9/2015 4:35 AM

To:Al Noumani, Huda Salim <alnouman@email.unc.edu>;

Huda

I am happy to give permission for you to use the B-IPQ in your doctoral research.

Have a look at the Illness Perception Questionnaire website to see if there is an Arabic translation there. If not then you will need to follow best practice guidelines for translating validated questionnaires.

all the best with your study,

Prof John Weinman

From: Al Noumani, Huda Salim <alnouman@email.unc.edu>
Sent: 09 February 2015 01:34
To: Weinman, John
Subject: Brief Illness Perception Questionnaire Request

Re: Medication Adherence Self-Efficacy Scale Request

Ogedegbe, Olugbenga <Olugbenga.Ogedegbe@nyumc.org>

Sun 2/8/2015 8:59 PM

To:Al Noumani, Huda Salim <alnouman@email.unc.edu>;

Importance: High

You have my permission to use the MASES.
There is currently no Arabic version of the MASES.
Good luck with your research!

Gbenga Ogedegbe, MD, MPH
Professor of Medicine
Professor of Population Health

Vice Dean & Chief Medical Officer
Global Institute of Public Health
New York University

Chief, Division of Health and Behavior
Director, Center for Healthful Behavior Change
Department of Population Health
NYU School of Medicine
Ph: 212-263-4183

From: "<Al Noumani>", Huda Salim <alnouman@email.unc.edu>
Date: Sunday, February 8, 2015 8:40 PM
To: Ogedegbe Gbenga <olugbenga.ogedegbe@nyumc.org>
Subject: Medication Adherence Self-Efficacy Scale Request