Beliefs about Hypertension Among People with Uncontrolled Hypertension

Michelle M. Edwards

A thesis

submitted in partial fulfillment of the

requirements for the degree of

Master of Public Health

University of Washington

2015

Reading Committee:

Hendrika W. Meischke, Chair

Ian S. Painter

Program Authorized to Offer Degree:

School of Public Health - Health Services

University of Washington

Abstract

Beliefs about Hypertension Among People with Uncontrolled Hypertension

Michelle M. Edwards

Chair of the Supervisory Committee:
Hendrika W. Meischke, PhD
Professor, Department of Health Services

Background: Uncontrolled hypertension leads to severe yet preventable outcomes including heart attack, stroke, and chronic kidney disease. Almost a third of the adults in the US have hypertension and only about half of them have their blood pressure (BP) under control. Although increases in public knowledge and awareness about hypertension have improved BP control rates, a better understanding of the hypertension beliefs among uncontrolled hypertensives is needed to create new behavioral interventions to further improve BP control. Using a well-established framework, such as the Health Belief Model (HBM), to systematically study these beliefs is essential in learning how certain beliefs may impact BP self-management behavior.

Objectives: The aim of this study was to examine the beliefs about hypertension among people identified with high blood pressure and to find possible associations between demographics, beliefs, and the behavior of taking prescribed antihypertensive medication.

Methods: Using an existing dataset from a previous study, hypertension beliefs, defined by the HBM framework, and BP medication use in a Pacific Northwest community were analyzed. The data came from a 2007-2009 population-based survey and included the responses of 181 Seattle area residents who had a markedly elevated BP during a recent, non-life threatening 911-call visit and who reported awareness of their current or previous high blood pressure diagnosis. Relationships between variables were examined using chi-square, Mantel-Haenszel, and Fisher's exact tests, as well as bivariate and multivariate logistic regression.

Results: *Demographics, beliefs, and behaviors*: Increasing age was associated with low perceived susceptibility and high self-efficacy. Living with others was associated with perceived benefits of treatment. White race and speaking only English were each associated with high self-efficacy. Lower educational attainment and income were each associated with perceived financial barriers to treatment. Increasing age and having health insurance each independently increased the likelihood of taking BP medications. *Beliefs and behaviors*: Medication use was associated with lower perceived susceptibility and greater perceived expense of treatment. Among females, lower perceived susceptibility and greater self-efficacy were positively associated with medication use.

Conclusion: This study found several beliefs to be associated with demographic groups at risk for uncontrolled hypertension, and some beliefs were associated with medication use. These must be further studied in hopes of guiding intervention design to improve BP self-management behavior.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

I sincerely thank Hendrika Meischke for her mentorship through my first public health research experience and Ian Painter for his guidance throughout my MPH thesis process and with the statistics in this study. I also thank Carol Fahrenbruch for all her help with the dataset for this study. I thank Mark Oberle for advising me during my first year of the Executive MPH Program. Lastly, but not at all least, I warmly thank my family and friends for all the ways they support me in my career-changing endeavors.

DEDICATION

To my father and mother who have used their gifts and developed their skills not for their own satisfaction, but for the benefit of others. They continue to do many things in their daily lives that support the mission of public health whether they know it or not. Thanks Mom and Dad.

BACKGROUND

UNCONTROLLED HYPERTENSION

Hypertension, defined as a systolic blood pressure (BP) persistently ≥140mmHg or a diastolic BP persistently ≥90mmHg, leads to severe yet preventable outcomes including heart attack, stroke, and chronic kidney disease (CDC, 2014). Hypertension is known as "the silent killer" because it typically exists without symptoms until a life threatening event occurs with little to no warning. The impact of hypertension on strokes worldwide is astonishing with an estimated 34.6% of strokes attributed to hypertension (population-attributable risk), which increases to 52% if a BP greater than 160/90mmHg is documented (Sharma and Hakim, 2011). The brain may be at higher risk of damage from hypertension than other organ systems but may also be more responsive to treatment. Stroke victims are more likely to be hypertensive than heart attack victims, and BP lowering medications reduce the incidence of stroke more than that of heart attacks. Uncontrolled hypertension also increases the risk of cognitive impairment, such as dementia, which is on the rise as our population ages (Sharma and Hakim, 2011). The prevalence of these outcomes of vascular disease could be reduced if hypertension is better controlled at a population level.

Approximately 31% of American adults have hypertension (CDC, 2013), yet only about half of them have their BP under control (Yoon et al., 2015). Daily lifelong prescribed antihypertensive medication is the mainstay of treatment along with maintaining a healthy lifestyle. A study of the trends from the most recent National Health and Nutrition Examination Survey (NHANES) 2003 to 2012 reported that among hypertensive adults (i.e. those having a measured BP ≥140/90mmHg or taking prescription BP medication), awareness (i.e. answering affirmatively to the question "Have you ever been told by a doctor or health professional that you

had hypertension, also called high blood pressure?") increased from 75.2% to 82.1%, treatment with medications increased from 65.0% to 74.5%, and the percentage with controlled BP (defined as having a BP <140/90mmHg) increased from 39.4% to 51.8%. Among patients taking BP medications, the percentage still with uncontrolled BP decreased from 38.1% to 29.6%. Although these trends seem favorable, the overall prevalence of hypertension has remained unchanged in the past decade, and the rate of control is still well below the Healthy People 2020 goal of 62.1% (Yoon et al., 2015).

To achieve further improvements in hypertension trends, developers of public health interventions will need to understand the many factors that have produced the current trends in specific populations. Demographic characteristics, including gender, race, and socioeconomic factors are known to play a role in BP control (Chiong, 2008). These demographic risk factors help to identify groups that are at high risk for developing uncontrolled hypertension. Understanding the perspective of each group, including what influences them and what barriers they face, is essential in designing effective tailored interventions. Potentially modifiable factors include knowledge of the nature of the condition of hypertension, self-awareness of one's diagnosis and current BP status, and beliefs about hypertension and its treatment. The question then becomes how do awareness, knowledge, and beliefs interact to produce the health behaviors involved in managing hypertension?

KNOWLEDGE, AWARENESS, AND BELIEFS

The terms 'knowledge', 'awareness', and 'beliefs' are distinct yet interrelated; therefore, defining and conceptualizing these terms for the purposes of this discussion is prudent. Knowledge refers to information that has been learned and can generally be labeled as correct or incorrect based on an accepted standard. Awareness is the status of having acknowledged some

specific information concerning oneself that had been sought, discovered, or received from a source. Beliefs are unique personal judgements regarding a topic or information based on one's own culture, values, and experience. Using the example of hypertension, we can reason that beliefs are more than just personalized knowledge, and knowledge does not imply awareness of one's own diagnosis or blood pressure status. Figure 1 shows a conceptual diagram representing the likely relationships between knowledge, awareness, and beliefs about hypertension. The 'knowledge' information presented is based on the generally accepted knowledge about hypertension and its management from the medical professionals' perspective.

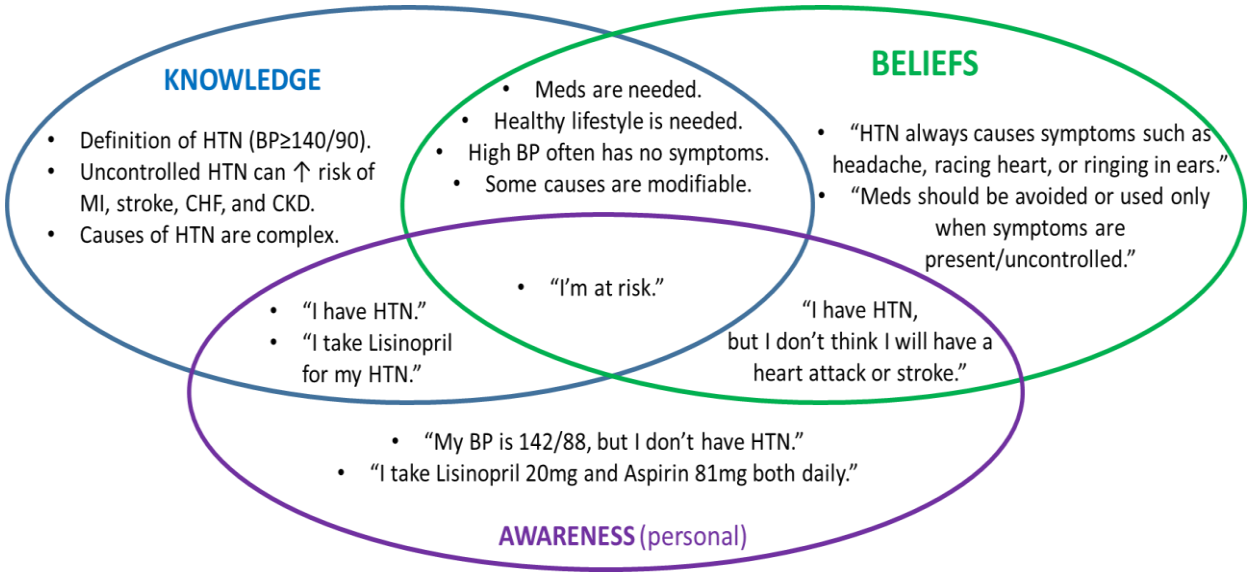

Figure 1. Conceptual diagram showing examples of knowledge, beliefs and awareness about hypertension and how to control it. The examples of 'knowledge' are based on what is generally accepted by medical professionals. (HTN=hypertension, MI=myocardial infarction, CHF=congestive heart failure, CKD=chronic kidney disease)

Many researchers, including Egan et al. (2003 and 2010), Redon et al. (2008), Whelton et al. (2004), Khatib et al. (2014), and others, have studied knowledge and awareness among patients with hypertension. A review and meta-analysis by Khatib et al. (2014) showed that "lack of knowledge was the most common barrier to hypertension awareness." Egan et al. (2003)

found that among patients who reported having their blood pressure measured within the past year, 46% did not know their blood pressure reading, exhibiting lack of awareness. They also found that 30% of those reporting a systolic blood pressure of ≥140mmHg stated that they do not have high blood pressure, which shows a lack of knowledge of the definition of high blood pressure (Egan et al., 2003). Many researchers have advised to better educate the public; however, several studies show that even knowledgeable subjects often fail to adopt recommended health behaviors (Graham et al., 2006; and Newell et al., 2009). Many studies also conclude that awareness needs to improve when a population's BP control is suboptimal, but this also assumes that awareness alone sufficiently translates into behavioral changes that will improve BP control. Behaviors that have consistently been shown to improve blood pressure control include taking prescribed medicines, monitoring blood pressure regularly, maintaining a low sodium diet, exercising, maintaining a healthy weight, limiting alcohol use, and not smoking (CDC, 2012). The trends in awareness, treatment, and BP control in the NHANES study (Yoon et al., 2015) support a positive association between awareness and control, as do many studies in Hispanic populations (Kountz, 2004; and Bersamin et al., 2009). In fact, because greater than 50% of hypertensives worldwide are unaware of their condition, the World Hypertension League (WHL), comprised of 85 national organizations concerned with hypertension, established May 17th as World Hypertension Day annually beginning in 2005 to raise global awareness of hypertension (Chockalingam, 2008). Although some studies do show behavioral benefits of awareness and knowledge, they also show some insufficiencies. A study of the elderly in urban China showed that those aware of their hypertension had more frequent health care visits and were more willing to make lifestyle changes and that knowledge of risk factors for developing hypertension correlated with controlled BP (Zhang et al., 2009). However, the same study also

found many other cultural and economic reasons for not taking BP medications unrelated to awareness. A Portuguese study by Morgado et al. (2010) reasoned that some medication nonadherence comes from not knowing one's target BP or one's current BP in order to correctly identify when uncontrolled. They also observed that knowing drug indications, the possible drug side effects, and the risks of future complications of untreated hypertension improved medication adherence. Yet, the same study also found that in addition to medication nonadherence, living alone and having diabetes were each independently associated with poor BP control (Morgado et al., 2010). Several other studies suggest that awareness is not enough to produce BP control in populations. A study of African Americans in South Carolina found a low rate of BP control despite relatively high awareness and treatment rates and pointed to unhealthy diet and lack of exercise as likely contributors (Dickson et al., 2006). Similarly, Filipino Americans in two California cities also had difficulty with lifestyle changes and medication adherence regardless of hypertension awareness (dela Cruz and Galang, 2008). A Canadian study found that women over the age of 60 were more likely to have uncontrolled BP even though they were more likely to be aware of their hypertension diagnosis than men of that age (Gee et al., 2012). McDonald et al. (2009) reported similar findings in U.S. adults age 65 and older. A social marketing media campaign designed to raise public awareness of hypertension documented improved rates of treatment and BP control; however, these were only temporary with a return to baseline at six months (Petrella et al., 2005). The literature overall suggests that knowledge, awareness, and beliefs interact in complex and varied ways depending on culture and demographics to influence the health behaviors and ultimately the BP control of hypertensive patients.

BELIEFS ABOUT HYPERTENSION: THE HEALTH BELIEF MODEL

According to the Health Belief Model (HBM), knowledge alone is not enough to change behavior (Glanz et al., 2008). Originally developed to explain why people fail to participate in disease prevention and detection programs, the HBM is an expectancy-value based cognitive theory of behavior. This model posits that motivation leads to intent which drives behavior, and motivation is determined by a person's expectation and the magnitude (i.e. value or strength) they assign to that expectation. For example, a person may hold the belief (i.e. expectation) that uncontrolled hypertension poses a high risk of suffering a future stroke if left untreated (i.e. the magnitude of this belief is high). A person with this belief will be motivated not to leave her hypertension untreated (i.e. she intends to act). The six HBM constructs that explain what produces and influences people's intent to act are (1) perceived susceptibility, (2) perceived severity, (3) perceived benefits, (4) perceived barriers, (5) cues to action, and (6) self-efficacy. The combination of perceived susceptibility and perceived severity is referred to as perceived threat. If a person believes, for example, that she is personally susceptible to developing hypertension and that it poses severe health risks, then to her, hypertension is a perceived health threat. Believing that taking medication will very effectively lower BP is an example of a perceived benefit of that action. Perceived barriers, such as believing that medication is expensive or causes bothersome side effects, will inhibit the intent or the performance of the action. A cost/benefit analysis takes place for individuals between their perceived benefits and perceived barriers; the results of this analysis will influence the intent. A high self-efficacy (i.e. confidence in one's ability to successfully perform an action) will support the intention, performance, and maintenance of the action. Cues to action can be anything that serves as a reminder for someone to actually perform the intended behavior, such as verbal reminders from a

spouse, postcard reminders from a doctor's office, or one's own perceived symptoms (Glanz et al., 2008). Figure 2 shows how the Health Belief Model may explain the relationships between beliefs about a health problem and performing a recommended health behavior.

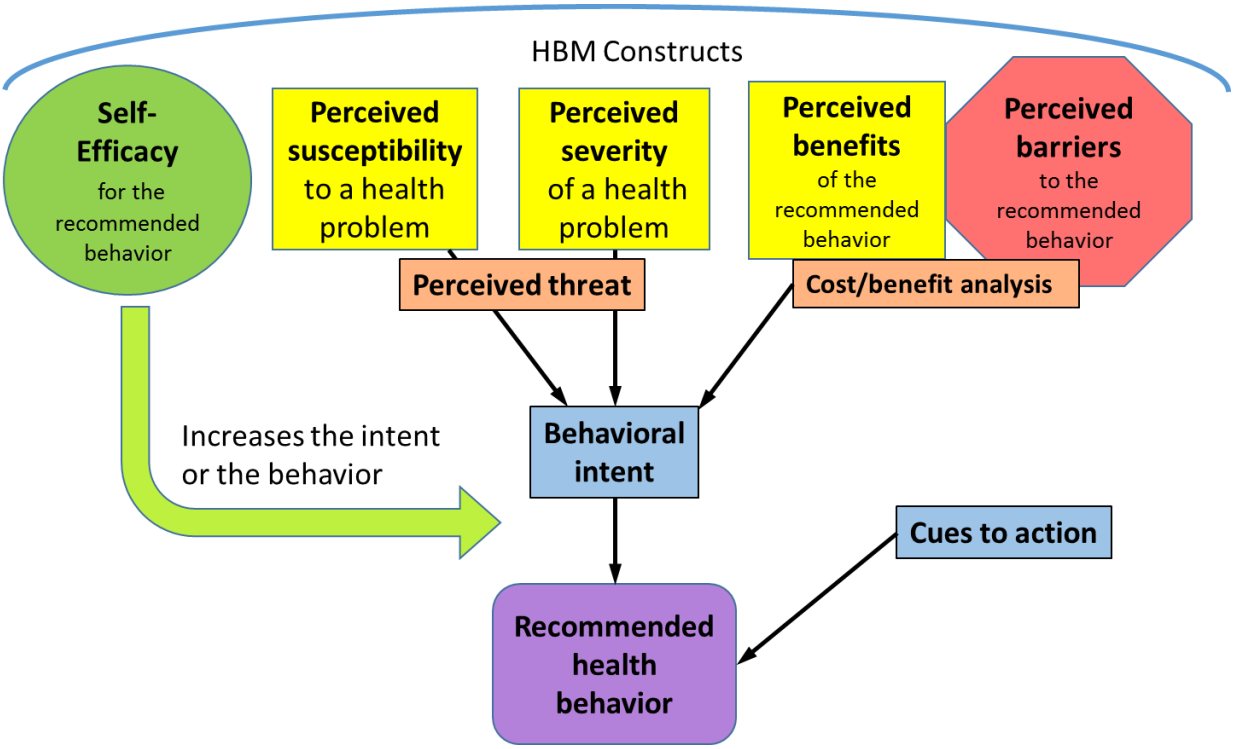

Figure 2. Conceptual diagram of the Health Belief Model (HBM).

A few hypertension studies have used the HBM to examine beliefs and behavior. Zhao et al. (2015) found that when perceived barriers were low and when perceived susceptibility, cues to action, and self-efficacy were high, medication adherence was more likely among Chinese hypertensive patients. A study of blacks in the UK demonstrated that accurate knowledge of risk factors for developing hypertension was not associated with risk-reducing behaviors, but rather, lifestyle risk factors decreased as self-efficacy to perform lifestyle changes increased (Newell et al., 2009). Interventions based on the HBM have also been used in hypertension management. Jones et al. (1987) reported that hypertensive patients seen in a northeastern Ohio hospital

emergency department were 50% more likely to make a follow-up appointment and 47% more likely to keep a referral appointment to reevaluate their high BP if they had received any of the three HBM-based interventions compared to the control group receiving no intervention. Kimberly Murphy Thalacker, RN, MSN (2011) proposed that the HBM is useful in explaining health behaviors in hypertensive Hmong Americans and should be used in designing culturally competent health promotion interventions in this population. Jennifer L. Middleton, MD, MPH (2009) reviewed studies of the health beliefs and behaviors of hypertensive African Americans and proposed a blended model that combines constructs from the HBM and Social Cognitive Theory to be used as a framework to create public health interventions to improve BP control in this population. Further research employing theoretical frameworks is needed to strengthen our understanding of how beliefs about hypertension influence behavior and respond to theory-based interventions in hopes of ultimately leading to improved consequential health outcomes.

OBJECTIVES

The aim of this study was to examine the beliefs about hypertension among people identified with a high blood pressure and to find possible associations between demographics, beliefs, and the behavior of taking prescribed antihypertensive medication. Understanding these associations, if they exist, would be useful because interventions may be designed to change the dysfunctional beliefs in specific groups to promote behavioral change that will improve hypertension control. This study used the HBM to define the beliefs about hypertension and examined the hypotheses that taking antihypertensive medication will be more likely among subjects with a high perceived susceptibility and severity of the threat of uncontrolled

hypertension, a high perceived benefit of monitoring and treating hypertension, and a high self-efficacy for achieving BP control. Additionally, taking medication was expected to be less likely among subjects who believe treating hypertension is difficult or expensive (perceived barriers). The conceptual diagram in Figure 3 uses the HBM constructs to show how beliefs about hypertension and taking prescription BP medication were hypothesized to be related.

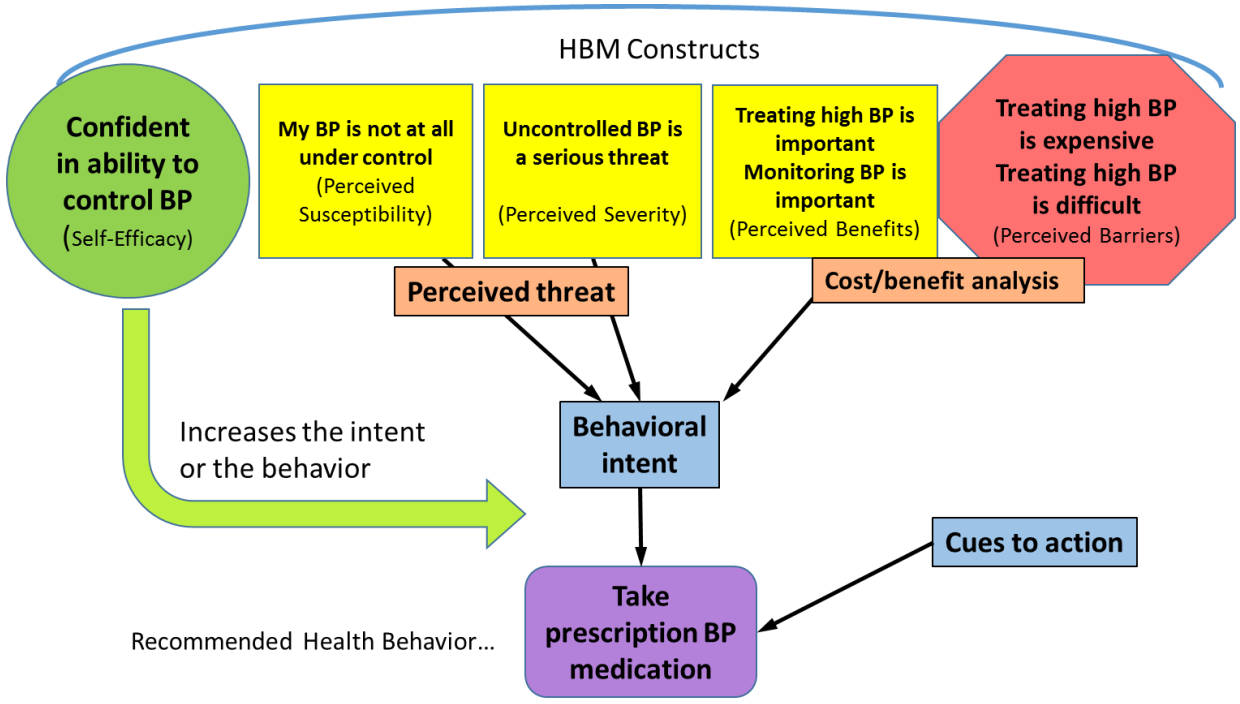

Figure 3. Conceptual diagram using the Health Belief Model (HBM) to show how beliefs about hypertension may relate to the recommended health behavior of taking prescription BP medication.

METHODS

STUDY POPULATION

This descriptive study used an existing dataset of a cross-sectional sample of adults from a randomized controlled intervention study. The original study participants were residents of four

fire districts in the Seattle, Washington metropolitan area (Meischke et al., 2013). Emergency Medical Services (EMS) technicians documented a systolic BP ≥160mmHg or a diastolic BP ≥100mmHg in 10597 subjects who called 911 for non-life threatening medical emergencies between July 2007 and September 2009. Of those, 7106 subjects were eligible to participate in the study and were randomized to one of four intervention groups, each to receive a different mailing with information about their high BP, or to the control group which was not to receive a mailing. Table 1 shows the eligibility criteria of the original study.

Table 1. Eligibility criteria to participate in the original study (Adapted from Meischke et al., 2013).

All study subjects had an elevated BP measurement documented by an EMS provider within the past 6-8 weeks.
Inclusion Criteria ▪ At least 18 years of age ▪ Systolic BP ≥ 160mmHg and/or diastolic BP ≥ 100mmHg ▪ Have an address in or near an area served by a participating fire department ▪ Have a phone number recorded on the medical incident report form (MIRF) or publically available on a web-based phone directory
Exclusion Criteria ▪ Transported to a hospital (indicates a more serious medical problem) ▪ Transported by police or sheriff ▪ Attended by EMS at a jail or police station or other custodial setting ▪ Resident of a nursing home (due to their regular access to nursing care)

About 4-6 weeks after the mailing was sent, subjects were contacted and completed either a long or a short interview by phone (Meischke et al., 2013). This study used a subset of the control group subjects who were assigned and completed the long interview that included the HBM-based questions regarding hypertension beliefs, and who expressed awareness of their hypertension. Figure 4 shows the attrition of the original study resulting in the sample of subjects used in this study. A total of 181 subjects were included in this analysis.

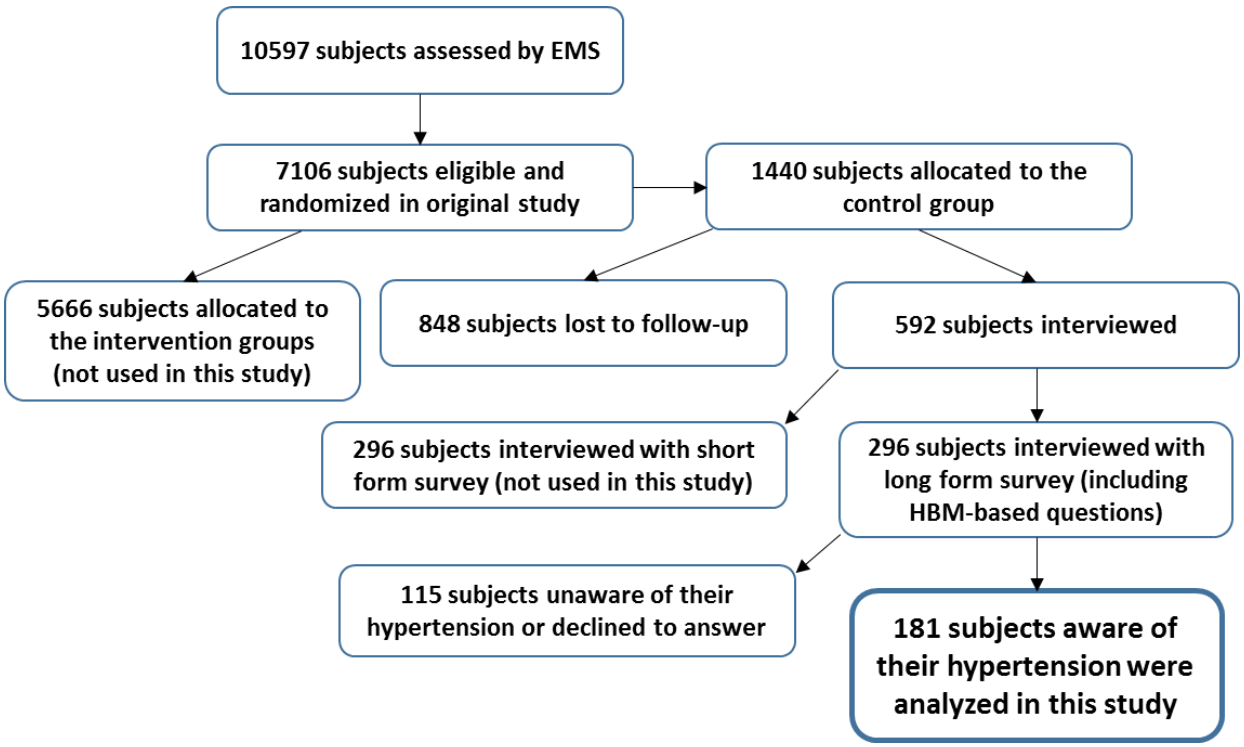

Figure 4. Sample population from the original study resulting in the dataset used in this study (Adapted from Meischke et al., 2013).

STUDY VARIABLES

The HBM-based questions in the long interview survey were designed to elicit subjects' perceived personal susceptibility to having uncontrolled BP, self-efficacy in the ability to control one's BP, perceived severity of uncontrolled BP as a health threat, perceived benefit of treatment and regular BP monitoring, and perceived barriers (expense and difficulty) of treatment. These HBM constructs were used as independent variables in this study. The outcome of interest was the behavior of taking prescribed antihypertensive medication (BP medication). This behavior was selected because it is widely recommended by medical professionals, and achieving control of hypertension is unlikely without this behavior. All study variables are described in Table 2

and Table 3 including the wording of the survey questions. Only valid responses to the questions were included in the analyses.

Table 2. Description of study variables.

Independent Variables	**Survey Question**	**Valid Responses**
Demographics (See Table 3)		
HBM Constructs (beliefs)		
Perceived Susceptibility	Is your BP under control, somewhat under control, or not at all under control?	Yes; Somewhat; Not at all
Self-efficacy	How confident are you that you can control your BP?	Very; Somewhat; Not at all
Perceived Severity	Is uncontrolled high BP a serious threat to your health, a somewhat serious threat to your health, or not at all a serious threat to your health?	Yes; Somewhat; Not at all
Perceived Benefit	Is treating high BP important to your health, somewhat important to your health, or not at all important to your health?	Yes; Somewhat/Not at all (combined)*
Perceived Benefit	Is regularly checking your BP important for your health, somewhat important for your health, or not at all important for your health?	Yes; Somewhat; Not at all
Perceived Barrier	Is treating high BP expensive, somewhat expensive, or not at all expensive for you?	Yes/Somewhat (combined); Not at all*
Perceived Barrier	Is treating high BP difficult, somewhat difficult, or not at all difficult for you?	Yes; Somewhat; Not at all
Dependent Variable (behavior)	**Survey Question**	**Valid Responses**
Taking BP medication	Are you NOW taking medications for high BP?	Yes; No

*Recoded to be binary for validity of hypothesis testing.

STATISTICAL ANALYSIS

SPSS (Version 19; IBM Corporation, Armonk, NY) was used to code and analyze the data. Two-tailed analyses were performed using a significance level of 0.05. Two of the HBM variables were recoded to be binary (see Table 2) to avoid expected cell counts of zero.

Race/ethnicity was also recoded as binary (i.e. white and non-white) since the study sample had very few minorities. Age was analyzed as both a continuous variable and a categorical variable. The relationship between demographics and beliefs about hypertension (i.e. the HBM variables) was examined using a chi-square test, a chi-square trend test (Mantel-Haenszel test), or Fisher's exact test depending on the expected cell count requirements and contingency table size. Bivariate logistic regression was used to examine possible associations between demographics and the behavior of taking BP medications. Although gender was not initially identified as significant in the bivariate analysis, other research typically finds gender differences in hypertension management. Therefore, a chi-square analysis of the HBM variables and taking BP medications stratified by gender was additionally performed. Multivariate logistic regression was then used to test for associations between the HBM variables and the behavior of taking BP medications, correcting for any demographics that were previously found to be significantly associated with the behavior by including these variables as covariates.

RESULTS

STUDY POPULATION CHARACTERISTICS

The mean age of the subjects was 65 years with a range from 18 to 96 years, 61.9% were female, the majority (77.3%) were white, and most (86.2%) had health insurance. Table 3 presents the demographic characteristics of the study subjects.

Table 3. Demographic characteristics of study subjects.

DEMOGRAPHIC	**N (percent)**
Study subjects	181 (100)
Age Mean (±standard deviation)	65 (±17.2) years

<60 years old	64 (35.4)
60-80 years old	73 (40.3)
>80 years old	44 (24.3)
Gender	
Male	69 (38.1)
Female	112 (61.9)
Has health insurance	
Yes	156 (86.2)
No	12 (6.6)
No response	13 (7.2)
Lives with others in household	
Yes	113 (62.4)
No	55 (30.4)
No response	13 (7.2)
Marital status	
Married or has life partner	80 (44.2)
Not married or has no life partner	87 (48.1)
No response	14 (7.7)
Race/ethnicity	
White	140 (77.3)
Black/African American	10 (5.5)
Asian	9 (5.0)
Hispanic/Latino	4 (2.2)
Native Hawaiian/Pacific Islander	1 (0.6)
American Indian/Alaska Native	0 (0.0)
Non-white groups combined	24 (13.3)
No response	17 (9.4)
Primary language	
English only	149 (82.3)
English and other languages	10 (5.5)
Not English	9 (5.0)
No response	13 (7.2)
Highest level of education	
Less than high school degree	11 (6.1)
High school degree	49 (27.1)
Some college	49 (27.1)
College degree	41 (22.7)
Post college	18 (9.9)
No response	13 (7.2)
Household income	
< $20,000	32 (17.7)
$20,000 - $40,000	45 (24.9)
$40,001 - $60,000	27 (14.9)
$60,001 – $80,000	9 (5.0)
> $80,000	23 (12.7)
No response	45 24.9)

HYPERTENSION BELIEFS

Sample Characteristics

In this study sample, 51.9% of the subjects felt that their BP is under control (low perceived susceptibility), and 54.1% felt very confident that they can control their BP (high self-efficacy). When subjects were asked if uncontrolled high blood pressure is a serious threat to their health, 55.8% answered yes (high perceived severity), yet a higher proportion (79.6%) believed that checking their BP regularly is important (high perceived benefit of monitoring BP), and even more (84.0%) felt that treating high BP is important (high perceived benefit of treatment). More than half of the subjects had low perceived barriers with 57.5% stating that treating high BP is not at all expensive and 61.9% believing that treating high BP is not at all difficult. Table 4 summarizes these results.

Table 4. Frequencies of hypertension beliefs and taking BP medication.

	N (percent); Total = 181 (100)			
Survey Question	**Yes or Very**	**Somewhat**	**Not at all**	**No response**
Perceived susceptibility: Is your BP under control?	107 (59.1)	47 (26.0)	14 (7.7)	13 (7.2)
Self-efficacy: How confident are you that you can control your BP?	98 (54.1)	50 (27.6)	13 (7.2)	20 (11.0)
Perceived severity: Is uncontrolled high BP a serious threat to your health?	101 (55.8)	31 (17.1)	34 (18.8)	15 (8.3)
Perceived benefit: Is treating high BP important to your health?	152 (84.0)	19 (10.5)	1 (0.6)	9 (5.0)
Perceived benefit: Is regularly checking your BP important for your health?	144 (79.6)	20 (11.0)	5 (2.8)	12 (6.6)

Perceived barrier: Is treating high BP expensive?	30 (16.6)	29 (16.0)	104 (57.5)	18 (9.9)
Perceived barrier: Is treating high BP difficult?	24 (13.3)	25 (13.8)	112 (61.9)	20 (11.0)
Medication: Are you now taking medications for high blood pressure? [Yes or No]	145 (80.1)	0 (0)	34 (18.8)	2 (1.1)

Demographics and Beliefs

A few of the demographic characteristics showed statistically significant associations with some of the hypertension beliefs. As subjects' age increased, so did the strength of their belief that their BP was under control and their confidence in their ability to control their BP (p-values 0.035 and 0.001 respectively, chi-square trend test). Subjects living with others in their households were more likely to believe that treating high BP is important than those who live alone (p-value 0.006, chi-square test). White subjects were more likely than non-white subjects to have high self-efficacy in controlling their BP (p-value 0.028, chi-square trend test). Subjects who speak only English had the highest likelihood of feeling very confident in controlling their BP (p-value 0.012, chi-square trend test). As educational attainment increased, the likelihood of subjects believing their BP was under control also increased (p-value 0.018, chi-square trend test). However, educational attainment was negatively associated with the belief that treatment is expensive (p-value 0.042, chi-square trend test). Likewise, as household income increased, so did the proportion of subjects believing that treating hypertension is not at all expensive (p-value 0.024, chi-square trend test). Table 5 displays these results.

Table 5. Associations between demographics and beliefs about hypertension. A two-tailed analysis using a chi-square test, a chi-square trend test (Mantel-Haenszel test), or Fisher's exact test was done depending on the expected cell count requirements and contingency table size. Valid sample size (N) ranged from 126 to 172.

	Beliefs about hypertension and p-values						
Demographic (A description is given for significant associations)	**Perceived Susceptibility** Is your BP under control?	**Self-efficacy** Confidence in ability to control BP	**Perceived Severity** Is high BP a serious threat to your health?	**Perceived Benefit** Is treating high BP important?	**Perceived Benefit** Is checking BP regularly important?	**Perceived Barrier** Is treating high BP expensive?	**Perceived Barrier** Is treating high BP difficult?
Age	0.035*	0.001*	0.092	0.652	0.541	0.216	0.105
(Older age was associated with low perceived susceptibility and high self-efficacy.)							
Gender	0.383	0.269	0.467	0.255	0.105	0.979	0.660
Health insurance	0.239	0.886	0.494	0.638	0.593	0.499	0.656
Lives with others	0.560	0.773	0.657	0.006*	0.072	0.831	0.935
(Living with others in the household was associated with high perceived benefit of treatment.)							
Marital status	0.796	0.426	0.762	0.218	0.267	0.796	0.982
Race/ethnicity	0.656	0.028*	0.189	0.742	0.272	0.589	0.308
(Being white was associated with high self-efficacy.)							
Language	0.636	0.012*	0.366	0.523	0.165	0.221	0.162
(Speaking only English was associated with high self-efficacy.)							
Education	0.018*	0.099	0.264	0.557	0.686	0.042*	0.479
(Educational attainment was negatively associated with both perceived susceptibility and the perceived barrier of believing that treatment is expensive.)							
Household income	0.130	0.377	0.935	0.670	0.651	0.024*	0.067
(Household income was negatively associated with the perceived barrier of believing that treatment is expensive.)							

*p-value less than 0.050

DEMOGRAPHICS AND BEHAVIOR

In this study sample, 80.1% reported currently taking BP medications. Increasing age and having health insurance each independently increased the likelihood of taking BP medications (for 10-year incremental age increases OR 0.74, p-value 0.006; and for health insurance OR 9.17, p-value 0.001). No other significant demographic associations were found independently with medication use. Table 6 summarizes these results.

Table 6. Associations between demographics and taking BP medications. A two-tailed bivariate logistic regression analysis was used for each demographic. Valid sample size (N) ranged from 135 to 179.

Demographic	Reference or description	OR*	95% CI (upper, lower)	p-value
Age**	As age increases by 10-year increments	0.74	(0.59, 0.91)	0.006***
Overall				0.098
60-80 years old	(vs <60 years old)	0.52	(0.23, 1.20)	0.125
>80 years old	(vs <60 years old)	0.34	(0.12, 1.01)	0.051
Gender				
Female	(vs Male)	0.63	(0.30, 1.34)	0.228
Health insurance				
No	(vs Yes)	9.17	(2.50, 33.68)	0.001***
Lives with others				
No	(vs Yes)	1.08	(0.48, 2.44)	0.847
Marital status				
Not married or has no life partner	(vs Married or has life partner)	0.91	(0.42, 1.98)	0.820
Race/ethnicity				
Non-white groups combined	(vs White)	1.45	(0.52, 4.01)	0.475
Language				
Overall				0.126
English and other languages	(vs English only)	3.28	(0.86, 12.48)	0.081
Not English	(vs English only)	2.46	(0.58, 10.50)	0.224
Education				
Overall				0.302
High school degree	(vs No high school degree)	0.57	(0.14, 2.28)	0.425
Some college	(vs No high school degree)	0.25	(0.06, 1.12)	0.070
College degree	(vs No high school degree)	0.42	(0.10, 1.81)	0.247
Post college	(vs No high school degree)	0.22	(0.03, 1.49)	0.120
Household income				
Overall				0.406
$20,000 - $40,000	(vs < $20,000)	0.32	(0.10, 1.07)	0.064
$40,001 - $60,000	(vs < $20,000)	0.94	(0.30, 3.00)	0.919
$60,001 - $80,000	(vs < $20,000)	0.73	(0.13, 4.20)	0.725
> $80,000	(vs < $20,000)	0.71	(0.20, 2.49)	0.593

*'NOT taking BP medications' was assigned as the outcome in the analysis; therefore groups with an OR > 1 are more likely to NOT be taking BP medications.
**Age was analyzed as both a continuous variable and as a categorical variable.
***p-value less than 0.050

BELIEFS AND BEHAVIOR

A few statistically significant associations were found between hypertension beliefs and the behavior of taking BP medications. As summarized in Table 7, those believing that their BP is not under control were more likely to state they were not taking BP medications compared to those who believe theirs is controlled (OR 17.21, p-value 0.046). Subjects believing that hypertension treatment is not expensive were more likely than the rest to not be taking BP medications (OR 5.04, p-value 0.048). Compared to those who believe hypertension is difficult to treat, subjects believing it is only somewhat difficult were less likely to report no BP medication use (OR 0.051, p-value 0.048). Among the females in this study sample, the more firm the belief that their BP is under control, the more likely to be taking BP medications (p-value 0.013, chi-square trend test). Also among females, the higher the self-efficacy in controlling their BP, the higher the likelihood of taking BP medications (p-value 0.010, chi-square trend test). These associations were not seen among the males (p-values 0.901 and 0.397 respectively, chi-square trend test).

Table 7. Associations between hypertension beliefs and taking BP medications. A two-tailed multivariate logistic regression analysis was used correcting for age, gender, and having health insurance. Valid sample size N=132.

HBM Construct	Description	OR*	95% CI (upper, lower)	p-value
Perceived susceptibility: Is your BP under control?	Somewhat (vs Yes)	2.15	(0.40, 11.64)	0.376
	No** (vs Yes)	17.21	(1.05, 281.70)	0.046***
Self-efficacy: How confident are you	Somewhat (vs Very)	1.05	(0.21, 5.37)	0.954

that you can control your BP?				
	No (vs Very)	3.87	(0.43, 34.53)	0.226
Perceived severity: Is uncontrolled high BP a serious threat to your health?	Somewhat (vs Yes)	1.36	(0.26, 7.26)	0.716
	No (vs Yes)	1.70	(0.35, 8.39)	0.514
Perceived benefit: Is treating high BP important to your health?	Somewhat/No (vs Yes)	0.11	(0.00, 2.85)	0.184
Perceived benefit: Is regularly checking your BP important for your health?	Somewhat (vs Yes)	1.81	(0.20, 16.35)	0.598
	No (vs Yes)	9.03	(0.36, 229.55)	0.183
Perceived barrier: Is treating high BP expensive?	No (vs Yes/Somewhat)	5.04	(1.02, 25.01)	0.048***
Perceived barrier: Is treating high BP difficult?	Somewhat (vs Yes)	0.051	(0.00, 0.98)	0.048***
	No (vs Yes)	0.75	(0.15, 3.75)	0.727

*'NOT taking BP medications' was assigned as the outcome in the analysis; therefore groups with an OR > 1 are more likely to NOT be taking BP medications.
**'No' in this table corresponds to 'Not at all' from the valid responses in the survey.
***p-value less than 0.050

DISCUSSION

This study examined participants who expressed awareness of their diagnosis of hypertension, and most of them stated that they are now taking medications; however, a few of their associated beliefs about hypertension differed from what was hypothesized. Subjects with a low perceived susceptibility (i.e. those believing that their BP is well controlled) were more likely to report taking BP medications than those with high perceived susceptibility (i.e.

believing that their BP is not at all controlled). This result opposes the hypothesis that a high perceived susceptibility would correspond to a higher likelihood of medication use. One explanation is that the behavior assessed in this study has already occurred, and perhaps the experience of taking BP medications has a reassuring effect which decreases subjects' perceived susceptibility to the health threat. In other words, engaging in the behavior may change people's beliefs from initially feeling highly susceptible to subsequently feeling protected from the health threat. This study did find a statistically significant association between perceived susceptibility and medication use, but longitudinal studies are needed to assess the direction. Also contrary to the hypothesis, subjects believing that treating hypertension is not at all expensive (a low perceived barrier) were more than five times as likely as the others to report no BP medication use. Perhaps those taking medications were associated with believing treatment to be expensive because they interpreted the question of treatment expense not as a barrier, but rather as a personal opinion or judgement based on their experiences. The experience of purchasing BP medication may serve to inform people of the cost and induce the perception that treatment is expensive perhaps relative to lifestyle behaviors. Finally, the difference in likelihood of medication use between those believing that treating high BP is difficult versus somewhat difficult was curious. In fact, the groups expressing the two extreme beliefs about treatment difficulty ("yes" and "not at all" difficult) seemed to be more similar in behavior than the group with the moderate beliefs (high BP is "somewhat" difficult to treat). Again, this question may have been interpreted as a judgement rather than a barrier to action, or this could be a statistical artifact due to a low sample size. These associations found between hypertension beliefs and taking BP medications may have differed from the study hypotheses because the HBM may be better at explaining intent to act in people who are not continually involved in the behavior with

these particular study variables. Like other periodic preventive health behaviors, such as getting vaccines and breast cancer screenings, perhaps periodic BP management behaviors, such as monitoring BP monthly or visiting a health care provider quarterly, would better correlate with HBM constructs than taking medications daily on a continual basis.

Many of the demographic associations with the hypertension beliefs and the patterns of medication use in this study were consistent with general expectations and with other research. Increasing age and having health insurance were both associated with taking medications. Self-efficacy also increased with age. Also expected was the finding that believing treatment to be expensive was associated with both lower educational attainment and lower household incomes which demonstrates how socioeconomic status influences perceived economic barriers. The findings among the females in this study were interesting and seem consistent with what is known about preventive health behavior. Only the women in our stratified analysis showed an association between BP medication use and a high self-efficacy as well as feeling that their BP is well controlled. Women tend to use the medical system for preventive care more than men, which may explain why other studies have found men to be less aware of their BP status, less adherent to treatment, and more likely to feel they don't need a physician (Victor et al., 2008). Similar results have been seen in blacks and younger subjects (Graham et al., 2004; Miller et al., 2010; and Gooding et al., 2014). This suggests a difference in how these groups perceive their health care needs. Women and older persons may feel satisfaction when they attend to their health care needs, while men and younger persons may view such behavior as admitting their vulnerabilities. Also interesting were our findings associated with race/ethnicity and language. In our study, white subjects and those who speak only English were more likely to feel very confident (i.e. have high self-efficacy) in their ability to manage their hypertension compared to

minorities and bilingual or non-English speakers. Minority groups may feel a sense of powerlessness (i.e. low self-efficacy) to control their health situation due to a lack of resources, discrimination, a mistrust of the medical system, and a language barrier. Enlisting the social support of family and friends may be a good way to address these barriers as subjects in this study who live with others in their households were more likely than those living alone to believe that treating high BP is important (high perceived benefit of treatment). The demographic associations with hypertension beliefs in this study suggest different interventional approaches for different groups. Low perceived susceptibility and self-efficacy should be addressed in the younger population and less so as they get older. The barrier of treatment expense should be addressed in lower socioeconomic groups. The results also suggest that men and women should be approached differently when addressing their perceived susceptibility and self-efficacy. Minorities and non-English speakers are particularly vulnerable to low self-efficacy. And finally, providers should focus on the benefits of treatment among those who live alone.

STRENGTHS AND LIMITATIONS

This study adds to the body of knowledge concerning lay beliefs about hypertension, and the use of the HBM to systematically categorize and study these beliefs in a population is its primary strength. The HBM was developed with preventive health behaviors in mind, and because hypertension is an asymptomatic condition, treating it is not unlike engaging in other preventive health behaviors. The HBM has already been useful in both research and interventions involving the management of hypertension (Jones et al., 1984; Newell et al., 2009; Middleton, 2009; Thalacker, 2011; and Zhao et al., 2015).

Although not unlike other studies of hypertension using the HBM, one limitation of this study was the small sample size. However, the participants were community residents accessing the EMS system rather than all being primary care recipients, for example, and may include a good representation of the many beliefs in the community, thus increasing the generalizability of the results. Perhaps another limitation was that BP medication use was measured only as a dichotomous variable. Subjects answering "Yes" to the question "Are you now taking blood pressure medication?" may still be nonadherent with using the medication exactly as prescribed by their providers. Furthermore, nonadherence may be either intentional, stemming from beliefs that are incongruent with recommendations, or it may be unintentional, whereby beliefs may remain congruent with adherence to medical advice. A validated questionnaire, such as the Morisky Medication Adherence Scale (MMAS) may be useful in a future similar study (Morisky et al., 2008). An advantage of a binary measurement of medication use, however, is the simpler interpretation of the associations with hypertension beliefs which was one of the main objectives of this study. HBM-based hypertension beliefs may also be more precisely measured using a validated five-point Likert scale adapted from the instrument developed by Champion et al. (1984) which has also been used in other studies. Regarding barriers to medication use, this study inquired only about financial expense although we did find statistically significant associations with this. It would be useful for future studies to also assess fears of addiction, dependence, tolerance, and side effects as these were important concerns in qualitative studies (Marshall et al., 2012). Finally, the lack of minority representation in this study may limit its generalizability, however, this sample may well represent the hypertensive adults with self-reported awareness in this particular community. Future studies may need to include those who

are unaware or who do not acknowledge their hypertension to acquire greater diversity to guide and inform the development of culturally sensitive interventions regarding hypertension beliefs.

CONCLUSION

Although the subjects in this study were aware of their current or previous diagnosis of hypertension, they nonetheless had a remarkably high BP recorded by EMS, thus suggesting that something more than knowledge and awareness is needed to get them on the path to better hypertension control. Beliefs about hypertension among people with uncontrolled hypertension were systematically examined using the HBM in this study, and some were significantly associated with groups known to be at risk of poor BP self-management. In particular, younger people and minorities, especially non-English speakers had significantly lower self-efficacy, and those with lower socioeconomic status were more likely to perceive economic barriers to treatment. This cross-sectional descriptive study summarizes these beliefs and associations. Longitudinal studies are needed to assess possible causal relationships between beliefs and behaviors or distal outcomes, such as heart attack or stroke incidence. Educating the public and increasing awareness are no longer enough to improve hypertension trends. Understanding beliefs about hypertension and BP self-management in order to develop tailored behavioral interventions is the next step, and studies such as this one, using models, such as the HBM, serve as important tools to guide both research and intervention designs.

REFERENCES

1. Bersamin, A., Stafford, R. S., & Winkleby, M. A. (2009). Predictors of hypertension awareness, treatment, and control among Mexican American women and men. *J Gen Intern Med, 24 Suppl 3*, 521-527. doi:10.1007/s11606-009-1094-6
2. CDC 2012 – CDC. (2012). Getting blood pressure under control infographic text. Centers for Disease Control and Prevention (CDC) Website. Retrieved from http://www.cdc.gov/VitalSigns/Hypertension/infographic-text.html#graphic-three
3. CDC 2013 – CDC. (2013). High blood pressure facts. Centers for Disease Control and Prevention (CDC) Website. Retrieved from http://www.cdc.gov/bloodpressure/facts.htm
4. CDC 2014 – CDC. (2014). Effects of high blood pressure. Centers for Disease Control and Prevention (CDC) Website. Retrieved from http://www.cdc.gov/bloodpressure/effects.htm
5. Champion, V. L. (1984). Instrument development for health belief model constructs. *ANS Adv Nurs Sci, 6*(3), 73-85.
6. Chiong, J. R. (2008). Controlling hypertension from a public health perspective. *Int J Cardiol, 127*(2), 151-156. doi:10.1016/j.ijcard.2007.10.039
7. Chockalingam, A. (2008). World Hypertension Day and global awareness. *Can J Cardiol, 24*(6), 441-444.
8. dela Cruz, F. A., & Galang, C. B. (2008). The illness beliefs, perceptions, and practices of Filipino Americans with hypertension. *J Am Acad Nurse Pract, 20*(3), 118-127. doi:10.1111/j.1745-7599.2007.00301.x
9. Dickson, B. K., Blackledge, J., & Hajjar, I. M. (2006). The impact of lifestyle behavior on hypertension awareness, treatment, and control in a southeastern population. *Am J Med Sci, 332*(4), 211-215.
10. Egan, B. M., Lackland, D. T., & Cutler, N. E. (2003). Awareness, knowledge, and attitudes of older Americans about high blood pressure: implications for health care policy, education, and research. *Arch Intern Med, 163*(6), 681-687.
11. Egan, B. M., Zhao, Y., & Axon, R. N. (2010). US trends in prevalence, awareness, treatment, and control of hypertension, 1988-2008. *JAMA, 303*(20), 2043-2050. doi:10.1001/jama.2010.650
12. Gee, M. E., Bienek, A., McAlister, F. A., Robitaille, C., Joffres, M., Tremblay, M. S., . . . Campbell, N. R. (2012). Factors associated with lack of awareness and uncontrolled high blood pressure among Canadian adults with hypertension. *Can J Cardiol, 28*(3), 375-382. doi:10.1016/j.cjca.2011.12.012
13. Glanz, K., Rimer, B. K., Viswanath, K. (Eds.). (2008). Health behavior and health education: Theory, research, and practice (4th ed.). San Francisco, CA: Jossey-Bass.
14. Gooding, H. C., McGinty, S., Richmond, T. K., Gillman, M. W., & Field, A. E. (2014). Hypertension Awareness and Control among Young Adults in the National Longitudinal Study of Adolescent Health. *Journal of General Internal Medicine, 29*(8), 1098-1104. doi:10.1007/s11606-014-2809-x
15. Graham, G. N., Leath, B., Payne, K., Guendelman, M., Reynolds, G., Kim, S., . . . Buggs, G. (2006). Perceived versus actual risk for hypertension and diabetes in the African American community. *Health Promot Pract, 7*(1), 34-46. doi:10.1177/1524839905283891

16. Jones, P. K., Jones, S. L., & Katz, J. (1987). Improving follow-up among hypertensive patients using a health belief model intervention. *Arch Intern Med, 147*(9), 1557-1560.
17. Khatib, R., Schwalm, J.-D., Yusuf, S., Haynes, R. B., McKee, M., Khan, M., & Nieuwlaat, R. (2014). Patient and Healthcare Provider Barriers to Hypertension Awareness, Treatment and Follow Up: A Systematic Review and Meta-Analysis of Qualitative and Quantitative Studies. *Plos One, 9*(1). doi:10.1371/journal.pone.0084238
18. Kountz, D. S. (2004). Hypertension in ethnic populations: tailoring treatments. *Clin Cornerstone, 6*(3), 39-46; discussion 47-38.
19. Marshall, I. J., Wolfe, C. D., & McKevitt, C. (2012). Lay perspectives on hypertension and drug adherence: systematic review of qualitative research. *BMJ, 345*, e3953. doi:10.1136/bmj.e3953
20. McDonald, M., Hertz, R. P., Unger, A. N., & Lustik, M. B. (2009). Prevalence, awareness, and management of hypertension, dyslipidemia, and diabetes among United States adults aged 65 and older. *J Gerontol A Biol Sci Med Sci, 64*(2), 256-263. doi:10.1093/gerona/gln016
21. Meischke, H., Ike, B. R., Fahrenbruch, C., Kuniyuki, A., Hannon, P., Parks, M. R., . . . Harris, J. R. (2013). Hypertension identification via emergency responders: a randomized controlled intervention study. *Prev Med, 57*(6), 914-919. doi:10.1016/j.ypmed.2013.05.010
22. Middleton, J. L. (2009). A Proposed New Model of Hypertensive Treatment Behavior in African Americans. *Journal of the National Medical Association, 101*(1), 12-17.
23. Miller, N. H., Berra, K., & Long, J. (2010). Hypertension 2008-Awareness, Understanding, and Treatment of Previously Diagnosed Hypertension in Baby Boomers and Seniors: A Survey Conducted by Harris Interactive on Behalf of the Preventive Cardiovascular Nurses Association. *Journal of Clinical Hypertension, 12*(5), 328-334. doi:10.1111/j.1751-7176.2010.00267.x
24. Morgado, M., Rolo, S., Macedo, A. F., Pereira, L., & Castelo-Branco, M. (2010). Predictors of uncontrolled hypertension and antihypertensive medication nonadherence. *J Cardiovasc Dis Res, 1*(4), 196-202. doi:10.4103/0975-3583.74263
25. Morisky, D. E., Ang, A., Krousel-Wood, M., & Ward, H. J. (2008). Predictive validity of a medication adherence measure in an outpatient setting. *J Clin Hypertens (Greenwich), 10*(5), 348-354.
26. Newell, M., Modeste, N., Marshak, H. H., & Wilson, C. (2009). Health beliefs and the prevention of hypertension in a black population living in London. *Ethnicity & Disease, 19*(1), 35-41.
27. Petrella, R. J., Speechley, M., Kleinstiver, P. W., & Ruddy, T. (2005). Impact of a social marketing media campaign on public awareness of hypertension. *Am J Hypertens, 18*(2 Pt 1), 270-275. doi:10.1016/j.amjhyper.2004.09.012
28. Redon, J., Brunner, H. R., Ferri, C., Hilgers, K. F., Kolloch, R., & van Montfrans, G. (2008). Practical solutions to the challenges of uncontrolled hypertension: a white paper. *J Hypertens Suppl, 26*(4), S1-14. doi:10.1097/01.hjh.0000343507.74401.45
29. Sharma, M., & Hakim, A. M. (2011). The management of hypertension for primary stroke prevention: a proposed approach. *Int J Stroke, 6*(2), 144-149. doi:10.1111/j.1747-4949.2010.00569.x
30. Thalacker, K. M. (2011). Hypertension and the Hmong community: using the health belief model for health promotion. *Health Promot Pract, 12*(4), 538-543.

doi:10.1177/1524839909353735
31. Victor, R. G., Leonard, D., Hess, P., Bhat, D. G., Jones, J., Vaeth, P. A., . . . Haley, R. W. (2008). Factors associated with hypertension awareness, treatment, and control in Dallas County, Texas. *Arch Intern Med, 168*(12), 1285-1293. doi:10.1001/archinte.168.12.1285
32. Whelton, P. K., Beevers, D. G., & Sonkodi, S. (2004). Strategies for improvement of awareness, treatment and control of hypertension: results of a panel discussion. *J Hum Hypertens, 18*(8), 563-565. doi:10.1038/sj.jhh.1001738
33. Yoon, S. S., Gu, Q., Nwankwo, T., Wright, J. D., Hong, Y., & Burt, V. (2015). Trends in blood pressure among adults with hypertension: United States, 2003 to 2012. *Hypertension, 65*(1), 54-61. doi:10.1161/hypertensionaha.114.04012
34. Zhang, X., Zhu, M., Dib, H. H., Hu, J., Tang, S., Zhong, T., & Ming, X. (2009). Knowledge, awareness, behavior (KAB) and control of hypertension among urban elderly in western China. *Int J Cardiol, 137*(1), 9-15. doi:10.1016/j.ijcard.2008.06.003
35. Zhao, Y., Chen, L., Qi, W. L., & Wang, B. (2015). Application of the health belief model to improve the understanding of antihypertensive medication adherence among Chinese patients. *Patient Education and Counseling, 98*(5), 669-673. doi:10.1016/j.pec.2015.02.007

BIBLIOGRAPHY

1. Bersamin, A., Stafford, R. S., & Winkleby, M. A. (2009). Predictors of hypertension awareness, treatment, and control among Mexican American women and men. *J Gen Intern Med, 24 Suppl 3*, 521-527. doi:10.1007/s11606-009-1094-6
2. CDC 2012 – CDC. (2012). Getting blood pressure under control infographic text. Centers for Disease Control and Prevention (CDC) Website. Retrieved from http://www.cdc.gov/VitalSigns/Hypertension/infographic-text.html#graphic-three
3. CDC 2013 – CDC. (2013). High blood pressure facts. Centers for Disease Control and Prevention (CDC) Website. Retrieved from http://www.cdc.gov/bloodpressure/facts.htm
4. CDC 2014 – CDC. (2014). Effects of high blood pressure. Centers for Disease Control and Prevention (CDC) Website. Retrieved from http://www.cdc.gov/bloodpressure/effects.htm
5. Champion, V. L. (1984). Instrument development for health belief model constructs. *ANS Adv Nurs Sci, 6*(3), 73-85.
6. Chiong, J. R. (2008). Controlling hypertension from a public health perspective. *Int J Cardiol, 127*(2), 151-156. doi:10.1016/j.ijcard.2007.10.039
7. Chockalingam, A. (2008). World Hypertension Day and global awareness. *Can J Cardiol, 24*(6), 441-444.
8. dela Cruz, F. A., & Galang, C. B. (2008). The illness beliefs, perceptions, and practices of Filipino Americans with hypertension. *J Am Acad Nurse Pract, 20*(3), 118-127. doi:10.1111/j.1745-7599.2007.00301.x
9. Dickson, B. K., Blackledge, J., & Hajjar, I. M. (2006). The impact of lifestyle behavior on hypertension awareness, treatment, and control in a southeastern population. *Am J Med Sci, 332*(4), 211-215.
10. Egan, B. M., Lackland, D. T., & Cutler, N. E. (2003). Awareness, knowledge, and attitudes of older Americans about high blood pressure: implications for health care policy, education, and research. *Arch Intern Med, 163*(6), 681-687.
11. Egan, B. M., Zhao, Y., & Axon, R. N. (2010). US trends in prevalence, awareness, treatment, and control of hypertension, 1988-2008. *JAMA, 303*(20), 2043-2050. doi:10.1001/jama.2010.650
12. Gee, M. E., Bienek, A., McAlister, F. A., Robitaille, C., Joffres, M., Tremblay, M. S., . . . Campbell, N. R. (2012). Factors associated with lack of awareness and uncontrolled high blood pressure among Canadian adults with hypertension. *Can J Cardiol, 28*(3), 375-382. doi:10.1016/j.cjca.2011.12.012
13. Glanz, K., Rimer, B. K., Viswanath, K. (Eds.). (2008). Health behavior and health education: Theory, research, and practice (4th ed.). San Francisco, CA: Jossey-Bass.
14. Gooding, H. C., McGinty, S., Richmond, T. K., Gillman, M. W., & Field, A. E. (2014). Hypertension Awareness and Control among Young Adults in the National Longitudinal Study of Adolescent Health. *Journal of General Internal Medicine, 29*(8), 1098-1104.

doi:10.1007/s11606-014-2809-x
15. Graham, G. N., Leath, B., Payne, K., Guendelman, M., Reynolds, G., Kim, S., . . . Buggs, G. (2006). Perceived versus actual risk for hypertension and diabetes in the African American community. *Health Promot Pract, 7*(1), 34-46. doi:10.1177/1524839905283891
16. Jones, P. K., Jones, S. L., & Katz, J. (1987). Improving follow-up among hypertensive patients using a health belief model intervention. *Arch Intern Med, 147*(9), 1557-1560.
17. Khatib, R., Schwalm, J.-D., Yusuf, S., Haynes, R. B., McKee, M., Khan, M., & Nieuwlaat, R. (2014). Patient and Healthcare Provider Barriers to Hypertension Awareness, Treatment and Follow Up: A Systematic Review and Meta-Analysis of Qualitative and Quantitative Studies. *Plos One, 9*(1). doi:10.1371/journal.pone.0084238
18. Kountz, D. S. (2004). Hypertension in ethnic populations: tailoring treatments. *Clin Cornerstone, 6*(3), 39-46; discussion 47-38.
19. Marshall, I. J., Wolfe, C. D., & McKevitt, C. (2012). Lay perspectives on hypertension and drug adherence: systematic review of qualitative research. *BMJ, 345*, e3953. doi:10.1136/bmj.e3953
20. McDonald, M., Hertz, R. P., Unger, A. N., & Lustik, M. B. (2009). Prevalence, awareness, and management of hypertension, dyslipidemia, and diabetes among United States adults aged 65 and older. *J Gerontol A Biol Sci Med Sci, 64*(2), 256-263. doi:10.1093/gerona/gln016
21. Meischke, H., Ike, B. R., Fahrenbruch, C., Kuniyuki, A., Hannon, P., Parks, M. R., . . . Harris, J. R. (2013). Hypertension identification via emergency responders: a randomized controlled intervention study. *Prev Med, 57*(6), 914-919. doi:10.1016/j.ypmed.2013.05.010
22. Middleton, J. L. (2009). A Proposed New Model of Hypertensive Treatment Behavior in African Americans. *Journal of the National Medical Association, 101*(1), 12-17.
23. Miller, N. H., Berra, K., & Long, J. (2010). Hypertension 2008-Awareness, Understanding, and Treatment of Previously Diagnosed Hypertension in Baby Boomers and Seniors: A Survey Conducted by Harris Interactive on Behalf of the Preventive Cardiovascular Nurses Association. *Journal of Clinical Hypertension, 12*(5), 328-334. doi:10.1111/j.1751-7176.2010.00267.x
24. Morgado, M., Rolo, S., Macedo, A. F., Pereira, L., & Castelo-Branco, M. (2010). Predictors of uncontrolled hypertension and antihypertensive medication nonadherence. *J Cardiovasc Dis Res, 1*(4), 196-202. doi:10.4103/0975-3583.74263
25. Morisky, D. E., Ang, A., Krousel-Wood, M., & Ward, H. J. (2008). Predictive validity of a medication adherence measure in an outpatient setting. *J Clin Hypertens (Greenwich), 10*(5), 348-354.
26. Newell, M., Modeste, N., Marshak, H. H., & Wilson, C. (2009). Health beliefs and the prevention of hypertension in a black population living in London. *Ethnicity & Disease, 19*(1), 35-41.
27. Petrella, R. J., Speechley, M., Kleinstiver, P. W., & Ruddy, T. (2005). Impact of a social marketing media campaign on public awareness of hypertension. *Am J Hypertens, 18*(2 Pt 1), 270-275. doi:10.1016/j.amjhyper.2004.09.012
28. Redon, J., Brunner, H. R., Ferri, C., Hilgers, K. F., Kolloch, R., & van Montfrans, G. (2008). Practical solutions to the challenges of uncontrolled hypertension: a white paper. *J Hypertens Suppl, 26*(4), S1-14. doi:10.1097/01.hjh.0000343507.74401.45

29. Sharma, M., & Hakim, A. M. (2011). The management of hypertension for primary stroke prevention: a proposed approach. *Int J Stroke, 6*(2), 144-149. doi:10.1111/j.1747-4949.2010.00569.x
30. Thalacker, K. M. (2011). Hypertension and the Hmong community: using the health belief model for health promotion. *Health Promot Pract, 12*(4), 538-543. doi:10.1177/1524839909353735
31. Victor, R. G., Leonard, D., Hess, P., Bhat, D. G., Jones, J., Vaeth, P. A., . . . Haley, R. W. (2008). Factors associated with hypertension awareness, treatment, and control in Dallas County, Texas. *Arch Intern Med, 168*(12), 1285-1293. doi:10.1001/archinte.168.12.1285
32. Whelton, P. K., Beevers, D. G., & Sonkodi, S. (2004). Strategies for improvement of awareness, treatment and control of hypertension: results of a panel discussion. *J Hum Hypertens, 18*(8), 563-565. doi:10.1038/sj.jhh.1001738
33. Yoon, S. S., Gu, Q., Nwankwo, T., Wright, J. D., Hong, Y., & Burt, V. (2015). Trends in blood pressure among adults with hypertension: United States, 2003 to 2012. *Hypertension, 65*(1), 54-61. doi:10.1161/hypertensionaha.114.04012
34. Zhang, X., Zhu, M., Dib, H. H., Hu, J., Tang, S., Zhong, T., & Ming, X. (2009). Knowledge, awareness, behavior (KAB) and control of hypertension among urban elderly in western China. *Int J Cardiol, 137*(1), 9-15. doi:10.1016/j.ijcard.2008.06.003
35. Zhao, Y., Chen, L., Qi, W. L., & Wang, B. (2015). Application of the health belief model to improve the understanding of antihypertensive medication adherence among Chinese patients. *Patient Education and Counseling, 98*(5), 669-673. doi:10.1016/j.pec.2015.02.007