January 2010

Implementation of Hypertension Treatment Recommendations

Veronica Shead
Washington University in St. Louis

WASHINGTON UNIVERSITY IN ST. LOUIS

Department of Psychology

Dissertation Examination Committee

Denise Head, Chair

Martha Storandt

Brian Carpenter

Richard Abrams

Vetta Sanders-Thompson

Monique Williams

IMPLEMENTATION OF HYPERTENSION TREATMENT RECOMMENDATIONS

by

Veronica Lynnette Shead

A dissertation presented to the
Graduate School of Arts and Sciences
of Washington University in
partial fulfillment of the
requirements for the degree
of Doctor of Philosophy

August 2010

Saint Louis, Missouri

Abstract

There are currently lifestyle modifications and medications that are highly successful in controlling hypertension. Nevertheless, many hypertensive individuals do not implement lifestyle changes and fail to adhere to medication regimens (Fullwood et al., 2006; Wetzels et al., 2006). The current study sought to understand both sociodemographic and intrinsic factors associated with the implementation of recommended lifestyle modifications for treatment of hypertension. The study represents the first step in the application of the Information-Motivation-Behavioral Skills (IMB) model of health behavior and health promotion to hypertension. The primary goal was to provide a profile of the variables relevant for adherence to the multifaceted treatment recommendations for the hypertensive population. 151 participants, aged 55 to 79 with a hypertension diagnosis, completed questionnaires that assessed demographic and socioeconomic status, medical history, gross mental status, personality, self-efficacy, health locus of control, perceived social support, stage of change, and behavioral change since diagnosis of hypertension. The study examined the predictive power of these sociodemographic and intrinsic variables on the recommended lifestyle modifications (medication adherence, physical activity, diet, weight reduction or maintenance of normal weight, moderation of alcohol consumption, and smoking status), as well as total change. The results show there was no set of sociodemographic or intrinsic factors that predicted implementation of all lifestyle modifications. Although age and socioeconomic status are significant risk factors for hypertension, neither was found to be significant indicators of change. It was found that for most modifications there were intrinsic factors that had limited predictive power. Perceived instrumental social support, Conscientiousness, and Neuroticism were

predictive of physical activity levels; perceived emotional social support and Conscientiousness were predictive of a healthy diet; and perceived emotional social support and Neuroticism were predictive of total change. In addition, a healthy diet was associated with increased physical activity, lower body mass index (BMI), and greater overall change. Hypertensive patients were also more likely to implement dietary change than other lifestyle modifications. Overall, hypertensive patients are not consistently implementing the recommended behavioral modifications, and despite reported adherence to medication regimens, their blood pressure and BMI on average remain above recommended levels. The study revealed that overall intrinsic factors do play a role in implementation of behavioral recommendations, and that the personality factors of Conscientiousness and Neuroticism along with perceived social support may be important factors to consider when addressing health-related change behavior. In the future these findings could provide researchers with individualized motivation to change information and assist in developing more individualized treatment paradigms.

Acknowledgements

I would like to thank all of those who made it possible for me to reach this point in my graduate education. I would like to first acknowledge my committee. I appreciate the efforts of Dr. Richard Abrams, Dr. Vetta Sanders-Thompson, and Dr. Monique Williams. I thank Dr. Brian Carpenter for his contribution as a core committee member. I give a special thank you to Dr. Martha Storandt for supporting my development over the course of my entire graduate education as my advisor, and for serving as a core committee member. I would like to express great appreciation to Dr. Denise Head for serving as my dissertation chair and providing guidance throughout the project.

I would like to acknowledge my family and friends for their support, continued prayers, and love. I thank my aunts, Linda Shead and Jacqueline Randle, for their love and support throughout my life. A special thanks to my cousins, Alice Cage, Kimberly Shead, Melissa Jones and her daughters, Michaela and Marissa, for their support, love, and laughter. Thank you to my fellow graduate students, Jessica Paxton and Christie Spence, for their friendship and understanding. A special thanks to my track team, my pride and joy, and an unexpected source of strength and support.

I dedicate this dissertation to my mother, Sylvia Shead, a lifelong educator, who instilled in me the value of education. She has demonstrated through her efforts and accomplishments that through hard work I can accomplish any goal, despite the challenges and setbacks, by remaining faithful. I would not be here today without her love and continued sacrifice for my overall well-being. She has been my inspiration and I appreciate all she has done for me.

Table of Contents

List of Tables

List of Figures

List of Appendices

CHAPTER 1: INTRODUCTION

Hypertension, or high blood pressure, is often referred to as the silent killer. The disorder is often characterized by few to no symptoms and yet is a risk factor for numerous other deadly diseases and disorders. Hypertension is the leading chronic medical diagnosis in the United States, yet less than 50% of those with hypertension are aware of their diagnosis, and of those who are aware many do not have their blood pressure under control (American Heart Association, 2007; Chobanian et al., 2003).

There are currently lifestyle modifications and medications that are highly successful in controlling hypertension. Nevertheless, many hypertensive individuals do not implement lifestyle changes and fail to adhere to medication regimens (Fullwood Guyton-Krishman, Wallace, & Sommer, 2006; Wetzels et al., 2006). Motivation to implement change in their lifestyles is crucial to the success of any intervention and especially important in self-care treatment interventions that are often used with hypertensive individuals. Therefore, researchers and clinicians must assess people's motivation to change in addition to providing them with a diagnosis and information about the disorder.

In this study variables influencing the implementation of lifestyle change were examined for their overall effect. The study was designed within the context of the Information-Motivation-Behavioral Skills (IMB) model of health behavior and health promotion. The study sought to understand the influence of both sociodemographic and intrinsic factors on the implementation of treatment recommendations and to provide information for future formulation and implementation of individualized self-care treatment interventions for hypertensive individuals.

CHAPTER 2: LITERATURE REVIEW

Overview

Approximately one-third of adults in America are coping with hypertension (Ong, Cheung, Man, Lau, & Lam, 2007). The following sections first define hypertension and detail the negative consequences of the disorder. Next, current prevention and treatment recommendations are described along with some previous intervention studies. The IMB model is then described; it provides a model for health behavior change as well as a model for empirical research on health behavior. Finally, variables associated with behavioral change are discussed.

Hypertension

Definition of Hypertension

Hypertension is defined as a systolic blood pressure equal to or greater than 140 mmHg or a diastolic blood pressure greater than 90 mmHg. Systolic pressure indicates the force of the blood in the arteries as the heart beats. Diastolic pressure is the force of blood in the arteries as the heart relaxes.

There are three stages of hypertension: prehypertension includes individuals with a systolic blood pressure of 120 to 139 mmHg or a diastolic blood pressure of 80 to 89 mmHg. Stage 1 hypertension includes individuals with systolic blood pressure of 140 to 159 mmHg or diastolic blood pressure of 90 to 99 mmHg. Stage 2 hypertension includes individuals with systolic blood pressure of 160 mmHg or higher or diastolic blood pressure of 100 mmHg or greater (Chobanian et al., 2003). Individuals in the prehypertensive stage are at increased risk and twice as likely to develop hypertension

(Chobanian et al., 2003; Vasan, Larson, Leip, Kannel, & Levy, 2001). The goal for the prehypertension diagnosis is to heighten awareness and encourage individuals to work toward decreasing their risk through the recommended behavioral changes.

Hypertension is the number one primary medical diagnosis in the United States; 72 million people are thought to be hypertensive. The worldwide estimate is 1 billion individuals with a hypertension diagnosis (American Heart Association, 2007; Chobanian et al., 2003). It has been estimated that the total annual cost of hypertension in the United States alone is approximately 55.5 billion dollars (American Heart Association, 2007). The incidence of hypertension continues to increase, and the costs associated with treatment are likely to increase as well. Moreover, an estimated 30% of people with hypertension remain undiagnosed, and about 65% of those who are diagnosed do not have their condition under control (American Heart Association, 2007). These latter statistics suggest that hypertensive individuals are unaware of the dangers associated with the disorder and suggest a significant need to increase diagnosis, treatment, awareness, and prevention.

Standard of Care

Hypertension is often characterized by an absence of signs and symptoms. Therefore, it is recommended that all individuals have blood pressure measurements taken at least every 2 years. For individuals at greater risk for developing hypertension, such as elderly adults, those with a familial history of hypertension or heart disease, overweight or obese individuals, and those of African-American or Hispanic heritage, blood pressure measurements should be taken at least annually (Krautkramer, 2006). Blood pressure measurements taken at a health care visit should be obtained with proper

equipment, and two or more measurements should be taken at each visit to ensure the validity and persistence of the blood pressure level (American College of Cardiology et al., 2005). Hypertension is diagnosed following at least two consecutive medical visits with elevated blood pressure.

Once diagnosed with hypertension individuals should develop a plan of care with their physician that includes recommended changes in diet (including reduced sodium and alcohol intake) and increased exercise as well as pharmacological treatment. Following initial diagnosis individuals are encouraged to return for follow-up visits as frequently as monthly until medication and behavioral changes adequately control blood pressure levels and every 3 to 6 months thereafter (American College of Cardiology et al., 2005).

Risk Factors

Heredity. There are numerous risk factors for hypertension. These risk factors affect diverse groups of individuals, and frequently individuals have multiple risk factors that increase their likelihood of developing hypertension. Heredity has recently been investigated as a possible factor that predisposes people to hypertension, and numerous studies have sought to determine if there is a hypertension susceptibility gene or genes. Thus far a gene for this disorder has not yet been confirmed, but research has identified some promising candidates through genome linkage studies such as gene SLC4A5 (Arnett et al., 2007). A genetically predisposed individual will most likely develop hypertension despite a healthy diet and lifestyle (Giampietro, 2003). Many hypertensive individuals have a familial history of the disorder; however, this may be attributable to the high prevalence of the disorder rather than heredity.

Body weight and diet. Approximately 122 million people in the Unites States are overweight or obese (Flegal, Croll, Ogden, & Johnson, 2002). The significant increase in the number of overweight and obese Americans has significantly increased the number of people with hypertension. In addition, weight is an independent risk factor for heart disease such that individuals who are overweight or obese and also hypertensive have a compounded risk for cardiovascular disease.

Classification as overweight consists of a body mass index between 25 and 30, and an obese classification is a body mass index of 30 or greater (American Heart Association, 2007). Body mass index is a measure that assesses body weight in relation to height and is highly correlated with body fat composition. In some cases a body mass index above the healthy range may not indicate excessive weight due to fat but rather weight due to increased muscle mass. In this case, body fat measures and waist circumference (when measured just above the navel) may be better estimates of body fat composition and risk for hypertension. Waist circumference for men should be less than 40 inches and less than 35 inches for women (American Heart Association, 2007).

As an individual's weight increases, the risk for disease increases as well. Therefore, any reduction in weight decreases one's risk for disease. There are a number of factors contributing to the increase in American body weight including diets high in saturated fat, diets high in sodium content (processed foods), and increasingly sedentary lifestyles. Often a significant change in diet and adopting an exercise regimen can significantly improve the health of an individual and reduce or eliminate the risk for hypertension or regulate existing hypertension.

Socioeconomic status (SES). Individuals from lower SES backgrounds have a higher incidence of cardiovascular disease and higher mortality rates (Winkleby, Kraemer, Ahn, & Varady, 1998). They are also more likely to have hypertension. In addition, lower SES is thought to pose a barrier to blood pressure control, especially in minority populations (Chobanian et al., 2003).

Several indicators of SES may be relevant to the implementation of lifestyle modifications. Three of these indicators are limited access to health care, lack of education, and low household income (Krautkramer, 2006). Access to medical care is of particular importance in diagnosis, treatment, and management of hypertension. One indication of access to medical care is insurance status (insured, uninsured, and Medicaid). About half of all uninsured persons with chronic conditions such as hypertension forgo needed medical care or fail to use prescription drugs due to cost (Krautkramer, 2006). In addition, education is thought to be related to overall health and health management. The percentage of adults diagnosed with hypertension with less than a high school education was 1.4 times the rate of those with a college education (Carroll, 2004). Similarly, household income levels affect hypertension rates; low-income individuals have a higher rate of hypertension diagnosis than individuals with high income (Carroll, 2004). Along with the issues discussed, the lower socioeconomic population has limited access to the resources needed to implement lifestyle and behavior changes necessary to affect their health.

Minority status. Some minority groups are differentially affected by hypertension. Hypertension is more prevalent in African-Americans (28.5%)than in their Caucasian counterparts (22.1%) (Carroll, 2004). On the other hand, hypertension is

diagnosed less frequently for the Hispanic population (12.3%) than for their Caucasian counterparts; however, Hispanic hypertensives have less positive outcomes (Carroll, 2004).

There exists a treatment gap for both African-Americans and Hispanics. This may reflect the influence of SES. African-American and Hispanic hypertensive individuals have less education and are more likely to be uninsured and lack access to or ability to pay for medications (Carroll, 2004; Krautkramer, 2006). In addition, African-Americans have been found to respond differently to certain medications, although this is often eliminated by combination drug treatment (Chobanian et al., 2003). There are also cultural differences in diets and in beliefs about and experiences with the heath care system that may influence hypertension treatment (Betancourt, Carrillo, & Green, 1999).

Aging. As advances in sanitation and medicine have decreased death rates due to communicable disease, disorders associated with aging have increased due to aging of the overall population (American Heart Association, 2007). Advancing age is associated with increased risk for developing hypertension. As the population has aged, hypertension has become the number one diagnosis in America (Chobanian et al., 2003). Across the world the incidence of hypertension has increased, and now there are thought to be approximately 1 billion people worldwide with hypertension (American Heart Association, 2007). By age 55 adults in the United States have an approximately 90% chance of developing hypertension in their lifetime (Vasan, 2001). In addition, older adults are less likely to have their hypertension under control (Chobanian et al., 2003)

According to socioemotional selectivity theory, when perceived boundaries on time become shorter people tend to have present-centered goals as opposed to future-

oriented goals (Lockenhoff & Carstensen, 2004). With aging, perceived time boundaries become shorter, and older adults may be less likely to focus on long-term effects. Socioemotional selectivity theory is of particular interest in health-related behavior changes as older adults may be less motivated to make such changes, which are future focused. Lockenhoff and Carstensen (2004) found that older adults are more reluctant to make health-related decisions and often delegate the decision-making responsibility.

Negative Consequences of Hypertension

Hypertension has numerous negative consequences and was recorded as the primary or contributing cause of death in 326,000 deaths in the United States in 2006 (American Heart Association, 2010). Hypertension is a major risk factor associated with cardiovascular disease and predisposition to heart attack, heart failure, stroke, and kidney disease (Chobanian et al., 2003). High blood pressure has been consistently correlated with cardiovascular disease. The risk for cardiovascular disease doubles with each increasing increment of 20 mmHg in systolic blood pressure or 10mm Hg in diastolic blood pressure (Lewington, Clark, Qizilbash, Peto, & Collins, 2002). Hypertension is a risk factor for the first, third, and ninth most common causes of death, which are heart disease, stroke, and kidney disease, respectively (National Center for Health Statistics [NCHS], 2010). Hypertension is a factor in 67% of heart attacks, 74% of heart failures, and 77% of strokes (U.S. Department of Health and Human Services, National Heart, Lung, and Blood Institute [NHLBI], 2010). For those over the age of 50 it is important to note that systolic blood pressure greater than 140 mmHg indicates a more significant cardiovascular risk than high diastolic blood pressure (Kao, 2003). Nevertheless, the risks

for these disorders can be decreased with appropriate treatment and management of hypertension (NHLBI, 2010).

In addition to being a risk factor for other disorders, hypertension can also affect cognitive functioning. Hypertensive individuals show poorer performance on neuropsychological tests (Elias, D'Argostino, Elias, & Wolf, 1995; Mazzucchi et al., 1986). Hypertension has also been shown to interact with the aging process. Hypertensive older adults tend to show poorer cognitive performance than their normotensive peers (Strassburger et al., 1997).

Prevention and Recommended Treatment of Hypertension

Prevention

Recently there has been an increase in efforts to prevent hypertension. Due to recent findings, there is now a new classification of prehypertension for those with blood pressure in the 120/80 to 130/89 range. This categorization is based on research findings indicating heightened risk for cardiovascular disease with only slightly heightened blood pressure levels (Vasan et al., 2001). Furthermore, individuals classified as prehypertensive have an increased risk for developing hypertension. It is recommended that persons in the prehypertensive stage implement the same behavioral modifications as hypertensive individuals but with no pharmacological intervention component. Thus, the behavior modifications include reduced sodium diet, low fat diet, reduced alcohol consumption, and physical exercise. Prehypertensive individuals often have additional risk factors for cardiovascular disease and hypertension such as being overweight or obese, and inactive. Therefore, as with numerous other diagnoses, preventative measures seek to increase healthy eating, implement an exercise regime, and eliminate smoking.

Moreover, hypertension education and awareness is an important factor in prevention and treatment of the disorder. Hypertension is often present without symptoms, and therefore the public needs to be aware of the condition, the risks, and the need to know their blood pressure.

Recommended Treatments

Overview. Hypertension can often be successfully controlled through lifestyle modification and drug therapy. The lifestyle modifications include weight reduction or maintenance of normal weight, reduced sodium intake, increased physical activity, reduction in alcohol consumption, and smoking cessation. Weight reduction and normal body weight maintenance is defined as attaining and maintaining a body mass index within the normal range (18.5 to 24.9). A reduction in dietary sodium intake is the second recommendation. Both weight management and sodium reduction can be addressed by following the Dietary Approaches to Stop Hypertension (DASH) eating plan with reduced sodium intake (Appel et al., 1997). Physical activity is the third modification and includes at least 30 minutes of aerobic activity three times per week (NHLBI, 2010). The fourth recommendation, reduction of alcohol consumption, is of great importance. In many instances alcohol not only affects organ functioning, but it may also interact with many hypertensive medications. As with all cardiovascular disorders and most other health-related issues, smoking cessation is also recommended. Although smoking does not pose a risk factor for hypertension, smoking does exacerbate the negative effects of hypertension (Chobanian et al., 2003). All of these lifestyle modifications work to eliminate the risk factors for development of hypertension by decreasing blood pressure

and decreasing an individual's chances of developing other more serious related disorders.

Many hypertensive individuals are prescribed at least one antihypertension medication, and many are prescribed a two-drug combination. Nevertheless, many hypertensive and prehypertensive individuals have not made the recommended lifestyle changes nor do they adhere to the prescribed medication regime (Chobanian et al., 2003). Therefore, emphasis now focuses on a comprehensive treatment plan that includes lifestyle modification as well as medication adherence. Pharmacological treatment and life style treatments are described in more detail in the following sections.

Pharmacological treatment. Pharmacological treatment of hypertension has shown excellent results in lowering blood pressure. There are several classes of antihypertensive medications including thiazide-type diuretics, angiotensin-converting enzymes, angiotensin receptor blockers, beta-blockers, and calcium channel blockers (MacMahon et al., 2000). Of these medications, many individuals begin with one, usually a thiazide, and are often prescribed an additional medication to fully control their condition.

It has been found that pharmacological intervention reduces cardiovascular risks but does not eliminate them (MacMahon & Rogers, 1993). Although pharmacological treatment is highly successful, often medication is under prescribed, and when prescribed adherence to the medication regimen is problematic due to lack of symptomatology, cost, demands of multiple medications, and adverse side effects (Chobanian et al., 2003).

Physical activity. It is recommended that all adults engage in at least 30 minutes of moderate intensity physical activity most days of the week for a total of 150 minutes of

moderate to intense physical activity or 75 minutes of vigorous activity to achieve health benefits (Pate et al., 1995). The recommendations do not differ for hypertensive individuals; they are encouraged to engage in regular physical activity and, more specifically, regular aerobic exercise (Chobanian et al., 2003). Engaging in the recommended physical activity can, on average, reduce blood pressure by 4 to 9 mmHg (Chobanian et al., 2003). In addition to a significant reduction in blood pressure, physically active people have lower morbidity and mortality rates, are more likely to maintain a healthy weight, and have improved cognition (NHLBI, 2010; Pate et al., 1995). Nevertheless, 60% of American adults are considered physically inactive (Crespo, Escobales, & Rodriguez-Sargent, 1996).

Diet. The DASH eating plan is a diet that focuses on sodium reduction and emphasizes foods rich in calcium and potassium (Sacks et al., 2001). It is recommended that the daily intake of sodium be less than 100 mmol (2.4 g sodium or 6 g of sodium chloride) for hypertensive individuals (Chobanian et al., 2003). The DASH diet results in average reductions in blood pressure of 8 to14mmHg (Chobanian et al., 2003). Dietary intervention alone has an effect comparable to that of single prescription drug therapy (Sacks et al., 2001).

Weight reduction. Obesity, characterized by a body mass index of 30 and higher, is a major risk factor for both hypertension and cardiovascular disease. Further, obese hypertensive individuals have a greatly increased risk for developing major cardiovascular disease and often suffer additional complications (American Heart Association, 2007). A core lifestyle modification is weight reduction or maintenance of normal body weight defined as a body mass index in the 18.5 to 24.9 range. Weight

reduction on average reduces blood pressure by 5 to 20 mmHg (Chobanian et al., 2003). Weight reduction is often addressed in concert with physical activity and dietary modification.

Moderation of alcohol consumption. This recommendation suggests no more than two servings (one serving equals 15 ml of ethanol) daily for men and one serving for women and smaller adults (Chobanian et al., 2003). Reduction of alcohol consumption can reduce blood pressure by an average of 2 to 4 mmHg. In addition, reduced alcohol consumption will limit possible drug interactions with antihypertensive medication and decrease problematic drinking and the multiple adverse side effects (Chobanian et al., 2003).

Smoking cessation. Smoking cessation is recommended for all regardless of hypertensive status. Although smoking does not cause hypertension, it is one of the six main risk factors along with hypertension for cardiovascular disease (American Heart Association, 2007). Smoking injures the walls of blood vessels and accelerates atherosclerosis (hardening of the arteries), which causes narrowing of the arteries and reduced oxygenated blood flow to organs, including the heart (NHLBI, 2010). Arthrosclerosis is associated with the development of stroke, angina, abnormal cardiac rhythms, heart attack, and congestive heart failure (NHLBI, 2010) and accounts for nearly 75% of all deaths from heart disease (American Heart Association, 2004). Hypertension is also a causative factor in arthrosclerosis; therefore hypertensive individuals who smoke are at increased risk for the development of arthrosclerosis

Intervention Studies

Overview

Treatment for hypertension is primarily self-care such that individuals are responsible for their treatment adherence. In a study focusing on self-care for heart failure individuals who were more knowledgeable about their diagnosis were not necessarily more likely to implement the recommended lifestyle changes (Riegel et al., 2006). Nevertheless, many interventions focus on education.

Interventions that do focus on behavioral intervention often focus on initiation and maintenance of only one or two behavioral changes such as diet, exercise, or medication adherence (Miller et al., 2002). Often interventions do not integrate the numerous behavioral changes necessary to implement a comprehensive intervention. These interventions and the few studies that do focus on multiple behavioral changes are highly controlled with experimenters providing meals, supervised exercise programs, and other monitoring devices (Appel et al., 1997; Gerin et al., 2007; Lasser et al., 1995; Miller et al., 2002; Sacks et al., 2001). These instruments are necessary for empirical research yet impractical for implementation in the primary care setting.

Moreover, individualized interventions are more successful for treatment of chronic illness (Riegel et al., 2006). Tailored individualized treatment plans for hypertensive individuals, however, may be even less practical for the primary care setting. Therefore, implementing more practical, empirically based short-term interventions may be more successful. The following sections describe interventions used for hypertension.

Dietary Intervention

Dietary interventions have been thoroughly addressed in the research literature on hypertension. The most comprehensive dietary intervention and currently one of the

behavioral health recommendations for prehypertensive and hypertensive individuals is the DASH, which is an eating plan that was developed and studied with the purpose of decreasing blood pressure levels through dietary change (Appel et al., 1997). The diet promotes increased consumption of fruits, vegetables, low-fat dairy products, fiber, potassium, magnesium, and calcium. The diet limits the amount of total fat, saturated fats, cholesterol, and sugar. The diet also can be altered to fit the dietary needs of a range of individuals. Individuals vary in their recommended caloric intake, required weight loss plan, and nutritional needs based on age, gender, current weight, and physical activity levels. Thus, the flexibility of the diet is crucial as it allows for applicability to a wider range of hypertensive individuals.

Since its development the DASH has been used in numerous intervention studies. The effects on blood pressure of the DASH diet in conjunction with reduced sodium intake (less than the US recommended levels of 5 g/day) is equal to or greater than that of a single drug intervention (Sacks et al., 2001). The majority of dietary intervention studies were conducted in highly controlled situations in which participant's meals were prepared and supplied by the experimenters (Appel et al., 1997; Miller et al., 2002). Adherence to the DASH diet is important and interventions now need to address a hypertensive individual's ability to initiate the DASH diet and commit to the changes permanently.

Medication Adherence

Medication is often very effective in regulating blood pressure and thereby reducing risk factors for cardiovascular and other disorders (Chobanian et al., 2003: Cushman et al., 2002). Nevertheless, pharmacological treatment is not effective without

adherence to the medication regime. Medication adherence remains problematic; over one-third of hypertensive individuals have uncontrolled blood pressure (Chobanian et al., 2003). A number of intervention studies have focused on medication adherence (Cappuccio, Kerry, Forbes, & Donald, 2004; Gerin et al., 2007). Many of these studies were designed to prove the efficacy of medication adherence on blood pressure control and have not explored reasons for noncompliance (Gerin et al., 2007). It may be difficult to generalize the results of these interventions to real world applications (Gerin et al., 2007).

In current adherence studies researchers are now looking at the possibility of tailoring interventions to the unique needs of the individual with the intention of finding more promising results (Wetzels et al., 2006). The intention of individualized treatment is to understand the underlying reasons that hypertensive individuals are non-compliant. The reason individuals do not take their medications can include factors such as attitude towards healthcare and medication, discipline, aversion towards medication, and active coping with health problems (Wetzels et al., 2006)**.** Understanding the underlying causes of noncompliance is necessary for understanding and implementing other interventions as well.

Multidimensional Interventions

The intervention for hypertension is multifaceted and therefore must address multiple behavioral recommendations. Although few in number, some intervention studies have addressed the need for comprehensive behavioral interventions (Elmer et al., 2006; Miller et al., 2002) and have reported compound benefits of multifaceted interventions. Elmer et al. (2006) examined the effects of comprehensive lifestyle modification including diet,

weight, and physical fitness on blood pressure control and found decreased blood pressure in the experimental groups, but theses differences were not significantly different from those in the advice-only control group, as advice may pose as an intervention. They concluded that prehypertensive and Stage 1 hypertensive individuals are capable of maintaining multiple lifestyle modifications. In addition, multiple lifestyle modifications, if implemented, can control blood pressure (Elmer et al., 2006).

Miller et al. (2002) demonstrated a 9.5 mmHg/5.3 mmHg decline in blood pressure for overweight hypertensive individuals on one medication. These individuals also increased physical activity levels, decreased weight, and showed positive effects on LDL cholesterol levels, all or which are important for improving overall risk for cardiovascular disease. These reductions were significant, and they were similar to those achieved with pharmacotherapy alone; however, their benefits also further reduce risk for coronary heart disease, kidney disease, and stroke (Miller et al., 2002). In addition, the lifestyle modification could lead to the decrease or elimination of hypertensive medication.

These multifaceted interventions are more congruent with the recommendations set forth for hypertension care. Therefore, research now needs to focus on multifaceted interventions. The focus of research should not only be the effect on blood pressure but also include the behavioral characteristics necessary to implement and maintain all of the recommended behavioral changes.

Information-Motivation-Behavioral Skills Model (IMB)

The IMB skills model developed by Fisher and Fisher (1992, 2000) is a social psychological theory for understanding and promoting health behavior (see Figure 1).

This model posits that there are three major influences on health behaviors: information, motivation, and behavioral skills. Information includes basic facts related to the health behavior. Fisher, Fisher, and Harman (2003) called these facts “relevant heuristics," which are simple rules or thoughts that people have that influence their behavior. These facts can be true but are often untrue. For example, a hypertensive individual may think that limitations in physical activity are necessary due to the diagnosis of the disease, whereas physical activity is actually a recommended health behavior. According to the model, information is considered to be directly related to the implementation of the health behavior only if that information can be enacted by the individual in the current social environment (Fisher & Fisher, 1992, 1993, 2000). For example, in the case of dietary intervention, if an individual is aware of the need to implement healthier eating habits but access to healthy foods is limited in the neighborhood, then being knowledgeable of the fact that healthier eating is beneficial is limited by the environment.

The second component of the model is motivation. What is the person's motivation to change? An individual may be well informed and have access to sufficient resources to implement these changes but not necessarily motivated to enact the health behavior (Fisher et al., 2003). Motivation is characterized by two components: personal motivation and social motivation. Personal motivation includes an individual’s attitude toward performance of the health behavior. Social motivation is characterized by social support (perceived or real) surrounding the health behavior. For example, research shows that performance of breast-self examination is predicted by attitudes and social support surrounding breast-self examination (Champion, 1990; Fisher et al., 2003; Lierman,

Kasprzyk, & Benoliel et al., 1991; Misovich, Martinez, Fisher, Bryan, & Catapano, 2003).

The third and final component of the model is behavioral skill. Behavioral skill is a person's ability to enact a health behavior. It also includes the person's level of self-efficacy as it relates to the specific behavioral skill. Therefore, an individual could be well informed and motivated but lack the skill set necessary to enact the health behavior. One example would be the use of medical equipment such as a blood pressure monitor. A person may be aware of the diagnosis and the need to monitor blood pressure but unable to manipulate and read the blood pressure monitor. In this example the health behavior will not be successfully implemented.

All three components of the model are critical; none is sufficient by itself for behavioral change, which leads to a stepwise approach to health promotion. There are three steps included in this approach: elicitation, intervention, and evaluation (see Figure 2; Fisher & Fisher, 1993). The elicitation stage assesses the individual's current levels of health-related information, motivation to change, health behavior skills, and current level of health promotion behaviors (Fisher & Fisher, 1993). This assessment stage serves to identify the areas in need of improvement and, therefore, intervention. This allows focus on the needs of the individual patient and leads to a more efficient and effective intervention. In the second step the intervention is designed to address the deficiencies in the areas of health information, motivation, behavioral skill, and health promotion found in the elicitation stage (Fisher & Fisher, 1993). This, therefore, produces an intervention tailored to the individual. The third and final step is evaluation. In the evaluation stage the intervention developed and implemented in the intervention step is evaluated for its

effect on the areas of health information, motivation, behavioral skills, and health behavior (Fisher & Fisher, 1993). Has the intervention had any significant effects? If so, were these effects sustained over time? Multiple assessment and evaluation approaches are used to evaluate and determine the effects.

There is empirical evidence that confirms the usefulness of the IMB model for health promotion in intervention research. Much of this research has been done in the area of HIV prevention (Bryan, Fisher, & Benzinger, 2001; Fisher & Fisher, 2000). In an effort to demonstrate the generalizability of the IMB model, Fisher and colleagues have applied the model to other health behaviors including the use of motorcycle safety gear (Murray, 2000), breast self–examination (Misovich et al., 2003), and adherence to medication regimens (Fisher, Fisher, Amico, & Harman, 2006).

The proposed study will focus on the elicitation stage of the IMB model in the context of hypertension. The study will derive information about people with hypertension, the variables influencing their implementation of recommended health behaviors, and their implementation of current recommended health behaviors.

Intrinsic Variables Associated with Behavioral Change

Overview

Numerous variables may influence a hypertensive individual's implementation of recommended behavioral changes. Sociodemographic and environmental effects were described in the section on causes and risk factors. In addition, intrinsic variables may influence the likelihood of behavioral change. An intrinsic variable such as motivation may involve many other variables such as self-efficacy, locus of control, perceived social support, and personality. Each which will be discussed in the following sections.

Motivation to Change and Stage of Change

Within the framework of the IMB model, the proposed study integrates the transtheoretical model developed by Prochaska, DiClemente, and Norcross (1992) to understand motivation. In the transtheoretical model behavioral change is viewed as a process that takes place over multiple stages (Prochaska & Norcross, 2001). These stages include precontemplation, contemplation, preparation, action, and maintenance. In each stage an individual's motivation to change and behaviors are assessed.

In the precontemplation stage an individual has no foreseeable intention to change and often has little knowledge of the problem. In the contemplation stage an individual has knowledge of the problem and intends to change in the future but has not yet committed to making the changes necessary to cope with the problem. The third stage is the preparation stage in which individuals intend to change within a month and have made small changes that are not yet significant enough to be considered full implementation of behavior change; many have unsuccessfully attempted to implement change in the past 12 months (Prochaska & Norcross, 2001). The action stage is the first stage in which individuals have implemented significant behavioral change. In this stage individuals have committed to change and have altered not only their behavior but also their environment to address the problem. The fifth and final stage is maintenance. In this stage individuals work to maintain the behavioral and environmental changes implemented in the action stage and have remained successfully committed for more than 6 months.

Interventions based on the transtheoretical model were developed for individuals in substance abuse treatment and have been adapted to address various health behaviors

(Weinstein, Rothman, & Sutton, 1998). The interventions assess a participant's motivation and behavior stage in the change process with a short assessment or interview. A participant's motivational stage can be determined with a few questions, usually around five, which makes the assessment process efficient. Once classified, an individual's treatment can be tailored for their motivational stage.

Interventions are differentially effective for individuals at various change stages (Rosen, 2000). Behavioral models suggest that hypertensive individuals will only initiate change when sufficiently motivated (Chobanian et al., 2003). Therefore, it may prove important to assess a hypertensive individual's change stage and provide the individual with the appropriate and most effective intervention for that stage. The majority of intervention studies using the transtheoretical model look at one significant behavioral change area such as increasing physical activity, smoking cessation, or implementation of a low-fat diet. Hypertensive individuals need to implement numerous behavioral changes and therefore need stage assessment for numerous behaviors rather than only one. This type of intervention has not yet been conducted but is necessary for the application of the transtheoretical model to hypertension.

Self-Efficacy

According to Bandura's (1982) social learning theory, an individual's actions are mediated by self-referent thought and not by knowledge of what actions to take. Self-efficacy is the belief in one's ability to successfully complete a behavior necessary for an expected outcome. Therefore, self-efficacy is a mediating factor between motivation and behavior. Efficacy also contributes to adaptive coping and psychological well-being in relation to chronic illness (Devins et al., 1982). Self-efficacy is thought to determine

motivation to cope with life situations by determining the individual's initiation and maintenance of the action. It also contributes to the continuation of the behavior change through adverse situations (Bandura, 1977).

Protection motivation theory states that coping behavior is a stronger motivating factor in promoting compliance with preventative behavior than knowledge of risk factors or fear (Yardley, Sharples, Beech, & Lewith, 2001). Therefore, a person can be fully knowledgeable about what needs to be done, yet not comply. Self-efficacy works to connect knowledge with action by providing understanding of people's perception of their ability to implement behaviors, which in turn affects their motivation for behavioral change (Bandura, 1982). Self-efficacy can be skill specific. If people have low perceived self-efficacy for a particular health behavioral skill, they are less likely to implement that behavioral change. Subsequently, people's perception of their ability to implement the behavioral changes associated with hypertension management may influence their compliance.

Locus of Control

Locus of control is often linked to self-efficacy as an intrinsic factor that addresses expectancies for reinforcement (Rotter, 1992). People have perceptions of their influence on situational outcomes, which is a common factor in both locus of control and self-efficacy. To differentiate the two, locus of control is defined as a sense of control over expected outcomes rather than a perception of skill required to reach an expected outcome as in self-efficacy. The source or locus that controls outcomes can be internal, powerful others, fate, chance, or some higher power. With internal locus of control, an individual has a general feeling of control over the outcomes in the situation. The sense

of internal control has been identified as a component in successful outcomes, coping, and successful aging (Lachman & Weaver, 1998). In addition, locus of control, like self-efficacy, can be domain specific, and domain specific measures are more predictive of positive behavioral outcomes (Lachman, 1986). Locus of control for a specific domain therefore appears to be more indicative of outcomes related to that particular behavior. As with self-efficacy, perception of personal or intrinsic sense of control over a domain strongly influences motivation and initiation of change behaviors. Also, the perceived outcome is often based on a person's sense of self and is highly influenced by prior experience or lack thereof (Lachman & Weaver 1998).

Health locus of control focuses on people's sense of control related to personal health. Health locus of control distinguishes between personal control, control by others, and chance or fate. A strong sense of internal or personal health locus of control is predictive of more positive outcomes (Ai, Peterson, Rodgers, & Tice, 2005; Wallston , Wallston, & DeVellis, 1978), although this does not appear to have been studied in individuals with hypertension.

Perceived Social Support

Social support consists of the overall comfort and support, both instrumental and emotional, that is provided by an individual's social network. Social support is a multidimensional construct that includes social embeddedness, received support, and perceived support (Krause, 1999). Of these three dimensions, perceived social support may be more strongly associated with health outcomes and may serve as a psychological buffer in stressful life situations (Rook, 1994). Aging research suggests that those who remain actively involved in social networks remain in better physical and mental health

than those who do not remain involved (Antonucci, 1990; Krause, 1999). Studies show that perceived social support exhibits stronger relationships with health outcomes and buffers the adverse effects of life stress on psychological stress than received social support (Rook, 1994). Social support is often divided into instrumental and emotional components (Antonucci, 1990). Previous research has found that emotional social support is related to reduced mortality, whereas instrumental social support has been associated with increased mortality (Penninx, van Tilburg, Kriegsman, Deeg, Boeke, & van Eijk, 1997). Therefore, an individual's perceived social support is an important factor in understanding implementation of hypertension treatment recommendations. The degree to which an individual feels supported in making changes, and the manner in which the support is provided may influence implementation of change and resulting blood pressure.

Personality

Personality consists of traits that remain relatively stable across the lifespan. There are a number of theories of personality. The five factor theory defines five major dimensions that together form personality (McCrae & Costa, 1990; Soldz & Vaillant, 1999). The five factors are neuroticism, extraversion, openness, agreeableness, and conscientiousness, and each factor is rated on a continuum. Those high on neuroticism tend to experience negative emotions such as anxiety and depression, are intense, and overly emotionally reactive. High scores on extraversion are indicative of people who engage with the outside world and are highly energetic and very social. Individuals with low extraversion (introverts) are quiet, less energetic, often shy and independent. Openness is characterized by intellectual curiosity, emotional awareness, creativity, and

acceptance of change. Agreeableness characterizes people who view others as honest and trustworthy; these individuals are friendly, considerate, and cooperative. Conscientiousness is indicative of emotional control, and those high on this factor are in control and lack impulsivity.

These personality factors influence lifestyle, adaptation, success, and other life course variables longitudinally (Soldz & Vaillant, 1999). Research suggests that personality traits have an effect on perceived health. Specifically, individuals high in neuroticism and individuals low on extraversion are more likely to have worse perceived health (Chapman, Duberstein, Sorensen, & Lyness, 2006). Worse perceived health has a negative effect on morbidity, mortality, and health service use (Chapman et al., 2006). Perceived health is a multidimensional concept that incorporates an individual's cognitive awareness and biopsychosocial dimensions of health (Benyamini & Idler, 1999; Bosworth, 1999; Lewis & Riegel, 2010). Perceived health for older adult hypertensive patients in particular incorporates realistic appraisal of age, chronic illness, recent acute events, functional status , and stress (Lewis & Riegel, 2010). More realistic appraisal of these factors, allows for more effective utilization of treatment, resulting in more positive health outcomes, which for hypertensive patients equals lowered and controlled blood pressure. Personality factors may influence these factors and overall perceived health. Neuroticism and extraversion may therefore have a differential effect on change-related behaviors and the ability to implement change. In addition, conscientiousness has been shown to predict health-promoting behaviors (Bogg & Roberts, 2004). Specifically, a positive relationship between physical activity and conscientiousness has been demonstrated (Rhodes & Smith, 2006).

Hypertension intervention is a patient-centered process. A person's specific personality characteristics may influence the degree to which the person is able to initiate lifestyle changes. Those implementing change may, in fact, demonstrate a different profile on the personality factors, particularly in terms of neuroticism, conscientiousness, and extraversion. Each of these factors should be evaluated for its effect on lifestyle modifications.

CHAPTER 3: PURPOSE, RESEARCH DESIGN, AND HYPOTHESES

Purpose

Controlled blood pressure through a healthy lifestyle and/or medication is critical to management of hypertension and to reduction of the negative effects associated with the disorder. The primary goal of this study was to gain an understanding of the variables that influence compliance with hypertension treatment recommendations. The study represents the first step, elicitation, in the application of the IMB model of health behavioral change and promotion (see Figure 2) to hypertension.

In this elicitation stage information is obtained regarding current levels of health-related information, motivation to change, health behavior skills, and current levels of health promotion behaviors. The study examined sociodemographic, motivational, and other intrinsic variables thought to affect implementation. The underlying premise in the IMB skills model of health behavior (see Figure 1) is that these variables influence health behavioral change, particularly when complicated or new behavioral skills are required to implement the intervention. As the intervention for hypertension is multifaceted, including recommendations for diet, exercise, alcohol consumption, smoking cessation and medication, the study examined the variables affecting implementation of each of the recommended interventions.

This study provides critical information regarding the variables that affect implementation of health behavior change in the hypertensive population. Specifically, the study provides a profile of the variables relevant for adherence to the multifaceted treatment recommendations for the hypertensive population. These variables can then be the focus for future research designed to improve adherence to treatment. The current

study forms the foundation for future development of an empirically based intervention for the implementation of recommended hypertension treatment.

Research Design

The 151 participants, 55 to 79 years of age and of diverse socioeconomic and racial backgrounds, were recruited for a 90-minute assessment session. Each participant completed questionnaires assessing demographic information, SES, medical history, gross mental status, personality, self-efficacy, health locus of control, perceived social support, stage of change, and behavioral change since diagnosis of hypertension. Participants had their blood pressure measured twice, once following consent and again following completion of the questionnaires.

The hypothesized models (see Figures 3 and 4) in this study demonstrate how multiple variables may predict compliance with lifestyle modifications resulting in improved blood pressure in individuals with hypertension. In the study current lifestyle measurements of medication adherence, physical activity, diet, weight reduction or maintenance of normal weight, moderation of alcohol consumption, and smoking status were the dependent variables for the hypothesized model of current lifestyle (Figure 3). As for the second hypothesized model for change since diagnosis, total change across physical activity, diet, weight, alcohol consumption, and smoking status were the dependent variables (Figure 4). The independent variables measured for both models were age at diagnosis, SES, self-efficacy, and health locus of control, perceived social support, personality, and stage of change.

Hypotheses

Hypothesis 1

It was hypothesized that age at diagnosis would negatively influence implementation of lifestyle changes, with those diagnosed at a younger age more likely to implement lifestyle change.

Hypothesis 2

It was hypothesized that socioeconomic variables including objective SES (years of education) and subjective SES would be positively related to implementation of lifestyle modifications.

Hypothesis 3

It was hypothesized that self-efficacy and health locus of control would demonstrate a positive relationship with implementation of lifestyle modification. Further, health locus of control should represent a stronger positive relationship with lifestyle modification than would general self-efficacy because it is more focused on health-related factors.

Hypothesis 4

It was hypothesized that perceived social support, both emotional and instrumental, would demonstrate a positive relationship with implementation of lifestyle modifications.

Hypothesis 5

It was hypothesized that personality variables would influence an individual's implementation of lifestyle modifications. Specifically, it was hypothesized that Neuroticism would demonstrate a negative relationship with implementation of behavioral modifications whereas Extraversion and Conscientiousness would have a

positive relationship with implementation of lifestyle modifications. No specific predictions are made about the personality traits of Openness or Agreeableness

Hypothesis 6

Hypertensive individuals may be more likely to implement particular lifestyle changes than others. For example, it is possible that hypertensive individuals are more likely to reduce sodium in their diet than to engage in regular exercise. It is possible that some lifestyle modifications may be easier to implement either because they were easier to incorporate into their schedule, less time consuming, or less aversive. Thus, the current study examined whether there were differences in the number of individuals engaging in each of the treatment recommendations.

Hypothesis 7

It was hypothesized that if hypertensive individuals are at differing stages of change for each of the treatment recommendations, then the likelihood of implementing treatment recommendation would also differ. Thus, there would be a positive relationship between the stage of change for a particular treatment recommendation and implementation of that recommendation. For example, individuals in the action stage for physical exercise are more likely to be exercising regularly than those at earlier stages of change.

CHAPTER 4: METHOD

Participants

The sample consisted of 151 participants recruited from the Washington University Psychology Department Older Adult volunteer pool and Volunteers for Health, a pool of community-dwelling research volunteers recruited at Barnes-Jewish Hospital. Study participants were between the ages of 55 and 79 years and had received a hypertension diagnosis (see Table 1 for sample characteristics). The participant sample was 56% female, 83 % Caucasian, and 15% African-American. Of the participants included in the sample, 97% were on prescription medication, and 87% were taking prescription blood pressure medication.

Participants were excluded for cardiovascular disease and identifiable causes of hypertension including sleep apnea, steroid therapy, kidney disease, primary aldosteronism, renovascular disease, pheochromocytoma, coarctation of aorta, and thyroid or parathyroid disease, as patients with these diagnoses have a different standard of care than those with only a hypertension diagnosis. Other exclusionary diagnoses were current psychiatric illness or dementia, which could interfere with the accuracy of the self-report measures used in this study.

Materials

Screening and Background Information

Demographic information. Participants completed a questionnaire on educational attainment (years completed), job activity, household composition, and household income levels. Participants also reported their age, gender, racial and ethnic background, and marital status.

Health. Participants completed a general health questionnaire with items about their overall health, current medications, and any co-morbid conditions.

Gross cognitive status. Participants were administered the Short Blessed Test, which assesses orientation, memory, and concentration (Katzman et al., 1983) to screen for dementia and other cognitive disorders. Individuals who scored six or greater were excluded. Of the 153 participants screened only 2 participants were excluded, resulting in 151 participants included in data analysis.

Social desirability. Social desirability is defined as the tendency to answer in a manner in line with culturally acceptable and approved behaviors, which are also unlikely to occur (Crowne & Marlowe, 1960). Because of the heavy reliance on self-disclosure for many of the measures used in the current study, participants completed the Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1960), a self-report scale that consists of 33 true-false questions where higher scores indicate greater tendency to answer in a socially desirable manner. The Cronbach's alpha for the sample was .81, suggestion good internally consistency. This scale was not used as a screen but to demonstrate the level of social desirability exhibited in the sample.

Depressive Symptoms. Similarly, participants were administered the 15-item Geriatric Depression Test (Sheikh & Yesavage, 1986) to demonstrate the degree of depressive symptoms in the sample.

Blood pressure. Blood pressure was measured on two occasions, once at the onset of the session and again at the end of the session. The first measurement was taken approximately 5 minutes into the session following granting of informed consent. Measures of blood pressure were obtained using an automated oscillometric procedure with

portable BpTRU equipment. At each blood pressure assessment the appropriate size cuff was placed on the upper right arm and six sequential measurements were obtained with a 60 second interval between measurements. The first two readings were discarded. Thus, there were a total of eight blood pressure measurements (four from each occasion) that were averaged to yield a single blood pressure value for diastolic and systolic for use in data analysis. The blood pressure measure was then converted to mean arterial pressure measure (MAP) to derive one combined blood pressure variable (Brown et al., 2008). The MAP variable was computed by first determining the pulse pressure (PP) which is equal to systolic blood pressure minus the diastolic blood pressure measure. The formula for MAP = diastolic blood pressure + (PP/3).

Dependent variables

Medication adherence. The Brief Medication Questionnaire (BMQ) is a self-report measure developed to monitor medication adherence and the barriers to adherence (Svarstad, Chewning, Sleath, & Claesson, 1999). The measure was developed to detect various types of adherence with multiple medications. The measure consists of a 5-item regimen screen, a 2-item belief screen, and 2-item recall screen. The current study only used the 5-item regimen screen (Questions 1a through e) to assess medication adherence for the past week. This portion of the BMQ asks the individual to list all medications taken in the past week (Svarstad et al., 1999). For this study, the question was modified to ask specifically which blood pressure medications were taken in the past week (see Appendix 1). The BMQ then asks the individual to specify for each drug "How many days did you take it? How many times per day did you take it? How many pills did you take each time? How many times did you miss taking a pill?" The scoring for this

modified regimen section followed the same guidelines outlined for the original with a score of one or more indicating potential nonadherence. Therefore, higher scores were indicative of poorer adherence.

Physical activity. Participants' physical activity levels were measured with the Physical Activity Scale for the Elderly (PASE; Washburn, Smith, Jette, & Janney, 1993). The PASE has 10 main questions divided into leisure, occupational, and household activities during the past week with some in a yes or no format and other items based on a 4-point Likert scale. Dependent on the answers to the 10 main questions, there are subsequent questions about the specific type and duration of the activities. The final scores are computed by multiplying the activity weights, the developer-derived values used to weight the activities that correspond to activity level, by reported activity frequencies. The PASE has proven validity with perceived health, Sickness Impact Profile total score, heart rate, grip strength, static balance, and dominant leg strength with significant Pearson correlations ranging from .68 to .84 and the reliability measured by Cronbach's alpha was .69 (Washburn et al., 1993). In our sample the internal consistency was measured with Cronbach's alpha of .54, and with question 10 pertaining to work related activity eliminated, the consistency increased to .73.

Diet. Participants completed a Healthy Eating Questionnaire (HEQ) about their current dietary practices (see Appendix 2). The measure was developed following the format of the Women's Healthy Eating and Living Study Lifestyle Questionnaire (Thomson et al., 2002) that asks individuals what foods they were eating the year prior to diagnosis and if they changed their dietary pattern following diagnosis. The current study asked what foods they are eating presently (following diagnosis with hypertension). The

majority of the food items were retained, an item about salt was added, and items regarding alcoholic beverages were eliminated. The number of servings on average per week of each food item or category was rated on a 5-point Likert scale. The non-compliant food items were scored negatively, and total scores were used in analysis with higher scores indicative of healthier eating. The total scores for the measure could range from -64 to 36 as more non-compliant foods were incorporated into the measure.

Body Mass Index (BMI). The height and weight of each participant was measured using a physician height and weight scale. The height and weight measurements were used to calculate BMI for each of the participants. BMI was calculated as: ([weight in pounds /height in inches]/height in inches) x 703. BMI categories are: underweight (<18.5), normal (18.5-24.9), overweight (25-29.9), and obese (30 and greater).

Alcohol consumption. Participants answered questions about current alcohol consumption as part of the general health questionnaire. The question asked " Do you drink alcohol," with the option to answer yes or no. The follow-up question asked, "If yes, how many alcoholic beverages (i.e., beer, wine, champagne, liquor, etc.) do you consume on average per week?" The total number of alcoholic beverages on average over a week (7-day period) was used as the outcome measure.

Smoking status. Participants answered questions about current smoking status and amount as a part of the general health questionnaire. The total number of cigarettes smoked over a week (7-day period) was used as the outcome measure.

Change since diagnosis. Participants completed a questionnaire consisting of items pertaining to their lifestyle changes since diagnosis (see Appendix 3). The measure

was developed for this study to obtain an estimate of change since diagnosis for all of the suggested lifestyle modifications. The scale includes six items, each devoted to a specific lifestyle modification. Individuals rated their current performance on each modification compared with their performance prior to diagnosis. The scale ratings were on a 5-point Likert scale ranging from 1 (*much less*) to 5 (*much more*). Item 3 dealing with physical activity was scored in reverse due to the need to increase physical exercise as opposed to the decrease for all other changes. The specific modification change scores were used for Hypothesis 7. The total change score was used in the other analyses.

Independent Variables

Age at diagnosis. Age at diagnosis was calculated by subtracting reported years since diagnosis from age at interview.

Socioeconomic status. The objective SES measure used in analyses was total years of formal education. In addition, participants completed a subjective SES measure (Ostrove, Adler, Kuppermann, & Washington, 2000). The MacArthur Scale of Subjective Social Status was developed to capture people's sense of place on the social ladder (Adler, Epel, Castgellazzo, & Ickovics, 2000). The measure consists of pictures depicting two social ladders and asks participants to place an *X* on the rung consistent with their perceived standing in the community (community ladder) and their perceived standing in the United States for the second ladder (SES ladder). The community ladder captures individuals' perception of their place in society without the influence of income, occupation, or education (Adler et al., 2000). The SES ladder is thought to be influenced by traditional SES factors yet provide additional information about an individuals' place in society. The two ladders allow for the comparison of subjective SES with the objective

SES measures in research. Both ladder measures have been shown to capture unique information beyond traditional SES indicators (Adler et al., 2000). Subjective status, as estimated with both the SES and community ladders, is associated with mental and physical health outcomes with higher ladder ranking associated with more positive health outcomes (Adler, 2000; Ostrove et al., 2000). Each ladder has five rungs, and the score is equivalent to the individual's placement of the X. In this study the two subjective SES measures were standardized and averaged to derive the composite subjective SES variable.

Self-efficacy. Participants completed a self-efficacy measure focusing on self-perception of coping ability and internal attribution of success. The General Self-Efficacy Scale (GSE) was developed to assess the general sense of perceived self-efficacy in order to predict coping with daily life challenges and adaptation to stressful life events (Jerusalem & Schwarzer, 1992). Although the measure was developed in German, it has been adapted to over 26 languages for the general adult (12 years and over) population. The GSE was designed for integration in larger questionnaires developed for research purposes, and has Cronbach's alphas ranging from .76 to .90. In this sample, the Cronbach's alpha was consistent with previous findings at .88. The measure consists of 10 items rated on a 4-point Likert scale with composite scores ranging from 10 to 40 with higher ratings indicating a higher sense of self-efficacy.

In addition, participants completed three health specific self-efficacy measures dealing with nutrition, physical exercise, and alcohol reduction (Schwarzer & Renner, 2000). The brief scales were developed for integration into health behavior studies. All scales were preceded by the question, "How certain are you that you could overcome the

following barriers?" Also, each question was answered using a 4-point Likert scale with higher scores indicating greater self-efficacy. The 5-item nutrition self-efficacy scale stated, "I can manage to stick to healthful foods…" and then listed the five possible barriers that were rated. The 5-item physical exercise self-efficacy scale stated, "I can manage to carry out my exercise intentions," and then listed the 5 possible barriers. The 3-item Alcohol Resistance Self-Efficacy scale stated, "I am certain that I can control myself to…" and listed the 3 possible barriers.

In past research, the dimensionality of the scale was measured with principal components analysis with varimax rotation on the 13 items. A three component solution accounted for 68% of the total variance and grouped each item correctly for each of the self-efficacy inventories (Schwarzer & Renner, 2000). Internal consistency (Cronbach's alpha) was .88 for the nutrition and exercise scales and .79 for the alcohol scale (Schwarzer & Renner, 2000). Participants, however, demonstrated great difficulty completing the specific self-efficacy measures, with many leaving items blank or providing answers that contradicted previously reported information. Therefore, specific self-efficacy scores were considered to be invalid or missing for numerous participants and were not included in the data analyses.

Health locus of control. Form C of the Multi-Dimensional Health Locus of Control Scales, a condition-specific measure of locus of control, was modified for hypertension specificity (Wallston, Stein, & Smith, 1994). The measure follows Form B of the Multi-Dimensional Health Locus of Control Scales (Wallston et al, 1978), which was found to have a three-factor structure based on confirmatory factor analysis in an older adult sample (Robinson-Whelen & Storandt, 1992). Form C of the measure was

similar but designed for use in specific health conditions. The measure used the word "condition" in all 18-items, which can be replaced with a term or terms describing the specific condition being assessed. For this study the words “blood pressure” were substituted for “condition” in all 18 items.

The measure was in questionnaire format with individuals responding using a 6-point Likert scale ranging from 1 (*strongly agree*) to 6 (*strongly disagree*). The scale consisted of four subscales: Internal, Chance, Doctors, and Other People. The Internal and Chance subscales contained six items each; the Doctors and Other People scales contained only three items. Nevertheless, the reliability as assessed with Cronbach's alpha remained acceptable and ranged from .70 to .87. The lower reliability corresponded to the 3-item Doctor and Other People subscales (Wallston et al., 1994). In this sample, the Cronbach’s alphas were .86 for Internal, .76 for Chance. .76 for Doctor, and was low for Other at .58. A higher score on the Internal scale indicated a greater internal health locus of control, a higher Chance score indicated greater chance locus of control, a higher score on the Doctor scale indicated a perception of medical professional control, and a higher score in the Other scale indicated that there was a greater sense of others having control over an individual’s health condition. The Internal subscale score was used in the analysis with higher scores reflecting more positive internal locus of control.

Perceived social support. Participants completed the perceived social support subscale of the Berlin Social Support Scale (BSSS), which measured both instrumental and emotional support (Schwarzer & Schulz, 2000). The BSSS was developed as a multidimensional measure of social support (Schulz & Schwarzer, 2003). The perceived social support scale includes eight items about emotional and instrumental support.

Participants rated their agreement with the statements on a 4-point Likert scale ranging from 1 (*not true at all*) to 4 (*exactly true*). The composite score is a sum of scores with negative items scored in reverse. The perceived social support subscale has been shown to be reliable with an internal consistency as assessed with Cronbach's alpha of .83 (Schulz & Schwarzer, 2003). The alphas for this sample were .90 for the instrumental dimension, and .76 for the emotional dimension. Separate estimates of instrumental and emotional social support were used in analyses with higher scores representing greater perceived support.

Personality. Participants completed the NEO-FFI (Costa & McCrae, 1992), which is a brief measure of five personality traits. The measure consists of five 12-item scales that measure each of the five personality traits of neuroticism, extraversion, openness, agreeableness, and conscientiousness. The NEO-FFI is the shortened 60-item version of the original NEO-PI-R questionnaire (Costa & McCrae, 1992). The NEO-FFI has been validated with the NEO-PI-R showing correlations ranging from .75 to .89 (Costa & McCrae, 1992). The NEO-FFI is a self-report paper-and-pencil measure designed for adults 17 years of age and older. In this study, the combined gender scoring grid was used to calculate the T scores for each of the five traits for the participants. The measure has a three-item validity check at the end, and if these checks imply dishonesty or faulty administration, the measure would not have been scored. Only measures of Neuroticism, Extraversion, and Conscientiousness were used in the analyses to address specific hypotheses. Higher scores indicate more of that personality characteristic.

Motivation to change. Participants completed five measures of motivation to change based on the transtheoretical model (Prochaska et al., 1992): one for following a

low-fat diet, one for reducing sodium intake, one for increasing physical activity, one for alcohol consumption, and one for smoking cessation. Each measure classified the participants into the precontemplation, contemplation, preparation, action, and maintenance stages for the specified lifestyle modification. The basic procedure of these measures follows the guidelines set forth in prior studies using the transtheoretical model to classify individuals into stages of change and has proven classification ability (Greene et al., 1999; Kristal, Glanatz, Curry, & Patterson, 1999; Prochaska & Norcross, 2001; Ronda, Van Assema, & Brug, 2001).

For all of the measures, the items asked (a) if participants intended to change the specified behavior within the next 6 month (yes or no); (b) if so, whether they planned to make changes within the next 30 days (yes or no); (c) if they changed the specified behavior in the past 6 months (increase, decrease, no change). Depending on the participants' responses they were classified into stages of change. Participants who initiated change prior to 6 months in the past were classified as in the maintenance stage and given a score of 5. Participants who initiated change within the last 6 months were considered to be in the active stage and given a score of 4. Participants who intended to change in the next 30 days were in the preparation stage and given a score of 3. Those intending to change in the next 6 months were in the contemplation stage and given a score of 2. Those participants with no intention to change their behavior were classified as in the precontemplation stage and given a score of 1.

Data Conditioning

Occasionally participants omitted one or more items on a scale; if the number of such omissions were relatively small (primarily 1-2 missing items, and overall less than

1/4th of the items), a summary score for the scale was prorated (e.g., the proportion of items endorsed in the reduced set of items multiplied by the total possible score). Values on any independent or dependent measure greater than 2.5 standard deviations from the mean of the sample were considered outliers in the dataset. Outlier values were treated as missing data points and then replaced using regression imputation, which replaces the missing data point based on values of all other independent and dependent variables.

Procedure

All participants attended a 90-minute session. After providing informed consent, blood pressure was measured. The participants then completed the packet of questionnaires. Following completion of the packet, blood pressure was measured again. At the conclusion of the session participants received $15 for their participation. The individual sessions took place in the psychology department at Washington University.

CHAPTER 5: RESULTS

Preliminary analyses

Participants' responses about current behavior showed little variance for three of the six dependent variables. Adherence to the medication regimen was reported to be extremely good; 91% of the participants on medication reported perfect adherence the previous week. Although 65 individuals reported alcohol use, most participants did not consume more than the recommended amount and there was little change following diagnosis. Only 6% of the participants (8) were smokers, resulting in insufficient variability in the sample to capture change or implementation. Therefore medication adherence, alcohol use, and smoking cessation were not included as dependent variables in the data analyses.

Descriptive statistics for the remaining three current life style behaviors and for total change since diagnosis are shown in the upper portion of Table 2. Descriptive statistics for the independent variables are shown in the lower portion of Table 2. Table 3 contains the Pearson correlations between the dependent and independent variables that were used to test a number of the hypotheses. An alpha level of .05 was used throughout.

Hypothesis 1

It was hypothesized that age at diagnosis would negatively influence implementation of lifestyle changes, with those diagnosed at a younger age more likely to implement lifestyle change. As shown in Table 3, this hypothesis was not supported. The correlations between age and current life style behaviors ranged from -.14 to .03; none were significant. Further, the correlation (- .14) between age and self-reported change in lifestyle was also not significant. Thus, no support was observed for Hypothesis 1.

Hypothesis 2

It was hypothesized that socioeconomic variables including objective SES (years of education) and subjective SES would be positively related to implementation of lifestyle modifications. As shown in Table 3, however, none of the correlations between the objective measure of SES (years of education) or the subjective measure of SES with the current lifestyle factors (physical activity, diet, BMI) or self-reported change were significant. The values of the correlations ranged from -.02 to .11. Thus, no support was observed for Hypothesis 2.

Hypothesis 3

It was hypothesized that both general self-efficacy and health locus of control would be positively related to implementation of lifestyle modifications. Further, it was expected that health locus of control would represent a stronger positive relationship with the lifestyle behaviors and modification than would general self-efficacy because it is more focused on health-related factors.

As shown in Table 3, there was a significant correlation (.20) between general self-efficacy and physical activity level, but self-efficacy was not correlated with diet or BMI or with self-reported change. These values ranged from -.01 to .14. Contrary to hypothesis, health locus of control did not show a stronger relation with either current behaviors or change. As can be seen in Table 3, the values of the correlations ranged from -.11 to .08, and none were significant. Thus, Hypothesis 3 was only partially supported.

Hypothesis 4

It was hypothesized that perceived social support, both emotional and instrumental, would demonstrate a positive relationship with implementation of lifestyle modifications. As shown in Table 3, there were no significant correlations between physical activity and perceived social support, but the correlations between perceived social support, both instrumental and emotional, and the lifestyle factors of diet and BMI as well as self-reported change yielded significant relationships. There were significant positive correlations with diet for both emotional (r = .30, p <.001) and instrumental (r = .22, p = .006) perceived social support that remain significant when corrected for the number of tests. Individuals with higher perceived social support reported healthier eating. There was also a significant negative correlation between emotional social support (r = -.17, p = .042) and BMI. Individuals with increased perceived emotional social support had lower (healthier) BMI. The correlation (r = -.13) between instrumental social support and BMI did not achieve significance (p = .12). In addition, both emotional (r = .27, p = .001) and instrumental (r = .18, p = .023) perceived social support were significantly correlated with reported change, with the relationship between change and emotional remaining significant when corrected. Greater change was associated with greater perceived emotional and instrumental perceived social support. Thus, by and large, Hypothesis 4 was supported. Greater perceived social support was associated with the implementation of a healthier lifestyle.

Hypothesis 5

The relationships between the current lifestyle behaviors and reported change in those behaviors and three personality factors were examined. As shown in Table 3, Neuroticism was negatively associated with both physical activity and reported change

(both *r*s = -.20, *p* = .01). More neurotic people reported less activity and less change. Extroversion was not significantly associated with any of the dependent variables; the correlations ranged from -.03 to .16. It should be pointed out, however, that the *p* value for the correlation between Extraversion and diet was .052. Conscientiousness was significantly correlated with three of the four dependent variables: physical activity, *r* = .23, *p* = .005; diet, *r* = .24, *p* = .003; and BMI, *r* = -.20, *p* = .016. The directions of these correlations indicate that more conscientious people reported healthier current lifestyle behaviors. Thus, there was support for Hypothesis 5 in terms of two aspects of personality influencing the behaviors that are needed for satisfactory treatment of hypertension.

Hypothesis 6

The number of individuals engaging in each of the treatment recommendations was examined to determine if hypertensive individuals are more likely to engage in particular lifestyle behaviors than other lifestyle behaviors The proportion of individuals engaging in each of the treatment recommendations (reduced fat and sodium intake, satisfactory weight, physical activity) and the 95% confidence limits of those proportions are shown in Table 4. A significant proportion of individuals reported implementing each of the lifestyle modifications as indicated by the fact that the 95% confidence intervals did not include zero for any of the modifications. A greater proportion of participants reported change in fatty food intake and sodium intake than the other lifestyle modifications as indicated by nonoverlapping confidence intervals. The proportions for fatty food intake and sodium intake were similar as reflected in their overlapping confidence intervals. The proportion of participants reporting implementation of weight

reduction and exercise was similar with overlapping 95% confidence intervals as well, but lower than the intervals reported for fatty food intake and sodium intake.

Hypothesis 7

The proportion of participants in each stage of change for three lifestyle behaviors (decreased use of fatty foods and sodium and increased physical activity) are shown in Table 5. It was hypothesized that if hypertensive individuals are at differing stages of change for each of the treatment recommendations, then the likelihood of implementing treatment recommendation would also differ. Thus, there would be a positive relationship between the stage of change for a particular treatment recommendation and implementation of that recommendation.

Due to the ordinal nature of the stage of change variable, Kendall's tau-b was used to assess the relationship between lifestyle behaviors and stage of change. This relationship was examined for three lifestyle behaviors: fatty food, sodium intake, and physical activity. In all three cases there was a significant relationship. The Kendall's tau-b for the relation between stage of change for fatty foods and reported change in fatty food intake was .35 ($p < .001$); individuals in the active and maintenance stages were more likely to have reduced their fatty food intake. The value for the relation between stage of change for sodium and reported change in sodium intake was .30 ($p < .001$); those in the active and maintenance stages were more likely to report that they had reduced use of sodium. Similarly, those in the active and maintenance stages for physical activity reported increased engagement in physical activity since diagnosis, Kendall's tau-b = .26, $p < .001$.

Multiple Regression Analyses

Multiple regression analysis was performed for each of the four dependent variables: physical activity, diet, BMI, total change. To increase the power of these analyses, the demographic variables (age at diagnosis and the two SES measures) and Extroversion were not included in these analyses because they had not produced any significant relationship with any of the dependent variables in any of the previous analyses. The remaining independent variables were entered simultaneously. Then, if the R was significant, a stepwise backwards analysis was conducted to determine which of the independent variables could be eliminated.

Physical Activity

The R^2 from the simultaneous analysis for physical activity was .09, F (6, 144) = 2.42, p = .03. The adjusted R^2 was .05. The results for the regression coefficients from the final step in the backwards stepwise analysis are shown in Table 6. The R^2 for the final step remained .09, F(3, 147) = 4.61, p = .004, and the adjusted R^2 was .07.

The independent variables remaining in the model were instrumental perceived social support and the personality measures of Neuroticism and Conscientiousness. Notice that instrumental perceived social support is acting as a suppressor variable in this model. Although its zero-order correlation with activity is small (r = -.06), through its correlation with both of the personality measures it suppresses variance in both Neuroticism and Conscientiousness thereby enhancing the overall prediction.

Diet

The R^2 from the simultaneous analysis for diet was .13, F(6, 144) = 3.62, p = .002. The adjusted R^2 was .09. The results for the regression coefficients from the final step in the backwards stepwise analysis are shown in Table 6. The R^2 for the final step

was .11, $F(2, 148) = 9.42$, $p < .001$. The adjusted R^2 was .10. The two independent variables that remained in the model were perceived emotional social support and the personality factor of Conscientiousness.

BMI

The R^2 from the simultaneous analysis for BMI was .06, $F(6, 144) = 1.45$, $p = .20$. The adjusted R^2 was .02. Because the simultaneous analysis did not produce an R significantly different from zero, no backwards stepwise regression analysis was conducted.

Change

The R^2 from the simultaneous analysis for total change was .10, $F(6, 144) = 2.56$, $p = .02$. The adjusted R^2 was .06. The results for the regression coefficients from the final step in the backwards stepwise analysis are shown in Table 6. The R^2 for the final step was .10, $F(2, 148) = 7.84$, $p = .001$. The adjusted R^2 was .08. The two independent variables that remained in the model were perceived emotional social support and the personality factor Neuroticism.

Additional Analysis

Correlations among the four dependent variables are shown in Table 7. Current physical activity was associated with healthier diet ($r = .20$) but not with the other two dependent variables. Healthier diet was associated with both better BMI ($r = -.22$) and with reported more total change since diagnosis ($r = .42$). Better weight was not associated with more total change since diagnosis.

CHAPTER 6: DISCUSSION

Overview

This study was designed as a first step in the development of a behavioral treatment intervention model for hypertensive patients. The purpose of this study was to examine variables that might influence this particular population's ability to implement the suggested treatment recommendations and whether they changed their behavior following diagnosis. This study provided support for some aspects of the proposed models but not for others. I will discuss the results related to the proposed model of current behavior and then the proposed model related to change in behavior. The limitations of the present study will then be discussed as well as future directions.

Model of Current Lifestyle Behaviors

The hypothesized model (Figure 3) of variables influencing current compliance with healthy lifestyle behaviors thought to improve blood pressure in individuals with hypertension was supported in part, although the amount of variance explained in current behaviors was not large. The two current behaviors that were explained by variables in the model were physical activity and diet. They were associated with social support and personality, although with different aspects of social support and personality for the two behaviors.

For physical activity the best predictors were instrumental social support, Neuroticism, and Conscientiousness. These variables predict a modest 9% of the variance in current activity level. The relationships between the two personality factors and physical activity level are straightforward. Higher Neuroticism was associated with less activity; greater Conscientiousness was associated with greater activity. These findings

are consistent with those reported by Rhodes and Smith (2006). In addition, high Conscientiousness scores and low Neuroticism scores are thought to be associated with adherence to exercise regimens (Courneya &, Hellsten, 1998). Therefore, interventions may need to be tailored for these groups with high Conscientiousness versus high Neuroticism. For those high on conscientiousness, it is possible that education is all that is necessary for them to implement change and specifically increase activity. Those with high neuroticism scores, however, may need education along with additional support. Interestingly, it has been found that those who are high on neuroticism are more motivated to exercise by their body image and general appearance (Courneya & Hellsten, 1998). Therefore, interventions with persons with higher neuroticism may focus on not only improving health but also the physical changes that result from maintaining a consistent exercise regime. According to the findings it may be possible to use interventions focused on social support to assist those with higher neuroticism scores to implement change as well.

The role of instrumental social support is not so straightforward. It had a non-significant correlation with current physical activity level in and of itself. Thus, people are not more active because others provide instrumental support with regard to activity. Instead, instrumental support was correlated -.16 with Neuroticism and .23 with Conscientiousness. Higher Neuroticism was associated with less instrumental social support, and higher Conscientiousness was associated with more instrumental social support. Therefore, including instrumental social support suppressed variance in Neuroticism and Conscientiousness, which enhanced their correlation with activity thereby improving the overall prediction by the model. Note that the measure of

instrumental social support used in this study was based on self-report, not observed social support. Perceived social support has been thought of as more of a trait or characteristic and has been implicated as a better indication of mental health and more relevant to health outcomes than actual support (Barrera, 1986; Hwang et al., 2009; McDowell & Serovich, 2007). Therefore, the assessment of perceived social support may prove useful in intervention development, and increasing perceived support may increase compliance. The focus of intervention could be to alter or improve the individual's perception of support. Also it may be possible to increase the perception of support by including a person's reported social network (family and friends) in the intervention, improve the quality of relationships, and/or develop new relationships (Hogan, Linden, & Najarian, 2002). These methods may increase the perception of support as well as actual support. With physical activity, some interventions could include recruiting family members or friends as exercise partners or simply joining an exercise class with people at a similar ability level.

Emotional social support and Conscientiousness together account for 13% of the variance in diet. Here the relations were straightforward. More emotional social support and greater Conscientiousness were associated with a healthier diet. These findings are consistent with previous findings noting that personality factors influence lifestyle, adaptation, success and other life course variables (Soldz & Vaillant, 1999). It is possible that interventions can focus on the combination of emotional social support and Conscientiousness, in particular those with high Conscientiousness, but who lack emotional social support. These individuals may be encouraged to gain social support by expanding their social network of friends or involving their family, or they may benefit

from interventions such as support groups dealing with diet and overall coping with hypertension. In addition, emotional social support may be able to increase compliance for those low on Conscientiousness. The intervention again may be a support group, but may provide the participants with more structure, such as a structured method for following the DASH diet, as well as social support through interaction with others.

Neither age at diagnosis or SES was related to current lifestyle behaviors. Although hypertension may increase with age and be more prevalent in those of lower SES, it appears that once hypertension is diagnosed age and SES no longer play a role, at least with regard to the current behaviors examined in this study. Those with lower SES may have access to fewer resources, but it appears that they were as able to follow a healthy diet and maintain good activity levels as those of higher SES. This could also indicate that participants were not implementing a healthy diet or adequate activity levels, and therefore the SES differences although important, could be secondary to motivation to change behavior. Also, the range of SES in this study population was somewhat limited in that most participants were high school graduates and mean education was at an associate degree level. Therefore, it is possible that the full influence of SES was not captured, as low and higher SES groups were not fully represented in the population.

The third dependent variable assessing current lifestyle behaviors was BMI. There were modest zero-order correlations of BMI with emotional social support (-.17) and Conscientiousness (-.20), but the multiple R^2 (.06) was not significant. Thus, there was no support for the proposed model in terms of predicting current weight, although there was a modest (-.22) correlation in the expected direction between the independent variables of diet and BMI. It should be noted that the average BMI for this sample was

31, which is in the obese range. Other variables that might be related to achieving and maintaining appropriate weight need to be considered. It has been found that, in addition to engaging in high levels of physical activity and a healthy diet, eating breakfast, regularly monitoring weight, a consistent eating pattern, as well as weight loss initiated following a medical event are associated with successful long-term weight loss (Wing & Phelan, 2005).

Model of Change in Lifestyle Behaviors

There were differences as predicted in implementation of lifestyle modifications. This was indicated by the proportion of individuals engaging in each of the treatment recommendations. Participants were more likely to have implemented change in their diet by reducing their fatty food intake and sodium intake. This was followed by change in physical activity level and weight reduction. Perhaps dietary change is easier for this age group, or these hypertensive participants understand dietary change to be more important than physical exercise or weight loss. In addition, dietary changes may be the first step for many in pursuing a healthier lifestyle. It is possible that many find dietary changes or reporting dietary change to be easier than increasing physical activity levels; dietary changes may not disrupt their schedule as much as inserting activity.

Some support for portions of the hypothesized model of change in lifestyle behaviors since diagnosis (Figure 4) was obtained. For total self-reported change since diagnosis 10% of the variance was associated with emotional support and Neuroticism. Individuals who reported that they had more emotional support also reported more total change. This was similar to the results obtained in analysis of the model for the current behavior of diet, which is reasonable given that the major changes reported were in diet.

The results, however, were different in terms of the personality characteristic related to total change. Those who were more neurotic reported less change since diagnosis. This result is compatible with earlier research that found that high Neuroticism scores were correlated with worse perceived health, which then negatively influenced health outcomes (Chapman et al., 2006). In the analysis of current behavior related to diet (the major behavior reported to change), however, the personality trait identified as significant was Conscientiousness. This is also consistent with prior research that has found that both Conscientiousness and Neuroticism were related to eating habits, but specifically found Conscientiousness important. Those higher on Conscientiousness were more likely to have restrained diets, and those with low Conscientiousness were more emotional and external eaters (Haven, Mulligan, Merrilees, Woods, & Fairooz, 2001). It is possible that Conscientiousness was indicated as a significant factor in total change due to the stronger relationship between diet and Conscientiousness.

As predicted, there was a positive relationship between the stage of change for a particular treatment recommendation and the implementation of that recommendation. More advanced stages of change for fatty food intake, sodium intake, and physical activity were related to greater reduction in fatty food and sodium intake and increased physical activity levels since diagnosis. This relationship connects one's motivation to change with actual implementation of change behavior. It must be noted that, although this relationship was found, some participants reported change since diagnosis, but their reported motivation to change did not correspond to having implemented change. Perhaps these participants were rating their current motivation to change their behavior as opposed to their motivation to change at the time of their diagnosis.

As in the analyses of the model of current behaviors, age at diagnosis, SES, self-efficacy, health locus of control, and Extraversion were not related to reported change since diagnosis. Thus, no support was found for inclusion of these variables in the model of either current lifestyle behaviors or change in lifestyle behaviors.

Methodological Limitations.

This study was retrospective and relied heavily on self-report. Although, self-report is often very reliable and necessary for many assessment measures, the study would have provided more accurate measures of change if it were based on chart review, supplemented with self-reports, or done longitudinally. In a longitudinal design the behavior could be measured at the time of hypertension diagnosis, rather than years later as was the case for the majority of participants in this study, and then again at subsequent intervals to determine change. In addition, this was a correlational study and therefore causality cannot be inferred, and directionality of effects other than those hypothesized or observed are possible.

There was minimal precedent for this type of study, as the majority of intervention studies examine change or implementation of one behavioral modification, rather than multiple factors or changes in behavior. Therefore, there were numerous variables of interest that were examined in a relatively small sample.

Objective socioeconomic status was estimated using education level, and although education is related to other SES estimates and often used as an indicator of SES, other estimates such as household income, insurance status, and/or access to healthcare, may have provided a more detailed picture of SES for the sample and could be included in future studies.

This sample did not demonstrate much variability in smoking and alcohol intake, which made it impossible to perform analyses of these targeted lifestyle behaviors. It is not clear that a longitudinal design conducted today in this country would avoid these problems. The rates might be similar there as well. A longitudinal study, however, would have eliminated one of the major methodological limitations of the current study: blood pressure was correlated with only one of the behavioral modifications (BMI, $r = .289$, $p<.01$). This is problematic because it indicates that changes to the behavioral modifications would most likely have little to no effect of change on blood pressure, which is the ultimate goal of implementing lifestyle changes. The major contributing factor to the lack of relationship between the lifestyle factors and blood pressure is likely due to the fact that 87% of the sample population was on hypertension specific medication, and the majority of participants reported medication adherence. Medication has been found to be very successful in controlling blood pressure, therefore the amount of variability found in blood pressure measurements may be limited.

Nevertheless, the mean systolic blood pressure remained in the prehypertensive range (131), above ideal, and diastolic pressure remained only slightly within normal range (79). Therefore, although the majority of participants were on hypertensive medication and reported taking their medication, many participants had blood pressure that remained high, regardless of time since diagnosis. In addition, the average BMI for this population was 31, which is in the obese range. Both high blood pressure and obesity are risk factors for cardiovascular disease and other diseases as well. Therefore, medication is not enough for hypertensive individuals to lower their risk for associated disease. It is believed that the lifestyle modifications in combination with medication

would produce even more ideal blood pressure measures, but according to the results of this study, many hypertensive patients are not implementing the lifestyle modifications that are needed to greatly reduce their risk for other health-related consequences.

Future Directions

As a next step, partial replication of this study with a larger, more representative sample would allow for the inclusion of additional variables. Ideally, participants would enter the study at the time of diagnosis and assess stage of change for the behavioral modifications immediately. This information could provide researchers with individualized motivation to change information prior to measuring change and assist in developing more individualized treatment paradigms. Also, it would be informative to assess the amount of information on hypertension and the actual recommended treatments provided by the physician to the patients. If patients are not being educated, then they may not be aware of the need to implement the recommended lifestyle modifications.

The information provided by the current study has also lead to more specific questions about the usefulness of stage of change in predicting actual change outcomes, the relationship of specific personality factors such as Conscientiousness and Neuroticism with motivation and implementation of change, and the ways to focus interventions on areas where hypertensive patients are less likely to change such as weight reduction and increased physical activity.

References

Adler, N. E., Epel, E., Castellazzo, G., & Ickovics, J. (2000). Relationship of subjective and objective social status with psychological and physiological functioning: Preliminary data in healthy white women. *Health Psychology, 19,* 586-592.

Ai, A.L., Peterson, C., Rodgers, W., & Tice, T.N. (2005). Effects of faith and secular factors on locus of control in middle-aged and older cardiac patients. *Aging & Mental Health, 9*, 470-481.

American College of Cardiology, American Heart Association, & Physician consortium for Performance Improvement. (2005). Clinical performance measures hypertension tools developed by physicians for physicians. *American Medical Association* Retrieved from http://www.ama-assn.org/ama1/pub/upload/mm/370/hypertension-8-05.pdf

American Heart Association. (2004). *Heart disease and stroke-statistics-2004 update, vol. 18* Dallas, TX: American Heart Association.

American Heart Association. (2007). *Blood pressure*. Retrieved from http://www.americanheart.org/presenter.jhtml?identifier=2114

American Heart Association. (2010). *High blood pressure Statistics-2010 update* Retrieved from http://www.americanheart.org/presenter.jhtml?identifier=3000946

Antonucci, T. C. (1990). Social supports and social relationships. In R. H. Binstock & Geroge (Eds.), *Handbook of aging and social sciences* (pp. 205-226). San Diego, CA: Academic Press.

Appel. L. J., More, T. J., Obarzanek, E., Vollmer, W., Svethey, L. P., Sacks, F. M.,

…Harsha, D.W. (1997). A clinical trial of the effects of dietary patterns on blood pressure. DASH Collaborative Research Group. *The New England Journal of Medicine, 336,* 1117-1124.

Arnett, D. K., Baird, A.E., Barkley, R.A., Basson, C.T., Boerwinkle, E., Ganesh, S. K., …O'Donnell, C. J. (2007). Relevance for genetics and genomics for prevention and treatment of cardiovascular disease: A scientific statement from the American Heart Association council on epidemiology and prevention, the stroke council, and the functional genomics and translational biology interdisciplinary working group. *Circulation, 115, 2878-2901.* doi:10.1161/CIRCULATIONAHA.107.183679.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*, 191-215.

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist, 37*, 122-147.

Barrera, M. (1986). Distinctions between social support concepts, measures, and models. *American Journal of Community Psychology, 14*, 413-445.

Benyamini, Y. & Idler, E.L. (1999). Community studies reporting association between self-rated health and mortality: Additional studies, 1995-1998. *Research on Aging, 21*, 392-401

Betancourt, J. R., Carrillo, J. E., & Green, A. R. (1999). Hypertension in multicultural and minority populations: Linking communication to compliance. *Current Hypertension Report, 1*, 482-488.

Bogg, T., & Roberts, B.W. (2004). Conscientiousness and health-related behaviors: A

meta-analysis of the leading behavioral contributors to mortality. *Psychological Bulletin, 130,* 887-919.

Bosworth, H. (1999). The relationships between self-rated health and health status among coronary artery patients. *Journal of Aging Health, 11*, 565-584.

Brown, A. D., McMorris, C. A., Longman, R.S., Leigh, R., Hill, M.D.,…Poulin, M.J. (2008). Effects of cardiorespiratory fitness and cerebral blood flow on cognitive outcomes in older women. *Neurobiology of Aging*, Advance online publication. doi: 10.1016/j.neurobiolaging.2008.11.002

Bryan, A. D., Fisher, J. D., & Benzinger, T. J. (2001). Determinates of HIV risk among Indian truck drivers: An information-motivation-behavioral skills approach. *Social Science and Medicine, 53,* 1413-1426.

Cappuccio, F.P., Kerry, S.M., Forbes, L., & Donald, A. (2004). Blood pressure control by home monitoring: meta-analysis of randomized trials. *BMJ (Clinical research Ed.). 329* (7458), 145.

Carroll, W. (2004). Hypertension in America, 2002: Estimates for the U.S. civilian non-institutionalized population ages 18 and older. *Medical Expenditure Panel Survey Statistical Brief # 59.*

Chapman, B. P., Duberstein, P. R., Sorensen, S., & Lyness, J. M. (2006). Personality and perceived health in older adults: The five factor model in primary care. *Journal of Gerontology: Psychological Sciences, 61B,* 362-365.

Champion, V. L. (1990). Breast-self examination in women 35 and older: A prospective study. *Journal of Behavioral Medicine, 13*, 523-538.

Chobanian, A. V., Bakris, G. L., Black, H. R., et al. (2003). The seventh report of the

Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: The JNC 7 report.

Costa, P. T., & McCrae, R.R. (1992). Revised *NEO PI-R Professional Manual*. Odessa, FL: Psychological Assessment Resources.

Courneya, K.S., & Hellsten, L. M. (1998). Personality correlates of exercise behavior, motives, barriers and preferences: An application of the five-factor model. *Personality and Individual Differences, 24,* 625-633.

Crespo, M.J., Escobales, N., & Rodriguez-Sargent, C. (1996). Endothelial dysfunction in the San Juan hypertensive rat: Possible role of the nitric oxide synthase. *Journal of Cardiovascular Pharmacology, 27,* 802-808.

Crowne, D. P., & Marlowe, D. (1960). A new scale of social desirability independent of psychopathology. *Journal of Consulting Psychology, 24,* 349-354.

Cushman, W. C., Ford, C. E., Cutler, J. A., Margolis, K. L., Davis, B.R., Grim, R. H., …Walsh, S. M. (2002). Success and predictors of blood pressure control in diverse North American settings: The Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial (ALLHAT). *Journal of Clinical Hypertension (Greenwich), 4,* 393-404.

Devins, G. M., Binik, Y. M., Gorman, P., Dattel, M., McCloskey, B., Oscar, G., & Briggs, J. (1982). Perceived self-efficacy, outcome expectancies, and negative mood states in end-stage renal disease. *Journal of Abnormal Psychology, 91,* 241-244.

Elias, P.K., D'Argostino, R. B., Elias, M.F., & Wolf, P.A. (1995). Blood pressure,

hypertension, and age as risk factors for poor cognitive performance. *Experimental Aging Research, 21,* 393-417.

Elmer, P.J., Obarzanek E., Vollmer, W.M., Simons-Morton, D., Stevens, V.J., Young, D.R., …Appel, L.J. (2006). Effects of comprehensive lifestyle modification on diet, weight, physical fitness, and blood pressure control: 18-month results of a randomized trial. *Annals of Internal Medicine, 144,* 485-495.

Fisher, J. D., & Fisher, W. A. (1992). Changing AIDS risk behavior. *Psychological Bulletin, 111,* 455-474.

Fisher, J. D., & Fisher, W. A. (2000). Theoretical approaches to individual level change in HIV risk behavior. In J. L. Peterson & R. J. DiClemente (*Eds.*), *Handbook of HIV prevention (pp. 3-56).* New York: Kluwer Academic/Plenum.

Fisher, J. D., Fisher, W. A., Amico, K., & Harman, J. (2006). An information-motivation-behavioral skills model of adherence to highly active anti-retroviral therapy. *Health Psychology, 25,* 462-473.

Fisher, W. A. & Fisher, J. D. (1993). A general social psychological model for changing AIDS risk behavior. In J. Pryor & G. Reeder (Eds.). *The social psychology of HIV infection* (pp. 127-153). Hillsdale, NJ: Erlbaum.

Fisher, W. A., Fisher, J. D., & Harman, J. (2003). The information-motivation-behavioral skills model: A general social psychological approach to understanding and promoting health behavior. In J. Suls & K. A. Wallston (Eds.), *Social psychological foundations of health and illness* (pp. 82-106). Malden, MA: Blackwell Publishing.

Flegal, K. M., Croll, M., D., Ogden, C. L., & Johnson, C. L. (2002). Prevalence and trends in obesity among US adults, 1999-2000. *Journal of the American Medical Association, 288*, 1723-1727.

Fullwood, R., Guyton-Krishnan, J., Wallace, M., & Sommer, E. (2006). Role of community programs in controlling blood pressure. *Current Hypertension Reports, 8*, 512-520.

Gerin, W., Tobian, J. N., Schwartzer, J. E., Chaplin, W., Rieckmann, N., Davidson, K. W., …Ogedegbe, G. (2007). The medication adherence and blood pressure control (ABC) trial: A multi-site randomized controlled trial in a hypertensive, multi-cultural, economically disadvantaged population. *Contemporary Clinical Trials, 28*, 459-471.

Giampietro, P. F. (2003). Can genomic medicine be applied to the management of essential hypertension? *Clinical Medicine & Research, 1*, 271-272.

Greene, G. W., Rossi, S. R., Rossi, J. S., Velicer, W. F., Fava, J. L., & Prochaska, J. O. (1999). Dietary applications of the stages of change. *Journal of the American Dietetic Association, 99*, 673-678.

Heaven, P.C., Mulligan, K., Merrilees, R., Woods, T., & Fairooz, Y. (2001). Neuroticism and conscientiousness as predictors of emotional, external, and restrained eating behaviors. *International Journal of Eating Disorders, 30*, 161-166.

Hogan, B.E., Linden, W., & Najarian, B. (2002). Social support interventions: Do they work. *Clinical Psychology Review, 22*, 381-440.

Hwang, S.W., Krist, M.J., Chiu, S., Tolomiczenko, G., Kiss, A., Cowan, L., & Levinson,

W. (2009). Multidimensional social support and the health of homeless individuals. *Journal of Urban Health: Bulletin of the New York Academy of Medicine, 86,* doi:10.1007/s11524-009-9388-x

Jerusalem, M., & Schwarzer, R. (1992). Self-efficacy as a resource factor in stress appraisal processes. In R. Schwarzer (Ed.), *Self-efficacy: Thought control of action* (pp. 195-213). Washington, DC: Hemisphere.

Kao, A. (2003). Treating hypertension. *Clinical Pearl: American Medical Association., 5(6).* Retrieved from http://www.ama-assn.org/ama/pub/category/10582.html

Katzman, R., Brown, T., Fuld, P., Peck, A., Schechter, R., & Schimmel, H. (1983). Validation of a short orientation-memory-concentration test of cognitive impairment. *American Journal of Psychiatry, 140,* 734-739.

Krause, N. (1999). Assessing change in social support during late life. *Research on Aging., 21,*539.

Krautkramer, C. J. (2006). Policy Forum: What good is hypertension screening if you don't do anything about it? *American Medical Association Virtual Mentor* Retrieved from http://www.ama-assn.org/ama/pub/category/15806.html

Kristal, A. R., Glantz, K., Curry, S.J., & Patterson, R. E. (1999). How can stages of change be best used in dietary interventions? *Journal of the American Dietetic Association. 99,* 679-684.

Lachman, M. E. (1986). Locus of control in aging research a case for multidimensional and domain –specific assessment. *Psychology and Aging, 1,* 34-40.

Lachman, M. E., & Weaver, S. L. (1998). Sociodemographic variations in the sense of

control by domain findings from the MacArthur studies of midlife. *Psychology of Aging, 13,* 553-562.

Lasser, V. I., Raczynski, J. M., Stevens, V. J., Mattfeldt-Beman, M. K., Kumanyika, S., Evans, M., et al.. (1995). Trials of hypertension prevention phase II: Structure and content of the weight loss and dietary sodium reduction interventions. *Annual Epidemiology, 5,* 156-164.

Lewington, S., Clark, R., Qizilbash, N., Peto, R., & Collins, R. (2002). Age-specific relevance of unusual blood pressure to vascular mortality: A meta-analysis of individual data for one million adults in 61 prospective studies. *Lancet, 360,* 1903-1913.

Lewis, L. M. & Riegel, B. J. (2010). Determinants of perceived health in older adults with hypertension. *Heart & Lung, 39,* 41-49.

Lierman, L. M., Kasprzyk, D., and Benoliel, J. Q. (1991). Understanding adherence to breast self-examination in older women. *Western Journal of Nursing Research, 13*, 46-61.

Lockenhoff, C. E. & Carstensen, L. L. (2004). Socioemotional selectivity theory, aging, and health: The increasingly delicate balance between regulating emotions and making tough choices. *Journal of Personality, 72,* 1395-1424.

MacMahon, S., & Rogers, A. (1993). The effects of blood pressure reduction in older patients: An overview of five randomized controlled trials in elderly hypertensives. *Clinical and Experimental Hypertension, 15*, 967-968.

Mazzucchi, A., Mutti, A., Poletti, A., Ravanetti, C., Novarini, A., & Parma, M. (1986).

Neuropsychological deficits in arterial hypertension. *Acta Neurologica Scandinavica, 73,* 619-627.

McCrae, R. R., & Costa, P.T. (1990). *Personality in adulthood*. New York: Guliford.

McDowell, T.L., & Serovich, J. M. (2007). The effect of perceived and actual social support on the mental health of HIV-positive persons. *AIDS Care, 19,* 1223-1229.

Miller, E. R., Erlinger, T. P., Young, D.R., Jehn, M., Charleston, J., Rhodes, D.,…Appel, L. J. (2002). Results of the diet, exercise, and weight loss intervention trial (DEW-IT). *Hypertension, 40,* 612-618.

Miscovich, S.J., Martinez, T., Fisher, J. D., Bryan, A., & Catapano, N. (2003). Predicting breast self-examination: A test of the information-motivation-behaviorla skills model. *Journal of Applied Social Psychology, 33,* 775-790.

Murray, D. M. (2000). Exploring motorcycle safety gear use: A transtheoretical approach. Unpublished master's thesis, Department of Psychology, University of Connecticut, Storrs, CT.

National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention, Vital statistics of the U.S. 2001. U. S. Department of Health and Human Services, Rockville, MD. Retrieved from http://www.cdc.gov/nchs/nvss.htm

Ong, K. L., Cheung, B. M., Man, Y. B., Lau, C. P., & Lam, K. S. (2007). Prevalence, awareness, treatment and control of hypertension among United States adults 1999-2004. *Hypertension, 49,* 69-75.

Ostrove, J. M., Adler, N. E., Kuppermann, M., & Washington, A.E. (2000). Objective and subjective assessments of socioeconomic status and their relationship to self-

rated health in an ethnically diverse sample of pregnant women. *Health Psychology, 19,* 613-618.

Pate, R.R., Pratt, M., Blair, S. N., Haskell, W.L., Macera, C.A., Bouchard, C., …Wilmore, J. (1995). Physical activity and public health: A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *Journal of the American Medical Association, 273,* 402-407.

Penninx, B. W.J. H., vanTilburg, T., Kriegsman, D. M. W., Deeg, D. J. H., Boeke, A.J.P., & van Eijk, J. T.M. (1997). Effects of social support and personal coping resources on mortality in older age: The Longitudinal Aging Study Amsterdam. *American Journal of Epidemiology, 146,* 510-519.

Prochaska, J.O., DiClemente, C.C., & Norcross, J.C. (1992). In search of how people change: Applications to addictive behaviors. *American Psychologist, 47,* 1102-1114.

Prochaska, J. O., & Norcross, J. C. (2001). Stages of change. *Psychotherapy: Theory Research, Practice, Training, 38,* 443-448.

Rhodes, R. E., & Smith, N. E. (2006). Personality correlated of physical activity: A review and meta-analysis. *British Journal of Sports Medicine, 40,* 958-965.

Riegel, B., Dickson, V. V., Hoke, L, McMahon, J. P., Reis, B. F., & Sayers, S. (2006). A motivational counseling approach to improving heart failure self-care: Mechanisms of effectiveness. *Journal of Cardiovascular Nursing, 21,* 232-242.

Robinson-Whelen, S., & Storandt, M. (1992). Factorial structure of two health belief measures among older adults. *Psychology and Aging, 7,* 209-213.

Ronda, G., Van Assema, P., & Brug, J. (2001). Stages of change, psychological factors and awareness of physical activity levels in The Netherlands. *Health Promotion International,16,* 305-314.

Rook, K. S. (1994). Assessing the health related dimensions of older adults' social relationships. *Annual Review of Gerontology and Geriatrics, 14*, 142-181.

Rosen, C.S. (2000). Is the sequencing of change processes by stage consistent across health problems? A meta-analysis. *Health Psychology, 19,* 593-604.

Rotter, J. B. (1992). Some comments on the "Cognates of personal control." *Applied & Preventative Psychology, 1*, 127-129.

Sacks, F. M., Svetkey, L. P., Vollmer, W. M., Appel, L. J., Bray, G. A., Harsha, D., …Pao-Hwa, L. (2001). Effects on blood pressure of reduced dietary sodium and the dietary approaches to stop hypertension (DASH) diet. *The New England Journal of Medicine, 344,* 3-10.

Schulz, U., & Schwarzer, R. (2003) Social support in coping with illness: The Berlin Social Support Scales (BSSS). *Diagnostica, 49,* 73-82.

Schwarzer, R., & Renner, B. (2000). Social-cognitive predictors of health behavior: Action self-efficacy and coping self-efficacy. *Health Psychology, 19,* 487-495.

Schwarzer, R. & Schulz, U. (2000). Berlin Social support scales. Retrieved from http://www.coping.de

Sheikh, J. I., & Yesavage, J.A. (1986). Geriatric Depression Scale (GDS): Recent evidence and development of a shorter version. In T.L. Brink (Ed.), *Clinical gerontology: A guide to assessment and intervention* (pp. 165-173). New York: The Haworth Press.

Soldz, S., & Vaillant, G. E. (1999). The big five personality traits and the life course: A 45-year longitudinal study. *Journal of Research in Personality, 33,* 208-232.

Strassburger, T. L., Hing-Chung, L., Daly, E. M., Szczepanik, J., Krasuski, J.S., Mentis, M. J., …Alexander, G. E. (1997). Interactive effects of age and hypertension on volumes of brain structures. *Stroke, 28*, 1410-1417.

Svarstad, B. L., Chewning, B.A., Sleath, B. L., & Claesson, C. (1999). The Brief Medication questionnaire: A tool for screening patient adherence and barriers to adherence. *Patient Education and Counseling. 37*, 113-124.

Thomson, C.A., Flatt, S. W., Rock, C.L., Ritenbaugh, C., Newman, V., & Pierce, J. P. (2002). Increased fruit, vegetable and fiber intake and lower fat intake reported among women previously treated for invasive breast cancer. *Journal of the American Dietetic Association, 102*, 801-808.

U.S. Department of Health and Human Services, National Heart, Lung, and Blood Institute (NHLBI). (2010). National High Blood Pressure Education Program. Retrieved from http://www.Nhlbi.nih.gov/about/nhbpep/index.htm.

Vasan, R. S., Larson, M. G., Leip, E. P., Kannel, W., & Levy, D. (2001). Assessment of frequency of progression to hypertension in nonhypertensive participants in the Farmington Heart Study: A cohort study. *Lancet, 358,* 1682-1686.

Wallston, K. A., Stein, M. J., & Smith, C. A. (1994). Form C of the MHLC scales: A condition-specific measure of locus of control. *Journal of Personality Assessment 63,* 534-553.

Wallston, K. A., Wallston, B.S., & DeVellis, R. (1978). Development of the multi-

dimensional health locus of control (MHLC) scales. *Health Education & Behavior, 6,* 160-170.

Washburn, R.A., Smith, K.W., Jette, A. M., & Janney, C. A. (1993). The physical activity scale for the elderly (PASE): Development and evaluation. *Journal of Clinical Epidemiology, 46,* 153-162.

Weinstein, N.D., Rothman, A.J., & Sutton, S.R. (1998). Stage theories of health behavior: Conceptual and methodological issues. *Health Psychology, 13*, 290-299.

Wetzels, G., Nelemans, P, van Wijk, B., Broers, N., Schouten, J., & Prins, M. (2006). Determinants of poor adherence in hypertensive patients: Development and validation of the "Maastrucht Utrecht Adherence in Hypertension (MUAH)-questionnaire." *Patient Education and Counseling, 64*, 151-158.

Wing, R. R., & Phelan, S. (2005). Long-term weight loss maintenance. *American Journal of Clinical Nutrition, 82,* 222S-225S.

Winkleby, M.A., Kraemer, H.C., Ahn, D.K., & Varady, A. N. (1998). Ethnic and socioeconomic differences in cardiovascular disease risk factors, findings for women from the third national health and nutrition examination survey, 1988-1994. *Journal of the American Medical Association. 280*, 356-362.

Yardley, L., Sharples, K., Beech, S., & Lewith, G. (2001). Developing a dynamic model of treatment perceptions. *Journal of Health Psychology*. *6,* 269-282.

Table 1

Sample Characteristics

Variable	*M*	*SD*	Range	Skew
Age at interview	65.48	5.64	24	-.67
Systolic blood pressure	131.82	15.98	67	-.16
Diastolic blood pressure	79.55	11.17	46	-.21
Mean arterial pressure	96.53	9.50	49	.18
Social Desirability	20.93	5.67	33	-.44
Depressive Symptoms	1.03	1.36	7	5.12

Note: The standard error of the skew is 0.197.

Table 2

Descriptive Statistics for Dependent and Independent Variables

Variable	*M*	*SD*	Range	Skew
	Dependent variables			
Physical Activity	157.14	70.90	322.29	.53
Diet	3.84	6.94	34	.09
Body Mass Index	31.09	5.13	24.20	.31
Total change	14.88	2.97	13	-.37
	Independent variables			
Age at diagnosis	56.12	7.70	56	-1.50
SES (education)	15.17	2.52	12	.30
SES (subjective)	0	1.71	9.82	-.19
Self-efficacy	33.35	3.70	16	.13
Health Locus of Control	27.60	5.75	23.0	-.513
Support (emotional)	14.41	1.82	13	-1.02
Support (instrumental)	14.52	1.67	7.83	.00
Neuroticism	42.02	8.77	40	-.26
Extraversion	54.11	8.88	41	-.57
Conscientiousness	51.16	9.79	44	-.39

Note: SES = socioeconomic status
The SES subjective variable was a standardized composite and therefore the mean is equal to 0.
The standard error of the skew is 0.197.

Table 3

Correlations of Independent Variables with Dependent Variables

Independent variables	Dependent variables			
	Physical Activity	Diet	BMI	Change
Age at diagnosis	-.05	.03	-.14	-.14
SES (education)	.11	.08	.00	.04
SES (subjective)	.07	.10	-.02	.01
Self-efficacy	.20*	.10	-.01	.14
Health Locus of Control	.04	-.11	.08	-.01
Social support (emotional)	.04	.30**	-.17*	.27**
Social support (instrumental)	-.06	.22**	-.13	.18*
Neuroticism	-.20*	-.12	.05	-.21*
Extroversion	.10	.16	-.03	.12
Conscientiousness	.23**	.24**	-.20*	.14

Note: SES = socioeconomic status

*$p < .05$.

**$p < .001$.

Table 4

Percentages and Confidence Intervals (95%) of Sample Reporting Different Life Style Changes

Change	Lower limit	*p*	Upper limit
Fat intake	.66	.74	.81
Sodium intake	.64	.71	.79
Weight	.34	.42	.51
Activity	.33	.41	.49

Table 5

Percentage of Sample in Each Stage of Change for Three Lifestyle Behaviors

Stage of change	Fatty foods	Sodium	Activity
Precontemplation	22	26	13
Contemplation	5	2	16
Preparation	7	3	17
Active	11	10	12
Maintenance	55	59	42

Table 6

Final Step from Three Backwards Stepwise Regression Analysis with Physical Activity, Diet, and Total Change as the Dependent Variables

Independent variables	B	SE_B	β	*t*	*p*
			Activity		
Support (instrumental)	-5.40	3.24	-.14	-1.67	.10
Neuroticism	-1.23	0.68	-.15	-1.81	.07
Conscientiousness	1.50	0.62	.21	2.43	.02
			Diet		
Support (emotional)	0.96	0.31	.25	3.06	.003
Conscientiousness	0.11	0.06	.15	1.57	.06
			Total change		
Support (emotional)	0.39	0.13	.24	2.98	.003
Neuroticism	-0.05	0.03	-.15	-1.83	.07

Table 7

Correlations Among the Dependent Variables

Variable	Diet	BMI	Change
Physical Activity	.20*	-.06	.11
Diet		-.22**	.42**
BMI			-.09
Change			

*$p < .05$.

**$p < .001$.

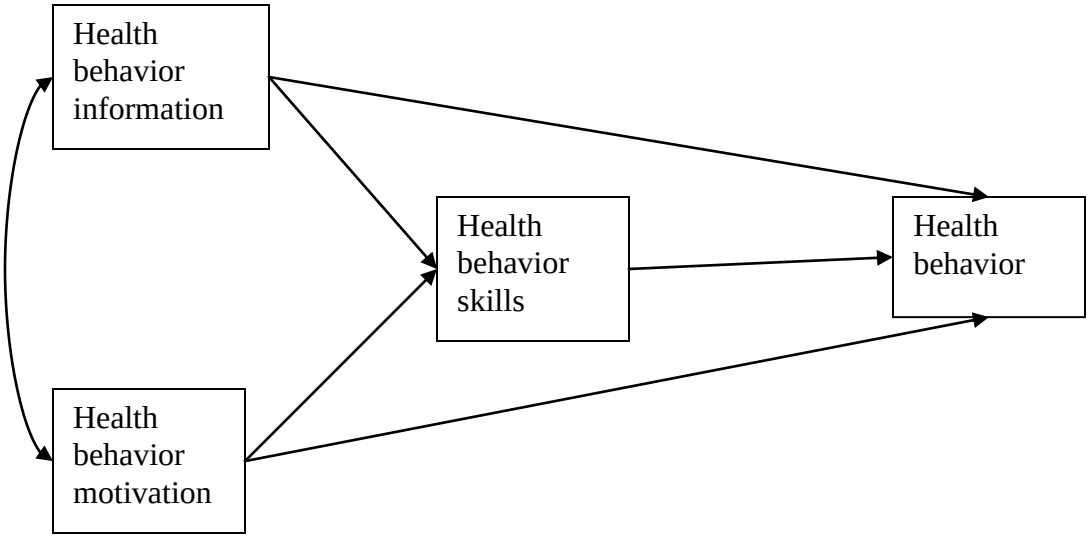

Figure 1: The Information-Motivation-Behavioral Skills Model of health behavior.

Fisher, J. & Fisher. (1992). Changing AIDS risk behavior. *Psychological Bulletin, 111*, 455-74.

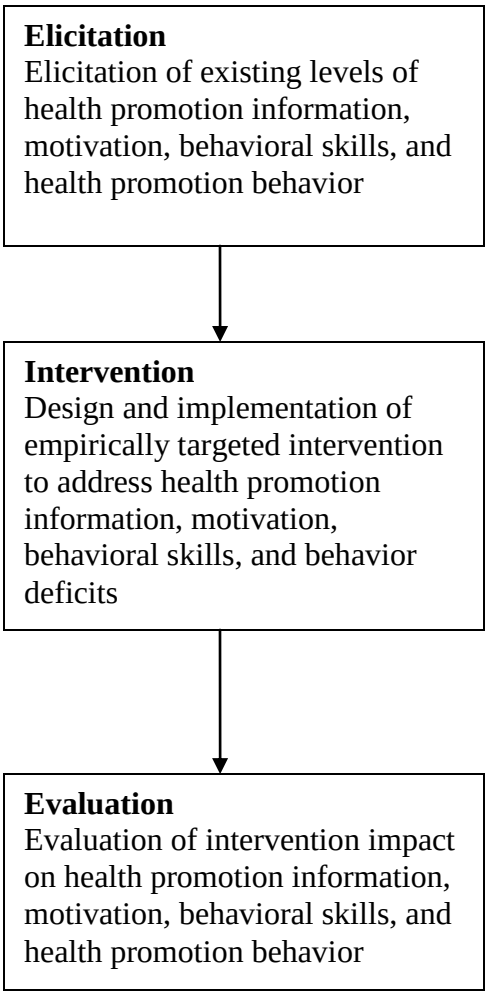

Figure 2: The Information-Motivation-Behavioral Skills Model approach to the promotion of health behavior. Fisher & Fisher, J. (1993). A general social psychological model for changing AIDS risk behavior. In J. Pryor & G. Reeder (Eds.), *The social psychology of HIV infection* (pp. 27-53).

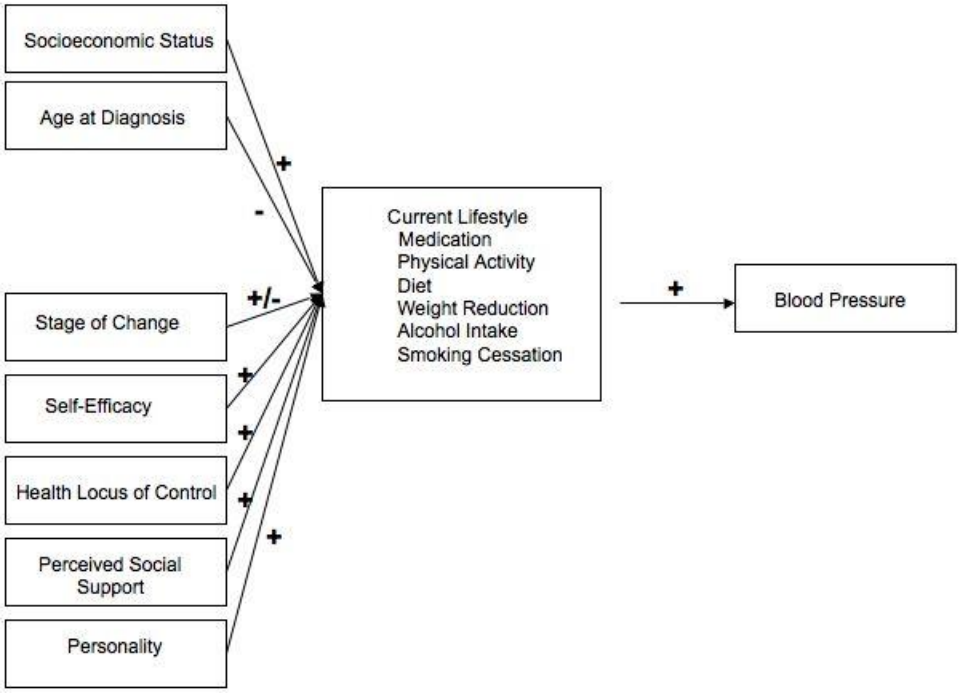

Figure 3: Hypothesized model of motivation to implement current lifestyle

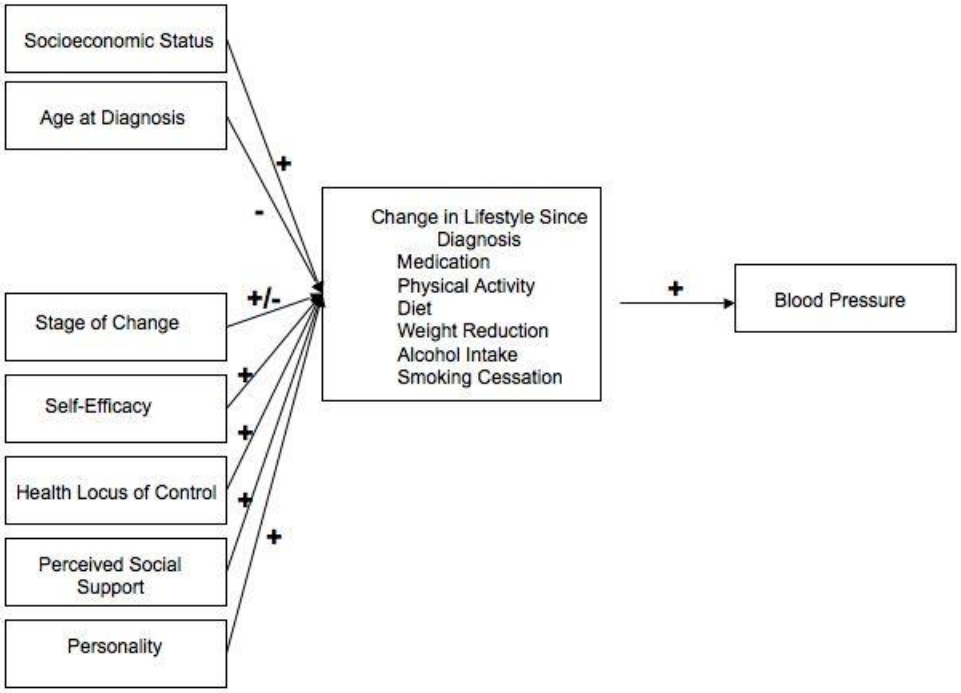

Figure 4: Hypothesized model of motivation to change lifestyle since diagnosis

Appendix 1
Brief Medication Questionnaire (Questions 1a through e)

Brief Medication Questionnaire Item 1a-e

Please list below all of the Blood Pressure medications you took in the PAST WEEK. For each of the medications you list, please answer each of the questions listed below.

In the Past Week:

a.) Medication Name and Strength	b.) How many days did you take it?	c.) How many times per day did you take it?	d) How many pills did you take each time?	e.) How many times did you miss taking a pill?

Appendix 2
Healthy Eating Questionnaire

Please indicate the approximate number of servings of each food item/category you consume on average per week.

Food Item	0 servings	1-3 servings	4-6 servings	7-9 servings	10+ servings
Whole milk products					
Reduced–fat milk products					
Cheese					
Reduced-fat cheese					
Red meat					
Pork					
Poultry					
Fish					
Whole eggs					
Vegetables					
Fruit					
Whole grains					
Sugar					
Salt					
Fried foods					
Grilled foods					
Pizza					
Hamburgers					
Other fast foods					
Candy					
Nuts					
Regular ice cream					
Cake/sweet desserts					
Vegetable oil					
Margarine/shortening					
Butter					

Appendix 3
Change Since Diagnosis Questionnaire

Please answer the following questions in reference to changes since your diagnosis of hypertension.

1. How does your current fatty food intake compare with your intake prior to diagnosis of hypertension?

Much less	Somewhat less	No change	Somewhat more	Much more
1	2	3	4	5

2. How does your current sodium intake compare with your intake prior to diagnosis of hypertension?

Much less	Somewhat less	No change	Somewhat more	Much more
1	2	3	4	5

3. How does your current amount of physical activity compare with your activity level prior to diagnosis of hypertension?

Much less	Somewhat less	No change	Somewhat more	Much more
1	2	3	4	5

4. How does your current weight compare with your weight prior to diagnosis of hypertension?

Much less	Somewhat less	No change	Somewhat more	Much more
1	2	3	4	5

5. How does your current alcohol intake compare with your intake prior to diagnosis of hypertension?

Much less	Somewhat less	No change	Somewhat more	Much more
1	2	3	4	5

6. How does your current smoking habit compare with your smoking habit prior to diagnosis of hypertension?

Much less	Somewhat less	No change	Somewhat more	Much more
1	2	3	4	5