Characteristics Predictive of Lifestyle Change
Among Older Adults with Hypertension

A Dissertation Presented
by
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To
The School of Nursing in the
Bouvé College of Health Sciences
In partial fulfillment of the requirements for the degree of
Doctor of Philosophy in Nursing

Northeastern University
Boston, Massachusetts

May 2012
ABSTRACT

Hypertension (HTN) affects 67% of adults age 60 and older, a disproportionate percentage when compared with other age-specific groups. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-7) cites the primary objective in the evaluation of individuals with HTN is to assess adherence to therapeutic lifestyle change (TLC). However, even with the well-known association between the performance of TLCs and lowered blood pressure levels, inadequate or inconsistent attention is given to lifestyle changes. The purpose of this cross-sectional correlational predictive study was to develop a prediction model of demographic and sociobehavioral characteristics that are common among older adults with HTN who engage in TLC. The outcome variables for the study were the TLCs defined by the JNC-7: adhering to a low-sodium diet, adhering to the DASH diet plan, maintaining a normal BMI, engaging in regular exercise, and consuming alcohol in moderation. The Interaction Model of Client Health Behavior was the theoretical framework that guided the selection of the 15 explanatory variables. Data was collected from 156 older adults who were members of faith-based and senior citizen organizations throughout Boston. Regression analyses found that select demographic and sociobehavioral characteristics were predictive of engagement in TLC. Age, gender, education level, marital status, self-rated health, stage of change for physical activity, reading food nutrition labels, and having diabetes, were significantly predictive of engagement in one or more TLCs. The explained variance for the models ranged from 13.3% to 15.2%. Further studies are needed to validate and extend the scope of the findings. A positive assessment of the study population that has implications for practice is that older adults are actively engaged in, and knowledgeable about, TLCs recommended to manage HTN.
ACKNOWLEDGEMENTS

I would like to sincerely thank my family for their support and patient understanding over the past 5 years as I completed this amazing journey. Special heartfelt gratitude goes to Dallas, my husband and soul mate for the past 33 years, who knows me better than anyone. Dallas was my strongest ally readily taking on additional responsibilities to give me time to devote to this endeavor. He tirelessly encouraged me to achieve my personal goal.

I would also like to thank my oldest daughter, Dr. Alicia Douglas, who, having already travelled this road, understood when I needed encouragement and wise counsel. My other children Stacia, Brandon, and Brecia each had special ways of showing their support: Stacia for being my sounding board and providing me with 3 adorable grandsons who helped keep everything in perspective, Brandon for being sensitive and bringing me my favorite coffee just when I needed it, and Brecia for sharing my work patterns and sitting side-by-side with me as we worked late into many nights. My mother deserves my gratitude for faithfully upholding me in prayer and for her frequent stops at my home to help out in myriad ways so I could stay focused. My family is the center of my world and I would not have been successful without their love and understanding. They are wonderful and deserve to share in the credit.

Dr. Elizabeth Howard, the Chair of my Dissertation Committee, became my mentor as she generously gave of her time and patiently guided the shaping of my study. I will always be grateful. Dr. Lea Ann Matura and Dr. Alice Gervasini, also on my dissertation committee, inspired me to think in different ways. I am thankful for these accomplished women and their capable guidance. I wish to express my gratitude to my friends and colleagues at the Northeastern University School of Nursing who encouraged me in so many ways and were always willing to offer the benefit of their wisdom.
I did not conduct this study alone. I had the help of two wonderful people. Kara Fellows is an incredibly bright and capable senior nursing student who traveled with me throughout Boston to collect data. She should consider a future in research! I also want to thank my dear friend, Lois Edilson, who happens to be a professional editor willing to share her knowledge and expertise. I am indebted to her for the countless hours she spent making sure my dissertation was well written, and I cherish our many enjoyable conversations about the study.

Last, but certainly not least, I would like to thank Dr. Ihab Hajjar for providing the idea for the study and for helping to formulate the initial plans for the study.
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Chapter 1: Background and Significance

Introduction

Hypertension is ranked as the most common primary diagnosis for which adults seek medical attention in the United States (Cherry, Hing, Woodwell, & Rechtsteiner, 2008). The condition affects 1 in 3 adults age 20 and older with the prevalence rate rising across all age-specific categories particularly adults age 60 and older (D. Lloyd-Jones, et al., 2010; Ostchega, Yoon, Hughes, & Louis, 2008). Data from the 2005-2006 National Health and Nutrition Examination Survey (NHANES) show that 67% of adults age 60 and older have high blood pressure compared to 30% for those age 40 to 59 (Ostchega, Yoon, et al., 2008). The prevalence of hypertension (HTN) among older adults in the United States will likely continue to increase given the expanding aging population where 20% of the population is expected to be age 60 or older by 2030 (W. He, Sengupta, Velkoff, & DeBarros, 2005). Findings from the Framingham Heart Study have demonstrated those who are normotensive at age 55 or 65 have a 90% lifetime risk of developing hypertension by age 80 or 85, respectively (Vasan, et al., 2002).

While the burden of HTN among older adults is increasing, the ability to control HTN has remained well below the Healthy People 2020 goal of 50%; a goal that has been carried over from Healthy People 2010 (USDHHS, 2000, 2011b). Based on analyses of 2005-2006 NHANES data, the control rate for all adults, defined as achieving a blood pressure level of 140/90 mmHg or less, is 43% (BMC, 2011). While those age 60 and older are more likely to receive medication for the treatment of HTN, they are less likely to achieve control: 72% of those age 18 to 59 achieve control compared to 58% for those age 60 and older (Chobanian, 2003; Ostchega, Yoon, et al., 2008). The challenge of improving HTN control is particularly significant given the relationship uncontrolled HTN has to cardiovascular disease (CVD), heart
failure, stroke, kidney disease, and retinal diseases, and that advancing age itself is the most powerful explanatory predictor of CVD (Hajjar & Kotchen, 2003; Mokdad, et al., 2004). In fact, although death rates from CVD are declining, 2003-2004 NHANES data found three fourths of adults with CVD have HTN as a co-morbidity (Wong, et al., 2007).

The combined significance of the aging population in the United States, the number of older adults affected by HTN, and the adverse effects that uncontrolled blood pressure has on cardiovascular morbidity and mortality demonstrate the mounting pressure on the health care system to manage resources and costs. Efforts therefore to control HTN, as a modifiable risk factor that can interrupt the link to cardiovascular disease, is a leading public health concern (Sidani & Ziegler, 2008). Even with the well established long-term benefits of controlling HTN, evidence suggests that care individuals with HTN receive during health care encounters is less than optimal (Fahey, Schroeder, Ebrahim, & Glynn, 2009).

**Broad Area of Concern**

HTN control receives significant attention with the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-7) clearly setting standard of care guidelines (Chobanian, 2003). Blood pressure controlled to target ranges involves a comprehensive approach that includes both the use of pharmacotherapy and therapeutic lifestyle changes (TLC). TLCs are a primary prevention treatment for those with prehypertension and an adjuvant treatment for people with Stage I and Stage II HTN as presented in Table 1 (Chobanian, 2003).
Table 1

**Blood Pressure Classification**

<table>
<thead>
<tr>
<th>Blood Pressure classification</th>
<th>SBP* mmHG</th>
<th>DBP* mmHG</th>
<th>TLCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt;120</td>
<td>&lt;80</td>
<td>Encourage</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>120-139</td>
<td>80-89</td>
<td>Yes</td>
</tr>
<tr>
<td>Stage 1 HTN</td>
<td>140-159</td>
<td>90-99</td>
<td>Yes</td>
</tr>
<tr>
<td>Stage 2 HTN</td>
<td>≥160</td>
<td>≥100</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*SBP, systolic blood pressure; DBP Diastolic blood pressure

TLCs can lower blood pressure (Bavikati, et al., 2008; Miller, et al., 2002) and, in a study that reviewed data from 1980-2000, lifestyle changes were found to account for 44% of the decline in deaths from heart disease (Ford, et al., 2007). The most frequent recommended TLCs that have been shown to lower blood pressure are weight loss in overweight or obese people, adhering to the Dietary Approaches to Stop Hypertension (DASH) diet plan—a diet high in fruits, vegetables, grains, and low-fat dairy products, and low in saturated fat, total fat, and cholesterol—adhering to a diet low in sodium, regular exercise, and moderate alcohol intake (Chobanian, 2003).

A primary objective in the evaluation of individuals with HTN is to assess adherence to TLC to help guide treatment decisions (Chobanian, 2003; Muchiteni & Borden, 2009). However, even with the known association between the performance of TLC and lowered blood pressure levels, studies indicate that inadequate or inconsistent attention is given to lifestyle changes during health care encounters (Cobb, Brown, & Davis, 2006; Elhani, Cleophas, & Atiqi, 2009). Evaluation of the performance of TLC and the subsequent provision of advice or education to
promote the consistent adoption of TLC to manage HTN is not a routine part of HTN management. Practical considerations point to barriers that make treating lifestyle risk more difficult when compared to treatment with pharmacootherapy.

Barriers at the patient, practitioner, and organizational level are implicated in the inability to achieve lower blood pressure levels. There are many identified practitioner and organizational barriers including time constraints, reimbursement concerns, and inadequate system infrastructure. (Castaldo, et al., 2005; Gordon, et al., 2001; Holland, et al., 2008; Ockene & Ockene, 1996). These barriers cumulatively offer some explanation for why lifestyle change management is given low priority during health care encounters.

A barrier at the patient level perceived to influence the achievement of blood pressure goals is the unwillingness of people to engage in TLC (Holland, et al., 2008). A nationally representative sample of women in a 2006 study found awareness of personal risk for CVD to be positively associated with the performance of TLC (Mosca, et al., 2006). Likewise, findings from the Behavioral Risk Factor Surveillance Survey (BRFSS), the largest surveillance system among the elderly that primarily monitors personal behaviors, found that across ten years—from 1990 to 2000—older adults tend to engage in more health-related behaviors, such as exercising and consuming more fruits and vegetables, than previously thought (Mokdad, et al., 2004).

The collective barriers point to a potential disconnect between the well-established benefits the performance of TLC has to the management of HTN, and the attention TLC, as an important component of treatment and intervention, receives during health care encounters. It is recognized that developing strategies to improve health behaviors of older adults is a high priority both as a primary prevention strategy and as a secondary treatment strategy.
Groundwork for the Research Question

While it is encouraging that adults with HTN seek medical attention, findings from a comprehensive literature review indicates that an optimal way to organize and deliver care has yet to be identified (Fahey, et al., 2009). The lack of an optimal way to deliver care to patients with HTN is evident in the inconsistency that exists between the knowledge practitioners have regarding guideline recommendations and ways to mitigate risks of uncontrolled HTN, and what occurs during the patient-practitioner encounters. The planned study proposes to develop a prediction model of demographic and sociobehavioral characteristics of those likely to engage in TLC. The proposed prediction model can serve as one way to organize care delivery. Literature evinces supporting evidence of why a prediction model may be of practical use in the practice setting.

Risk scores to quantify risk for developing a particular condition are frequently used to guide clinical decision making and allocation of resources (Cui, 2009). A prediction model of individual demographic and sociobehavioral characteristics that identifies those likely to engage in TLC is comparable to a risk score. This score may be of similar value in identifying those at risk and may be used to guide the patient-practitioner encounters and intervention measures.

Similar to the use of risk scores to guide interventions, evidence suggests that prompting can be a positive cue to produce desired action. The results of a meta-analysis assessing the impact of using prompts to signal the need for intervention found a significant increase in the performance of preventive care and health education when prompts were used (Balas, et al., 2000). Prompts serve as reminders of what needs to be done and facilitates the needed interaction (Ockene & Ockene, 1996). Likewise, prediction scores can serve as prompts to indicate the need
for advice, education, or encouragement to promote the performance or the continued performance of TLC.

It is recognized that patient-centered care fosters enhanced communication that can lead to improved patient outcomes (Barrier, Li, & Jensen, 2003). Studies have found that shared decision making and proactive communication about abnormal blood pressure readings have direct explanatory effects on blood pressure control (Naik, Kallen, Walder, & Street, 2008). Large studies including the PREMIER trial, the Trial of Non-pharmacologic Intervention in the Elderly (TONE) study, and analysis of data from the population-based 2005 BRFSS found that individuals who receive health care advice are more likely than those who have not received advice about TLC to take some action toward a lifestyle change (L.J. Appel, et al., 2003; Elliot, 2001; Elmer, et al., 2006; Viera, Kshirsagar, & Hinderliter, 2008). Studies have additionally found that practitioners are the most trusted source of health information for older adults, and older adults prefer to receive advice about TLC from their health care practitioner (Kaboli, et al., 2007; Ockene & Ockene, 1996; Schutzer & Graves, 2004). With the availability of health information in print and on the Internet, older adults are known to seek information and are more aware of what they need to do to stay healthy, yet they still prefer to get information and advice from their practitioner (Taha, Sharit, & Czaja, 2009; Ybarra & Suman, 2008). The patient-practitioner encounter is also the place where people think more seriously about their health, and decisions surrounding their health, making it an optimal opportunity to have a positive impact on the performance of sustained engagement in TLC (Ockene & Ockene, 1996).

Although it is recognized that sustaining multiple lifestyle changes for the long term is difficult, it can be achieved by motivated individuals. Analysis of the effects of the PREMIER trial at 18 months found that individuals who received health care advice were able to make
sustained behavior changes in several lifestyle domains simultaneously (Elmer, et al., 2006). This speaks to the importance of offering advice but also to the recognition of the effect trust and motivation have on the ability to sustain TLC. The authors of the JNC-7 guidelines are careful to point out the importance of patient motivation in the management of HTN, and the role of the practitioner in ensuring positive health care experiences that builds trust and culminates in patients motivated to adhere to a therapeutic regimen (Chobanian, 2003).

There are many studies that look at various aspects of HTN and TLC and the associations between performing a particular lifestyle behavior and select demographic characteristics. However; there is no study that specifically looks at the influence of demographic and sociobehavioral characteristics on engagement in TLC. In an analysis of the concept of adherence, many factors are recognized as antecedents to adhering to a recommended health regimen including the influence of demographic and sociobehavioral characteristics (S. M. Cohen, 2009). One study of the relationship between co-morbidity and lifestyle behaviors found that demographic factors explained more of the variance in lifestyle behaviors than did having HTN and other co-morbidities (Nothwehr & Perkins, 2002). These findings may speak more to the effect of having more than one health condition on behavior, however; it also speaks to the potential contribution of demographic factors as predictors of behavior.

**Problem Statement**

The prevalence of HTN is high among adults age 60 and older and is expected to continue increasing given the positive association HTN has to age and the fact that the United States has a rapidly aging population. The high prevalence rate is compounded by the relationship HTN has to the risk for cardiovascular morbidities and the significant challenge of achieving blood pressure control among adults age 60 and older. Despite health care practitioner
agreement that TLCs are a key component in the management of HTN, the reality of clinical visits deviates from the ideal when multiple perceived and actual barriers are encountered. A prediction model can help to prioritize and organize the patient-practitioner encounter to optimize care delivery to the older adult with HTN.

**Purpose of the Study**

The purpose of the study was to develop a prediction model of demographic and sociobehavioral characteristics that are common among older adults with hypertension who engage in TLC. The research questions and associated hypotheses the study aimed to answer were:

1. Are select demographic and sociobehavioral characteristics related to TLC among hypertensive adults age 60 and older?

   Hypothesis 1: There is a relationship between demographic and sociobehavioral characteristics and TLC among older hypertensive adults.

2. Is there a select set of demographic and sociobehavioral characteristics predictive of engagement in TLC among hypertensive adults age 60 and older?

   Hypothesis 2: There is a common set of characteristics that can predict the older hypertensive adult who is likely to engage in TLC.

If health care practitioners were able to identify patients with the most need for intervention focused on TLC, based on an index score generated from a model of demographic and sociobehavioral characteristics, they would be able to organize and prioritize care by targeting at-risk individuals and following up with appropriate interventions.
Operational Definitions

For the purpose of the study, operational definitions were provided for older adults, HTN, demographic and sociobehavioral characteristics, and TLC. Older adults were defined as individuals age 60 and older, which is consistent with the age-specific categories of many studies. It should be noted, however, that United States census reports define older adults as age 65 and older. Where there is a discrepancy, the text will clearly indicate the age range. HTN is defined as self-report of a diagnosis of HTN, or self-report of taking a prescribed antihypertensive or diuretic medication.

The prediction model will include select demographic and sociobehavioral characteristics that have a theoretical or empirical link to the performance of TLC to manage HTN. Demographic data was operationalized as age, gender, ethnicity, presence of co-morbid conditions, marital status, annual income, and education level. Sociobehavioral characteristics were defined as self-perceived qualitative indicators and practices likely to remain consistent over time. Self-perceived qualitative indicators included quality of life, social support, perceived stress, and stage of change for physical activity. Practices likely to remain consistent over time included home blood pressure monitoring (HBPM), cigarette use, reading food nutrition labels, and keeping medical appointments. Characteristics of individuals likely to engage in TLC were thought of as a set of characteristics of a person who was likely to adhere to a specific therapeutic regimen. Consequently, data collected for potential inclusion in the prediction model were based on findings from studies about adherence to a TLC intervention. Studies demonstrating characteristics associated with achieving blood pressure control using pharmacotherapy in the absence of an intervention relative to a lifestyle change were not used.
The outcome of the prediction model is engagement in TLC practices to manage HTN. TLC is recommended as a first line therapy for people with Stage 1 hypertension and no evidence of target organ damage, and is considered an indisputable part of the management of HTN at all stages (Chobanian, 2003). The definition of what is included under the umbrella of TLC can be variable; however, this study used the JNC-7 definition. Major TLCs found to lower blood pressure are maintaining a normal weight (J. He, Whelton, Appel, Charleston, & Klag, 2000; Unknown, 1997), engaging in regular exercise (Kelley & Kelley, 2000; S. P. Whelton, Chin, Xin, & He, 2002), adhering to the DASH diet plan—a diet high in fruits vegetables, grains, and low-fat dairy products, and low in saturated and total fat, and cholesterol (Sacks, et al., 2001)—adhering to a diet low in sodium (Chobanian & Hill, 2000; Sacks, et al., 2001; Vollmer, et al., 2001), and moderation in alcohol consumption (Xin, et al., 2001).

Assumptions

It could be assumed that characteristics of people who actively engage in performing TLCs as a consistent part of daily life are also likely to be characteristics of people who consistently adhere to a medication regimen. While it is intuitive that there may be similarities in the characteristics of those who engage in TLC and those who adhere to a medication regimen, making this assumption is a fallacy, since medication adherence is a complex phenomenon beyond the scope of this study.

There are two assumptions inherent in the theoretical model guiding this study, the Interaction Model of Client Health Behavior. The model assumes that people are capable of making informed, independent and competent choices about their health behaviors that are affected by their uniqueness including demographic and sociobehavioral characteristics. A further assumption is that people are able to control, within the limits of their internal and
external environments, the quality of their health and the actions taken to preserve that health (Cox, 1982). These assumptions are mirrored in this study as it assumed people internalize the responsibility for engaging in positive health behaviors to manage HTN and mitigate complications associated with uncontrolled HTN.

**Theoretical Framework**

The theoretical framework used to support and guide this study was the Interaction Model of Client Health Behavior (IMCHB) (Appendix A) (Cox, 1982). The IMCHB model was developed by incorporating many of the basic elements of previously developed health behavior models including the Health Belief Model (Rosenstock, 1966), the Suchman model (Suchman, 1967), the Andersen and Newman model (Andersen & Newman, 1973), and the Self-Regulation Model (Leventhal & Cameron, 1987). The IMCHB recognizes the importance of the collectively identified variables and constructs germane to health behavior offered by previous health behavior models but extends usefulness by including a practical component that recognizes the relevance of the unique individual physio-psycho-socio-environmental factors to positive health behaviors.

The three major elements of the IMCHB are elements of client singularity—that includes background variables, motivation, cognitive appraisal, and affective response—elements of client-professional interaction, and elements of health outcome. The model specifies a time ordering of variables such that background variables necessarily occur before and, as such, are considered contributing antecedents to subsequent variables in the model. The goal of the model—to identify explanatory relationships and provide high level predictive theory to facilitate patient care interventions—is consistent with this study that sought to identify a common variable list of demographic and sociobehavioral characteristics predictive of
individuals who engage in positive health behavior, namely TLC. The subsequent predictive score can be used for the purpose of directing and facilitating patient-practitioner interaction and health care intervention.

The IMCHB is an abstract model that has been empirically tested in other studies to guide the selection of variables that fit the problem or question under consideration and specify the relationships to be investigated between variables (Cox, 1986; Cox & Roghmann, 1984). In the study, the explanatory variables were guided by the variables found in the model’s elements of client singularity. In addition to demographic variables, the sociobehavioral characteristics fit within specific background variables in the element of client singularity: social influence was operationalized as having social support; previous health experience was operationalized as keeping medical appointments; environmental resources were operationalized as annual income; intrinsic motivation was operationalized as stage of change for physical activity; cognitive appraisal was operationalized as HBPM, reading nutrition labels, cigarette use, and perceived quality of life; and affective response was operationalized as perceived stress. Adherence to a recommended therapeutic regimen was the outcome variable operationalized as TLC that included maintaining a normal weight, engaging in regular exercise, adhering to the DASH diet plan, adhering to a diet low in sodium, and moderation in alcohol consumption.

The model was uniquely suited to guide the selection of the explanatory variables as engaging in TLC lies within the realm of an individual’s personal responsibility and control, which was defined by the variables within the elements of client singularity. The model further explicated the relationship that was studied, which was, if the elements of client singularity were associated with, and predictive of, engagement in positive TLC behaviors.
Concepts and Variables Definitions

The variables defined for the study were the components of TLC, the outcome variables. These definitions are consistent with those of JNC-7 guidelines and the National High Blood Pressure Education Program (Chobanian, 2003; NHBLI). Definitions for each TLC component are:

1. Maintenance of a normal body weight: A body mass index (BMI) of 18.6 – 24.9 kg/m$^2$ calculated from self-report height and weight.
2. Physical exercise: Self-report of engagement in regular physical activity such as brisk walking for 30 minutes for 5 or more days of the week.
3. Adherence to the DASH diet plan: Self-report of a daily diet high in fruits, vegetables, grains, and low-fat diary, and low in saturated fat, total fat, and cholesterol.
5. Moderation in alcohol consumption: Self-report of limiting consumption to no more than two drinks per day for men and 1 drink per day for women.

Significance and Rationale

In the United States we are faced with an increasingly aging population with a high prevalence rate of HTN that is expected to increase given the direct relationship of HTN to advancing age. Although blood pressure control rates are improving nationally, they remain significantly lower for older adults when compared to younger adults. The low control rates and the direct association uncontrolled HTN has to the development of CVD and other co-morbidities points to the need for further research to identify ways to deliver more efficient and organized care. The aim of the study is to develop a prediction model to identify older adults likely
to engage in TLC may offer one way to better organize care for the older adult with HTN. While there are numerous prediction models that identify individuals at risk for the development of HTN and its associated complications, there is no prediction model that identifies those who engage in TLC.

**Importance**

This study has importance at the practice level. Health care practitioners recognize the need for the performance of TLC as a health promotion measure to manage HTN, however; studies have identified barriers to providing this type of care. The use of a prediction model to identify those who are likely to engage in TLC can serve a practical purpose at the patient-practitioner interaction level. At a basic level, a prediction score, as a reliable indicator of those likely to engage in TLC, has the ability to help practitioners prioritize care thereby facilitating the allocation of scarce resources by efficiently identifying those at risk who require targeted services. Use of the model can further serve as a reminder or prompt to practitioners to address TLC. Finally, the prediction score can help practitioners organize patient care by providing a starting point for the encounter that is patient specific. The prediction score can serve as an indicator that allows the patient-practitioner interaction to begin within a positive framework that validates TLC behavior and moves to concordant interaction where shared decision making about future efforts can occur. Communication at this level can translate into deeper motivation and more thorough adherence to a treatment regimen (S. M. Cohen, 2009).

**Projected Outcomes**

This study was projected to represent the initial study in a program of research where future studies replicate and substantiate the robustness of the prediction model. It is anticipated that the prediction model could be useful to practitioners and patients. The usefulness and ease of
use of the model may be appealing to practitioners to help organize and prioritize patient care. For patients, use of the tool may promote satisfaction in the patient-centered care they receive that translates into motivation to begin or to continue to engage in TLC. Motivating patients to begin or continue to engage in TLC ultimately will have a positive impact on HTN control rates among older adults.

Contributions to Future Knowledge

This study represents the first in a program of research that focuses on methods to organize care delivery to older adults with HTN to promote active and sustained engagement in TLC. Assessing adherence to TLC during the course of patient-practitioner encounters supports JNC-7 guidelines for the evaluation and treatment of individuals with HTN (Chobanian, 2003). The model can further contribute to future knowledge as it can be used as a recruitment tool to identify participants for inclusion in a research study where engagement in TLC is an important factor, or to identify those likely to adhere to a treatment protocol and therefore mitigate attrition. Findings from future studies of older adults with HTN will expand the current knowledge base about how to better care for older adults with HTN to improve HTN management and minimize the development of complications.
Chapter 2: Literature Review

Introduction

The current study recognizes the importance of TLC to the treatment of HTN. It is well documented and acknowledged that engagement in TLC can have a beneficial effect on reducing blood pressure levels. In this study it is hypothesized that there is a common set of demographic and sociobehavioral characteristics that are predictive of older hypertensive adults who are likely to engage in TLC. Empirical and theoretical support is provided for the inclusion of select demographic and sociobehavioral characteristics in the prediction model. Determining the data necessary to answer the research question was an important step in ensuring validity of the findings and the eventual model. In this chapter support will be provided for using TLC as the outcome variables and the select demographic and sociobehavioral characteristics as the explanatory variables.

A recognized indispensable part of the management of HTN is engagement in TLC (Chobanian, 2003). For the past 12 years, goals in Healthy People 2010, and now Healthy People 2020, have focused on HTN prevention, treatment and control with some success. Healthy People 2020 built on the achievements of, and the unmet goals of, Healthy People 2010 (Fielding & Kumanyika, 2009), retaining the following objective: Increase the proportion of adults with prehypertension and the proportion of adults with hypertension who meet the recommended guidelines for BMI, saturated fat consumption, sodium intake, physical activity, and moderate alcohol consumption (HHS, 2009). The objective supports the importance of TLC for HTN prevention and management across all stages.

The Institute of Medicine (IOM)—as a non-governmental organization that provides explanatory guidance and analysis to the government to improve the nation’s health—assists in
providing guidance to determine high priority areas for the reduction and treatment of HTN. The IOM report, released in February 2010, entitled, A Population-Based Policy and Systems Change Approach to Prevent and Control Hypertension, focuses HTN reduction strategies on population-based approaches and provides guidance to improve the quality of care provided to individuals (IOM, 2010). One of the priority recommendations of the IOM is to improve the consistency with which current treatment guidelines are used to provide quality of care to individuals with HTN (IOM, 2010).

Inadequate physician adherence to guidelines is a key factor contributing to the lack of awareness of having HTN, as well as the inability of individuals with HTN to achieve blood pressure control (Chiong, 2008). Studies have shown that practitioners are more reticent to treat elevated blood pressure in older adults than in younger adults even though they are more likely to benefit from interventions (Berlowitz, et al., 1998; Chiong, 2008; Hyman & Pavlik, 2001; Izzo, Levy, & Black, 2000; D. M. Lloyd-Jones, Evans, Larson, & Levy, 2002). In addition, among those being treated, there is inadequate advice and counseling about TLC (Cobb, et al., 2006; Elhani, et al., 2009; Schutzer & Graves, 2004). In fact, some studies indicate that discussions about TLC may be prompted by a high BMI rather than by having a diagnosis of HTN (Carlson, Maynard, Fulton, Hootman, & Yoon, 2009; Lopez, Cook, Horng, & Hicks, 2009). Current treatment guidelines per the JNC-7 recommend TLC as the primary treatment for prehypertension, and TLC in combination with pharmacotherapy for Stage 1 and Stage 2 HTN (Table 1).

**Therapeutic Lifestyle Changes (TLC)**

There is strong and consistent evidence linking unhealthy dietary practices, high sodium intake, high BMI, decreased physical activity, and high alcohol consumption to HTN (IOM,
TLC for the management of HTN recommended by the JNC-7 are weight reduction in overweight or obese individuals, engaging in regular physical activity, adhering to the DASH diet plan, adhering to a diet low in sodium, and moderation in alcohol consumption (Chobanian, 2003). Seminal and other studies provide overwhelming substantive data about the significant effects of TLC on blood pressure. Seminal studies, presented in Appendix B, include the Trials of HTN Prevention 1 and 2 (TOHP1 and TOHP 2), the Senior Hypertension and Physical Exercise (SHAPE) study, the TONE study, the DASH study, the Optimal Macronutrient Intake Trial to Prevent Heart Disease (Omnihart) trial, and the PREMIER trial (L. J. Appel, et al., 2003; Appel, et al., 2001; Appel, et al., 1997; Appel, et al., 2005; Stevens, et al., 2001; P. K. Whelton, et al., 1997). The seminal studies demonstrate that it is possible for adults, including older adults, to achieve the following:

- Lower blood pressure by adopting TLC
- Sustained lower blood pressure levels for long periods of time
- Sustained engagement in multiple TLC simultaneously

Although only the TONE and SHAPE trials were conducted exclusively with older adults, the range of mean ages for the other studies—43 to 54—coupled with standard deviation information makes the findings of these studies relevant to older adults.

**DASH Diet and Dietary Sodium Reduction**

Based on 2004 statistics, 87% of adults consume more sodium than recommended by the Dietary Guidelines for Americans (NCHS, 2008). The 2005 Guidelines and the American Heart Association (AHA) recommend that individuals consume less than 2,300 mg of sodium and individuals with hypertension, African American or blacks, and middle-aged and older adults consume no more than 1,500 mg of sodium per day (HHS, 2009). It is additionally
recommended that consuming greater amounts of fruits, vegetables, and unsaturated fats can significantly reduce blood pressure levels. Results of the DASH diet and the OmniHeart diets support these recommendations and demonstrate that greater blood pressure reductions are realized by those with a diagnosis of HTN (Appel, et al., 1997; Appel, et al., 2005).

The DASH study and the OmniHeart trials studied the effects of dietary practices on blood pressure (Appel, et al., 1997; Appel, et al., 2005). The DASH study randomized participants, who had a mean age of 44, to one of three diets: a fruit and vegetable diet; a combination diet high in fruits, vegetables, and dairy products with reduced saturated and total fat; and a control diet that was low in fruits, vegetables and dairy products with a fat content typical of the average American diet. Sodium intake and body weight were maintained at constant levels. All participants consumed a controlled diet for 3 weeks followed by prepared diets for 8 weeks. Significant reductions in blood pressure were demonstrated for all groups, although when compared to the control diet, the combination group as a whole had the greatest mean reductions in systolic blood pressure (SBP) and diastolic blood pressure (DBP) at -5.5 mmHG and -3.0 mmHg, respectively \( (p = 0.001 \text{ for each}) \). Those with Stage 1 hypertension realized even greater mean SBP and DBP reductions at -11.4 mmHG and -5.5 mmHG, respectively \( (p = 0.001 \text{ for each}) \).

The DASH trial led to further investigation of the effects of the DASH diet combined with reduced sodium intake. In the DASH-sodium trial, a randomized controlled trial with a crossover design that assessed the effects of specific sodium levels—3,000, 2,400, and 1,500 mg/d—on blood pressure (Sacks, et al., 2001). All groups showed significant reductions in blood pressure with the blood pressure response increasing with progressively lower levels of sodium. In a subgroup analysis of the DASH-sodium trial, non-hypertensive adults over the age of 45
realized the greatest reductions in SBP and DBP compared to those younger than age 45 [7.0 mmHG and 3.8 mmHG (p = 0.001), and 3.7 mmHG and 1.5 mmHG (p = 0.05), respectively] (Vollmer, et al., 2001).

The OmniHeart trial, with a mean age of 53.6 (SD = 10.9) compared the effects of combinations of macronutrients on blood pressure (Appel, et al., 2005). In the controlled trial the participants were randomized to a carbohydrate-rich diet similar to the DASH diet, an unsaturated fat diet that emphasized monosaturated fats, and a protein diet that emphasized plant sources of protein. Participants were provided all of their food for 6 weeks and each menu was designed with five caloric levels to allow for caloric adjustment to maintain a stable weight within 2% of their baseline. Participants were instructed to maintain the same pattern of exercise and alcohol consumption. Study results were similar to those found in the DASH-sodium study with all groups—carbohydrate, protein, and unsaturated fat—demonstrating reductions in blood pressure: SBP decreased by a mean of -8.2 mmHG, -9.5 mmHG, and -9.3 mmHG, and DBP decreased by a mean of -4.1 mmHG, -5.2 mmHG, and -4.8 mmHG, respectively. Similar to findings in other studies, even greater reductions were found among those with HTN in each of the three groups: SBP reductions of -12.9 mmHG, -16.1 mmHG, and -15.8 mmHG, and DBP reductions of -6.3 mmHG, -8.6 mmHG, and -8.2 mmHG, respectively.

Modest reductions in sodium intake to reduce blood pressure levels have been replicated by other studies. A study of middle aged adults with HTN who typically consumed three or more grams of sodium per day found that consuming a “no added salt” diet for 6 weeks, with no other dietary sodium reduction measures, significantly reduced SBP, DBP, and 24-hour urinary sodium excretion when compared to the control group (Kojuri & Rahimi, 2007). Further analysis
indicated the beneficial effects of reduced sodium intake on blood pressure persisted 4 years after the study ended (Kostis, Wilson, Shindler, Cosgrove, & Lacy, 2002).

Weight Reduction

Weight loss and associated reductions in blood pressure are well documented. In a meta-analysis of randomized controlled trials between 1996 and 2002, with a total of 4874 participants, the relationship between weight loss and blood pressure reduction was clearly demonstrated (Neter, Stam, Kok, Grobbee, & Geleijnse, 2003). The TOPH 1 study included weight loss along with multiple dietary measures and found weight loss and sodium reduction lowered blood pressure significantly at 6 and 18 months (P. K. Whelton, et al., 1997). Results encouraged the TOPH 2 study to assess the long term effects—3 years—of weight loss and sodium reduction, or their combination on blood pressure (Stevens, et al., 2001). Participants in the intervention groups who were 110% to 165% of their ideal body weight at baseline had significantly lower blood pressures at 6, 18, and 36 months (Stevens, et al., 2001). In fact, the study demonstrated that even modest sustained weight loss can significantly reduce blood pressure. Participants who lost at least 4.5 kg at 6 months, and were able to maintain the weight loss for the following 30 months, had the greatest reductions in blood pressure.

The TONE trial was the largest lifestyle intervention study conducted with older adults between the ages of 60 and 80 (P. K. Whelton, et al., 1998). With a mean age of 66.5 (SD = 4.6), this longitudinal multi-center controlled clinical trial specifically focused on sodium reduction alone, and in combination with weight loss. Participants progressed through a 4-month intensive phase with core knowledge and behavior skills, a 4-month extended phase that focused on problem solving and prevention of relapse, and a maintenance phase (Appel, et al., 1995). The study demonstrated that mean SBP and DBP values were significantly lower in all intervention
groups, particularly in the combined sodium reduction and weight loss group (mean change in SBP was -5.3 mmHg and DBP was -3.4 mmHg) (P. K. Whelton, et al., 1998). In addition to demonstrating that weight loss and sodium reduction were effective in lowering blood pressure among older adults, the study provided important information about the sustainability of TLC performance in older adults. At the 36-month follow up, blood pressure reductions persisted as long as engagement in reduced sodium intake and weight loss activities continued (P. K. Whelton, et al., 1998).

Regular Physical Activity

Similar to weight loss, physical activity has well documented positive effects on blood pressure. Two well-known randomized controlled studies—the Diet, Exercise, and Weight Loss Intervention Trial (DEW-IT) and the PREMIER trial—included physical activity as part of a comprehensive lifestyle intervention (L. J. Appel, et al., 2003; Miller, et al., 2002). These studies demonstrated that individuals were capable of engaging in multiple TLCs simultaneously. The DEW-IT trial demonstrated that a full range of TLCs can substantially lower blood pressure in hypertensive overweight adults (BMI > 25kg/m²) (Miller, et al., 2002). The intervention group was fed a low-calorie version of the DASH diet with reduced sodium and participated in 30-45 minutes of moderate intensity exercise three times per week for 9 weeks. The between group difference for 24-hour SBP and DBP was significant at -9.5 mmHg ($p = 0.0001$) and -5.3 mmHg ($p = 0.002$), respectively.

The PREMIER trial, a study of 810 adults with above-optimal blood pressure including Stage 1 hypertension, randomized participants to three groups: an established group that implemented established TLCs including weight loss, sodium reduction, increased physical activity, and limited alcohol intake; an established plus-DASH group; and an advice-only group
(L. J. Appel, et al., 2003). The study found that blood pressures declined progressively over time. At 6 months, the intervention groups had significant mean reductions in SBP and DBP with the greatest reductions realized in the established plus DASH diet group. In addition, the intervention groups had significant SBP between group differences when compared to the advice-only group: 3.7 mmHg ($p = .001$) in the established group and 4.3 mmHg ($p = .001$) in the established plus-DASH group. Results at 18 months continued to demonstrate reduced blood pressures from baseline in both intervention groups.

Although the mean age of the DEW-IT and PREMIER trials are 50 and 54, respectively, many studies with older adults have demonstrated similar blood pressure effects with physical activity. The SHAPE trial, a six-month randomized controlled trial with 104 older adults—mean age of 63.5—with untreated mild HTN, focused on reduction of blood pressure after engagement in a supervised program of aerobic and resistance training (Stewart, et al., 2005). The study found significant reductions in SBP and DBP in both the intervention group and the control group although only the DBP reached a significant between group difference: the intervention group had a mean DBP decrease of 3.7 mmHg and the control group had a mean DBP decrease of 1.5 mmHg ($p = 0.02$) (Stewart, et al., 2005).

Another study of 62 older adults with a mean age of 66.7 compared a 12-week moderate-intensity aerobic program with a light-intensity T’ai Chi program (Young, Appel, Jee, & Miller, 1999). The study participants had a SBP of 130-159 mmHg and a DBP <95 mmHg and did not take antihypertensive medication. The study found significant SBP reductions at 12 weeks: the mean change in the aerobic group was -8.4 mmHg ($p = .001$) and the mean change in the T’ai Chi group was -7.0 mmHg ($p = .001$). A significant mean change in DBP of -3.2 mmHg (P=0.002) was also found in the aerobic group. There were no significant between group
differences. Similarly, a prospective randomized study of sedentary older adults \((n = 115)\) age 55-75 with untreated pre or mild HTN who engaged in 6 months of supervised aerobic and strength training found that exercisers had a significant between group reduction in DBP: -3.7 mmHg for the exercise group and -1.5 mmHg for the control group \((p = .02)\) (Barone, Wang, Bacher, & Stewart, 2009). However, while reduction in SBP was not statistically significant, it was independently associated with decreased waist circumference and increased fitness, factors that influence SBP levels.

Community-based studies with exercise interventions have also demonstrated reductions in blood pressure. In a study of Chinese adults with a mean age of 66 \((SD = 8.3)\) who participated in a T’ai Chi intervention three times per week for 12 weeks (Taylor-Piliae, Haskell, & Sivarajan Froelicher, 2006), and a trial with 91 women with a mean age of 67.5 who participated in a 20-week low-intensity exercise program with relaxation classes found significant reductions in blood pressure \((p = .01 \text{ and } p = .009, \text{ respectively})\) (Kolbe-Alexander, Lambert, & Charlton, 2006). Another feasibility study with a small sample \((n = 22)\) of low-income African American individuals with a mean age of 76.4 \((SD = 7.6)\) was conducted in a senior housing site. A 12-week program of motivational, educational, and exercise sessions designed to improve adherence to healthy behaviors to prevent CVD found significant reductions in SBP and DBP \((p = .02 \text{ and } p = .01, \text{ respectively})\) (Resnick, 2009).

While studies consistently demonstrate reductions in blood pressure with increased physical activity, it is not uncommon to find a lack of significance in SBP, DBP, or both between intervention and control groups (Barone, et al., 2009; Kolbe-Alexander, et al., 2006; Stewart, et al., 2005; Young, et al., 1999). In the SHAPE trial, the SBP failed to reach significant between group differences \((5.3 \text{ mmHg and } 4.5 \text{ mmHg, respectively})\) (Stewart, et al., 2005). Likewise, in
the PREMER trial analysis, results at 18 months continued to demonstrate reduced blood pressures from baseline in the intervention groups, indicating that multiple lifestyle changes can be achieved and maintained over time; however, the differences were not statistically significant when compared with the advice-only group (Elmer, et al., 2006). Although the small sample size of 104 may be a mitigating factor in the Stewart et al. study (2005), the failure to find significant between group differences in these studies may generally reflect the positive effect health care advice related to healthy lifestyle behaviors can have on managing blood pressure.

Still other studies demonstrate that engagement in physical activity in the absence of an intervention tends to be associated with lower blood pressure levels. A longitudinal study examining CVD and its risk factors found a combination of occupational and leisure physical activity was associated with lower SBP, although the association did not reach significance (Howard., et al., 1996). These findings suggest that exercise intensity may not be as important as just being active. Given that estimates suggest that at least half of the burden of disease associated with HTN occurs in individuals with a mean SBP <145 mmHg (Lawes, et al., 2006), even small reductions in BP are encouraging.

Moderation in Alcohol Consumption

Moderation in alcohol consumption is the fifth TLC recommended by the JNC-7 to reduce blood pressure. This recommendation is well founded, as many observational epidemiologic studies have demonstrated that alcohol consumption is positively and independently associated with higher blood pressure (J. He & Bazzano, 2000; Howard, Carson, Holmes, & Kaufman, 2009). In fact, a meta-analysis of 15 randomized controlled trials conducted before June 1999, with a total of 2,234 participants, found that alcohol reduction significantly decreased mean SBP and DBP (-3.31 mmHg and -2.04 mmHg, respectively) (Xin,
The analysis further found that a dose-response relationship existed between decreased alcohol consumption and reduced blood pressure levels. However, there is some evidence that alcohol use is not as prevalent in older adults as in younger adults. Although alcohol use may be underreported, 94% of older adults reported that they consume no alcohol or only moderate amounts of alcohol (Dufour, 2001; Pronk, et al., 2004).

**Engagement in Multiple TLC**

It is intuitive that many TLC practices occur simultaneously in individuals; therefore, study findings that corroborate this thought are encouraging (Pronk, et al., 2004; Resnick, 2009). The PREMIER trial found that more goals were achieved by participants given the most goals (Young, et al., 1999). At 6 months, 44.6% of participants in the established plus-DASH intervention had met three intervention goals, while 19.3% in the established intervention had met two goals. In another long-term study, the Treatment of Mild Hypertension study (TOMHS), success with multiple simultaneously performed TLCs—weight reduction, sodium and alcohol intake reduction, and increased physical activity—were achieved by 74%, 70%, and 59% of participants at the 2-, 3-, and 4-year follow-up, respectively (Elmer, et al., 1995). It has been further found that adherence to diet recommendations and adherence to exercise recommendations are significantly predictive of each other (Uzun, et al., 2009).

It is well documented that concurrent engagement in more than one lifestyle change has a subadditive effect on blood pressure, such that a lesser effect is achieved with multiple TLCs than would be predicted based on the effect of one lifestyle change alone (L. J. Appel, et al., 2003; Appel, et al., 1997; P. K. Whelton, et al., 1998). For instance, the Trial of Hypertension Prevention found that the effect of sodium reduction and weight loss on blood pressure, although significant, was less than expected given the anticipated effect of each lifestyle change alone (P.
Despite this, TLC known to have a positive effect on blood pressure should be recommended as some additive effect is likely (Elmer, et al., 2006).

**Demographic and Sociobehavioral Characteristics**

There is theoretical and empirical evidence that demographic and sociobehavioral characteristics are associated with the performance of TLC. While not always consistent, studies have demonstrated associations between demographic and sociobehavioral characteristics and the performance of single or multiple TLCs among older adults. A secondary analysis of combined data from five population-based studies determined that lifestyle changes were not consistently related to demographic characteristics, however, other studies have found that demographic factors explained more of the variance in lifestyle behavior than did level of morbidity, and more of the variance in perceived health than did social support or lifestyle factors (Blissmer, et al., 2010; Lewis & Riegel, 2010; Nothwehr & Perkins, 2002).

The explanatory variables proposed for inclusion in the present study are categorized as demographic characteristics and sociobehavioral characteristics. Demographic characteristics include age, gender, ethnicity, co-morbid conditions, marital status, education level, and annual income. Sociobehavioral characteristics are categorized as self-perceived qualitative indicators and characteristics likely to remain consistent over time. Self-perceived qualitative indicators include quality of life, social support, perceived stress, and stage of change. Characteristics likely to remain consistent over time include HBPM, cigarette smoking, reading food nutrition labels, and keeping medical appointments. Literature was reviewed to identify studies of adherence behavior specifically related to TLCs. Common characteristics associated with adherence behavior are described below and are presented in Appendix C.
Demographic Characteristics

Common demographic characteristics were found among participants of studies requiring adherence to a dietary regimen. A 12-week community educational program, focused on increasing physical activity and improving nutrition, was conducted with 759 adults age 60 and over recruited from 8 Older American Act Nutrition Program sites across the nation (Kirk-Sanchez, Wellman, & Kamp, 2005). The study found that non-smokers (75% non-smokers versus 45% smokers, \( p = .001 \)), 9 or more years of education (75% versus 61%, \( p = .017 \)), household income below the poverty level (79% versus 63%, \( p = .005 \)), and fewer co-morbid conditions (mean number of co-morbidities = 1.97 versus 2.34, \( p = .02 \)) were associated with dietary adherence. Wanke et al., (2007) investigated factors associated with successful long-term—4 years—adherence to multiple aspects of dietary modification among 833 adults age 36-85 and found adherence was associated with more education, being married, never having smoked, and a history of stable weight. The study further found that older adults age 69-85 were less likely to be adherent than younger adults. A meta-analysis of random controlled trials with dietary interventions, however, found the opposite: older men were significant more likely to achieve long-term adherence to dietary measures than younger men (Martin, Bowen, Dunbar-Jacob, & Perri, 2000). The analysis further found that being white, not smoking, more education, lower body weight, and having fewer perceived stressful life events were significant predictors of long term adherence to healthy diets.

A descriptive survey study conducted with a sample of 592 hypertensive adults age 65 and older found factors associated with a higher intake of fruits and vegetables, and a higher intake of dairy products were being female (\( p = .001 \) and \( p = .015 \), respectively), spending time with others (\( p = .033 \) and \( p = .001 \), respectively), and using multivitamins and minerals (\( p = \)}, \ldots)
.001 and \( p = .008 \), respectively) (Lancaster, 2004). The study additionally found that age \( (p = .049) \) was associated with a higher intake of fruits and vegetables, while being white \( (p = .001) \) was associated with higher dairy food intake. In another descriptive study of 150 adults with a mean age of 56 \( (SD = 12) \), adherence behavior was assessed for diet, exercise, HBPM, and smoking (Uzun, et al., 2009). Significant predictors of dietary adherence were higher income \( (OR 5.27; p = .001) \) and regular exercise \( (OR 9.9; p = .001) \), while significant predictors of exercise adherence were dietary adherence \( (OR 9.9; p = .001) \) and more education \( (OR 6.5; p = .001) \). Adherence to three or more lifestyle changes simultaneously was associated with lower income \( (OR 0.29; p = .001) \) and having a co-morbid condition \( (OR 2.33; p = 0.002) \).

There are common demographic and sociobehavioral characteristics among participants of studies with a physical activity intervention. Community-dwelling adults age 60 and older, randomly selected from a population-based survey in Australia, found men to be significantly more physically active than women, and those between the ages of 60-64 and over the age of 70 were more active than those between the ages of 65-69 (Booth, Owen, Bauman, Clavisi, & Leslie, 2000). Age was similarly found to be associated with exercise adherence in a subsample of middle-aged and older women from the Strong Women Program, a nationally disseminated community-based strength-training program (Seguin, et al., 2010). Women with a mean age of 63 \( (SD = 11) \) were more likely to adhere to a 4-month twice-weekly strength training program than younger women. The study further identified that having better perceived health \( (p = .001) \), higher lifetime physical activity \( (p = .045) \), and living alone \( (p = .013) \) were predictive of adherence. Race and education, although not related to adherence, were included in the final model which was significant \( (p = .001) \).
In a cross-sectional explanatory study to test a predictive model of physical activity in 265 older hypertensive adults—mean age 69 ($SD = 4.1$)—being male ($p = .05$), higher income ($p = .01$), and previous exercise experience ($p = .001$) were found to be predictors of physical activity. Better perceived health ($p = .01$) was indirectly predictive when mediated by income level (Lee & Laffrey, 2006). The final model, that included the variables listed above, as well as various barriers to physical activity, environmental factors, self-efficacy, motivation for health, motivation for physical activity, awareness of blood pressure, and interpersonal influence explained 44% of the variance in physical activity. Previous exercise experience and higher exercise self-efficacy were also found to be related to exercise adherence, as was not smoking, in a meta-analysis of 21 random controlled trials with adults age 55 and older (Martin, et al., 2000).

A descriptive study using a random sample of members from a large Midwestern health plan identified characteristics associated with TLC, including regular physical activity, not smoking, high quality diet, healthy weight, and reduced alcohol consumption (Pronk, et al., 2004). Among adults age 65 and older—mean age 74.5 ($SD = 6.7$)—having a college degree (OR 1.61; $p = .05$) was the only factor significantly associated with adherence to multiple lifestyle behaviors. Descriptive analysis revealed 73% had HTN, 93% were non-smokers, and 94% reported no or moderate alcohol use. While only 12.8% of the participants achieved all five TLCs, it is encouraging that another 36% achieved four TLCs, and 37% achieved three TLCs.

In an evaluation of NHANES survey data from 1988-1994 (US population estimate 42,511,379) non-Hispanic Blacks (NHB) were more likely to report sodium reduction (OR 1.5, CI 1.1-2.0) and weight loss attempts (OR 1.7, CI: 1.3-2.3) when compared to non-Hispanic Whites (NHW) (Natarajan, Santa Ana, Liao, Lipsitz, & McGee, 2009). The study further found that Mexican Americans (OR 2.0, CI: 1.1-3.9) and NHB (OR 2.2, CI: 1.6-3.0) were more likely
to report following exercise recommendations, smoking cessation, and making dietary
modifications than NHW. In a more recent NHANES survey review with data from 1999-2004,
Mexican Americans were more unaware that they had HTN when compared to NHW; however,
the significance did not hold when a family history of HTN was added to the model, suggesting
that family history is an important determinant of awareness and actions to manage HTN
(Ostchega, Hughes, Wright, McDowell, & Louis, 2008). However, another study (Okonofua,
Cutler, Lackland, & Egan, 2005) found that Mexican Americans were more likely to perceive
aging and stress as main factors of HTN and were less likely to agree that TLCs are related to
HTN. These collective findings provide supporting evidence for including ethnicity as a potential
explanatory variable in the study, although the effect of culture needs to be considered in the
interpretation of findings.

A retrospective cohort study of hypertensive HMO members age 45-84 found that having
a history of CVD and coronary artery disease (CAD) was associated with achieving target blood
pressure levels at more than 50% of primary care visits (Andrade, et al., 2004). With similar
findings in the Uzun et al. (2009) study, this may suggest that people with co-morbid conditions
may recognize the importance of TLC and therefore adhere to the practice of TLC to manage
blood pressure levels. Further support for this assertion is found in an analysis of 40,011
participants in the European Investigation into Cancer and Nutrition (Scheltens, et al., 2010). The
study found that being aware of having HTN was associated with better adherence to guidelines,
and individuals with a history of diabetes, CHF, CHD, angina, heart attack and stroke were
consistently more aware of having HTN, as were those with a family history of HTN, stroke,
myocardial infarction or angina. Conversely, other studies have demonstrated that having fewer
co-morbid conditions was associated with healthy lifestyle practices (Kirk-Sanchez, et al., 2005;
Collectively, the findings of these studies lend support for the inclusion of co-morbidities as an explanatory variable in the study.

**Sociobehavioral Characteristics**

Sociobehavioral characteristics are categorized as self-perceived qualitative indicators and practices likely to remain consistent over time. Self-perceived qualitative indicators include quality of life, social support, perceived stress, and stage of change. While studies show that perceived quality of life or perceived health and social support are frequently associated with the performance of TLC, perceived stress and stage of change have more theoretical than empirical support. Likewise, literature support for practices likely to remain consistent over time—smoking, HBPM, reading food nutrition labels, and keeping medical appointments—have a combination of empirical and theoretical support. Cigarette smoking and HBPM have empirical support while the inclusion of reading food nutrition labels and keeping medical appointments in the study is based primarily on theoretical support.

**Self-perceived Qualitative Indicators**

It is estimated that 92 million people worldwide (6.0%) have impaired quality of life as a result of HTN-related morbidity (Lawes, Vander Hoorn, & Rodgers, 2008). Quality of life or perceived health is a recognized important determinant of health outcomes. Subjective assessment of quality of life provides complementary information about an individual’s functional health and morbidity. In a descriptive study using NHANES III data, a decline in quality of life was associated with increasing morbidity (Nothwehr & Perkins, 2002). A secondary analysis of data from 1,485 hypertensive adults age 60 and older, revealed that those who reported higher perceived health made regular visits to a health care practitioner, maintained a normal BMI, were non-smokers, ate a healthy diet, and exercised regularly (Lewis & Riegel,
Likewise, engagement in regular physical activity and weight loss has been associated with improved quality of life, and conversely, higher perceived quality of life has been significantly associated with regular exercise (Grimm, et al., 1997; Seguin, et al., 2010).

Social support networks including family, friends, peers, and health care professionals supportive of healthy behavior practices are important determinants of engagement in healthy behaviors (Fosu, 1995; Lee & Laffrey, 2006; Resnick, 2009; Wanke, et al., 2007). Likewise, a study of southwestern adults age 60 and over found that social support and belongingness were predictive of positive health outcomes (Tomaka, Thompson, & Palacios, 2006). In another study, a population-based survey of community-dwelling older adults, social support was associated with engaging in physical activity on several levels (Booth, et al., 2000). Those who received support and encouragement from friends and family, those who had partners who were physically active, and those with family and friends who participated in physical activity were found to be significantly more active.

The Interheart study, an international longitudinal study, found that the magnitude of the association of chronic stress to HTN was equivalent to more traditional cardiovascular risk factors such as obesity, smoking and diabetes (Kawecka-Jaszcz, et al., 2005). There is ample evidence that stress management using diverse techniques has a positive effect on lowering blood pressure levels (Martin, et al., 2000). Various stress reduction techniques including progressive muscle relaxation, biofeedback, meditation, mindfulness-based stress reduction, and positive thinking have demonstrated reductions in blood pressure from 2 mmHg to 12 mmHg (Oberg, 2009). Similarly, a randomized controlled study of 35 hypertensive women age 63-77 found significant reduction in SBP and DBP after receiving a cognitive behavioral intervention which included relaxation techniques (Moreno, et al., 2006).
Another randomized controlled trial with 61 participants age 55 and older found that reductions in SBP and DBP were similar between the relaxation response training group and the lifestyle modification group, however; those in the relaxation group were significantly more likely to eliminate an antihypertensive medication while maintaining blood pressure control (Dusek, et al., 2008). Relaxation techniques and cognitive modeling are within the domain of stress management, and therefore individuals who are aware of, and take action to, manage stress may be more aware of the effects of stress on health outcomes. Individuals who understand the relevance of stress management to the maintenance of health and the management of HTN may also be more likely to engage in other healthy lifestyle practices.

Researchers in the field of psychotherapy have historically studied the processes by which health-related behaviors are adopted and maintained to improve health. The transtheoretical model (TTM) originated from an analysis of 18 systems of psychotherapy that identified common experiential and behavioral processes of change (J. O. Prochaska & DiClemente, 1982). Stage of change (SOC) is a dimension of, and the central organizing concept of, the TTM. As the temporal dimension of the TMM, SOC predicts motivational readiness to change behavior. Evidence indicates that the processes of change were similar across SOC for 9 different health problems (Greene, et al., 1999).

Change in health behavior has been shown to advance through an orderly progression of five stages: precontemplation identifies those not intending to make a change in the next 6 months; contemplation identifies those intending to make a change but not in the foreseeable future; preparation identifies those intending to make a change in the next month or are already making small changes; action identifies those actively engaged in a new health behavior but for less than 6 months; and maintenance identifies those with sustained engagement in a health

A 2-year observational study of self-change for smoking cessation supported that the processes of change were strongly related to the SOC (J.O. Prochaska & DiClemente, 1983; J. O. Prochaska, et al., 1991). SOC has also been demonstrated to be applicable to dietary behavior and exercise behavior (Barke & Nicholas, 1990; Blissmer, et al., 2010; Johnson, et al., 2008; J. O. Prochaska, et al., 2004). Barké and Nicholas (1990) were the first to apply the SOC model to the acquisition and maintenance of regular physical activity in older adults. The study found that the SOC model was able to distinguish between adults age 59-80 who engaged in exercise and those who did not. Blissmer et al. (2010) conducted a secondary analysis of smoking, diet, and sun exposure behavior from five population-based studies and found that those in the precontemplation stage had the smallest percentage of progress toward the action and maintenance phases, while those in the preparation phase had the highest percentage of progress.

Studies have further demonstrated that stage-based interventions are successful in helping participants progress through stages. A weight management study with overweight and obese adults that used stage-matched behavioral interventions found that those in the intervention group were significantly more likely to progress to the action and maintenance SOC (Johnson, et al., 2008). They further found significant improvement in healthy eating, engagement in exercise, and stress reduction. Likewise, Prochaska et al. (2004) found that stage-based interventions significantly improved smoking cessation and dietary fat reduction.

Experts advise that consideration of SOC in an older adult is an important strategy that can help practitioners understand where an older adult is on a continuum and target appropriate interventions to encourage progression to the next stage (Muse, 2005). Collectively, study
findings provide evidence that SOC may be a predictor of successful long-term engagement in TLC.

**Practices Likely to Remain Consistent over Time**

It would seem reasonable that there are practices that individuals with HTN may engage in that are likely to remain consistent over time. Developing a habit is related to the repetition of intentional behavior (Maddux & DeCharme, 1997). Reading food nutrition labels when purchasing groceries, remaining aware of and following blood pressure trends on a regular basis through HBPM, and keeping medical appointments are within the domain of behaviors that require intentional repetition.

JNC-7 guidelines indicate that HBPM may benefit individuals by promoting better adherence to therapy. The American Heart Association encourages the use of HBPM as a useful adherence-enhancing strategy, since success with lifestyle changes is often improved by encouraging individuals to become involved in their own care (Cuspidi & Sala, 2008; Pickering, et al., 2008). In a cross sectional study with 150 hypertensive adults, 63% reported consistently measuring blood pressure at home (Uzun, et al., 2009). An Internet survey of Japanese hypertensive adults age 40 to over 70 found that those who perform HBPM were more likely to adhere to exercise, diet and medication regimens than those who did not perform HBPM (Saito, et al., 2010).

Data from the 1994-96 U.S. Department of Agriculture Continuing Survey of Food Intakes by Individuals and the 1994-96 Diet and Health Knowledge Survey of adults age 51 and older revealed use of food nutrition labels to make consumption decisions was highest among those age 51 to 70 (Macon, Oakland, Jensen, & Kissack, 2004). They additionally revealed that those who read food nutrition labels had lower fat intake than those who did not read labels.
Analysis of the 2005-2006 NHANES data of adults age 20 and older revealed that, when advised by health care practitioners, those with a diagnosis of diabetes, HTN, and/or hyperlipidemia read food nutrition labels 50% more often than those without one of these diseases (OR 1.50, 95% CI: 1.12-2.0) (Post, Mainous, Diaz, Matheson, & Everett, 2010). Additionally, those who read food nutrition labels consumed less calories, saturated fat, carbohydrates, and sugar, and more fiber. Multiple logistic regression found that reading food nutrition labels was significantly associated with being female (three times more likely to read labels), having more than a high school education (twice as likely to read labels), higher incomes (a 1-unit increase in the poverty income ratio was associated with a 26% increase in the likelihood of reading labels), and being married (30% more likely to read labels).

If a parallel can be drawn between study participants who consistently attend intervention sessions and those who consistently keep medical appointments, then there is substantial support for including keeping medical appointments as an explanatory variable in the current study. Several studies cite regular attendance at intervention sessions as significant predictors of adherence behavior (Martin, et al., 2000; Schmid, Jeffery, Onstad, & Corrigan, 1991).

**Conclusion**

The study proposed to develop a prediction model to facilitate patient-practitioner interaction relative to the practice of TLC. A valid prediction model will be able to identify those who are likely to engage in TLC and alternatively, identify those at risk who would benefit from intervention measures to promote TLC adoption. A prediction model with variables firmly rooted in theoretical and empirical support is an important step in ensuring validity of the findings and the eventual model (Berman, 2007). Although there was not always strong empirical support for the selection of demographic and sociobehavioral characteristics, there was
adequate support, and where empirical support was weak or absent, theoretical support was used. It is important to recognize that characteristics associated with the performance of TLC may be different for younger adults than for those age 60 and over, therefore support was provided based on findings from studies with participants with a mean age close to 60 or older. A review of the explanatory variables used in the study demonstrated that they were consistent with the theoretical framework guiding the study, the Interaction Model of Client Health Behavior.
Chapter 3: Research Design and Methodology

Study design

HTN is a condition that is of primary concern to health care practitioners. The increasing prevalence of HTN, particularly among older adults, and the relationship HTN has to cardiovascular disease ranks it as a significant health care concern. Decreasing the prevalence of HTN and achieving target blood pressure goals is a matter of national priority. The performance of TLCs has been demonstrated to have a significant and positive effect on lowering blood pressure levels. Despite this recognition, evidence suggests that health care practitioners do not routinely include discussions of TLC performance when providing care to those with HTN (Cobb, et al., 2006; Elhani, et al., 2009; Schutzer & Graves, 2004). The purpose of the study was to develop a prediction model of demographic and sociobehavioral characteristics that are common among older adults with HTN who engage in TLC. A model that prompts and guides patient-practitioner interaction to include the performance of TLC can help to optimize care delivery to the older adult with HTN by targeting at-risk individuals and following up with appropriate interventions.

A cross-sectional correlational predictive design was used to identify a set of common variables predictive of individuals who engage in TLC. A predictive design is one approach to examining causal relationships between outcome and explanatory variables (Burns & Grove, 2005). The purpose of a correlational predictive design is to establish the strength and direction of relationships identified by previous research and theoretical support (Brink & Wood, 2001). A correlational predictive design indicates if the explanatory variables have an effect on the outcome variable (Brink & Wood, 2001; Loiselle & Profetto-McGrath, 2007). The goal of a
predicative design is to predict the level of engagement in TLC based on the values of select demographic and sociobehavioral characteristics (Burns & Grove, 2005).

In a correlational predictive design the selection of explanatory variables is vital to the development of a valid prediction model. Explanatory variables must have demonstrated theoretical or empirical evidence of high correlation with the outcome variables (Burns & Grove, 2005). Explanatory variables for the study were largely taken from studies that have found select demographic and sociobehavioral characteristics predictive of, or correlated with, engagement in TLC. Where empirical evidence was missing or weak, theoretical evidence supported the inclusion of the variable in the model.

**Methodology**

**Population, Source and Selection of Participants**

The sample for the study was community-dwelling hypertensive men and women age 60 and older from multiple ethnic backgrounds living in Boston and the greater Boston area in Massachusetts. The study used a cross-sectional non-probability convenience sampling strategy. Although an inherent weakness of a convenience sample is the limited ability to control for selection biases, steps can be taken to improve the representativeness of the sample (Brink & Wood, 2001; Burns & Grove, 2005; Loiselle & Profetto-McGrath, 2007). Controlling for selection bias is important to mitigate threats to the internal validity of the study which can result in the possibility of misleading results.

Minimal inclusion and exclusion criteria were purposely selected to control for selection bias and to be as inclusive as possible. Additionally, recruitment activities occurred in multiple venues across Boston and the greater Boston area where older adults congregate. A sample large enough to support the 15 explanatory variables in the study was recruited.
To improve the representativeness of the sample, efforts were made to recruit participants from ethnic backgrounds that approximate the ethnic composition of the older adult population in the Boston area. The ethnic composition of older adults age 60 and older living in Massachusetts and those living in Boston is very different. Estimates based on the 2010 census cite the ethnic composition of adults in Massachusetts as 88.8% White, 3.8% Black or African American, 2.9% Asian, and 3.4% Hispanic or Latino origin. For those aged 60 and older living in Boston in 2010 the ethnic composition is 59.3% White, 25.6% Black or African American, 8.8% Asian, and 9.9% Hispanic or Latino origin (AoA, 2010; FactFinder, 2010). Overall, 11.2% of the older adult population of Massachusetts is comprised of minority populations, compared with 40.7% for the city of Boston.

The primary recruitment strategy was the provision of blood pressure TLC educational sessions at various community settings such as senior centers, elder services agencies, and faith-based organizations. Contacts with community leaders were made by the principal investigator (PI) requesting permission to recruit participants and speak at venues where the primary audience is older adults. An educational program entitled “Manage Your Blood Pressure with TLC” was presented at each venue where the PI was invited to speak. A flyer was supplied to be posted at the venue for advertising purposes (Appendix D). The educational program included a discussion about blood pressure and how to manage blood pressure using TLC.

Prior to the educational session, the PI described the study and invited participation. Interested individuals who matched the inclusion criteria were invited to participate. The informed consent was reviewed with participants prior to completing the TLC questionnaire. The TLC questionnaire was read to participants who were unable to complete the questionnaire independently. During the time of data collection, a refreshment fruit platter was provided and
blood pressure measurements were taken by the PI and the research assistant, as a courtesy, for any interested individual. Individuals did not have to participate in the study to partake of the refreshments or to have their blood pressure taken. Pens were provided. The educational program was provided after the data collection period.

**Selection Criteria**

To be included, participants had to be age 60 or older and have HTN. Having HTN is defined as self-report of having been told by a health care practitioner that they have high blood pressure, or taking prescribed antihypertensive or diuretic medication. Fluency in speaking English was an inclusion criterion deemed germane to recruiting a representative sample of older adults. Fluency in speaking English enabled those who are unable to read due to poor literacy skills to participate by having the questionnaire read to them. The 2003 National Assessment of Adult Literacy estimates that Massachusetts has a Basic Prose Literacy Skills (BPLS) rate—defined as those age 16 and older who scored below basic on literacy skills or those who could not be tested due to language barriers—of 10% (95% CI 8.3, 12.1). However, the BPLS rate for those living in Suffolk County, of which the city of Boston is a large portion, is 25% (95% CI 18.6, 34.1) (NCES, 2003). Study exclusion criteria are being less than 60 years of age, not having HTN—defined as never having been told by a health care practitioner that they have HTN, or not taking a prescribed antihypertensive or diuretic medication—and not being fluent in speaking English.

**Power Analysis for Sample Size**

The size of the sample is directly related to the power of the study which is the ability to detect true relationships among variables as opposed to relationships that occur by chance (Loiselle & Profetto-McGrath, 2007). The degree to which sample results can reliably
approximate a relevant population value is related to the size of the sample (S. Cohen & Williamson, 1988). Larger samples, in general, are more likely to exhibit the characteristics of the sampling population and thus have smaller sampling errors and increased confidence in the findings (Loiselle & Profetto-McGrath, 2007). Further, to detect significant correlations requires a large variance in the variable responses that can best be achieved with large sample sizes (Burns & Grove, 2005). A large sample size will additionally have more power, which minimizes the threat of a Type II error, accepting the null hypothesis when it should have been rejected (Berman, 2007). In the study, the null hypothesis was that there is no difference in the characteristics of older adults with HTN who engage in TLC and those who do not engage in TLC. For a prediction model to be useful, confidence in the findings that the null hypothesis is rejected because it rightfully should have been rejected is essential. This confidence, in addition to the sampling plan, is largely a function of the sample size.

The four parameters of statistical inference are power, significance, sample size, and effect size, such that if the values of three of the parameters are known, the fourth parameter can be determined (J. Cohen, 1988). When multiple regression is to be used as the statistical technique, the sample size is an important consideration that is related to the number of explanatory variables to be measured. The larger the number of explanatory variables, the larger the sample size required to achieve a stable prediction equation (Munro, 2001). The power of the study or the likelihood of rejecting the null hypothesis was 80%, a level generally viewed as adequate (Berman, 2007; Munro, 2001). The significance level was set at 95%, based on the 0.05 level of significance set by similar prediction studies (Lancaster, 2004; Li, Wallhagen, & Froelicher, 2007; Seguin, et al., 2010; Shaya, et al., 2009). A medium effect size—the measure
of the strength of a relationship—was used based on literature support for the identified explanatory variables.

To determine the effect size, Cohen (1988) translates a small, medium and large effect size into $R^2$ values, which is the expression of results in multiple regression analyses. A small effect is defined as an $R^2$ of 0.02, a moderate effect as an $R^2$ of 0.13, and a large effect as an $R^2$ of 0.30. These $R^2$ values correspond closely to effect sizes of 0.02, 0.30, and 0.50, respectively. For example, a medium effect size the $R^2$ of 0.13 equates to an $R$ of 0.36 which is comparable to a medium effect size of 0.30 (S. Cohen & Williamson, 1988).

Cohen & Williamson (1988) further provide a table to determine an effect size index that is used in an equation to determine the sample size. An effect size index is defined as “a function of power and number of explanatory variables at a given level of alpha” (Munro, 2001). The equation requires the use of a v value—the degrees of freedom of the denominator of the F ratio—set at 20, 60, 120, or infinity. The v value chosen for the study was 120, as this value is considered to yield an effect size index of sufficient accuracy since the effect index values obtained by using any of the different v values are similar (Cohen, 1988). At a significance level of 0.05, a power of 0.80, a v of 120, and 15 explanatory variables, the effect size index is 20.7 (Cohen, 1988).

Applying these numbers to the following equation yields a sample size of 155:

$$N = L(1-R^2)/R^2 + u + 1$$

Given that:

$N =$ total sample size

$L =$ effect size index (20.7)

$R^2 =$ the effect size (0.13)
u = number of explanatory variables (15)

The equation becomes:

\[ N = \frac{20.7(1 - 0.13)}{0.13} + 15 + 1 \]

\[ N = 155 \]

A sample of 155 community-dwelling adults age 60 or older was needed for analysis of 15 explanatory variables. Adding a percentage for attrition is not a necessary consideration in a cross-sectional study, however; it is possible that some questionnaires would have missing data and consequently would not be useful for data analysis. For this reason, participants were recruited until 155 questionnaires were collected.

Data collection

A detailed questionnaire of self-report demographic and sociobehavioral characteristics and engagement in TLC was developed by the PI (Appendix E). To ensure appropriate question verbiage and type, questionnaire items were generated from sources including population-based surveys, tools with established reliability and validity, and from other studies. The questionnaire was formatted with an introduction and a salutation, with plenty of white space, with responses in upper case letters and arranged vertically, and with negative responses presented before positive responses in questions with likert-type scale responses (Rattray & Jones, 2007). In addition, to engage participants, demographic data were placed at the end of the questionnaire, and items that were considered emotive, such as perceived stress and social support, were placed in the middle of the questionnaire. Items from validated measurement tools had a mixture of positively and negatively worded items to help minimize acquiescence response bias.
Blood Pressure Measurement

Blood pressures were measured as a courtesy for any attendee, using an automated device. Automated devices are recommended as they are unlikely to develop calibration errors due to the demonstrated stability of the electronic pressure transducers and therefore are likely to be accurate without the need for periodic calibration (Parati, et al., 2008). The devices were checked for tubing and cuff integrity, and parts replaced as needed prior to each recruitment activity.

In accordance with standard procedure suggested by the JNC-7, blood pressure measurement was taken after the participant had been sitting quietly for 5 minutes, with both feet resting on the floor, the back supported, and the arm at heart level (Chobanian, 2003). Participants were measured for an appropriate-sized cuff where the bladder covers 80-100% of the upper arm circumference. Standard and large cuff sizes were available for use. The SBP is the point at which the first Korotkoff sound is heard (onset of phase 1) and the DBP is the point before the disappearance of Korotkoff sounds (onset of phase 5).

Explanatory Variables: Demographic Characteristics

The demographic items in the questionnaire were adapted from the Behavioral Risk Factor Surveillance Survey (BRFSS) and the inter RAI Community Health Assessment (CHA) (CDC, 2010; interRAI, 2010). The BRFSS survey is a personal behaviors surveillance survey administered by the Division of Adult and Community Health, National Center for Chronic Disease Prevention and Health Promotion. It has been administered since 1984 with data collected monthly in each state and territory. As the largest telephone health survey, it is used to track demographic information and health risk behaviors, preventive health practices, and health care access. In a meta-analysis of 200 studies, demographic characteristics and height and
weight were determined to be of high reliability and validity (Nelson, Holtzman, Bolen, Stanwyck, & Mack, 2001). Items adopted from the 2010 BRFSS Core Questionnaire, Section 12 Demographics, are the explanatory variables age, ethnicity, marital status, annual income, and education level.

The remaining two demographic characteristics, gender and co-morbid conditions, were adapted from the interRAI Community Health Assessment (CHA) tool, as were the sociobehavioral characteristics perceived quality of life and smoking, and the outcome variable, physical activity. The InterRAI CHA was developed by a multinational group of practitioners and researchers to assess healthy older adults living in the community, or other residential care settings, to identify those in need of further assessment to prevent functional and health decline (interRAI, 2010; Morris, et al., 2009). The CHA, formerly known as the interRAI Home Care (HC) was first developed in 1993 and has undergone several revisions since that time. Rigorous research and testing across multiple studies have been done to establish reliability and validity of items not only for use in North America but in multiple countries in Europe and Asia (Hirdes, et al., 2008). In general, kappa values—a measure of reliability where the proportion of individuals are consistently classified in the same category on two occasions which is beyond what is expected by chance—are predominantly above 0.6 (Morris, et al., 2009; Waltz, Strickland, & Lenz, 2005). Validity has been assessed for sub-scales via comparison to outcomes on similar measures of the same construct that have established validity (interRAI, 2010).

**Explanatory Variables: Sociobehavioral Characteristics**

The sociobehavioral characteristics assessed in the TLC questionnaire are adapted from a number of sources. Perceived quality of life and smoking were adapted from the interRAI CHA instrument as indicated above. Perceived quality of life was assessed with the question, “In
general, how would you rate your health?” The possible responses were “excellent,” “good,” “fair,” and “poor.” Perceived quality of life has been demonstrated to be a reliable and valid one-question subscale of the Health Status Questionnaire-12 (Barry, Kaiser, & Atwood, 2007). Smoking was assessed with the question, “Do you smoke tobacco daily?” Possible responses were “no,” “not in last 3 days but I am usually a daily smoker,” and “yes.”

Several questions of sociobehavioral characteristics including HBPM, keeping medical appointments, and reading food nutrition labels, as well as one outcome variable question, adhering to a low sodium diet, were adapted from a study entitled the “Multidisciplinary Management Program in Primary Care to Improve Hypertension Control and Healthy Behaviors in Elderly Patients” (Hajjar, et al., 2005). This intervention study of older hypertensive adults was conducted in 2000 at a community academic primary care geriatric practice in South Carolina. The study assessed the effectiveness of a multidisciplinary lifestyle education program to improve blood pressure control and health behavior practices. The intervention was developed to support TLCs recommended by the JNC-6. The questions were, “How often do you take your blood pressure at home?”, “How often do you read labels on food packages for salt, fat and sugar content when deciding to buy a food product?”, “How often do you keep your medical appointments?”, and “How often do you follow a low-salt diet?” The possible responses were “not at all,” “a little,” “somewhat,” “quite a bit,” “very much,” and “don’t know.”

Three explanatory variables in the study were concepts rather than specific behaviors and therefore required a reliable and valid tool for appropriate measurement. Perceived stress was measured using the four-item Perceived Stress Scale (PSS4), social support was measured using the 10-item Duke Social Support Index (DSSI), and stage of change was measured using the one-item SOC for physical activity measure. The PSS4 and DSSI scales produce a composite score
and therefore can each be counted as one explanatory variable for the purposes of performing a power analyses. All of the measures are available in the public domain.

The four-item PSS4 was used to measure perceived stress. Originally developed as a 14-item instrument, the PSS was designed to measure the degree to which life situations are perceived as stressful and is suggested as a measure of experienced levels of stress (S. Cohen, Kamarck, & Mermelstein, 1983). The instrument was designed to be used with community samples with at least a seventh grade education. The items are easy to understand, the responses are simple to grasp, and the tool is applicable to subpopulation groups, as the questions are worded in a general fashion.

Internal consistency was demonstrated across three separate samples with alpha coefficients of .84, .85, and .86, values indicating the high degree to which items are measuring a single attribute (Berman, 2007; Waltz, et al., 2005). To test stability over time, a test-retest correlation using Pearson’s Product-Moment Correlation was performed when the PSS was administered 2 days apart, and then 6 weeks apart, with results of .85 and .55, respectively. Although the 6-week test-retest correlation was less than desired—alpha values below .70 are considered poor—the authors identified that they told the subjects to strive for accuracy rather than consistency across time (Berman, 2007; S. Cohen, et al., 1983). The PSS was determined to be valid when it correlated in the expected direction with life-event scores, depressive and physical symptomology, utilization of health services, social anxiety, and smoking cessation maintenance.

A four-item abbreviated version of the PSS consisted of the four items that were the most highly correlated with the 14-item scale. The PSS4 had an alpha coefficient reliability of .72, a value indicating moderate reliability. Although the test-retest correlation over a two-month
interval was low at .55, it replicated results from the 14-item scale (Berman, 2007; S. Cohen, et al., 1983). In a later study with a representative sample, the PSS4 demonstrated an adequate alpha reliability coefficient of .60; however, comparisons between the PSS4 and other measures demonstrated good factor structure and predictive validity (S. Cohen & Williamson, 1988).

Cohen (1983) cautions that while the PSS4 has good utility because of the small number of items, this same fact causes the tool to lose internal reliability. Each item in the PSS4 is scored on a four-point scale with a score range of 4 to 16 where low scores indicate less stress. The sum of the four items is computed with items #1 and #4 scored in the forward direction and items #2 and #3 scored in reverse direction (See Appendix E, #12-15).

Social support was measured using the DSSI. The DSSI is an abbreviated 11-item version of the original 35-item instrument that was developed to reduce the overall length of the instrument while continuing to capture the essential components of social support related to health promotion (Koenig, et al., 1993). Data from secondary analysis of the Wave II of the National Institute of Mental Health Epidemiologic Catchment Area was analyzed using the entire sample and a subsample of chronically ill adults age 60 and older. Construct validity was demonstrated when the subscales compared favorably to each other and to the original scale. Convergent and discriminant validity were demonstrated when items correlated in the expected direction with existing validated measures of mental health and with use of health services, respectively (Koenig, et al., 1993).

A later study with a large representative sample of community-dwelling older Australian women age 70-75 found internal reliability to be reasonable for 10 of the 11 items and, therefore, the 11-item scale was reduced to a 10-item scale. The 10-item DSSI has two subscales: a 4-item network subscale that measures the size and structure of the social network, and the 7-item
satisfaction subscale that measures perceived satisfaction with behavioral and emotional support (Powers, Goodger, & Byles, 2004).

Construct validity was demonstrated by showing positive correlations between scores on the 10-item scale and the original 35-item scale with mental and physical health and life satisfaction, and negative or no correlation with stress and BMI (Powers, et al., 2004). Factor analysis indicated that the four items on the network subscale loaded on a single factor (loadings between .59-.76), and the six items on the satisfaction subscale loaded on a second factor (loadings between .64-.77) with overall Cronbach’s alpha reliability of .58 and .80, respectively. Cronbach’s alpha reliability was .76 for the 10-items combined indicating that the network subscale gains in internal consistency when administered together with the satisfaction subscale. Both the size and the representative nature of the sample increased confidence in the reliability of the results. Internal consistency remained consistent in a later longitudinal study where the Cronbach’s alpha coefficient for the network subscale was .60 and the satisfaction subscale was .80 (Pachana, Smith, Watson, McLaughlin, & Dobson, 2008). Each of the 10 items on the scale had three possible responses for a score range of 10-30 with higher scores indicating better social support (Powers, et al., 2004) (See Appendix E, #16-25).

The concept of SOC was measured using a one-item, five-response format to measure readiness to engage in moderate exercise at least 30 minutes per day for 5-7 days a week. The SOC instrument was originally developed to identify an individual’s placement within a stage regarding change in smoking behavior (J. O. Prochaska & DiClemente, 1982). Later, the model was applied to the acquisition and maintenance of regular physical activity in older adults (Barke & Nicholas, 1990). Reed and colleagues (1997) conducted a comparison of eight staging measures and recommended that assessment of intention to change, as well as behavioral
criterion—including frequency, intensity and duration of a targeted behavior—are critical to the reliability and validity of the stage distribution.

The recommended format is a single-item algorithm that includes five choices. Each choice represents a specific SOC. The first two choices assess intention to change, a requisite of individuals in the precontemplation and contemplation stages. The third choice assesses preparation to change and must include both intention as well as the behavior criterion to avoid overestimation of its prevalence. Finally, the fourth and fifth choices include behavior criteria to appropriately place individuals in the action and maintenance phase (Reed, Velicer, Prochaska, Rossi, & Marcus, 1997). These criteria were used to develop a single-item instrument for intention to engage in regular moderate intensity exercise (Sarkin, Johnson, Prochaska, & Prochaska, 2001). Moderate intensity exercise was defined as engaging in planned physical activity 5 to 7 times per week for 20-40 minutes each time that increases the rate of breathing and causes a light sweat.

Concurrent validity was assessed by examining mild, moderate, and strenuous activity across the stages and differences across stages. Construct validity was assessed by examining the relationship between exercise pros and cons and exercise confidence scores across stages. All analyses for concurrent and construct validity had significant results at $p = .001$ (Sarkin, et al., 2001). The SOC question and responses can be viewed in Appendix E, #26.

**Outcome Variables: TLC**

The five outcome variables in the study were the TLCs recommended by the JNC-7: weight maintenance or reduction in overweight and obese individuals, regular physical activity, adhering to a diet low in sodium, adhering to the DASH diet plan, and moderation in alcohol consumption. In multiple linear regression analyses the outcome variable is continuous, and in
logistic regression the outcome variable is dichotomous; therefore, cut points are described for each of the variables (Munro, 2001).

The NHANES 2007-2008 survey, a program of the National Center for Health Statistics, is a continuous national survey that represents a probability sample of non-institutionalized adults in the United States (CDC, 2007-2008). The NHANES was designed in the early 1960s to assess health and nutritional status using interviews and physical examinations. Outcome variables adopted from the NHANES 2007-2008 include height and weight measurements taken from the Person Questionnaire Weight History section, and moderation of alcohol consumption taken from the Computer Assisted Personal Interview Questionnaire Alcohol Use section.

JNC-7 TLC guidelines indicate the need to pursue weight reduction in overweight and obese individuals, with a recommendation to maintain a normal body weight. For the study, the outcome for this guideline was to have a normal weight as defined by the BMI. BMI will be calculated from self-report height and weight measurements. A longitudinal population-based study of adults age 40-88, with a mean age of 63.9, found a small difference between self-reported and measured height and weight (Dahl, Hassing, Fransson, & Pedersen, 2010). The conclusion is that cross-sectional study results should be interpreted with caution.

The questions used in the study were “How tall are you without shoes?” and “How much do you weigh without clothes or shoes?” A participant’s BMI was calculated using the following standard equation: weight in pounds/height in inches$^2$ x 703. A normal BMI is defined as 18.5-24.9 kg/m$^2$, underweight is less than 18.5 kg/m$^2$, overweight is 25-30 kg/m$^2$, and obese is greater than 30 mg/m$^2$ (NHBLI, 2010). As a categorical measure, those with a BMI of 18.5-24.9 kg/m$^2$ or less were considered to have met the TLC guideline.
The JNC-7 TLC guidelines for alcohol use is to consume moderate amounts of alcohol defined as no more than two drinks per day for men and no more than one drink per day for women. The question used in the study was, “In the past 12 months, when you drank alcoholic beverages, how many drinks did you have on average?” The possible numeric responses were “0,” “1,” “2,” “3,” “4,” and “5 or more.” For analyses requiring a categorical level of measurement, a response of “0” or “1” for women, and “0,” “1” or “2” for men was considered moderate alcohol consumption.

The JNC-7 TLC guideline for physical activity is to engage in regular physical activity at least 30 minutes most days of the week. In a 7-day week, most days is defined as 4 or more days per week. As previously mentioned, the question used is from the CHA tool, a tool with well-established reliability and validity (Morris, et al., 2009). The question used was, “What is the total number of hours you exercised or were physically active in the last 3 days?” Possible responses were “none,” “less than 1 hour,” “1-2 hours,” “2-3 hours,” “3-4 hours,” “more than 4 hours.” A study to describe the effect of physical activity on functional autonomy among 2,005 older adults in home care in Europe defined physically active as engaging in 2 or more hours of exercise in the last 3 days (Landi, Onder, Cesari, Soldato, & Bernabei, 2007). As a categorical level of measurement, participants who responded “2-3 hours,” “3-4 hours,” or “more than 4 hours” were considered to be physically active and met the TLC recommendation.

The JNC-7 TLC guideline relative to sodium use is to reduce dietary sodium. The specific recommendation is to reduce dietary sodium intake to no more than 2.4 grams per day. For the study, the spirit of the lifestyle change, to reduce sodium intake, was measured, rather than the numeric recommendation, which is more accurately measured by other methods. As previously mentioned, a question taken from a study of older adults enrolled in a community
academic primary care geriatric practice was used for the study (Hajjar, et al., 2005). The question used was “How often do you follow a low salt diet?” The possible responses were “not at all,” “a little,” “somewhat,” “quite a bit,” “very much,” and “don’t know.” Individuals who responded “quite a bit” or “very much” were considered to have met the TLC recommendation when a categorical level of measurement was required.

The final JNC-7 TLC guideline, adhering to the DASH diet plan, has multiple components including a diet rich in fruits, vegetables, and low-fat dairy, and reduced saturated and total fat (Chobanian, 2003). The DASH Food Frequency Questionnaire (FFQ) was developed for a study exploring the relationship between consumption of the DASH diet and risk of coronary heart disease and stroke among middle age women (Fung, et al., 2008). Food frequency questionnaires have long been used and validated to assess average food intake over time (Willett & Lenart, 1998).

Using a standard portion size and nine possible frequency of consumption responses ranging from “never or less than once per month” to “6 or more times per day,” FFQs have demonstrated good correlations with multiple weeks of food records (Willett & Lenart, 1998). In the Nurse Health Study FFQ validation study, the FFQ was validated via comparisons of self-report values with explanatory measures of diet such as dietary records (Willett & Lenart, 1998). For specific foods, adjusted Pearson correlation coefficients between FFQ and 28 days of dietary records were .81 for low-fat milk, .69 for broccoli, and .80 for apples. Likewise, de-attenuated correlation coefficients for nutrients between a 1986 FFQ and diet records ranged from .48 for poly-unsaturated fat to .79 for Vitamin A. Additional analyses demonstrated that the mean correlation coefficients between dietary records and two FFQs of 55 different foods administered 12 months apart was .57 (Salvini, et al., 1989).
The DASH FFQ used in the study was developed based on literature and a priori hypotheses (Fung, et al., 2008). The FFQ included the seven components of the DASH diet: high intake of fruits, vegetables, nuts and legumes, low-fat dairy, and whole grains; and low intake of sweetened beverages and red and processed meats (Fung, et al., 2008). Sodium consumption was an eighth component that was not used in the study. Composite DASH scores ranging from 7 to 72 were computed for the seven components. Foods where higher intake was desired—fruits, vegetables, nuts and legumes, low-fat dairy products, and whole grains—were scored in a positive direction and, conversely, foods where lower intake was desired—sweetened beverages and red and processed meats—were reverse coded. For analyses requiring a categorical level of measurement, recommended servings for each of the components was used to define the groups.

The table in the TLC questionnaire was modeled after a section of the FFQ (Fung, et al., 2008; Salvini, et al., 1989) (see Appendix E, #27).

Protection of Human Subjects

An application for approval to conduct the study was submitted to the Northeastern University Institutional Review Board (IRB) Office of Human Subject Research. The study used a questionnaire that posed minimal risk to the participants, as it did not stigmatize participants and did not place them at risk in terms of financial standing, employability, insurability, or reputation.

Participants who met the inclusion criteria and wished to participate in the study were provided a TLC questionnaire to complete prior to the educational session. Participants who were unable to read the questionnaire could have it read to them by the PI or the research assistant. Upon completion of the questionnaire, the participant’s contribution to the study was
completed. The questionnaires were collected prior to the beginning of the “Manage Your Blood Pressure with TLC” session.

Since researchers have the obligation to protect the confidentiality of participants (Burns & Grove, 2005), participation was anonymous with no individual identifying information collected, with the exception of the name of the venue. The IRB approved the use of an unsigned consent form. The questionnaires were kept in a locked drawer in the primary investigator’s office at Northeastern University. Access to the questionnaires for data entry purposes was restricted to the PI and the research assistant. The database was saved on an encrypted USB drive and stored in the same drawer as the questionnaires.

Data Analysis

Data analyses consisted of descriptive, correlational and multiple regression analyses. Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) for Microsoft Windows® version 18 available from Northeastern University. In the study, it was hypothesized that select demographic and sociobehavioral characteristics are predictive of engagement in TLC among hypertensive older adults. The hypothesis was directional, and therefore regression analyses were used to test the hypothesis. Descriptive statistics were used to describe the sample in detail and were used to determine if the sample was representative of the larger population of older adults by comparing to Boston population estimates for older adults.

Data preparation for analysis included reviewing questionnaires for completeness, assigning codes to responses, programming variables including the development of dummy variables, and creating equations to calculate composite scores for the items in the PSS4, DSSI, and DASH instruments, and calculating the BMI from height and weight data (Burns & Grove, 2005). Questionnaires with missing data were not used in data analysis. Data was entered into
the SPSS database and a back-up file was saved. Data entry was cross-checked with questionnaires for accuracy and errors corrected.

Internal consistency reliability of the instruments used in the questionnaire—PSS4, DSSI, SOC, and DASH—was tested by computation of Cronbach’s alpha coefficients (Munro, 2001). The goal was to demonstrate alpha coefficients of .70 or greater to indicate a moderate to high level of reliability (Berman, 2007). Findings compared favorably with values obtained in previous studies where the instrument was used (Burns & Grove, 2005).

To ensure that the data could be used for stepwise regression, data was checked to ensure assumptions were met. Measures of dispersion were used for explanatory and outcome variables to determine if the data were normally distributed or skewed, to determine if the variables had variability in responses called homoscedasticity, and to determine if the relationship between explanatory and outcome variables was approximately linear (Munro, 2001). If data were skewed, a correction factor was used and dispersion re-calculated to determine distribution after transformation (Munro, 2001). Means and standard deviations were calculated for variables with a normal distribution and medians were calculated for skewed distributions. Percentages were calculated for categorical variables. Outliers were examined, as they often contribute to a critical understanding of the data (Burns & Grove, 2005).

To be an effective predictor, explanatory variables must be highly correlated with the outcome variable but not with other explanatory variables (Burns & Grove, 2005). Explanatory variable selection was based on theoretical and empirical evidence that demonstrated an association between the explanatory variables and the outcome variables; however, to determine the interrelatedness of the explanatory variables, tests for multicollinearity or tolerance were conducted (Munro, 2001). Correlations of .85 or greater indicate a high correlation.
The level of significance was set at 95%, increasing the chance of a Type 1 error—finding that characteristics do predict engagement in TLC when they do not—while decreasing the chance of a Type 2 error, finding that characteristics do not predict engagement in TLC when they do (Burns & Grove, 2005). Given that the sample size is adequate but not large leads to the possibility that small differences could be overlooked if a more conservative 99% level of significance is used. For this reason, to decrease the chance of a Type 2 error, a more liberal level of significance of \( p = .05 \) was used (Munro, 2001).

The study used stepwise and logistic regression analyses. The goal of a prediction model is to find the smallest group of explanatory variables that account for the greatest proportion of variance of the outcome variable. To begin stepwise analysis, Pearson Correlation Coefficients and significance was analyzed for the explanatory variables with each of the outcome variables in turn. Explanatory variables that were demonstrated to be significant and correlated with an outcome variable were entered into a regression equation to determine how well the combination of explanatory variables explained the variance in the outcome variable as identified by the \( R^2 \). The adjusted \( R^2 \) was used, as it provided a more conservative estimate, given the sample size and the number of explanatory variables (Munro, 2001). Analysis of variance (ANOVA) determined the overall significance of the model. Beta coefficients with standardized \( z \)-scores—partial correlation coefficients that measure the relationship between the explanatory variables and the outcome variable while holding the other explanatory variables constant—were analyzed to determine the predictors that contributed significantly to the variance in the outcome variable. Once all of the outcome variables were analyzed separately for significant predictors, a common variable list of predictors was identified that contributed significantly to the explained variance.
As a final step, the results were interpreted from the perspective of the theoretical framework, the Interaction Model of Client Health Behavior (Cox, 1982).

**Limitations**

The sample size was a potential limitation that required results to be interpreted with caution. Although the sample size had been calculated by a statistically sound equation, it remained a recognized limitation, as some statisticians support very large sample sizes particularly when analyzing multiple explanatory variables. It is criticized that chance prevails in stepwise regression, as the order of entry of explanatory variables into the regression equation is based on statistical findings rather than theory (Nunnally, 1978). As a consequence, it is argued that internal validity is threatened and the possibility of making a Type 1 error is greatly increased with larger numbers of explanatory variables.

Generalizability is a limitation inherent in a study with a non-probability convenience sample. The sample was recruited from Boston and the greater Boston area with targeted efforts to oversample minority populations to gain a representative sample of the diverse older adult population of the area. Although representative samples typically support generalization, convenience samples have biases that must be considered (Berman, 2007). Participation may have been more appealing to individuals who already engaged in TLC and therefore this group may have over-represented the sample. Also, individuals who attended community educational offerings which required a level of independence and mobility to travel to and from the venue may not have been representative of the general population of older adults living in communities in and around Boston. Finally, many independent older adults from minority groups may not have spoken English well enough to participate, even if the questionnaire was read to them. Considering the 25% Basic Prose Literacy rate among adults in Boston, eliminating this group...
would skew the results preventing generalizability. A thorough description of the final sample using descriptive statistics allowed assessment for possible other biases (Burns & Grove, 2005).

There is ample empirical evidence that sustainability of lifestyle changes is difficult to achieve for the long term and can be impacted by myriad extraneous variables. For this reason, the cross-sectional nature of the study was a weakness that had to be factored into result analysis. It cannot be assumed that participant responses’ regarding the performance of TLC behaviors assumes that the same behavior pattern would be present at another time. In addition, the cross-sectional design prevents test-retest reliability from being performed. For these reasons, results must be interpreted with caution. As a preliminary study in the development of a prediction model, replication of results from future studies would be needed prior to using the model in practice.

Self-report information, although assumed to be accurate, is another limitation that must be considered when interpreting results. Self-report data is subject to recall ability and the potential for responding in socially desirable ways. To mitigate the latter concern, interested participants were invited to complete the questionnaire prior to attending the educational offering, as the purpose of the offering was to discuss target goals for the performance of TLC behaviors. Additionally, the introductory remarks at the beginning of the questionnaire requested participant candor. Regardless of these measures, self-report information, known to be subject to over or under reporting, must be interpreted with caution.

**Time table**

Completing the dissertation proposal and receiving the Dissertation Committee’s approval to proceed with the study was anticipated to occur in March 2011. Upon completion of the successful proposal, the IRB application was submitted and approved in May 2011.
Community leaders at various venues where community-dwelling older adults congregate in Boston and in the greater Boston area were then contacted and, if interested, a ‘Manage Your Blood Pressure with TLC’ educational session was scheduled. During this time consent forms and questionnaires were printed and blood pressure sphygmomanometers were purchased. It was anticipated that the data collection period would take approximately 2 to 3 months and would be completed by August 2011. Data analysis and completion of the study was anticipated for May 2012.
Chapter 4: Data Analysis

Introduction

The purpose of the study was to develop a prediction model of demographic and sociobehavioral characteristics that are common among older adults with HTN who engage in TLC. It was hypothesized that there is a common set of characteristics that can predict the older hypertensive adult who is likely to engage in TLC. The specific hypotheses of the study were twofold: that there is a relationship between demographic and sociobehavioral characteristics and TLC among older hypertensive adults; and that there is a common set of characteristics that can predict the older hypertensive adult who is likely to engage in TLC. Seven demographic characteristics and eight sociobehavioral characteristics were the 15 explanatory variables in the study. TLCs recommended for managing hypertension as defined by the JNC-7—maintaining a normal weight, engaging in regular exercise, adhering to the DASH diet plan, adhering to a diet low in sodium, and moderation in alcohol intake—were the five outcome variables of the study (Chobanian, 2003). A 33-item questionnaire was developed by the researcher for the study (Appendix E). Data were collected from 166 hypertensive adults age 60 and older who resided in Boston and the greater Boston area.

Organization of Data Analysis

The results of the data analysis are divided into four sections. The first section presents an overview of data collection. The second and third sections respectively provide descriptive analyses of the explanatory variables of the study -- demographic and sociobehavioral characteristics -- and the outcome variables of the study. Reliability analyses for the instruments used in the study -- the PSS4, the DSSI, the DASH FFQ, and the SOC -- are presented in the next section. The final two sections present the research questions and associated hypotheses, and
data analyses. Test statistics used to analyze the data are descriptive statistics, reliability analysis, correlational statistics, and regression statistics, both multiple linear regression and logistic regression. Finally, a summary of the results is provided.

Data Collection

Permission to conduct the study was received through the Northeastern University Institutional Review Board after review and approval of the IRB application. Data were collected at 13 faith-based and senior citizen organizations throughout Boston and the greater Boston area. Written permission was obtained from the director/organizer at each participating site prior to arrival. Only one site, the East Boston Social Center, cancelled due to scheduling conflicts.

Of the people who attended each event, the average number who participated was 12: the average rate of participation at each venue was 65%. Table 2 lists the sites and percentage of participation. The category labeled “miscellaneous individuals” was comprised primarily of those who were members of senior groups who could not attend on the day of the event or, for 3 individuals, who heard of the study via word-of-mouth, met the inclusion criteria, and requested to complete a survey which they either mailed or emailed to the researcher. A total of 166 questionnaires were completed however; 10 were incomplete and therefore not used in data analysis. The final number of participants in the study was 156.
Table 2

*Sites and Percentage of Participation*

<table>
<thead>
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<th>Site</th>
<th># Participants</th>
<th>% Participation</th>
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</thead>
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<td>Saint Katharine Drexel Parish</td>
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</tr>
<tr>
<td>12th Baptist Church</td>
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<td>64.7</td>
</tr>
<tr>
<td>Irish Pastoral Council Quincy</td>
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<tr>
<td>ABCD North End</td>
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<td>Saint Anthony's Shine</td>
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<td>81.0</td>
</tr>
<tr>
<td>Freedom House Senior Group</td>
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<td>60.0</td>
</tr>
<tr>
<td>Petersborough Senior Center</td>
<td>3</td>
<td>75.0</td>
</tr>
<tr>
<td>Peoples Baptist Church</td>
<td>9</td>
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</tr>
<tr>
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<td>90.9</td>
</tr>
<tr>
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<tr>
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<tr>
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</tr>
</tbody>
</table>

Descriptive Analyses of Explanatory Variables

Demographic Characteristics

**Age**

Participants ranged in age from 63 to 96 with a mean age of 77 \((SD = 6.9)\) and a mode of 78. Figure 1 demonstrates that age was approximately normally distributed with an acceptable skewness factor of 0.234. The largest age group was represented by those 70-79 years of age \((n = 74, 47.4\%)\) followed by the oldest participants who were between the ages of 80-96 \((n = 55,\)
35.3%). The smallest group was represented by the youngest participants, those between the ages of 60-69 ($n = 27, 17.3$).

Figure 1

*Histogram Distribution of Age*

Gender

Gender was unevenly represented with the majority of participants female. Of the 156 participants, 126 (80.8%) were female and 30 (19.2%) were male.

Ethnicity

Eighty-four participants were white (53.8%), and 67 were African American or Black (42.9%). A total of five participants were from other ethnic groups: two were Hispanic or Latino, one was Asian, one was American Indian, and one was other.

Marital Status

More participants were widowed ($n = 76, 48.7$%) than were married ($n = 40, 25.6$%). Among the other categories, divorced participants were approximately equal to those who were
never married, \( n = 18, 11.5\% \) and \( n = 19, 12.2\% \), respectively, and three participants were separated (1.9%).

**Annual Income**

Slightly more than one third of the participants (\( n = 58, 37.2\% \)) chose not to respond to the annual income question while 98 (62.8%) responded. Of the 156 participants, about one third reported an annual income of less than $20,000: 9.6% reported less than $10,000, 9.0% reported less than $15,000, and 9.6% reported less than $20,000. Fifteen percent reported an annual income of less than $35,000; while 5.8% each had an annual income less than $50,000 and less than $75,000 (9 or 5.8% each). Only two participants (1.3%) had an annual income $75,000 or more. Due to the large number of missing responses, this variable was not used in the regression analyses.

**Education**

Approximately 90% of participants completed education at a high school or higher level. Seventy participants (44.9%) completed grade 12 or earned a GED, 38 (24.4%) completed 1-3 years of college, and 31 (19.9%) completed 4 or more years of college. Of those with lesser amounts of education, six (3.8%) completed grades 1-8 and 11 (7.1%) completed grades 9-11.

**Co-morbid Conditions**

Of the 156 participants, 64 (41%) reported not having any other medical condition other than HTN. An equivalent number of participants, 67 (42.9%), had one co-morbid condition in addition to HTN. Eighteen participants (11.5%) had 2 additional co-morbid conditions, five participants (3.2%) had three additional co-morbid conditions, and two participants (1.3%) had four additional co-morbid conditions. The most common co-morbidity was diabetes (\( n = 19, 12.2\% \)) followed by cancer (\( n = 9, 5.8\% \)).
Sociobehavioral Characteristics

Sociobehavioral characteristics were divided into two categories: self-perceived qualitative indicators and practices likely to remain consistent over time. Self-perceived qualitative indicators were identified as self-rated health, perceived stress, social support and stage of change. Practices likely to remain consistent over time were identified as HBPM, smoking, keeping medical appointments, and reading food nutrition labels.

Self-rated health

The ordinal variable self-rated health was assessed with the question, “In general, how would you rate your health?” Two thirds of the participants rated their health as “good” (n = 100, 64.1%) with “good” as the median response. One quarter rated their health as “fair” (n = 40, 25.6%). Only 16 participants (10.3%) felt that their health was “excellent” and no one assessed their health to be “poor.”

Perceived Stress

Perceived stress was measured using the Perceived Stress Scale, a short four-question instrument designed to measure the degree to which life situations are perceived as stressful. Item responses were coded 0 to 4 with two questions reverse coded for a possible composite score ranging from 0 to 16 where lower scores indicated less perceived stress. Scores in the 0-4 category indicated less perceived stress and those in the 5-16 category indicated more perceived stress. More than one half of participants (57.7%) perceived that they had low levels of stress (n = 90), while slightly less than one half (42.3%) perceived that they had high levels of stress (n = 66). The mean and median score was the same, 4 (SD = 3.0). In order to allow for adequate interpretation of scores, missing data were compensated for with mean substitution. Overall, responses were missing from five questions.
Social Support

Social support was measured using the 10-item Duke Social Support Index that has two subscales, a 4-item network subscale that measured the size and structure of the social network, and a 7-item satisfaction subscale that measured perceived satisfaction with behavioral and emotional support. Item responses were coded 1-3 with a possible composite score range of 10-30 where higher scores indicated better support. Scores dichotomized as 10-20 indicated less social support, and scores in the 21-30 category indicated more social support. The majority of the participants indicated that they had high levels of social support \((n = 142, 91\%)\). Only 14 participants \((9\%)\) indicated that they had low levels of social support. The mean and median score was the same at 26 \((SD = 3.1)\).

When the subscales were examined separately, the vast majority of participants indicated a high level of satisfaction with their behavioral and emotional support on the 7-item satisfaction subscale \((n = 144, 92.3\%)\) as opposed to 12 participants who had a lower level of satisfaction \((7.7\%)\). With a range of scores from 7-21, the mean was 16.5 \((SD = 2.1)\). However, for the 4-item network subscale, only about two thirds indicated they had a large social network \((n = 105, 67.3\%)\) while 32.7\% \((n = 51)\) indicated they had a smaller social network. With a range of scores from 4-12, the mean was 9.2 \((SD = 1.7)\).

Stage of Change

Stage of Change was measured using a one-item, 5 response format designed to measure readiness to engage in moderate regular exercise. Participants self-identified whether they did not exercise, planned to start exercising, or currently exercised. Responses corresponded to a specific SOC: pre-contemplation, contemplation, preparation, active and maintenance.
Approximately one half of the participants indicated they were at the maintenance stage of physical activity having exercised on a regular basis for longer than 6 months \((n = 77, \text{49.4\%})\). The remaining 50\% were distributed across the other four stages: 17.9\% \((n = 28)\) were in the active phase where they have exercised on a regular basis for less than 6 months; 10.3\% \((n = 16)\) were in the preparation phase where they currently did not exercise regularly but planned to start in the next 6 months; 12.8\% \((n = 20)\) were in the contemplation stage where they currently did not exercise regularly but they were thinking about starting in the next 6 months; and 9.6\% \((n = 15)\) were in the pre-contemplation stage where they did not exercise regularly and did not plan to start in the next 6 months. The pie chart in Figure 2 provides a pictorial representation of the distribution. The active phase was the median response: the individual has exercised on a regular basis for less than 6 months.
Home Blood Pressure Monitoring

Participants were asked with what frequency they took their blood pressures at home. Approximately one half responded that they did not take their blood pressures at home ($n = 78$, 48.7%). A quarter of the participants reported either taking their blood pressure “a little” or “somewhat” ($n = 16$, 10.3% and $n = 23$, 14.7%, respectively) and another quarter took their blood pressure “quite a bit” or “very much” ($n = 16$, 10.3% and $n = 23$, 14.7%, respectively). Two participants reported not knowing how frequently they performed HBPM. The median response was “a little.”
**Smoking**

At 98.1%, the vast majority of participants did not smoke ($n = 153$). Only three participants reported that they smoked (1.9%).

**Keep Medical Appointments**

Participants were asked how often they kept their medical appointments. Three quarters of the participants reported keeping their medical appointments “very much” ($n = 121$, 77.6%). An additional 14.1% ($n = 22$) kept their appointments “quite a bit.” Few participants, 11 (7.1%), kept their appointments “somewhat” and only two participants (1.3%) kept their appointments “a little” or “not at all”. The median response was “very much.”

**Reading Food Nutrition Labels**

Participants were asked with what frequency they read nutrition labels on food packaging when deciding to buy a food product. Less than two thirds (62.2%) read food nutrition labels “very much” or “quite a bit” ($n = 54$, 34.6 and $n = 43$, 27.6, respectively). Nineteen (12.2%) read food nutrition labels “somewhat,” 22 (14.1%) read food nutrition labels “a little,” and 17 (10.9%) did not read food nutrition labels at all. One participant did not know how much he or she read food nutrition labels. The median response was “quite a bit.”

**Descriptive Analyses of Outcome Variables**

**Body Mass Index (BMI)**

BMI was calculated from height and weight data. This ratio level of measurement variable had a range among participants of 10.98 kg/m$^2$ to 47.09 kg/m$^2$ with a mean of 27.73 kg/m$^2$ ($SD = 5.6$). Categorizing participants per BMI guidelines revealed that they were approximately evenly distributed between normal, overweight and obese. One third were obese with a BMI greater than 30 mg/m$^2$ ($n = 52$, 33.3%), another one third were overweight with a
BMI between 25-30 kg/m² \((n = 48, 30.8)\), and an additional one third were normal weight with a BMI between 18.5-24.9 kg/m² \((n = 53, 34\%)\). Three participants were underweight \((1.9\%)\) with a BMI less than 18.5 kg/m².

Graphic representation of the distribution of BMI using continuous data is provided in Figure 3. The histogram depicts the normal curve and the box plot indicates approximately normal distribution with 3 outliers. The BMI skewness factor was at the upper edge of acceptable at 0.496 (Bulmer, 1979).

**Figure 3**

*Box plot and Histogram of BMI Distribution*

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**DASH Diet Plan**

Adherence to the DASH diet plan was measured using the DASH Food Frequency Questionnaire. Each of 7 groups of food—fruits, vegetables, grains, nuts, low-fat dairy, meat, and sweetened beverages—was coded 1-9 based on self-assessed average servings per day in the past year. The meat and sweetened beverage group were reverse coded. A composite score of
the seven categories was computed where the higher the score, the more the person adhered to the DASH diet plan.

This interval level of measurement variable had a mean of 32.66 (SD = 6.3) and a score range of 19-55. Dichotomized scores were computed to identify those who adhered to the DASH diet plan based on dietary recommendations for frequency of daily servings within each of the food groups; however, it was found that no participant was included in the DASH diet plan group. As a result, the DASH score was used as a continuous variable where higher scores indicated that the DASH diet plan was adhered to more closely than lower scores. Scores were approximately normally distributed as indicated in the histogram and box plot below (Figure 4). The skewness factor was 0.414.

Figure 4

*Histogram of DASH Scores*
Exercise

Exercise was measured with an interval level of measurement. Approximately one half of participants responded that they exercised “less than one hour per week” in the past 3 days ($n = 30, 19.2\%$) or “1-2 hours” in the past 3 days ($n = 51, 32.7\%$). Of those who exercised the most, $16\% (n = 25)$ exercised “2-3 hours,” $7.7\% (n = 12)$ exercised “3-4 hours” and $14.1\% (n = 22)$ exercised “4 or more” hours. Only $10.3\% (n = 16)$ reported no exercise. When recoded as a dichotomous variable, more people ($n = 97, 62.2\%$) exercised less than 2 hours in the past 3 days compared with $37.8\% (n = 59)$ who exercised 2 or more hours in the past 3 days. As indicated in the boxplot and histogram below (Figure 5) the data appears slightly skewed to the left; however, the skewness factor was acceptable at 0.385. The median response was “1-2 hours” of exercise in the past 3 days.

Figure 5

Boxplot and Histogram of Exercise Distribution
Low Sodium Diet

To measure if participants adhered to a low sodium diet, an ordinal level of measurement question was used. Approximately one half of the respondents indicated that they adhered to a low sodium diet “very much” or “quite a bit” \((n = 40, 25.6\% \text{ and } n = 47, 30.1, \text{ respectively})\). An additional one third of participants responded that they adhered to a low sodium diet “somewhat” or “a little” \((n = 28, 17.9\% \text{ and } n = 26, 16.7, \text{ respectively})\). Fifteen responded that they did not adhere to a low sodium diet (9.6%). When recoded as a dichotomous variable, less than one half of the participants did not adhere to a low sodium diet \((n = 69, 44.2\%)\) while 55.7% \((n = 87)\) adhered a low sodium diet “very much” or “quite a bit”. The median response was “quite a bit.” Figure 6 demonstrates the data to be negatively skewed; however, the skewness factor was on the upper edge of acceptable at -0.448.

Figure 6

*Histogram of Low Sodium Diet*
Alcohol Use

The majority of participants did not drink alcohol or had 1 drink per day \((n = 92, 59\%\) and \(n = 24, 15.4\%,\) respectively). An additional 17.3\% \((n = 27)\) had 2 drinks per day while only 8.3\% of participants had more than 2 drinks per day: 3.2\% \((n = 5)\) had 3 drinks per day, 1.9\% \((n = 3)\) had 4 drinks per day and 3.2 \% \((n = 5)\) had 5 or more drinks per day. The mean response was 1.1 \((SD = 1.2)\). When recoded as a dichotomous variable, 78.2\% \((n = 122)\) followed guidelines for alcohol consumption meaning that women had no more than 1 drink per day and men had no more than 2 drinks per day. Thirty four participants (21.8\%) reported consuming more than that on a daily basis. The responses were highly skewed as indicated in Figure 7 with a skewness factor of -1.670.

Figure 7

*Boxplot of Alcohol Use Distribution*

Reliability Analysis of Instruments

Internal consistency reliability analyses were conducted on the four instruments used in data collection—PSS4, DSSI, DASH FFQ, and SOC—to determine how closely related the set
of items were as a group. Cronbach’s alpha coefficients were computed for the PSS4, DSSI, and DASH FFQ. Equivalence reliability was used for the SOC.

The PSS4 is an abbreviated version of the original 14-item scale. In this study, the PSS4 had a relatively low Cronbach’s alpha coefficient of .53; however, reliability coefficient analyses of the original scale ranged from .60 to .72, with .55 on test-retest. The author of the scale cautions that the few number of items adversely affects the reliability (S. Cohen, et al., 1983). It is recognized that a smaller number of items in a scale decreases the reliability coefficient; therefore, the low alpha coefficient may be a reflection of only having 4 items in the scale (Waltz, et al., 2005).

The DSSI is an abbreviated 10-item version of the original 35-item DSSI instrument (Koenig, et al., 1993). In this study the 10-item DSSI had an adequate Cronbach’s alpha coefficient of .75, a finding comparable to a previous study where the coefficient was .76 (Powers, et al., 2004). Internal consistency reliability of the 4-item network and the 7-item satisfaction subscales was .51 and .80, respectively, similar to findings in the Powers et al., (2004) study where alpha coefficients were .58 and .80, respectively. Similar to the PSS4, the small number of items in the network subscale may be reflected in the low alpha coefficient.

In this study, the DASH FFQ demonstrated a low Cronbach’s alpha coefficient of .46. Comparison with previous studies was not possible, as alpha coefficients were not stated; however, FFQ’s have been extensively validated via comparisons of self-report values with explanatory measures of diet such as dietary records where adjusted Pearson correlation coefficients ranged from .69 to .81 (Willett & Lenart, 1998). The low alpha coefficient in this study may be related to the fact that the data were slightly skewed to the left or that the participants were homogenous in this attribute (Waltz, et al., 2005).
Stage of change is a concept measured using a one-item, 5 response format. The question measures readiness to engage in moderate exercise at least 30 minutes per day for 5-7 days a week. Since it is a single question, it was not feasible to test for internal consistency reliability; therefore, equivalence reliability was used. The SOC variable was entered into the reliability analysis along with the variable about frequency of engaging in regular exercise. The alpha coefficient was low at .47. The low number of items—2—was a factor contributing to the low alpha. Table 3 summarizes the reliability analyses findings.

Table 3

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Current values</th>
<th>Original values</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSS4</td>
<td>.53</td>
<td>.60-.72</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Test-retest reliability 0.55</td>
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<tr>
<td>DSSI</td>
<td>.75</td>
<td>.76</td>
</tr>
<tr>
<td>DSSI network subscale</td>
<td>.51</td>
<td>.58</td>
</tr>
<tr>
<td>DSSI satisfaction subscale</td>
<td>.80</td>
<td>.80</td>
</tr>
<tr>
<td>DASH FFQ</td>
<td>.46</td>
<td>Unavailable</td>
</tr>
<tr>
<td>SOC</td>
<td>Equivalence reliability: 0.46</td>
<td>—</td>
</tr>
</tbody>
</table>

Research Questions and Associated Hypotheses

The purpose of the study was to develop a prediction model of demographic and sociobehavioral characteristics that are common among older adults with hypertension who engage in TLC. Explanatory variables were selected for inclusion in the study based on empirical
and theoretical support that the characteristic was associated with at least one TLC. The research questions and associated hypotheses of the study were:

1. Are select demographic and sociobehavioral characteristics related to TLC among hypertensive adults age 60 and older?

   Hypothesis 1: There is a relationship between demographic and sociobehavioral characteristics and TLC among older hypertensive adults.

2. Is there a select set of demographic and sociobehavioral characteristics predictive of engagement in TLC among hypertensive adults age 60 and older?

   Hypothesis 2: There is a common set of characteristics that can predict the older hypertensive adult who is likely to engage in TLC.

Demographic characteristics were age, gender, ethnicity, marital status, annual income, education level, and number of co-morbidities. Sociobehavioral characteristics were identified as practices likely to remain consistent over time and self-perceived qualitative indicators. Practices likely to remain consistent over time included HBPM, smoking, keeping medical appointments, and reading food nutrition labels. Self-perceived qualitative indicators included self-rated health, perceived stress, social support, and SOC. The five TLCs were adherence to a low sodium diet, adherence to the DASH diet plan, maintaining a normal BMI, regular exercise, and moderation in alcohol intake.

Data Analyses

Hypothesis 1

To test the first hypothesis that there is a relationship between demographic and sociobehavioral characteristics and TLC, correlational analyses were conducted. The Pearson Product Moment Correlation coefficient was used for the continuous outcome variables BMI,
DASH FFQ, and exercise. Kendall’s Tau-b test was used for the categorical outcome variables, low sodium diet and alcohol intake. A two-tailed test for significance was used since the direction of the relationships was not hypothesized. Table 4 shows the Pearson correlation coefficients that reached significance and Table 5 shows the Kendall’s Tau-b correlation coefficients that reached significance. The outcome variables are listed in the first column.

Table 4

*Pearson Product Moment Correlation Coefficients*

<table>
<thead>
<tr>
<th>Pearson correlation coefficients (r)</th>
<th>SOC</th>
<th>Diabetes</th>
<th>Education</th>
<th>Read labels</th>
<th>Marital status (separated)</th>
<th>Age</th>
<th>Self rated health</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
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<td>.875</td>
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<td>.397</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p value</td>
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<td>.006</td>
<td>.001</td>
<td>.001</td>
<td>.810</td>
<td>.394</td>
</tr>
<tr>
<td>Exercise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p value</td>
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<td>.929</td>
<td>.346</td>
<td>.895</td>
<td>.693</td>
<td>.033</td>
<td>.020</td>
</tr>
</tbody>
</table>

Table 5

*Kendall’s Tau-b Correlation Coefficients*

<table>
<thead>
<tr>
<th>Kendall’s Tau-b correlation coefficients (r)</th>
<th>Read Labels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Na+ diet</td>
<td>- .383</td>
</tr>
<tr>
<td>p value</td>
<td>.000</td>
</tr>
<tr>
<td>Alcohol use</td>
<td>- .025</td>
</tr>
<tr>
<td>p value</td>
<td>.735</td>
</tr>
</tbody>
</table>
The correlation coefficients in the above tables did not indicate strong relationships among the variables that were statistically significant. The sample size of 156 affected the level of statistical significance, such that larger samples require lower coefficient values to assume the relationship did not occur by chance. The coefficients also demonstrated the direction of the relationships. A lower BMI was associated with a higher SOC, and having a higher BMI was positively correlated with having diabetes. Higher levels of education, reading food nutrition labels, and being separated from a spouse were positively associated with adhering to the DASH diet plan. Those who exercise regularly tended to have a higher SOC, have higher self-rated health, and be younger. Those who adhered to a low sodium diet are more likely to read food nutrition labels. Alcohol use did not evince any significant relationships with the explanatory variables. The hypothesis was partially supported in that there is a relationship between demographic and sociobehavioral characteristics and TLC for four of the five TLC.

There were a few outcome variables related to other outcome variables that were not included in the tables, as they will not be entered the regression equations. BMI was significantly correlated with exercise; low sodium diet was significantly correlated with adhering to the DASH diet plan; and alcohol use was significantly correlated with BMI when BMI was used as a dichotomous variable.

Hypothesis 2

The second hypothesis stated that there is a common set of characteristics that can predict the older hypertensive adult who is likely to engage in TLC. Regression analyses were conducted to determine if the explanatory variables were predictive of the outcome variables, TLC. Multiple linear regression was used for continuous outcome variables and logistic regression was used for dichotomous outcome variables. The stepwise method was used for
entering explanatory variables into the regression equation. Each outcome variable was tested with the explanatory variables to determine the best set of predictors. Prior to performing linear regression, however, it was necessary to ensure that the assumptions of regression were met.

**Multiple Linear Regression Assumptions**

As previously demonstrated in Table 4 and 5, only 7 of the 14 explanatory variables were significantly correlated with any specific outcome variable and none had a correlation coefficient greater than .330.

For the purposes of determining multicollinearity, high correlation is defined as a correlation coefficient of .70 or higher (Tabachnick & Fidell, 1989). To test the correlations among the explanatory variables the Pearson Product Moment Correlation coefficient was used for variables measured at a ratio level of measurement: age, the PSS4 score, the DSSI score, and the number of co-morbidities. The remaining explanatory variables were either dichotomous or ordinal level of measurement and Kendall’s Tau-b test was used. A two-tailed test for significance was done since the direction of the relationships was not hypothesized. Review of the correlation coefficients and the level of significance revealed that although there were correlations that reached significance \( p = .05 \), the highest correlation was between marital status and gender with a correlation coefficient of .260 \( p = .000 \). Since the coefficients did not reach .70, it was determined to retain the 14 explanatory variables for entry into regression analyses. Multicollinearity was further tested with the tolerance test, an output of linear regression models.

Four of the five outcome variables were approximately normally distributed with skewness statistics below +/- 0.5. Only alcohol use was highly skewed and was therefore transformed to a dichotomous variable. Linearity was tested for continuous explanatory
variables against continuous outcome variables. No linear relationships were evident on scatterplots with raw data; however, plotting the residuals from the regression can suggest if a linear relationship exists. A linear regression model is appropriate if the residuals are randomly distributed above and below the horizontal x-axis. Figure 8 demonstrates that exercise and age are linearly related, normally distributed, and homoscedastic. This is the case if the residuals plot is rectangular, with a concentration of points along the horizontal x-axis (Tabachnick & Fidell, 1989). Since it was difficult to identify linear relationships with the raw data, explanatory variables known to be correlated or approximately correlated with the outcome variables were entered into regression analyses. Residuals from the analysis were checked to ensure that linear regression was the appropriate test for the data.

Figure 8

*Residuals Plot of Exercise Predicted by Age*

Model for BMI

Multiple linear regression was used to determine the explanatory variables predictive of BMI. BMI as a continuous variable and a set of explanatory variables were entered into the
regression equation using the stepwise solution. The residuals plots indicated that the variables were appropriate for linear regression. Tolerance was used to test for collinearity. Tolerance measures the proportion of the variance in the variable that is not accounted for by the other explanatory variables in the model where a tolerance of 0 means perfect collinearity (Munro, 2001). The tolerance statistic for collinearity showed a tolerance of 1 for both SOC and diabetes, indicating that multicollinearity was not a problem.

The model (Table 6) shows SOC \( p = .000 \) and diabetes \( p = .012 \) were significant predictors of BMI, meaning that they contributed significantly to the variance in BMI. The Beta standardized coefficients showed a negative relationship between SOC and BMI, indicating that those at a higher SOC had a lower BMI. Diabetes had a positive relationship to BMI, such that having diabetes was associated with having a higher BMI. The adjusted R-squared indicated that SOC and diabetes accounted for 13.3% of the variance of BMI. The ANOVA statistic indicated significance with \( p = .000 \).

Table 6

*Predictors of BMI*

<table>
<thead>
<tr>
<th>Coefficients(^a)</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>( t )</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1 (Constant)</td>
<td>31.452</td>
<td>.958</td>
<td>32.845</td>
<td>.000</td>
</tr>
<tr>
<td>SOC</td>
<td>-1.309</td>
<td>.302</td>
<td>-.330</td>
<td>-4.335</td>
</tr>
<tr>
<td>2 (Constant)</td>
<td>31.059</td>
<td>.954</td>
<td>32.558</td>
<td>.000</td>
</tr>
<tr>
<td>SOC</td>
<td>-1.309</td>
<td>.297</td>
<td>-.330</td>
<td>-4.407</td>
</tr>
<tr>
<td>Diabetes</td>
<td>3.207</td>
<td>1.268</td>
<td>.189</td>
<td>2.529</td>
</tr>
<tr>
<td>Model</td>
<td>Coefficient</td>
<td>Unstandardized</td>
<td>Standardized</td>
<td>t</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
<td>----------------</td>
<td>--------------</td>
<td>---</td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>31.452</td>
<td>.958</td>
<td>32.845</td>
</tr>
<tr>
<td></td>
<td>SOC</td>
<td>-1.309</td>
<td>.302</td>
<td>-4.335</td>
</tr>
<tr>
<td>2</td>
<td>(Constant)</td>
<td>31.059</td>
<td>.954</td>
<td>32.558</td>
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<tr>
<td></td>
<td>SOC</td>
<td>-1.309</td>
<td>.297</td>
<td>-4.407</td>
</tr>
<tr>
<td></td>
<td>Diabetes</td>
<td>3.207</td>
<td>1.268</td>
<td>.189</td>
</tr>
</tbody>
</table>

a. Outcome Variable: BMI

Model for Dash Diet Plan

The total DASH score was calculated from responses to 8 variables with a score range of 19-55. Multiple linear regression was used to determine the explanatory variables predictive of adhering to the DASH diet plan. DASH, as a continuous variable, and a set of predictor variables was entered into the regression equation using the stepwise solution. The residuals plots indicated that the variables were appropriate for linear regression, and collinearity statistics for the final model showed a tolerance statistic ranging from .988-.999, indicating that multicollinearity was not a problem. When DASH was regressed on 3 predictor variables—SOC, age, and self-rated health—15% of the variance in DASH was accounted for. The final model was significant at $p = .000$ level. Table 7 shows the significant contribution of each predictor to the variance in DASH. The Beta standardized coefficients were all positive,
indicating that marital status, specifically being separated from a spouse, reading food nutrition labels, and having more education were associated with having a higher DASH score.

Table 7

*Predictors of the DASH Diet Plan*

<table>
<thead>
<tr>
<th>Coefficients^a^</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>B</td>
<td>Std. Error</td>
</tr>
<tr>
<td>1 (Constant)</td>
<td>32.480</td>
<td>.495</td>
</tr>
<tr>
<td></td>
<td>separated</td>
<td>11.853</td>
</tr>
<tr>
<td>2 (Constant)</td>
<td>29.719</td>
<td>1.028</td>
</tr>
<tr>
<td></td>
<td>Separated</td>
<td>10.708</td>
</tr>
<tr>
<td></td>
<td>Food nutrition</td>
<td>1.065</td>
</tr>
<tr>
<td></td>
<td>labels 0-5</td>
<td></td>
</tr>
<tr>
<td>3 (Constant)</td>
<td>25.167</td>
<td>1.878</td>
</tr>
<tr>
<td></td>
<td>Separated</td>
<td>10.495</td>
</tr>
<tr>
<td></td>
<td>Food nutrition</td>
<td>1.043</td>
</tr>
<tr>
<td></td>
<td>labels 0-5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Education</td>
<td>1.322</td>
</tr>
</tbody>
</table>

^a^ Outcome Variable: DASH

Model for Regular Exercise

Two regression models were tested to determine predictors of regular exercise. The exercise variable was dichotomized to those who exercised “2-3 hours”, “4-5 hours”, or “more than 4 hours” in the last 3 days, and those who did not exercise on a regular basis as identified by the responses “none,” “less than 1 hour” or “1-2 hours” in the past 3 days. Logistic regression using exercise as a dichotomous variable revealed that higher self-rated health was a significant
predictor of those in the exercise group. However, when exercise, as an interval measure, was entered into multiple linear regression using the stepwise solution, SOC and age were added as significant predictors ($p = .05$), as shown in Table 8.

Table 8

*Predictors of Exercise*

Coefficients*

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>1.394</td>
<td>.259</td>
<td>5.376</td>
</tr>
<tr>
<td></td>
<td>SOC</td>
<td>.332</td>
<td>.082</td>
<td>.311</td>
</tr>
<tr>
<td>2</td>
<td>(Constant)</td>
<td>4.924</td>
<td>1.253</td>
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<tr>
<td></td>
<td>SOC</td>
<td>.364</td>
<td>.081</td>
<td>.341</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>-.047</td>
<td>.016</td>
<td>-.217</td>
</tr>
<tr>
<td>3</td>
<td>(Constant)</td>
<td>3.949</td>
<td>1.318</td>
<td>2.996</td>
</tr>
<tr>
<td></td>
<td>SOC</td>
<td>.343</td>
<td>.080</td>
<td>.321</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>-.049</td>
<td>.016</td>
<td>-.226</td>
</tr>
<tr>
<td></td>
<td>Self rated health</td>
<td>.416</td>
<td>.192</td>
<td>.162</td>
</tr>
</tbody>
</table>

a. Outcome Variable: Exercise 0-5

The Beta standardized coefficients showed a negative relationship between age and exercise and a positive relationship between SOC and self-rated health, indicating that being younger, being at a higher SOC, and having higher self-rated health were associated with more exercise. Collinearity statistics for the final model showed a tolerance statistic of .967 for SOC, .979 for age, and .980 for self-rated health. The ANOVA statistic showed the model to be
significant at $p = .000$ and the $R^2$ showed that the predictors accounted for 15.2% of the variance in exercise.

**Model for Low Sodium Diet**

Low sodium diet was measured using an ordinal level of measurement with the question, “Do you follow a low salt diet?” Logistic regression is appropriate for use with binary outcome variables to identify explanatory variables that affect the probability of group membership (Munro, 2001). Low sodium diet was dichotomized as “quite a bit” and “very much” in one category and “not at all,” “a little” and “somewhat” in a second category. Explanatory variables significant to the model were age ($p = .05$) and reading food nutrition labels ($p = .001$), as indicated in Table 9. Interpretation of the findings indicated that a one-year increase in age resulted in a 0.076 increase in the log odds of adhering to a low sodium diet, and reading food nutrition labels either “quite a bit” or “very much” resulted in a 1.76 increase in the log odds of adhering to a low sodium diet. The Akaike Information Criterion (AIC) for the model was 184.67. The AIC is a measure of the goodness of fit of a model relative to other models. The lower the AIC, the better the fit of the model, as a lower AIC indicates that the distance between the model and the truth is less (Burnham & Anderson, 2002).
Table 9

*Predictors of Low Sodium Diet*

Coefficients:

|            | Estimate | Std. Error | z value | Pr(>|z|)  | P-Value |
|------------|----------|------------|---------|-----------|---------|
| (Intercept)| -8.05025 | 2.38235    | -3.379  | 0.000727  | .001    |
| Age        | 0.07617  | 0.02842    | 2.680   | 0.007369  | .05     |
| Food nutrition labels | 1.75985 | 0.38646    | 4.554   | 5.27e-06  | .001    |

Model for Alcohol Use

Alcohol intake was measured as a ratio level of measurement from 0 to 5 or more drinks per day. Because the responses were highly skewed, the assumptions of regression could not be met, and the variable was therefore transformed to a dichotomous variable. Based on dietary recommendations, the variable was dichotomized such that having none or 1 drink per day for women, and having none, 1 or 2 drinks per day for men were categorized as one group, and drinking more per day for either gender was categorized as the second group.

As a dichotomous variable, logistic regression was used to determine which explanatory variables affected the probability of consuming alcohol in recommended quantities versus consuming alcohol in greater quantities. Explanatory variables significant to the model were age (\( p = .05 \)), gender (\( p = .05 \)), and diabetes (\( p = .05 \)) as indicated in Table 10. Interpretation of the findings indicated that a one-year increase in age or having diabetes resulted in a decrease in the log odds of consuming alcohol in recommended amounts by 0.067 and 2.24, respectively. Being
female increased the log odds of consuming alcohol per recommendations by 1.4. The AIC for the model was 155.19.

Table 10

*Predictors of Alcohol Use*

Coefficients:

|                 | Estimate | Std. Error | z value | Pr(>|z|) | P-value |
|-----------------|----------|------------|---------|----------|---------|
| (Intercept)     | 2.06909  | 2.37050    | 0.873   | 0.3827   |         |
| Age             | -0.06664 | 0.03087    | -2.159  | 0.0309   | .05     |
| Gender          | 1.40426  | 0.67035    | 2.095   | 0.0362   | .05     |
| Diabetes        | -2.24293 | 1.06975    | -2.097  | 0.0360   | .05     |

**The Final Model**

In summary, the hypothesis that there is a common set of characteristics that can predict the older hypertensive adult who is likely to engage in TLC was supported; however, not in a robust sense. There were significant predictor variables for each TLC outcome variable; however, the common variable list was brief, as depicted in Table 11. Only age was a predictor for three TLC behaviors, while reading food nutrition labels, SOC, and having diabetes were predictive of two TLC behaviors. The other predictors—being separated from a spouse, education level, self-rated health and gender—were predictive of only one TLC behavior.
### Table 11

**Final Predictors of Engagement in TLC**

<table>
<thead>
<tr>
<th></th>
<th>BMI</th>
<th>DASH</th>
<th>Exercise</th>
<th>Low Na⁺ Diet</th>
<th>Alcohol Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOC</td>
<td>.000</td>
<td></td>
<td>SOC</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>.012</td>
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<td>Diabetes</td>
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<td>.05</td>
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<td>Marital status</td>
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<td>(separated)</td>
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<td>Read labels</td>
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<td>Read labels</td>
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<td>.003</td>
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<td></td>
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<td>.05</td>
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</tbody>
</table>

**Summary of Findings**

One hundred and fifty-six adults age 60 and older who attended faith-based and senior citizen groups in Boston and the greater Boston area participated in the study. An average of 12 people from 13 venues completed questionnaires.

Internal consistency reliability coefficients were obtained for the instruments used in the study: PSS4, DASH FFQ, SOC, and DSSI. The PSS4, DASH FFQ and the SOC demonstrated low alpha coefficients, although the alpha coefficient for the PSS4 was similar to other studies. Homogeneity among the group, as well as instrument length, likely contributed to the low alpha scores. The DDSI measure had adequate Cronbach’s alpha coefficients that were consistent with findings in other studies.
Correlational analyses found that there were 9 statistically significant correlations between explanatory variables and the outcome variables thereby supporting hypothesis 1. To address hypothesis 2, multiple linear regression was used with the outcome variables BMI, DASH and exercise, and logistic regression was used with the outcome variables low sodium diet and alcohol use. Each of the five outcome variables demonstrated significant findings, thereby supporting the hypothesis. The findings, however, lacked robustness as the explained variance for the multiple regression models ranged from 13.3% to 15.2%. Overall, SOC, self-rated health, education level, gender, age, diabetes, reading food nutrition labels, and marital status were variables predictive of engagement in one or more TLC.

The next chapter will discuss the findings and conclusions, as well as implications and direction for future practice.
Chapter 5: Findings, Conclusions, Implications, and Future Direction

Introduction

This chapter presents an overview of the study, including the methodology and statistical findings. Conclusions are presented based on the research questions and discussed within the theoretical framework, the Interaction Model of Client Health Behavior (IMCHB). Implications for nursing practice and limitations of the study are discussed. Finally, suggestions for future research that add to the current body of knowledge regarding the care of older adults with HTN concludes the chapter.

Summary of Study

The purpose of the study was to develop a prediction model of demographic and sociobehavioral characteristics that are common among older adults with HTN who engage in TLC. HTN affects 67% of adults age 60 and older, a disproportionate percentage when compared with other age specific groups, and is independently and consistently linked to the development of cardiovascular sequelae (Ostchega, Yoon, et al., 2008). The JNC-7 cites the primary objective in the evaluation of individuals with HTN is to assess adherence to TLC (Chobanian, 2003). The JNC-7 specifically defines TLC as adhering to a low-sodium diet, adhering to the DASH diet plan, maintaining a normal BMI, engaging in regular exercise, and consuming alcohol in moderation. Seminal and other studies provide overwhelming substantive evidence about the significant effects of TLC on lowering blood pressure. However, even with the well-known association between the performance of TLC and lowered blood pressure levels, studies indicate that inadequate or inconsistent attention is given to lifestyle changes (Cobb, et al., 2006; Elhani, et al., 2009).

The research questions and associated hypotheses of the study were:
1. Are select demographic and sociobehavioral characteristics related to TLC among hypertensive adults age 60 and older?

   Hypothesis 1: There is a relationship between demographic and sociobehavioral characteristics and TLC among older hypertensive adults.

2. Is there a select set of demographic and sociobehavioral characteristics predictive of engagement in TLC among hypertensive adults age 60 and older?

   Hypothesis 2: There is a common set of characteristics that can predict the older hypertensive adult who is likely to engage in TLC.

The IMCHB is the theoretical framework that guided the study and the selection of explanatory variables. The goal of the model is to identify explanatory relationships to facilitate patient care interventions, a goal that was consistent with the aims of the study. The IMCHB was uniquely suited to guide the selection of the explanatory variables in the study, as the background elements in the model are inclusive of demographic and sociobehavioral characteristics, and are recognized as antecedents to health-related outcomes, defined in the study as engagement in TLC. Explanatory variables in the study were selected based on empiric and theoretical support that the variable was associated with at least one TLC.

A 33-item questionnaire was compiled by the researcher to gather data on the 15 explanatory variables and the five outcome variables. Three of the explanatory variables and one outcome variable, the DASH diet plan, were measured using valid and reliable instruments: perceived stress was measured using the PSS4, social support was measured using the DSSI, stage of change was measured using the SOC for physical activity, and adherence to the DASH diet plan was measured using the DASH FFQ. All of the other variables in the study were assessed with questions adopted from various reliable and valid instruments.
Data were collected at 13 faith-based and senior citizen organizations throughout Boston and the greater Boston area. Of those who attended at each site, an average of 12 individuals with self-reported HTN volunteered to participate in the study. A total of 166 questionnaires were collected; however, 10 were incomplete and therefore not used in the analysis. The final number of participants in the study was 156.

Findings

Demographic characteristics

Demographic characteristics in the study included age, gender, marital status, education level, ethnicity, annual income, and number of co-morbidities. Demographic characteristics of the study participants were compared to determine if the study population adequately represented the 60 and older population of Boston. Comparison revealed important differences. While the age of the study participants was well distributed, the mean age of participants was older than that of older adults residing in Boston (77 versus 69.9, respectively) (FactFinder, 2010). Females were over-represented in the study at 80% when compared to 58.1%, and more study participants were widowed (48.7% versus 18.8%, respectively) than married (25.6% versus 41.9%, respectively). Another difference was the higher level of education among study participants where more completed high school (49.9% versus 30.7%, respectively) or had some college (24.4% versus 16.2%, respectively) (FactFinder, 2010).

Recruitment efforts were aimed at obtaining a study population similar in ethnic composition to the older adult population in Boston. While the percentage of white participants—53.8%—was close to the percentage of white individuals age 60 and older living in Boston—59.3%—there were less Asian participants (0.6% versus 8.8%, respectively) and Hispanic participants (1.3% versus 9.9%, respectively) and more Black or African American
participants (42.9% versus 25.6, respectively) in the study. Collectively, the percentage of minority older adults in Boston was similar to the percentage of minority individuals who participated in the study, 40.7% and 46.2%, respectively. Examining the differences in demographic characteristics between the older adult population in Boston and the study population demonstrates that findings cannot be generalized, as the study did not recruit a representative sample.

Annual income was a question that participants were hesitant to respond to, as demonstrated by the 37.2% non-response rate for this item. The issue was perhaps more a matter of semantics than a reticence to divulge income information. This conclusion is based on anecdotal comments made by participants requesting clarification of the question, as retirement or social security income was viewed differently than earned income. Many participants indicated that they were not actively working as the reason for no response.

The majority of participants (84%) in the study reported having only HTN, or HTN and one other co-morbidity. The most commonly cited co-morbidities were cancer (5.8%) and diabetes (12.2%). Neither of these are surprising findings given the lifetime cancer prevalence rate is 41.6% for men and 32.2% for women, respectively, and the prevalence rate for diabetes among those age 65 and older is 26.9% (CDC, 2011; USDHHS, 2011a).

One group of participants, identified as “miscellaneous,” desired to participate in the study but were unable to attend one of the group sessions or were not members of a senior citizen group. Of the 10 people in this group, at least 6 were known to be members of a senior group. The intent of the inclusion criteria for the study was to be as inclusive as possible of community-dwelling older adults with hypertension; however, given that the methodology for data collection was different for this subgroup than for the main study population, demographic characteristics
were compared to determine if the groups were similar. In general, the subgroup tended to be younger with a mean age of 73 ($SD = 7.2$) compared to 77 ($SD = 6.9$), predominantly white (90% compared to 53.8%, respectively), more educated (60% having 4 or more year of college compared to 20%, respectively), have slightly higher incomes with more incomes in the less than 75,000 range (20% versus 5.8%, respectively), and male (70% versus 19%, respectively). When the other variables in the study were compared, there were no distinguishing differences with the main study population, nevertheless, the demographic differences posed a threat to the internal validity of the study (Burns & Grove, 2005).

**Sociobehavioral Characteristics**

Sociobehavioral characteristics were divided into two categories: self-perceived qualitative indicators and practices likely to remain consistent over time. Self-perceived qualitative indicators were identified as self-rated health, perceived stress, social support and SOC. Practices likely to remain consistent over time were identified as HBPM, smoking, keeping medical appointments, and reading food nutrition labels.

The sociobehavioral characteristics of the study population revealed a relatively healthy group of older adults with HTN. Subjective assessment of health by the participants supports the relative health of the sample with 74.4% rating their health as “good” or “excellent.” This is similar to data collected in the 2009 National Health Interview Survey where 76% of individuals age 65 and older reported their health to be “good” or “excellent” (USDHHS, 2011a).

Consistent with the general well-being of the study population, more participants perceived that they had less stress (57.7%) as measured by the PSS4 scale, and most (91%) felt that they had high levels of social support as measured by the DSSI scale. There was a difference, however, between the DSSI satisfaction subscale and the network subscale. While
92.3% indicated a high level of satisfaction with behavioral and emotional support as measured by the satisfaction subscale, only 67.3% indicated that they had a large social network. These findings indicated that the quality of the social network versus the quantity of people in the network was an important factor in self-assessed levels of social support.

For SOC, two thirds (67.3%) of the participants indicated they exercised and were in the “active” or “maintenance” stage for exercise. When SOC responses were compared with responses about actual hours of exercise in the past three days, data revealed that 37.8% reported exercising “2 or more hours” in the past 3 days, and 51.9% reported exercising “less than 2 hours” in the past 3 days. Only 16 participants reported not exercising at all. These findings may appear inconsistent, as more hours of exercise would seem to characterize the person in the “active” or “maintenance” SOC. However, when the questions were carefully reviewed, the findings were consistent.

The exercise question specifically asked the number of hours participants exercised in the past 3 days. The SOC question defined regular exercise as exercising for 5 or more days per week for 30 or more minutes each day. Many participants requested clarification of the exercise question, particularly when the survey was being completed on a Monday and the weekend was taken as an exercise “holiday.” In this situation, a respondent in the “active” or “maintenance” SOC may have exercised on Friday but not on Saturday or Sunday and therefore have responded that they exercised “less than 1 hour” or “1-2 hours” in the past 3 days. Likewise, a similar situation could exist for any day that the questionnaire was completed depending on the participants exercise schedule. This conclusion is supported further by the study finding that a higher SOC was a significant predictor of a normal BMI, although it is recognized that
physiologic and lifestyle factors that impact the BMI are more complex than this finding suggests.

HBPM was not a practice that was consistently practiced by more than 25% of the participants. However, the participants were conscientious about their health as 91.7% reported keeping scheduled medical appointments, and 62% reported reading nutrition labels on food packaging when making decisions about food purchases, a percentage parallel to those who reported adhering to a low-sodium diet (55.7%). Smoking and alcohol intake were also not habits typically practiced by the participants in this study as only 1.9% reported ever smoking, and 78.2% reported alcohol consumption within recommended guidelines. Although the findings may reflect a health consciousness among the study population, it may additionally be reflective of religious beliefs, as 58% were committed members of church groups.

Outcome Variables

BMI was relatively evenly distributed among those who were normal weight, overweight, and obese. It is notable that 64.1% of the participants were either overweight or obese, a proportion similar to population estimates. Data from the 2007-2008 NHANES survey, compared with data from 1999 through 2006, found that the combined prevalence for overweight and obesity for individuals age 60 and older (BMI > 25 kg/m^2) was 78.4% for men (95% CI: 74.8% - 81.9%), and 68.6% for women (95% CI: 64.4% - 72.7%) (Flegal, Carroll, Ogden, & Curtin, 2010).

The DASH diet score, based on responses to seven components of the DASH diet plan, was approximately evenly distributed with a mean score of 33 (SD = 6.3) and a range of 19-55. The score was used as a continuous variable such that higher scores indicated adhering to the DASH diet plan more closely. It was interesting to find that when scores were dichotomized to
reflect strict adherence to each of the seven components, no participant was in the adherence group. This finding perhaps points to the complexity of adhering to the DASH diet plan.

Conclusions

Hypothesis 1: Characteristics related to TLC

The first hypothesis in this study was that there is a relationship between demographic and sociobehavioral characteristics and TLC among older adults with HTN. Demographic characteristics included age, gender, ethnicity, marital status, annual income, education level, and number of co-morbidities. Sociobehavioral characteristics were identified as practices likely to remain consistent over time—HBPM, smoking, keeping medical appointments, and reading food nutrition labels—and self-perceived qualitative indicators including self-rated health, perceived stress, social support, and SOC.

Although strong relationships were not demonstrated between the explanatory variables and the outcome variables, there were significant correlations:

- A higher SOC and not having diabetes was significantly correlated with a normal BMI.
- More education, reading food nutrition labels, and being separated from a spouse were significantly correlated with adhering to the DASH diet plan.
- A higher SOC, higher self-rated health, and being younger was significantly correlated with regular exercise.
- Reading food nutrition labels and being older was significantly correlated with adhering to a low-sodium diet.
- There were no explanatory variables significantly correlated with consuming alcohol in moderation.
Each of the correlations listed above were demonstrated, per regression analyses, to be significant predictors of engagement in one or more TLC and therefore will be discussed with the second hypothesis.

It was interesting to discover a lack of expected correlation between income, perceived stress, and social support with any of the outcome variables. It is possible that the similarity between the participants in the study with respect to these variables contributed to a lack of variability in responses and therefore a lack of expected correlation. A future study with a more representative sample may yield relationships not found in the current study; however, it may be that the questions used in the study failed to accurately measure the variable of interest relative to the older adult population. This was particularly true of the annual income question and the perceived stress scale.

The annual income question requested “annual household income from all sources.” Based on comments by the study participants, the question would have been clearer if it had included income sources relevant to older adults. Likewise, the PSS4 that measures the degree to which environmental stressors overcome one’s coping ability may not measure the degree and type of stress typically experienced by older adults.

Another factor that was considered when questioning the lack of an expected correlation between perceived stress and the outcome variables was social desirability. The fact that the questionnaire was anonymous should have minimized the social desirability effect; however, anonymity became moot when participants, seated side-by-side, had informal discussions about responses. This situation could have prompted responses that were socially desirable. Additionally, if the questions evoked an emotional response, a socially acceptable answer may have been given as opposed to a true response (Waltz, et al., 2005).
Social support, as measured by the DSSI scale, appeared to have a ceiling effect which reduced variability in responses. With 91% of participants indicating high levels of social support, it was not possible to determine differences among the group. It is reasonable that participants did have high levels of social support, a conclusion supported by the fact that participants were actively involved members of a social group that met on a regular basis, and that they were well known to each other as evidenced by “saving seats” and making plans for meeting later in the week. The ceiling effect however, prevented the detection of potentially important differences within the group.

**Hypothesis 2: Characteristics Predictive of TLC**

The second hypothesis in the study is that there is a common set of characteristics that can predict the older hypertensive adult who is likely to engage in TLC. Analysis found that age, SOC, reading food nutrition labels, and diabetes were predictive of engagement in more than one TLC. Gender, education level, marital status, and self-rated health were significantly predictive of one TLC. The final model of explanatory variables predictive of outcome variables is presented in Table 12.
Table 12

*Final Model of Predictors of Engagement in TLC*

<table>
<thead>
<tr>
<th></th>
<th>BMI</th>
<th>DASH</th>
<th>Exercise</th>
<th>Low Na(^+) Diet</th>
<th>Alcohol Use</th>
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<tbody>
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<td></td>
<td>SOC .000</td>
<td></td>
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<tr>
<td>Diabetes</td>
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<td></td>
<td></td>
<td>Diabetes .05</td>
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<td></td>
<td>Read labels .001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education level</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
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<td>Age .05</td>
<td>Age .05</td>
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<td>Gender</td>
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</table>

**Characteristics Predictive of More than One TLC**

The model for BMI demonstrated that having diabetes was predictive of a higher BMI. This finding was not surprising given the recognized link between diabetes and higher weight. Diabetes is a recognized obesity-related condition, such that having a BMI equal to or greater than 25 kg/m\(^2\) is an established risk factor for the development of diabetes (Flood & Newman, 2007; Reis, et al., 2011). This relationship points to the need for interventions aimed at decreasing weight among older adults who have diabetes and HTN as co-morbid conditions, an incidence not uncommon given that 67\% of adults with self-report diabetes also report having HTN (CDC, 2011).

The model for alcohol consumption found that diabetes was additionally associated with greater log odds of consuming alcohol in quantities above recommendations. Although there is a
well-known association between higher alcohol intake and risk for diabetes, there is little empirical support for high alcohol consumption among hypertensive older adults who have diabetes as a co-morbidity (Reis, et al., 2011).

The model for BMI additionally found that having a higher SOC was predictive of a lower BMI, and the model for exercise found that having a higher SOC was predictive of engagement in regular physical activity. Contrary to these findings, a meta-analysis of nine studies conducted to determine the validity of the SOC scale, and to classify the magnitude of the relationship between measures of physical activity and SOC, failed to find a relationship between SOC and BMI (Hellsten, et al., 2008). The age range in the meta-analysis was 41 ($SD = 8.77$) to 82 ($SD = 6.5$), with four of the nine studies having a mean age above 60, indicating the findings are relevant for older adults. Although SOC was found to be a behaviorally valid measure of physical activity, lending support for the finding that SOC was predictive of engagement in regular physical activity, there was minimal evidence that SOC was related to BMI.

It is postulated that the lack of a relationship between SOC and BMI in the meta-analysis may be due to engaging in physical activity for health benefits that did not reach the volume and intensity needed to impact the BMI. Alternatively, with increased exercise, one may gain muscle mass while losing fat. Since muscles weigh more than fat, there may not have been enough weight change to impact the BMI. It is further thought that a pre- and post-intervention design may not have had a sufficient time lapse to indicate an increase in the SOC. However, another study with older adults with a mean age of 63.8 ($SD = 8.3$) examined intrinsic and extrinsic motives to differentiate between stages in the SOC and found that weight management, as a motive for engaging in physical activity, did not significantly differentiate between SOC activity levels (Dacey, Baltzell, & Zaichkowsky, 2008). This finding suggests that weight management
may not be a good mediator to promote an increase in physical activity among older adults as measured by the SOC. That a higher SOC was significantly predictive of a lower BMI in this study may be related to factors other than regular exercise, a consideration supported by the general health consciousness of the study population.

Reading food nutrition labels was predictive of adhering to a low-sodium diet as well as adhering to the DASH diet plan. 2005-2006 data from the nationally representative NHANES study—gathered through personal interviews and the average of two nonconsecutive 24-hour dietary recalls—was used to describe the prevalence of food nutrition label use and the association between label use and nutrient consumption. The study found that when food nutrition labels were used for the purpose of finding specific nutrient information, there was a significant difference in sodium intake between individuals who read labels and those who did not read labels (Ollberding, Wolf, & Contento, 2010).

Another study used the same dataset to determine if individuals who have HTN, diabetes and/or hyperlipidemia read food nutrition labels to change their eating habits when advised to do so by a health care practitioner. The study found that individuals with disease were significantly more likely to read food nutrition labels than individuals without disease (71.2% versus 59%, respectively, \( p = 0.0001 \)); however, regression analyses did not demonstrate a significant difference between those with disease who read food nutrition labels and consumption of a diet lower in sodium (Post, et al., 2010). Collectively, the findings have implications for health care practitioners to consider the quality and specificity of advice and education regarding food nutrition labels to lower sodium intake.

Literature support for the use of food nutrition labels to improve adherence to the DASH diet plan is not as consistent as support for adhering to a lower sodium diet. The previously
mentioned Post et al. (2010) study found that in an unadjusted model, reading food nutrition labels was associated with consuming less calories, less saturated fat, fewer carbohydrates, less sugar, and more fiber. However, when the DASH diet plan was used as a comparison diet, the study found that reading food nutrition labels did not have a significant effect on adherence to the DASH diet plan. This finding provides insight that the complexity of the DASH diet plan may be a factor that influences adherence.

Studies indicate that targeted interventions improve adherence to the DASH diet plan. For instance, a recent study with participants who were age 60 and older found that adherence was significantly improved with the provision of seven weekly home-delivered meals, indicating that modeling may be an important factor in adherence (Troyer, Racine, Ngugi, & McAuley, 2010). Another study with older adults found improved adherence after a behavioral counseling intervention that included training about the DASH diet, reading food nutrition labels, and food monitoring (Fernandez, Scales, Pineiro, Schoenthaler, & Ogedegbe, 2008).

The finding in this study that no participant could be dichotomized to the DASH diet group supported literature evidence that adherence to the DASH diet plan is complex and may have better outcomes when health care practitioners use a comprehensive approach. Nevertheless, the findings in this study that reading food nutrition labels was predictive of adhering to a low sodium diet as well as the DASH diet plan is encouraging and adds to the current body of knowledge that reading food nutrition labels is a beneficial strategy for promoting generally improved nutrition intake.

Age was found to be a significant predictor of three TLCs: regular exercise, adhering to a low sodium diet, and moderation in alcohol use. Younger age was significantly predictive of
regular exercise while older age was significantly predictive of adhering to a low-sodium diet and higher alcohol consumption. Literature provides varied support for these findings.

Among older adults, being younger is a variable that is consistently associated with greater physical activity. As older adults age and develop co-morbidities, engaging in physical exercise may become more difficult. A 2001 meta-analysis found that younger older adults are more likely to engage in more physical activity (King, et al., 2000). Likewise, in a more recent study of community-dwelling older adults with a mean age of 79, physical activity was assessed using the ActivPAL accelerometer for 7 days. Younger age and lower BMI were significant predictors of physical activity, explaining 36% of the total variance in physical activity (Lord, et al., 2011). The findings of these studies support that older adults engage in physical activity but younger older adults are more likely to engage in more physical activity.

The finding in this study that older adults were more likely follow a low-sodium diet is not well supported in the literature. The researcher believes, based on experience with older adults, that the finding was reasonable and makes sense. As older adults age, they seem to become more aware of actions they can take to stave off changes associated with aging, to prevent having to take new prescription medications or higher dosages of medications, and to prevent the onset of new health conditions. A belief the researcher holds is that older adults desire to stay healthy and active and are motivated to take action to maintain a level of health and well-being. This belief is consistent with the IMCHB theoretical model that guided the study and is based on the assumption that individuals are capable of making informed and competent choices about their health behavior. This belief is partially supported by findings in a study with chronic renal failure patients that found that being older ($p = .004$) was significantly associated with a lower consumption of foods high in sodium content (Agondi Rde, Gallani, Rodrigues, &
Cornélio, 2011). The mean age of the study participants was 51 with an age range of 20-80. Although the finding cannot be generalized to older adults with HTN, it suggests that being older may be a motivation for engaging in activities to maintain health.

A surprising finding of this study is that older age was predictive of higher alcohol consumption. Findings in the Peralta-Catipon & Hwang (2011) study found the opposite. The study explored whether or not personal factors were predictive of health-promoting behaviors among adults 55 and older and found that older age was predictive of a lower frequency of consuming higher amounts of alcohol, which was defined as three or more alcoholic beverages per day. Although age is frequently a variable in studies of lifestyle behavior, including alcohol intake behavior, findings are variable indicating the need for further exploration.

Characteristics Predictive of One TLC

Regular physical exercise in this study was found to be significantly predicted by higher self-rated health, a finding supported in the literature. A study that examined personal factors predictive of health-promoting behaviors, as measured by the Health Enhancement Lifestyle Profile (HELP), likewise found self-rated health to be significantly predictive of exercise ($p = .001$) (Peralta-Catipon & Hwang, 2011). That the study used a convenience sample of community-dwelling older adults, and used the same well-validated measure of self-rated health as this study, provides some validation for the finding in this study.

More education and being separated from a spouse were found to be predictive of adhering to the DASH diet plan in this study. The Ollberding et al. (2010) study found that more education was significantly associated with consuming a healthier diet. Although the study did not specifically assess the intake of nutrients defined as the DASH diet plan, components of “consuming a healthier diet” are parallel to components of the DASH diet plan. Other studies
have not found that being separated from a spouse was predictive of adhering to the DASH diet plan. In fact, Post et al. (2010) found that being divorced or separated was associated with being 30% less likely to read food nutrition labels.

Female gender was found in this study to be predictive of consuming alcohol within recommended guidelines. A similar finding was found in a study using a convenience sample of older adults, with a mean age of 75, who visited two large California Emergency Departments. The study found that being male was a significant predictor of higher alcohol intake (Woodruff, et al., 2009). Likewise, the National Social Life, Health, and Aging Project (NSHAP) assessed smoking behaviors and alcohol use, as factors relating to physical health and well-being, and found men reported greater alcohol use than women (Drum, Shiovitz-Ezra, Gaumer, & Lindau, 2009). Although these findings lend empirical support to the finding in this study that women were more likely to consume alcohol in recommended quantities than men, men were under-represented in this study and 58% of the study population were regular church attenders who may have had religious convictions concerning alcohol consumption. These considerations indicate that the finding should be regarded with caution.

**Implications**

The findings of this study have potentially important implications for the management of older adults with HTN. The researcher’s assessment of the study population is that they were engaged in their health, appreciated talking about efforts to maintain their health, and were knowledgeable about healthy lifestyle practices to manage HTN. The participants readily and actively engaged in discussions about TLC, even offering advice to each other about helpful strategies. Studies indicate however, that inadequate attention is given to lifestyle changes during health care encounters, a finding supported by participant comments. Study participants
consistently indicated that health care practitioners did not initiate discussion about TLCs, yet participants were well informed of lifestyle behaviors recommended to manage HTN. This finding has implications for health care practitioners to recognize that older adults may come to visits prepared with ready knowledge and a willingness to engage in discussions about the performance of TLCs, and to appreciate the opportunity this provides to offer advice and encouragement to promote or improve sustained engagement in TLCs.

The study findings relative to adhering to the DASH diet plan have implications for practice as well. The study finding that no participant adhered to all seven components of the DASH diet plan was surprising given the general health of the study population, and that the majority was engaged, on some level, in multiple TLC activities. The finding however, highlights the importance of a comprehensive approach to promote DASH diet adherence, a strategy repeatedly supported by findings in intervention studies. Studies support that adhering to the DASH diet plan is complex; and therefore, requires consistent effort by health care practitioners to identify and mitigate barriers to adherence.

While a strength of this study is that it was the first time this combination of demographic and sociobehavioral characteristics have been analyzed to determine common predictors of engagement in TLCs for older adults with HTN, there were several notable limitations. The use of a non-probability convenience sampling method was a recognized limitation, as biases likely existed within the study population. Indeed, in this study, a bias was introduced as the study population did not represent the population of older adults in Boston with respect to age, gender, ethnicity, and level of education. In addition, the inclusion of individuals who were unable to attend a senior citizen group event, and who proved to be demographically different from the main study population, created a threat to the internal validity of the study.
Another limitation was the homogeneity of the participants. The similarity among the participants in the attributes being studied contributed to less variability among responses and potentially limited explanatory variables from reaching a level of significance. Seven of the 13 data collection sites were faith-based organizations, while 6 were city-based senior citizen organizations. Recruiting from a more diverse set of venues, including senior residential communities, independent living facilities, adult day health care centers, and senior social activity groups would likely have improved variability among responses, and increased sample representativeness with city-level data. Particular consideration should be given to venues where older men are likely to be recruited.

The concept of social desirability was another potential limitation. Questionnaires were completed with participants sitting next to each other, where side conversations about responses were not uncommon. Particularly for emotion-evoking questions, such as perceived stress and social support, responding in a socially acceptable manner may have occurred. Likewise, for questions regarding exercise, or other health-related behaviors, the desire to be viewed favorably by fellow participants may have prompted socially acceptable responses.

Future Research

This is the first study that examined if common demographic and sociobehavioral characteristics are predictive of engagement in TLC among older adults with HTN. The number of participants in this study—156—was sufficient to detect a moderate effect with a power of 80%, and an alpha level of .05; however, the findings lacked robustness. As a preliminary study in this area of research, however, it was significant that age, reading food nutrition labels, SOC, and having diabetes were found to be common predictors of more than one TLC, while education level, gender, self-rated health, and being separated from a spouse were found to be predictive of
one TLC. It is notable that there is little empirical support for several of the predictors. A future study with a large random sample that exerts systematic control would strengthen the validity of the findings, and potentially extend the scope of the findings.

Throughout the data collection period, evidence that the study sample was vested in their health and desired to be actively engaged in managing their health became apparent. Other studies have similarly found that older adults take an active role in health maintenance (Ferri, Ilise, & Pruchno, 2009; Van Leuven, 2010). In fact, the optimism older adults have about their ability to accomplish healthy aging has been associated with engagement in health-promoting behaviors (Ruthig, Hanson, Pedersen, Weber, & Chipperfield, 2011). Further research that expands the current body of knowledge about the attitudes and motivations of older adults to maintain a level of health is needed. Findings may serve to increase awareness of health care practitioners regarding ways to structure health care encounters to support and enhance the efforts of older adults who engage in health-promoting behaviors.

**Summary**

The purpose of the study was to develop a prediction model of demographic and sociobehavioral characteristics that are common among older adults with HTN who engage in TLC. The Interaction Model of Client Health Behavior was the theoretical framework that guided the study and the selection of the explanatory variables. All of the explanatory variables in the study were used in regression analyses with the exception of annual income, which was eliminated because of a high non-response rate.

The demographic characteristics of the study population revealed important differences when compared to the adult population age 60 and older in Boston, a situation that prevented generalization of findings. Additionally, a different data collection methodology was used for
one group of participants who were notably different from the main study population in demographic characteristics. Although there were no distinguishing differences with the other variables in the study, the inclusion of this group presented a risk to the internal validity of the study.

The sociobehavioral characteristics of the study population revealed a relatively healthy group of older adults who were health conscious. Most participants reported having no co-morbid, or having one co-morbid condition, with cancer and diabetes being the most frequently cited co-morbidities. Two thirds or more of the participants reported high levels of social support, exercising on a regular basis, keeping medical appointments, never having smoked, and consuming alcohol within recommended quantities. More than one half reported having less stress, reading nutrition food nutrition labels, and adhering to a low-sodium diet. Despite the findings of positive health behaviors among the study population, it was notable that more than one half were overweight or obese, no participant reported strictly adhering to the seven components of the DASH diet plan, and most did not practice HBPM.

The study found that select demographic and sociobehavioral characteristics are related to engagement in TLC. Although strong relationships were not demonstrated between the explanatory variables and the outcome variables, there were significant correlations for each of the outcome variables with the exception of alcohol use. Regression analyses identified each significant correlation to be a significant predictor of one or more TLC. It was notable that expected correlations were not identified between perceived stress and social support and the outcome variables. The homogeneity of the study population may have been a contributing factor, although other explanations are possible, such as social desirability and a ceiling effect. It is possible that these variables should be measured differently in older adults.
The study further found that a select set of demographic and sociobehavioral characteristics are predictive of engagement in TLC. Age, SOC, reading food nutrition labels, and diabetes were found to be predictive of engagement in more than one TLC. Gender, education level, marital status, and self-rated health were significantly predictive of one TLC.

A finding that was not surprising was that having diabetes was predictive of a higher BMI. This finding, coupled with the result that more than two thirds of the study population were overweight or obese, points to the general need for interventions aimed at weight management among older adults, particularly those with diabetes and HTN as co-morbidities. The study findings, however, that SOC was predictive of a lower BMI and was additionally predictive of engagement in regular physical activity supports that being older does not mitigate the ability to manage weight through engagement in regular physical activity. Even so, it is recognized that myriad factors impact achieving a normal BMI. In this study, factors other than regular exercise, such as the general health consciousness of the study population, likely contributed to the findings. Higher self-rated health, found to be predictive of regular physical exercise in this study, supports this conclusion.

This study found that reading food nutrition labels was predictive of adhering to a low-sodium diet as well as adhering to the DASH diet plan. There is literature to support that reading food nutrition labels can have a positive impact on sodium consumption with the caveat that health care practitioners be cognizant of the quality of the advice they impart to include specifics of food nutrition label use. However, while this study and literature support that reading food nutrition labels does improve consumption of components of the DASH diet plan, targeted interventions may be needed to achieve strict adherence.
Age was found to be a significant predictor of three TLCs: younger age was significantly predictive of regular exercise, older age was significantly predictive of adherence to a low-sodium diet and consuming alcohol in quantities greater than recommended guidelines. With the exception that younger older adults were more likely to engage in regular physical activity, the findings relative to older age have little empirical support. Likewise, other findings in the study with little or no empirical support are education level and marital status as predictors of adhering to the DASH diet plan and having diabetes as a predictor of consuming alcohol in quantities greater than recommended guidelines. The lack of empirical support indicates further exploration is needed to provide validity for these findings.

A finding with substantial literature support is that consuming alcohol within recommended guidelines is significantly predicted by female gender. This finding should be regarded with caution, however, given that men were under-represented in the study, and 58% of the study population were regular church attenders who may have had religious convictions concerning alcohol consumption.

While the findings of this study lack robustness, they were significant in identifying a common set of demographic and sociobehavioral characteristics that are predictive of engagement in TLC. Further studies are needed to validate the findings, and extend the scope of the findings. A positive assessment of the study population, however, that has implications for practice, is that older adults are actively engaged in, and knowledgeable about, TLCs recommended to manage HTN.


NHBLI. *National High Blood Pressure Education Program*. from http://www.nhlbi.nih.gov/about/nhbpep/


Appendix A

Theoretical Framework: Interaction Model Of Client Health Behavior

Elements of client singularity

- Background Variables
  - 1. Demographic characteristics
  - 2. Social Influence
  - 3. Previous health experience
  - 4. Environmental resources

Elements of Client-Professional interaction

- Intrinsic motivation
  - Cognitive appraisal
  - Affective response

- Affective support
  - Health information
  - Decisional control
  - Professional/technical competencies

Elements of Health outcomes

- Utilization of health care services
- Clinical health status indicators
- Severity of health care problem
- Adherence to the recommended care regimen
- Satisfaction with care

Elements of client singularity

- Utilization of health care services
- Clinical health status indicators
- Severity of health care problem
- Adherence to the recommended care regimen
- Satisfaction with care
### Seminal Studies Supporting the Effect of TLC on Blood Pressure

<table>
<thead>
<tr>
<th>Study; Reference</th>
<th>Study Design; Sample size</th>
<th>Age of participants</th>
<th>Purpose</th>
<th>Duration</th>
<th>Effect on BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dietary Approaches to Stop Hypertension study (DASH) (Appel, et al., 1997)</td>
<td>Multicenter randomized feeding trial; 459 participants</td>
<td>22 and older; mean 44 (SD 11)</td>
<td>Effects of dietary patterns on BP: diets were fruits and vegetables, combination diet, and control diet</td>
<td>11 weeks</td>
<td>Compared to the control diet the combination diet reduced SBP and DBP by 5.5/3.0 mmHg more ($p = 0.001$ for each) and the fruit and vegetables diet reduced SBP and DBP by 2.8/1.1 mmHg more ($p = 0.001$ and $P=0.07$ respectively). Compared to the fruits and vegetables diet, the combination diet reduced SBP and DBP by 2.7/1.9 mmHg more ($P=0.001$ and $P=0.002$ respectively).</td>
</tr>
<tr>
<td>Trials of HTN Prevention 1 (TOHP1) (P. K. Whelton, et al., 1997)</td>
<td>Randomized 2x2 factorial trial; 744 participants</td>
<td>30-54; mean 43 (SD 6.1)</td>
<td>Effects of 7 non-pharmacologic interventions on BP</td>
<td>18 months</td>
<td>At 18 months SBP and DBP were significantly reduced by -2.9/-2.4 mmHG for weight loss and -2.1/-1.2 mmHg for sodium reduction.</td>
</tr>
<tr>
<td>Trial of Non-pharmacologic Intervention in the Elderly (TONE) (P. K. Whelton, et al., 1998)</td>
<td>Randomized 2x2 factorial trial; 975 participants</td>
<td>60-80; mean 66.5 (SD 4.6)</td>
<td>Effect of weight loss and sodium reduction and their combination on BP</td>
<td>36 months</td>
<td>Prior to med withdrawal, mean reduction in SBP and DBP for all participants was 4.3 mmHg ($p = 0.001$) and 2.0 mmHg ($P=0.001$).</td>
</tr>
<tr>
<td>Trials of HTN</td>
<td>Randomized</td>
<td>30-54; mean</td>
<td>Long term</td>
<td>36 months</td>
<td>At 6 months, BP decreased 3.7/2.7 mmHg in the</td>
</tr>
<tr>
<td>Study</td>
<td>Design</td>
<td>Participants</td>
<td>Effect Measure</td>
<td>Outcome Measures</td>
<td>Comments</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------------------------------</td>
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</tr>
<tr>
<td>Prevention 2 (TOHP 2) (Stevens, et al., 2001)</td>
<td>2x2 factorial trial; 2382 participants</td>
<td>43 (SD 6.1)</td>
<td>effect of weight loss and dietary sodium reduction and their combination on BP</td>
<td>weight loss group, 2.9/1.6 mmHg in the sodium reduction group, and 4.0/2.8 mmHg in the combination group (p = 0.001). At 36 months, BP decreased 1.3/0.9 mmHg in the weight loss group, 1.2/0.7 mmHg in the sodium reduction group, and 1.1/0.7 mmHg in the combination group reaching significance for SBP and DBP in the weight loss group, and for SBP in the sodium reduction group.</td>
<td></td>
</tr>
<tr>
<td>PREMIER clinical trial (L. J. Appel, et al., 2003)</td>
<td>Randomized controlled trial; 810 participants</td>
<td>Mean 50 (SD 8.9)</td>
<td>Effect on BP of 2 multicomponent behavioral interventions</td>
<td>Intervention 18 months; outcome measures at 6 months</td>
<td>At 6 months, mean reductions in SBP and DBP were 6.6/3.8 mmHg in the advice only group, 10.5/5.5 in the established group, and 11.1/6.4 in the established plus DASH diet group. Between group SBP differences were significant in the intervention groups (p = 0.001 for both) compared to the advice only group. Greater reductions noted among hypertensives.</td>
</tr>
<tr>
<td>Optimal Macronutrient Intake Trial to Prevent Heart Disease trial (OmniHeart) (Appel, et al., 2005)</td>
<td>Randomized 3-period crossover design; 164 participants</td>
<td>30 and over; mean 53.6 (SD10.9)</td>
<td>Compare the effects of a carbohydrate rich diet, a protein rich diet, and an unsaturated fat rich diet on BP</td>
<td>6 weeks</td>
<td>Compared to the carbohydrate diet, the protein diet reduced mean SBP by 1.4 mmHg (P=0.002) more in all participants and by 3.5 mmHg (p=0.006) more among those with HTN. Compared to the carbohydrate diet, the unsaturated fat diet reduced mean SBP by 1.3 mm HG (P=0.02) in all participants and by 2.9 mm Hg (p=0.006) more among those with HTN.</td>
</tr>
<tr>
<td>Senior Hypertension and Physical Exercise (SHAPE) study (Stewart, et al., 2005)</td>
<td>Randomized controlled trial; 104 participants</td>
<td>55-75; mean 63.5</td>
<td>Reduction in BP after supervised program of aerobic and resistance training</td>
<td>6 months</td>
<td>Mean decreases in BP were 5.3/3.7 mmHg for exercisers and 4.5/1.5 mmHg for controls (p = 0.001 for all). Only the DBP reduction was significant (P=0.02).</td>
</tr>
</tbody>
</table>
Appendix C

Characteristics Associated with Adherence to One or More TLC

<table>
<thead>
<tr>
<th>Reference</th>
<th>Age</th>
<th>Gender</th>
<th>Ethnicity</th>
<th>Education</th>
<th>Income</th>
<th>Co-morbidities</th>
<th>Marital Status</th>
<th>BMI</th>
<th>Sociobehavioral characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Booth, et al., 2000)</td>
<td>60-64 and &gt;70</td>
<td>Male</td>
<td>White</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Social support: Friends, family, active partners, family and friends co-participate</td>
</tr>
<tr>
<td>(Cuspidi &amp; Sala, 2008)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Home blood pressure monitoring</td>
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<tr>
<td>(Fosu, 1995)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Social support: Spouse, relatives, homemaker</td>
</tr>
<tr>
<td>(Kirk-Sanchez, et al., 2005)</td>
<td>&gt;9 years</td>
<td></td>
<td></td>
<td>Below poverty level</td>
<td>Less co-morbid conditions</td>
<td></td>
<td></td>
<td>Non-smokers</td>
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<tr>
<td>(Lancaster, 2004)</td>
<td>Older</td>
<td>Female</td>
<td>White</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Social support: Spending time with others</td>
</tr>
<tr>
<td>(Lee &amp; Laffrey, 2006)</td>
<td>Male</td>
<td></td>
<td></td>
<td>Higher income</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Better perceived health; Social support: Interpersonal influence; Previous exercise experience</td>
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<tr>
<td>(Lewis &amp; Riegel, 2010)</td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td>Better perceived health</td>
</tr>
<tr>
<td>(Martin, et al., 2000)</td>
<td>Older</td>
<td>Men</td>
<td>White</td>
<td>More education</td>
<td></td>
<td></td>
<td>Lower BMI</td>
<td></td>
<td>Fewer stressful events; Non-smokers;</td>
</tr>
<tr>
<td>Study</td>
<td>Characteristics</td>
<td>History of physical activity</td>
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<tr>
<td>(Natarajan, et al., 2009)</td>
<td>There is a difference</td>
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<tr>
<td>(Post, et al., 2010)</td>
<td>Female</td>
<td>Read labels when advised by HCP</td>
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<tr>
<td>(Pronk, et al., 2004)</td>
<td>College degree</td>
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<tr>
<td>(Saito, et al., 2010)</td>
<td></td>
<td>Home blood pressure monitoring</td>
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<tr>
<td>(Seguin, et al., 2010)</td>
<td>Older</td>
<td>Better perceived health; Higher lifetime physical activity</td>
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<tr>
<td>(Tomaka, et al., 2006)</td>
<td>Living alone</td>
<td>Social support: Belongingness support</td>
<td></td>
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<tr>
<td>(Uzun, et al., 2009)</td>
<td>More education</td>
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<tr>
<td>(Wanke, et al., 2007)</td>
<td>36-68 years</td>
<td>Social support ; Never smoked</td>
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<tr>
<td></td>
<td>More than high school</td>
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</tbody>
</table>
Appendix D

COME AND JOIN US:

“Manage your Blood Pressure with TLC”

*(Therapeutic Lifestyle Changes)*

A nursing team from Northeastern University will be discussing how to manage your blood pressure and also invite you to participate in a brief research questionnaire.

**The education program is *open to all!***

**Participation in the research study is *voluntary!***

Date:

Time:

Location:

Refreshments will be provided

Free blood pressure measurements

For more information contact: Brenda Douglas at (617)373-3106
Appendix E

TLC Questionnaire

Dear participant,

Thank you for taking the time to complete this questionnaire. We value your honest input in this research study as we are interested in understanding how people like you manage your hypertension as you live each day. Thank you for helping us to learn more about how to care for people with high blood pressure.

1. What is your age? ______

2. About how tall are you without shoes? _____ ft. _____ in.

3. About how much do you weigh without clothes or shoes? _____ lbs.

4. In general, how would you rate your health? Please circle response.
   
   POOR
   FAIR
   GOOD
   EXCELLENT

5. How often do you take your blood pressure at home? Please circle response.
   
   NOT AT ALL
   A LITTLE
   SOMewhat
   QUITE A BIT
   VERY MUCH
   DON’T KNOW
6. Do you smoke tobacco daily? Please circle response.
   NO
   NOT IN LAST 3 DAYS, BUT I AM USUALLY A DAILY SMOKER
   YES

   NOT AT ALL
   A LITTLE
   SOMEWHAT
   QUITE A BIT
   VERY MUCH

8. How often do you read labels on food packages for salt, fat and sugar content when deciding to buy a food product? Please circle response.
   NOT AT ALL
   A LITTLE
   SOMEWHAT
   QUITE A BIT
   VERY MUCH
   DON’T KNOW

9. How often do you follow a low salt diet? Please circle response.
   NOT AT ALL
   A LITTLE
   SOMEWHAT
   QUITE A BIT
   VERY MUCH

10. What is the total number of hours you exercised or were physically active in the last 3 days? Please circle response.
    NONE
    LESS THAN 1 HOUR
    1-2 HOURS
    2-3 HOURS
    3-4 HOURS
    MORE THAN 4 HOURS

11. In the past 12 months, when you drank alcoholic beverages, how many drinks did you have on average? Please circle response.
    1 DRINK
    2 DRINKS
    3 DRINKS
    4 DRINKS
5 OR MORE DRINKS
12. In the last month, how often have you felt that you were unable to control the important things in your life? Please circle response.
   NEVER
   ALMOST NEVER
   SOMETIMES
   FAIRLY OFTEN
   VERY OFTEN
   NOT SURE

13. In the last month, how often have you felt confident about your ability to handle your personal problems? Please circle response.
   NEVER
   ALMOST NEVER
   SOMETIMES
   FAIRLY OFTEN
   VERY OFTEN
   NOT SURE

14. In the last month, how often have you felt that things were going your way? Please circle response.
   NEVER
   ALMOST NEVER
   SOMETIMES
   FAIRLY OFTEN
   VERY OFTEN
   NOT SURE

15. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them? Please circle response.
   NEVER
   ALMOST NEVER
   SOMETIMES
   FAIRLY OFTEN
   VERY OFTEN
   NOT SURE

16. Other than members of your family how many persons in your local area do you feel you can depend on or feel very close to? Please circle response.
   NONE
   1-2 PEOPLE
   MORE THAN 2 PEOPLE
17. How many times during the past week did you spend time with someone who does not live with you, that is you went to see them or they came to visit you or you went out together? Please circle response.

- NONE
- 2 TIMES
- 3-7 TIMES
- MORE THAN 7 TIMES

18. How many times did you talk to someone, friends, relatives, or others on the telephone in the past week (either they called you or you called them)? Please circle response.

- NONE
- 1 TIME
- 2 TO 5 TIMES
- 6 OR MORE TIMES

19. About how often did you go to meetings or clubs, religious meetings, or other groups that you belong to in the past week? Please circle response.

- NONE
- 1 TIME
- 2 TO 5 TIMES
- 6 OR MORE TIMES

20. Does it seem that your family and friends (that is, people who are important to you) understand you? Please circle response.

- HARDLY EVER
- SOME OF THE TIME
- MOST OF THE TIME
- ALWAYS

21. Do you feel useful to your family and friends? Please circle response.

- HARDLY EVER
- SOME OF THE TIME
- MOST OF THE TIME
- ALWAYS

22. Do you know what is going on with your family and friends? Please circle response.

- HARDLY EVER
- SOME OF THE TIME
- MOST OF THE TIME
- ALWAYS
23. When you are talking with your family and friends, do you feel you are being listened to? Please circle response.
   HARDLY EVER
   SOME OF THE TIME
   MOST OF THE TIME
   ALWAYS

24. Do you feel you have a definite role (place) in your family and among your friends? Please circle response.
   HARDLY EVER
   SOME OF THE TIME
   MOST OF THE TIME
   ALWAYS

25. Can you talk about your deepest problems with at least some of your family and friends? Please circle response.
   HARDLY EVER
   SOME OF THE TIME
   MOST OF THE TIME
   ALWAYS

26. Please pick the one statement that best describes your current walking or exercise behavior. Regular means 5 or more days per week for 30 minutes or more each day.

   _____ a. I presently do not walk or exercise regularly, but I plan to start in the next 30 days.

   _____ b. I presently do not walk or exercise, but I have been thinking about starting to walk or exercise within the next 6 months.

   _____ c. I presently do not walk or exercise and do not plan to start walking or exercising in the next 6 months.

   _____ d. I presently walk or exercise on a regular basis and having been doing so for less than six months.

   _____ e. I presently walk or exercise on a regular basis and have been doing so for longer than 6 months.

7. For each food listed, check the box indicating how often, on average, you have used the amount specified during the past year.
Average use last year

<table>
<thead>
<tr>
<th>Foods and <strong>amounts</strong></th>
<th>6+ per day</th>
<th>4-6 per day</th>
<th>2-3 per day</th>
<th>1 per day</th>
<th>5-6 per week</th>
<th>2-4 per week</th>
<th>1 per week</th>
<th>1-3 per month</th>
<th>Never or less than once per month</th>
</tr>
</thead>
<tbody>
<tr>
<td>All fruits (1 fresh, ½ cup canned) Fruit juices (4 oz)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>All vegetables except potatoes or legumes (1/2 cup)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Nuts (1 oz) Peanut butter (1 Tbs) Dried beans, peas, tofu (1/2 cup)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Brown rice, cooked cereal, whole grain cereal, other grains, popcorn, bran (1 cup) Dark breads (1 slice)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Skim milk, yogurt (1 cup) Cottage cheese (1/2 cup)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Beef, pork, lamb, deli meats, organ meats (4-6 oz) Hot dogs (1) Bacon (2 slices)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Carbonated and non-carbonated sweetened beverages (8 oz)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>
Thank you for helping me with this study. So that I can know more about you, would you please answer the following questions?

28. Are you
   MALE
   FEMALE

29. Other than high blood pressure, do you have any of the following illnesses? Please circle all that apply to you.
   ANY FRACTURE DURING THE LAST 30 DAYS
   ALZHEIMER’S DISEASE
   DEMENTIA OTHER THAN ALZHEIMER’S DISEASE
   STROKE
   CORONARY HEART DISEASE
   CONGESTIVE HEART FAILURE
   CHRONIC OBSTRUCTIVE PULMONARY DISEASE
   ANXIETY
   BIPOLAR DISORDER
   DEPRESSION
   SCHIZOPHRENIA
   CANCER
   DIABETES MELLITUS
   OTHER _________________

30. Which one of these groups would you say best represents you?
   WHITE
   HISPANIC OR LATINO
   BLACK OR AFRICAN AMERICAN
   ASIAN
   NATIVE HAWAIIAN OR OTHER PACIFIC ISLANDER
   AMERICAN INDIAN OR ALASKA NATIVE
   OTHER _________________

31. Are you
   MARRIED
   DIVORCED
   WIDOWED
   SEPARATED
   NEVER MARRIED
   A MEMBER OF AN UNMARRIED COUPLE
32. What is your annual household income from all sources?
   LESS THAN $25,000
   LESS THAN $20,000
   LESS THAN $15,000
   LESS THAN $10,000
   LESS THAN $5,000
   LESS THAN $35,000
   LESS THAN $50,000
   LESS THAN $75,000
   $75,000 OR MORE

33. What is the highest grade or year of school you completed?
   NEVER ATTENDED SCHOOL OR ONLY ATTENDED KINDERGARTEN
   GRADES 1 THROUGH 8
   GRADES 9 THROUGH 11
   GRADE 12 OR GED
   COLLEGE 1 YEAR TO 3 YEARS
   COLLEGE 4 YEARS OR MORE

Thank you again,

Brenda Douglas