STATEMENT BY AUTHOR

This master’s report has been submitted in partial fulfillment of requirements for an advanced degree at the University of Arizona and is deposited in the University Library to be made available to borrowers under rules of the Library.

Brief quotations from this master’s report are allowable without special permission, provided that accurate acknowledgement of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the head of the major department or the Dean of the Graduate College when in his or her judgment the proposed use of the material is in the interests of scholarship. In all other instances, however, permission must be obtained from the author.

SIGNED: ______________________________________

APPROVAL BY MASTER’S REPORT DIRECTOR

This Master’s Report has been approved on the date shown below:

Kathleen Insel, PhD, RN  Date
Associate Professor
ACKNOWLEDGMENTS

I would like to express my sincere appreciation for Dr. Kathleen Insel who provided guidance, support, and encouragement throughout my undergraduate and graduate courses of study. Her leadership and direction as committee chair was invaluable in the preparation of an undergraduate honors thesis and this Master’s Report. I would also like to thank Dr. Ruth Taylor-Piliae, Master’s Report committee member, whose expert advice and insight crystallized the flow of ideas during the writing process. These exceptional nurse scholars consistently and patiently pushed for excellence for which I am grateful.
DEDICATION

This Master’s Report is dedicated first to my loving husband, Brett, who consistently supports all of my personal, professional, and academic endeavors. Throughout our courtship and marriage, he endured my perennial student status, long hours of study, intermittent frustrations, and elevated level of stress with astoundingly good humor; he frequently mustered requisite heartening words of assurance and encouragement. He deserves a significant share of the accomplishment of the completed product; he has envisaged its completion with growing enthusiasm over the months.

This Report is also dedicated to my family; my parents have always been supportive of my ambitions and have wholeheartedly urged my siblings and me to pursue higher education to the utmost degree. My siblings and I have shared many seasons of registration, challenging coursework, finals, and sporting successes and failures as we pursue our various studies at this University. My family shares in this academic and professional milestone.

.
TABLE OF CONTENTS

I. LIST OF ILLUSTRATIONS ......................................................... 7

II. LIST OF TABLES ................................................................. 8

III. ABSTRACT ................................................................. 9

IV. CHAPTER 1: INTRODUCTION .................................................. 10
   Statement of the Problem .................................................. 12
   Purpose Statement ......................................................... 12
   Background ................................................................. 13
   Meta-Analyses of Usual Blood Pressure and Disease Risk ............. 13
   Subsequent Analyses ....................................................... 17
   Significance to Nursing .................................................... 19
   Role of the Advanced Practice Nurse .................................... 20
   Pathophysiology ............................................................ 20
   Summary ................................................................. 22

V. CHAPTER 2: CONCEPTUAL FRAMEWORK .................................. 23
   Scope ................................................................. 23
   Origin ................................................................. 24
   Metaparadigm Concepts ................................................ 25
   Major Concepts ........................................................ 26
   Outcomes ............................................................... 29
   Implications for the Advanced Practice Nurse ......................... 29
   Congruency with Interventions ......................................... 30
   Applicability in Practice ............................................... 31
   Implications for the Management of Hypertension .................... 32
   Summary ............................................................... 33

VI. CHAPTER 3: REVIEW OF THE LITERATURE ................................ 34
   Collaborative Interventions ............................................. 34
   Diet ................................................................. 37
   DASH Diet ............................................................. 37
   Dietary Carbohydrate Content .......................................... 40
   Omega-3 Polyunsaturated Fatty Acids .................................. 42
   Caffeine ............................................................. 43
   Exercise ............................................................. 44
   Endurance Training ...................................................... 45
   Resistance Training ...................................................... 45
   Walking ............................................................. 46
Complementary Therapies ................................................................. 47
  Dietary Supplements ................................................................. 48
    Garlic .................................................................................. 48
    Soy Protein .......................................................................... 49
  Mind-Body Practices ................................................................. 51
    Stress Reduction .................................................................. 52
    Qigong ................................................................................ 53
    Tai Chi ................................................................................ 54
Educational Interventions .............................................................. 56
  Patient and Provider Education .............................................. 57
  Cognitive and Behavioral Counseling .................................... 58
Technology-Based Interventions ..................................................... 61
  Home and Self Monitoring ....................................................... 61
  Internet-Based Patient Coaching ............................................ 64
  Combination Technological Interventions ................................ 65
Summary .................................................................................... 66

VII. CHAPTER 4: ANALYSIS AND PRACTICE RECOMMENDATIONS ....68
Method of Analysis ................................................................. 68
Clinical Practice Recommendations ........................................ 70
Areas for Future Research ....................................................... 72
Conclusion ................................................................................ 73

VIII. REFERENCES ........................................................................ 74
LIST OF ILLUSTRATIONS

FIGURE 1: King’s Dynamic Interacting Systems……………………………………24
FIGURE 2: King’s Transactions in the Theory of Goal Attainment…………………27
FIGURE 3: Oxford Centre for Evidence-Based Medicine Levels of Evidence…….69
LIST OF TABLES

TABLE 1: Oxford Centre for Evidence-Based Medicine Levels of Evidence........70

TABLE 2: Strength of Evidence Supporting Interventions..............................71
ABSTRACT

Hypertension is prevalent globally, accounting for 13.5% of deaths and 6% of total disability life-years in 2001. Hypertension is implicated in the etiology of numerous disease processes: 54% of stroke, 47% of ischemic heart disease, 75% of hypertensive disease, and 25% of other cardiovascular disease worldwide. It is distressing to note that such pervasive negative effects are related to a modifiable cause because hypertension can effectively be treated. Hypertension is primarily treated pharmaceutically; however, research on adjunct non-pharmaceutical therapies is accumulating and they are increasingly recommended. Well researched interventions include lifestyle modifications such as diet, exercise, dietary supplementation and mind-body practices, educational interventions, and technology-based interventions. Due to the prevalence and disease causing potential of hypertension, clinicians should be familiar with all evidence-based interventions, which may contribute to the management of hypertensive patients. In this review, extant literature is reviewed, analyzed, and clinical recommendations are made.
CHAPTER 1: INTRODUCTION

Hypertension, elevated blood pressure, is a noteworthy public health concern worldwide due to its significant contribution to the global health burden and its role as a prominent risk factor for the development of a number of disease processes. In the year 2001, high blood pressure accounted for “54% of stroke, 47% of ischaemic heart disease, 75% of hypertensive disease, and 25% of other cardiovascular disease worldwide” (Lawes, Hoorn, & Rodgers, 2008). The negative impact of hypertension on health status is clear, especially taking into account the disability, decreased quality of life, and mortality associated with stroke and cardiovascular disease. In 2001, 7.6 million deaths (13.5% of all deaths) and 92 million disability life-years (6% of total) were attributable to systolic blood pressure greater than 115 mmHg (Lawes et al., 2008). It is distressing to note that such pervasive negative effects are related to such a modifiable cause.

In response to a recognized need and new evidence-based suggestions, the World Health Organization (WHO, 2003) released a revision of its statement on the management of hypertension. The WHO estimated that the condition accounted for 4.5% of the global disease burden and attributed the increase in hypertension to increasing contributing factors and coexisting cardiovascular risk factors such as obesity, poor diet, lack of physical activity, and smoking. Given the large scale and modifiable nature of the problem, it certainly warrants the attention of the health care community.

Domestically, the impact is no less impressive. According to the Healthy People 2010, about 50 million adults in the United States have hypertension and the average age of the hypertensive population is increasing as the general population ages (CDC & NIH,
Therefore, the goals of this initiative include to reduce the proportion of the population that is hypertensive and to increase the proportion of hypertensive individuals whose blood pressure is controlled. Looking specifically at the issue across the adult lifespan, one recent study reported that in the United States between 2003 and 2004 the prevalence of hypertension, defined as blood pressure $\geq 140/90$ or the use of antihypertensive medications, was “7.3±0.9%, 32.6±2.0%, and 66.3±1.8% in the 18 to 39, 40 to 59, and $\geq$60 age groups, respectively” (Ong, Cheung, Man, Lau, & Lam, 2007).

Within the next several years a greater proportion of our population will be older adults as the “baby boomers” enter older age groups. Therefore, a greater proportion of the population is likely to face this health issue in the future. Consequently, it is appropriate to examine how well the condition is being managed currently.

Generally speaking, there is progress in the areas of public awareness and control yet improvement is needed to minimize the risk of hypertension complications in the general population. Notably, the percentage of hypertensive individuals who were aware of their condition increased from 51% in the National Health and Nutrition Examination (NHNE) Survey II (1976-1980) to 73% in phase 1 of NHNE Survey III (1988-1991) (CDC & NIH, 2000). While this indicates an increase in awareness, over one fourth of all people with the condition are still uninformed. There is a demonstrated need for both increased detection and patient education on the part of health care providers.

Additionally, awareness is not synonymous with adequate control; only 18% of hypertensive adults 18 and older had their blood pressure adequately controlled despite 82% having taken action in an attempt to control it (CDC & NIH, 2000). The clinical
implication is that even among those who are actively trying to control their blood pressure most are not successful and require additional intervention. In an analysis comparing data from 1999-2000 and 2003-2004, there were nonsignificant increases in overall prevalence, awareness, and treatment rates of the condition (Ong et al., 2007). Clearly there is a need for the health care community to intervene to properly control this growing public health problem and reduce the risk of the many conditions with which it is associated in the general population.

As the focus of the health care industry shifts from secondary and tertiary interventions toward primary prevention and education, hypertension is a key target because of its chronic, silent nature and its role as a modifiable risk factor for multiple disease processes. This lends credence to the investigation of the particulars of its prevalence, impact, and effective interventions.

Statement of the Problem

Hypertension is a health concern of growing prevalence world and nationwide and is thus a concern for health care providers. Hypertension is also controllable with interventions. Health care providers work with hypertensive individuals to control the condition and to prevent the deleterious side effects of uncontrolled hypertension.

Purpose Statement

To compose a comprehensive review of the literature regarding evidence-based, non-pharmaceutical, management of hypertension that is clinically useful and relevant within a context that is unique to advanced practice nursing.
Background

Meta-Analyses of Usual Blood Pressure and Disease Risk

The significant effect of hypertension on health and its role as an important risk factor for a number of other disease processes have been investigated for decades. In 1990, investigators from nine prospective observational studies collaborated and combined their findings to analyze the relationship between usual diastolic blood pressure (DBP) and risk for stroke and coronary heart disease (CHD) and to determine the length of time a lowered DBP is required in order to reduce risks (MacMahon et al., 1990). After compilation, there were data available from 420,000 participants, ranging from 25 to 84 years of age, who were followed for an average of ten years after the initial measurement.

Previous studies drew correlations between a single baseline DBP measurement and risk for CHD and stroke. Diastolic blood pressures randomly fluctuate due to actual variation and measurement technique which impacts the association between diastolic pressure and cardiovascular disease. Rather than causing random changes in the association, these fluctuations cause a broad underestimation of the slope in the line of association because at baseline measurement a disproportionately high number of people in the lowest category have lower than usual DBP and a disproportionately high number of people in the highest category have higher than usual DBP. This phenomenon is referred to as regression dilution bias because the strength of the association is diluted. This analysis was the first to correct for this diluting impact of random fluctuations in individual DBP. Investigators used Framingham data to determine mean usual DBP for
each category and then plotted baseline DBP values from the current study against these unbiased estimates instead of plotting values against the mean baseline DBP in each category. Therefore, these authors were able to more accurately assess the relationship between usual DBP and risk for stroke and cardiac disease.

According to the resultant data, “differences in usual DBP of 5, 7.5, and 10 mmHg, respectively, were associated with at least 34%, 46%, and 56% less stroke and at least 21%, 29%, and 37% less CHD” (MacMahon et al., 1990). These differences are about 60% greater than had been reported in previous studies that utilized a single baseline DBP compared to mean within a category. Interestingly, within the study range of 70-110 diastolic blood pressure, decreases in pressure were strongly associated with lower risk for the two disease processes mentioned without a threshold below which benefits reached a plateau or above which risk increased at a greater rate. Clinical implications include that substantial benefits in terms of risk reduction may be obtained by reduction in DBP even among normotensive patients and that optimal diastolic pressure for risk reduction may be below the 70 mmHg mark.

In the second component of the above article, Collins and colleagues (1990) reported their analysis of 14 randomized trials investigating the impact of antihypertensive medication on diastolic blood pressure and the resulting impact on risk of stroke and coronary heart disease. The analysis excluded all studies which had been confounded by interventions additional to blood pressure control. The compiled data included almost 37,000 participants and 190,000 total years of patient follow-up.
The mean difference between participants receiving antihypertensive treatment and the control group was 5-6 mmHg DBP. Information regarding systolic blood pressure was available for some of the involved studies; these data suggest that the net difference in systolic blood pressure between groups was approximately double the difference in DBP. Among participants receiving treatment, incidence of both fatal and non-fatal strokes was significantly reduced (two sided $p < 0.0001$); incidence of overall stroke decreased 42%. The reduction in risk for CHD was less dramatic; a significant 14% reduction in total CHD and a non-significant 11% reduction in fatal CHD. The authors attributed the difference to the epidemiologically greater incidence of CHD compared to stroke. Additionally, diuretics, which are frequently used as a first choice long term therapy for hypertension have potentially negative effects on the cardiovascular system such as decreased serum potassium and increased serum lipids which could impact the likelihood of a CHD event. The study also showed significant reduction in overall mortality for those undergoing treatment.

The above studies focus on diastolic blood pressure as the primary means of determining risk for cardiovascular complications. The authors note that it is not possible to wholly characterize an individual’s blood pressure, whether momentary or usual, based on diastolic pressure alone and that other factors such as systolic and mean arterial blood pressure complicate the matter (Collins et al., 1990). However, they noted that the differences in usual DBP and usual SBP between groups in both the observational studies and the randomized trials included in the analyses were proportional. Furthermore, data regarding SBP were available for some of the studies included in the meta-analysis.
conducted by Collins and colleagues; these data suggest that the net decrease in SBP experienced by intervention participants compared with controls was proportionate and approximately double the net decrease in DBP (1990).

In light of the established proportionate relationship between SBP and DBP, it is reasonable to proceed with the understanding that reduction in one component of blood pressure will be associated with a reduction in the other. Therefore, risk reduction associated with decreased DBP will also be associated with decreased SBP. Given the ratio noted above, the absolute reduction in SBP will need to be approximately twice the reduction in DBP to engender comparable risk reduction. This relationship is useful in the analysis of currently available literature because recent guidelines regarding the management of hypertension and current research regarding interventions utilize SBP as the primary gauge of risk for disease related to hypertension.

The above studies represent the first large analyses to correct for the regression dilution bias associated with random fluctuations in individual blood pressure and as such reveal a stronger association between decreased usual blood pressure and reduced risk for the targeted disease processes: stroke and coronary heart disease. Given the relationship of blood pressure measurements described above, these studies are interpreted as robust reports of the risk reduction benefits of both diastolic and systolic blood pressure reduction. Subsequent large scale meta-analyses have corroborated these findings (PSC, 1995; PSC 2002).
Subsequent Analyses

The Prospective Studies Collaboration (PSC) analyzed the data from multiple studies to arrive at generalized conclusions with regard to the effects of hypertension on other disease processes. In 1995, the PSC published a meta-analysis of 45 prospective studies including data on 450,000 individuals with 5-30 years of follow-up. Dividing the participants into 6 categories by blood pressure, there was a range of 27 mmHg in diastolic pressure; participants in the highest category were 5 times more likely than participants in the lowest category to have a stroke regardless of history of coronary heart disease. Interestingly, age factored in significantly with middle aged participants experiencing the greatest risk of stroke in each diastolic blood pressure category. “Among those aged < 45, 45-64, and 65+ when screened, the differences in the relative risks of stroke (between the highest diastolic blood pressure category and a combination of the lowest two categories) were tenfold, fivefold, and twofold, respectively” (PSC, 1995, p. 1647). Conversely, absolute risk of stroke increases with incidence of 2, 5 and 8 per thousand for the same age groups. This dichotomy suggests that therapeutic blood pressure should be determined separately for different age groups. Generally, the clinical implications of the study are impressive; reducing diastolic pressure greatly reduces risk of stroke and a significantly lowered diastolic blood pressure may even compensate for the increased risk associated with a positive cardiac history.

The same group, the PSC, conducted a 2002 meta-analysis of 61 prospective studies including data gathered for about one million adults to determine the relationship between usual blood pressure and vascular mortality. This investigation found that
during both middle and older age, usual blood pressure (corrected for dilution regression) was directly associated with both vascular and all-cause mortality. During middle and older age, usual blood pressure (corrected for dilution regression) was directly associated with vascular mortality and overall mortality down to a threshold of at least 115/75 – there was too little evidence below this point to determine the relationship between blood pressure and mortality risk. Specifically, the authors found that during middle age, a 10 mmHg reduction in SBP or a 5 mmHg reduction in DBP was associated with a 40% decrease in risk of stroke-related mortality, and a 30% reduced risk of mortality related to ischemic heart disease or other vascular etiology. The risk reduction was slightly lower in the older population. Interestingly, a 2 mmHg reduction in usual SBP was associated with 10% reduced risk of stroke mortality and 7% lower ischemic heart disease and other mortality. The clinical implication is that even the most seemingly small reductions in blood pressure can result in significant positive clinical outcomes. This holds true even for those individuals who fall into the normotensive category. (PSC, 2002)

Another study examined the impact of hypertension on the risk of both stroke and cardiac events such as myocardial infarction. In a meta-analysis of nine randomized trials including data about 62,605 hypertensive patients with mean study ages ranging from 53 to 76, the investigators found that with isolated systolic hypertension, a reduction of 10 mmHg systolic and 4 mmHg diastolic reduced the risk of stroke by 30% and myocardial infarction 23% (Staessen, Wang, & Thijs, 2001). In those with diastolic hypertension, a 5-6 mmHg reduction in diastolic blood pressure resulted in 38% reduction in risk of stroke and a 16% reduction in risk of myocardial infarction (Staessen
et al., 2001). This is consistent with previous findings discussed above; reduction in blood pressure consistently reduces risk of cerebrovascular and cardiovascular events.

The above data showed that reduction in both systolic and diastolic blood pressures results in decreased cardiovascular complications. Based on the well established premise that control of hypertension improves health and reduced risk for cardiovascular and cerebrovascular complications as well as mortality, the natural progression is to examine interventions to control hypertension which have been studied and reported in the literature.

Significance to Nursing

Given the considerable and increasing prevalence of hypertension as well as its clinical significance, a substantial portion of the patient population of nearly every nurse caring for adults is impacted. Thus it behooves the bedside nurse to be knowledgeable about the impact of hypertension and its possible complications as well as the appropriate interventions. This is particularly important in outpatient clinic settings in which nurses may interact with the same patients on a regular basis and participate in patient education and assessment of patient understanding of the conditions as well as lifestyle modifications that have been undertaken. This assessment includes challenges and barriers to the success of antihypertension interventions. The nurse, armed with knowledge and resources, can intervene with education to positively impact the health of the patient.
Role of the Advanced Practice Nurse

Advanced practice nurses are uniquely suited to address the public health issue of hypertension. As holistic providers of primary care in the outpatient clinic setting, nurse practitioners interact with patients on a regular basis and empower and assist them to manage their chronic disease processes and prevent complications. They are in a position to collaborate with patients to determine the most appropriate and effective combination of interventions for each individual patient. Interventions within the scope of practice of the nurse practitioner include prescribing antihypertensive medication as well as education and strategies regarding lifestyle modifications.

Pathophysiology

Hypertension is a complex disease process in which multiple mechanisms disrupt homeostatic maintenance of normal blood pressure. Blood pressure determined by cardiac output and peripheral vascular resistance. Cardiac output is determined by blood volume, heart rate, and cardiac contractility. Peripheral vascular resistance is regulated systemically by the sympathetic nervous system and humoral factors and locally through auto-regulation and the vasculature’s response to pH and hypoxia. Alpha adrenergic stimulation, angiotensin II, thromboxane, endothelin, leukotrienes, and catecholamines cause vasoconstriction; beta adrenergic stimulation, prostaglandins, kinins, and nitric oxide cause vasodilation. Essential, or idiopathic, hypertension constitutes the majority of hypertension and is incompletely understood; it is postulated to result from the interaction of genetic predisposition, environmental factors including lifestyle choices, reduced renal excretion of sodium, and vasoconstriction (Schoen, 2005).
In the recent literature, oxidative stress and homocysteine levels, which cause arterial endothelium dysfunction resulting in increased vascular tone, have been implicated in the pathogenesis of essential hypertension. Characteristics of blood flow mediate the process. Smooth and consistent, or laminar, blood flow is associated with nitric oxide production and increased antioxidant expression which protect against oxidative vascular injury while turbulent flow and shear are associated with the production of reactive oxygen species (ROS) leading to oxidative damage, as occurs in hypertension (Paravicini & Touyz, 2006). Specifically, the production of ROS initiates several signaling cascades which result in the growth and migration of vascular smooth muscle cells, expression of inflammatory mediators, and changes in the extracellular matrix (Paravicini & Touyz, 2006). Therefore, oxidative stress is an imbalance of the opposite mechanisms described above.

The role of homocysteine is similar to that described above. High levels of homocysteine promote oxidative injury to the endothelium, limit available nitric oxide, increase oxidative stress, and stimulate overgrowth of vascular muscle cells (Rodrigo, Passalacqua, Araya, Orellana, & Rivera, 2003). All of these changes contribute to an increase in peripheral vascular resistance and systemic blood pressure. The implication of these pathophysiological mechanisms is that essential hypertension is primarily an inflammatory response to damage to the vascular endothelium. These mechanisms are not fully understood, but the current available knowledge is sufficient to provide a foundation upon which to treat the condition.
Summary

Hypertension is a clinically and epidemiologically significant health concern facing this country. Public awareness and available interventions are increasing slowly but the improvement is not sufficient to keep pace with the rapidly growing older population in which prevalence of hypertension is the highest. The health benefits, reduction of risk for stroke and cardiovascular incidents as well as vascular death, of reducing blood pressure have been well established in the literature. For all of the above reasons, it behooves nurses in any practice setting that provides care for adults to be knowledgeable about hypertension, its relationship as a risk factor for other disease processes, and interventions. Advanced practice nurses are uniquely suited to address this health concern among health care providers and should be aware of all the potential treatment options.
CHAPTER 2: CONCEPTUAL FRAMEWORK

It is helpful to approach the issue of hypertension through a theoretical paradigm which provides definitions for the relationship between nurse and client as well as a framework for interventions. An appropriate conceptual framework for this topic is King’s Theory of Goal Attainment which centers on and develops the concept of health as the goal for nursing through exploration of the interactions between human beings and their environments. Within the context of this theory, the goal of nursing is defined as “to help individuals and groups attain, maintain, or restore health” (Hood & Leddy, 2003, p. 186). Therefore, the nurse acts as an agent of positive change to support and encourage clients in their pursuit of health – the ultimate goal of nursing. Within the context of hypertension, ‘health’ is interpreted as adequate control and management of hypertension which results in prevention of complications.

Scope

The theory of goal attainment is a middle range theory; it is less comprehensive than a grand theory yet not as narrow as a practice theory. As such, it is derived from a larger conceptual model and does not seek to explain or conceptualize the entire human experience but rather serves as a bridge between a larger conceptual framework and the practice level of nursing. Hypotheses can be derived directly from the theory and it is also possible to develop more detailed practice theory under its umbrella.
Origin

Like many middle range nursing theories, the theory of goal attainment was the result of reflection on personal experiences, literature review, and development from a conceptual framework. As a nurse, educator, and scholar, King struggled to reconcile theories that did not fully account for what she perceived as the process of nursing; “the complexity and variety in nursing situations can hardly be reduced to two variables” (King, 1990b, p. 73). She therefore turned to systems theory in pursuit of a framework that was inclusive of the complexities of the human experience in relation to nursing.
This pursuit led King into the realm of the interactive-integrative worldview and initially yielded a conceptual framework entitled Dynamic Interacting Systems (DIS) (Figure 1) in which the personal, interpersonal, and social systems interact with the environment (King, 1997). This framework, which has been used by King and others throughout the literature, is explained in text and illustrated with the diagram from the original publication of the framework in 1981 (King 1990b, 1994, 1996, 1997, 1999). King then selected 10 from among the 15 concepts of the framework in order to develop the more specific midrange theory of goal attainment; narrower still is the transaction process which incorporates four of the original 15 concepts (Messmer, 2006). The theory of goal attainment outlines a set of concepts that are in constant interaction with each other under the umbrella of the DIS. The focal point of King’s perspective on nursing is health, which vividly emerges as the central theme of her theory at all levels.

Metaparadigm Concepts

In King’s theory, the metaparadigm concepts are defined from the perspective of an interactive-integrative model. As such, King defines person as a personal system, a clear reflection of the dynamic interacting system of her conceptual model (Frey, 1996). The theory regards environment as the setting for human interactions to include internal and external setting (Wills, 2007). King portrays nursing as a professional, scientific, unique discipline that functions as “a process of human interactions between nurse and client whereby each perceives the other and the situation (Frey, 1996, p. 228). There is a flow of information from nurse to patient and back again that results in an even exchange
in which the two become more familiar with each other and are able to establish a relationship in order to set mutual goals for each interaction.

Health is the most prominent of the metaparadigm concepts in the theory of goal attainment; it is the ‘goal’ referred to in ‘goal attainment’ and is to be the ultimate goal of nursing. Although the application of this idea is quite broad, for the purposes of this paper, goal will be defined as well controlled hypertension resulting in a lack of complications. King describes health as “a function of persons interacting with environment” (1990a, p. 127). This is especially applicable to hypertension as a specific disease state because of the substantial influence of lifestyle modifications on outcomes. She also attributes the following characteristics to her concept of health: “genetic, subjective, relative, dynamic, environmental, functional, cultural, and perceptual” (King, 1990a, p. 127). This is a thorough view of the concept of health and not all of the characteristics apply directly to the topic at hand.

Major Concepts

The core concepts of the theory of goal attainment are defined operationally, in terms of how they function in relation to the other concepts. This description is a function of the theory being based on an interactive-integrative worldview wherein each element interacts with the other elements. For example, transaction is “a process of interactions in which human beings communicate with the environment to achieve goals that are valued” (Wills, 2007, p. 179). The definition of this concept is describing the relationship between other central concepts of the theory. King defines each core concept
individually but the definitions must necessarily include how each element of the theory engages in interaction with the others.

Due to this focus on the interaction of the elements of the theory, the linkages between concepts are explicit. Figure 2 illustrates a transaction between nurse and patient as described in the theory of goal attainment. Most relationships are indicated with unidirectional arrows and transactions are illustrated with bidirectional arrows. The transaction is an interaction between two personal systems. The flow of energy through the systems during the exchange is nonlinear, complex, and the arrows depict this circulation of energy.

*Figure 2. King’s Transactions in the Theory of Goal Attainment.*
The 10 major concepts of the theory of goal attainment, in addition to the metaparadigm concepts addressed above, are perception, communication, interaction, transaction, self, role, stress, growth and development, time, and personal space (Messmer, 2006). The transaction process – a process of interactions in which human beings communicate with the environment to achieve goals that are valued” (Wills, 2007, p. 179) – can be used by nurses to complete all of the steps of the nursing process. The keynote of transaction is mutual goal setting because “when a nurse and a patient engage in mutual goal setting, agreeing to the means to achieve the goal, goals will be achieved, denoting favorable outcomes” (Messmer, 2006, p. 227). Thus, transactions are most effective when mutual goal setting guides and directs the interaction.

The theory of goal attainment operates on a number of basic assumptions about the nature of individuals, nurse-client interactions, and nursing. It asserts that individuals are social, rational, reacting, controlling, purposeful, and action and time oriented in their behavior (Wills, 2007). The theory also identifies that within nurse-client interactions the perceptions, goals, needs, and values of both parties impact the process, individuals have the right to know about themselves, be involved in decisions that will influence their lives, and accept or reject proposed care, and the goals of patients and health care providers may not be congruent (Wills, 2007). This assumption acknowledges that the nurse cannot be an impartial party and that even the professional providing health care will be influenced by his or her background and experience. King asserts that nursing is the care of human beings that takes place in the immediate environment with the goal of helping individuals or groups to attain, maintain, or restore
health (Wills, 2007). These assumptions account for a wide variety of experiences on the part of both the nurse and the patient.

Outcomes

The theory of goal attainment focuses on nurse and patient setting mutual goals and striving to achieve them, outcomes are essential to the theory. A positive outcome is the accomplishment of or progress toward the mutually agreed upon goal within the desired time. As King expressed in one article, “Goal attainment represents outcomes. Outcomes indicate a measure of quality care” (1999, p. 293). Through interactions and mutual goal setting with patients, nurses can give high quality care. This idea was of such importance that King developed a goal-oriented nursing record (GONR) in order to document the process by which nurses and clients set goals as well as the outcomes they achieved (Frey, 1996). The GONR system has been linked to positive outcomes such as continuity of care and quality assurance (Frey, 1996). The theory of goal attainment is focused on the realization of positive outcomes through quality transactions and mutual goal setting.

Implications for the Advanced Practice Nurse

Professional nurses seek to protect the trust the public places in them through maintaining high standards. The theory of goal attainment serves as a valuable tool in this quest. In 2006, King published an article addressing how the theory of goal attainment is useful in the application and practice of the ethical principles – justice, beneficence, nonmaleficence, confidentiality, veracity, autonomy – that are held to be the
standard of nursing care by the American Nurses Association (American Nurses Association, 2005). The theory supports practice that incorporates these values. Additionally, there is an expanding emphasis on the utility of and need for collaboration among health care professionals. This is particularly relevant in the role of the advanced practice nurse (APN) who functions in the primary care setting and at times must seek the advice of and even refer patients to other professionals and specialists to provide the best care. King’s theory has been shown to be “very useful in interdisciplinary involvement in addressing patient centered clinical outcomes” (King, 2006, p. 103). The APN may incorporate the concepts of transaction and mutual goal setting into relationships with patients as well as other healthcare providers in order to facilitate high quality communication and full understanding among all parties which will engender positive outcomes.

*Congruency with Interventions*

The theory of goal attainment is congruent with APN interventions in multiple ways and settings. Generally speaking, nurse practitioners are known for their holistic view and assessment of patients and the ability to collaborate to find interventions that will be meaningful to their patients. The theory of goal attainment defines this rich relationship as a dynamic transaction between two personal systems. It lends to advanced practice a structure within which the APN can care for the patient by facilitating an open exchange of ideas and encouraging the patient to be an active participant in his own health management through mutual goal setting. Through this process, the APN and the patient can develop an intervention plan that both parties are motivated to pursue and in
which they can become invested. The theory outlines and gives structure to processes that proficient APNs find and use intuitively in their practice.

Applicability in Practice

As a natural extension of the intuitive nature of the theory, it has been found useful in a variety of settings. Frey affirms that “several thousand hospitals have implemented practice based on King’s conceptual framework and theory of goal attainment in patient care departments or units” (1996, p. 236). The acute care setting encompasses a large range of patient populations and acuity levels. In the area of research, studies based on this theory have been conducted in such diverse settings as the southern United States, Japan, and Sweden (King, 1996). Additionally, 64 publications during the span from 1978-2000 applied King’s conceptual system and 93 publications during the years from 1983 to 2000 applied the theory of goal attainment (Frey, Seiloff, & Norris, 2002). Application of the theory suggests that it has been found informative and effective by nursing scholars. This applicability is a testament to the flexibility of the theory, which can be attributed to a genuine reflection of the way human beings communicate.

As the APN encounters a more diverse patient population in the primary care setting, mutual goal setting as described in King’s theory of goal attainment is especially relevant and appropriate because it accounts for cultural and value differences by involving the patient in his own plan of care. King states that the theory “can be used in any culture because it provides structure to observe the interacting elements in the environment that enhance or impinge on the quality of life” (1994, p. 30). Because the
theory takes into account that a person is constantly interacting with the surrounding interpersonal and societal systems, it can be used in a variety of cultural settings with patients with diverse backgrounds.

Implications for the Management of Hypertension

With regard to the management of hypertension, the theory of goal attainment is particularly constructive and pertinent. Hypertension is a chronic disease that, once detected, requires management and intervention indefinitely thereafter. It has the potential to be managed with lifestyle modifications alone and may also be controlled pharmaceutically if needed. Because of the wide variety of treatment options and the varying degrees of effectiveness of interventions based on the patient’s adherence, management of hypertension requires a good working relationship with the patient and a thorough assessment of his perceptions, readiness to learn, and motivation. Additionally, management of the disease may be complex because the ideal blood pressure for a patient may vary depending on his history and risk factors for complications. For all of these reasons, this is an ideal condition in which to use the theory of goal attainment to promote excellent, clear communication with the patient. With so much information to be exchanged between APN and patient, the structure of the theory and the ability to collaborate to set goals throughout the process of treatment lends personalization to the care of a patient. This nursing theory is ideally suited for use with this patient population.
Summary

The theory of goal attainment is a complex nursing theory derived from the integrative-interactive worldview and systems theory. It describes the interactions between nurses and patients as transactions in which the two are equals exchanging information and ideas and setting mutually acceptable goals for the patient’s health. The theory is widely useful in advanced nursing practice. It is also extremely well suited to be used as a guiding framework in the management of hypertension due to the chronic nature of the condition and the variety of treatment modalities available. This theory will therefore be used to guide an in depth review of the literature regarding specific interventions that the advanced practice nurse can utilize to manage hypertension.
CHAPTER 3: REVIEW OF THE LITERATURE

Hypertension is a complex disease process with a broad spectrum of interventions available for management. Pharmaceutical treatment is the predominant modality for primary care providers in the outpatient setting. Clinical questions such as which medications to utilize for particular patient populations, including those with comorbidity such as diabetes, has been thoroughly addressed in established guidelines. For example, the seventh report of the JNC makes recommendations about categories and specific medications to treat the respective stages of hypertension including guidelines for the treatment of complicated patients with a wide variety of comorbidities. In light of the available resources for the clinician and advanced practice nursing's unique holistic approach to patient care, the focus of this literature review will be non-pharmaceutical interventions and strategies for management of the hypertensive patient from the perspective of King’s theory of goal attainment.

Collaborative Interventions

Clinicians do not practice in a vacuum; seeking the advice and opinions of those more experienced or specialized is a mark of professional practice. Collaboration is a hallmark of advanced nursing practice and is increasingly recognized and utilized by other health professions as well. Research has targeted joint efforts of health care professionals to manage chronic disease processes such as hypertension; this is particularly true of the nurse-pharmacist relationship.

The SCRIP-HTN study used a controlled, randomized design to investigate the impact of a community-based multidisciplinary intervention on blood pressure control
among diabetics (McLean et al., 2008). From the patient populations of 14 community pharmacies, a total of 227 eligible participants enrolled in the study. Control group participants received a wallet blood pressure card, a pamphlet on diabetes, general diabetes advice, and usual care by their physician. Intervention group participants received care from a pharmacist and nurse team which included a wallet blood pressure card, cardiovascular risk reduction education and counseling, a pamphlet on hypertension, and four follow-up visits over 6 months. Additionally, participants were referred to their physician for further assessment and management; physicians were sent a one page summary of evidence based guidelines for treatment of hypertension among diabetics. Mean participant age was 64.9 years; mean baseline blood pressure was 141.2/77.3 mmHg.

Among the intervention group, systolic blood pressure was reduced an average of 5.6 mmHg at six months. Moreover, in those participants in whom baseline systolic blood pressure had been >160, blood pressure was reduced by a mean of 24.1 mmHg. The study demonstrates the efficacy, at least in the short term, of a collaborative educational program implemented by nurses and pharmacists in improving blood pressure control. The primary limitation of the study is its short duration.

A prospective, single-blinded, randomized, controlled trial investigated the effect of collaboration between primary care providers and pharmacists on blood pressure management over 12 months (Hunt et al., 2008). All participants were mailed an informative pamphlet about hypertension management at baseline. Control participants received care as usual. Intervention participants were scheduled for pharmacist visits in
which a pharmacist described the collaborative care model, reviewed participant medications and lifestyle, assessed vital signs, screened for drug interactions, identified barriers to adherence, optimized the anti-hypertensive medication regimen (dose adjustments, consolidation, additions), and scheduled follow-up appointments as necessary. The progress notes from each visit were forwarded to the primary care provider for co-signature.

After 12 months, intervention participants had significantly lower blood pressure, had more total visits but fewer physician visits, and were significantly more likely to be on generic anti-hypertensives. Both groups were taking a significantly increased number of anti-hypertensive medications but the intervention group had an insignificant decrease in daily pill burden due to combined dosages. There were nonsignificant differences between groups in hypertension knowledge, self-reported adherence, quality of life, and satisfaction with care. The study demonstrates that involvement of pharmacists in hypertension management results in improved blood pressure control and medication regimens that are not more complex or costly despite increased number of medications.

These studies demonstrate the efficacy of collaboration between nurses and pharmacists in the management of hypertensive patients, especially in cases of resistant hypertension. For resistant hypertensive patients whose care is more complex, the use of such an intervention may greatly decrease the time required of providers and, thus, increase the overall efficiency of the system. From the perspective of the theory of goal attainment, it is not surprising that this manner of intervention is effective; it consists of educational transactions between patient and health care professional and assistance with
informed, collaborative goal setting. Advanced practice nurses should be aware of similar interventions available in their communities and utilize services for those patients whose hypertension is difficult to control.

Diet

Alterations in diet have been a core aspect of the management of hypertension for a number of years. However, new findings continue to be reported in the literature to expand what is currently known about the most effective diet to reduce blood pressure. Several of these recent findings are detailed below.

**DASH Diet**

The efficacy of the Dietary Approaches to Stop Hypertension (DASH) diet has been well established in the literature and is generally accepted as a component of evidence based practice. The diet consists of increased consumption of fruits, vegetables, and low-fat dairy products, decreased dietary sodium, saturated fat, and total fat, and moderation of alcohol consumption. It is included in the JNC 7 recommendations for lifestyle modifications which assert that a 1600 mg sodium DASH diet has a positive effect on blood pressure similar to single drug therapy (2003). The JNC guidelines also note that better results can be attained with multiple lifestyle modifications.

Despite generally accepted effectiveness of the diet, less is known about its long-term impact. Dauchet and colleagues recently published a study investigating the long term impact of this diet on blood pressure in a clinical trial of antioxidants in France from 1994-2002 involving 4652 participants 35-63 years of age (2008). During the first year of monitoring, serial 24 hour diet records were recorded; dietary components such as
fruit, vegetables, dairy products, and fat were analyzed. The investigators conducted cross-sectional analysis of blood pressure at baseline and at study conclusion (median 5.4 years later). Mean decreases in blood pressure between the two measurements were 9.3 mmHg systolic and 4.5 mmHg diastolic. After adjusting data analysis to account for potential confounders, investigators found that higher fruit and vegetable consumption was associated with significantly lower baseline blood pressure and significantly smaller increase in systolic and diastolic blood pressure at follow-up. No relationship between dairy product or fat consumption and blood pressure was found. These results suggest that a diet high in fruit and vegetable content may be associated with lower elevation in blood pressure with aging.

A randomized controlled trial explored whether a dietary intervention to decrease sodium intake and increase intake of vitamin C, carotene, fruits, and vegetables would improve blood pressure among 550 healthy volunteers aged 40-69 years in two rural villages in Japan (Takahashi, Sasaki, Okubo, Hayashi, & Tsugane, 2006). The intervention included two 15 minute individual dietary counseling sessions at baseline and 5 months, a group lecture at 5 months, and two newsletters about recommended diet for hypertension sent to participants during the trial. At one year, the intervention group had significantly lower dietary sodium intake and urinary excretion of sodium as well as significantly reduced systolic blood pressure while the control group showed a slight increase in systolic blood pressure. There was no difference noted between groups regarding diastolic pressure. These results suggest that education regarding diet modification is effective in catalyzing change and that a diet low in sodium and high in
vitamin C, carotene, fruit and vegetables is associated with decreased blood pressure in this population.

Another study conducted at the Federico 2nd University of Naples in Naples, Italy investigated the impact on blood pressure of returning to habitual diet following a dietary intervention among 307 hypertensive patients who reported having returned to their usual diet after at least 6 months on a low-energy and/or low sodium diet (Ferrara et al., 2007). Habitual diet was determined by semi-quantitative 24-item food frequency questionnaire. Participants were divided into three groups based on systolic blood pressure. Average body mass index across the groups increased in association with systolic blood pressure; the number of anti-hypertensive medications taken and other metabolic parameters were similar across groups. Among the first group (lowest systolic pressure), the proportion of calories from saturated fat and dietary sodium were significantly lower compared to the third group while proportion of calories from carbohydrates, fiber content, and potassium content were significantly higher. The first group also consumed more servings of legumes, fish, and cooked vegetables compared to cheese and salami. The study results confirm that returning to a diet richer in vegetables, legumes, and fish with lower saturated fat and sodium content is associated with better control of blood pressure without additional anti-hypertensive medications.

The studies described above support the DASH diet as a guideline for hypertensive patients for extended periods of time. The second study also supports the effectiveness of even brief educational interventions in encouraging dietary modification. Therefore, the clinician has reasonable evidence that spending a portion of time, even 10-
15 minutes, counseling a hypertensive patient on the recommended diet may result in both dietary modifications and the associated improved blood pressure. Advanced practice nurses, with backgrounds in bedside care, are well prepared to incorporate educational transactions into patient care and to work with patients to establish specific, mutual goals regarding feasible diet changes. Additionally, should the services of a dietician be available in a particular clinical setting, this more extended transaction may be beneficial as well.

Dietary Carbohydrate Content

It is known that diets rich in monounsaturated fats, when compared to diets high in carbohydrates, are associated with lower fasting triglycerides, VLDL cholesterol, and glucose and higher HDL cholesterol; less is known about the impact of the two nutrients on blood pressure. In response to this ongoing debate regarding whether dietary saturated fat calories should be replaced by carbohydrate or unsaturated fat, researchers conducted a meta-analysis of intervention studies which investigated the impact of high carbohydrate diets versus diets high in monounsaturated fat on blood pressure (Shah, Adams-Huet, & Garg, 2007). Ten studies met inclusion criteria: participants' weight remained stable throughout the study and diets had to be isoenergetic.

The analysis found that diets rich in carbohydrate resulted in significantly higher systolic blood pressure (p = 0.02) and diastolic pressure (p = 0.05) compared to diets rich in monounsaturated fat. Alternative analysis including only randomized crossover trials (n = 6) showed non-significantly higher systolic and diastolic pressures were associated with the high carbohydrate diets. The investigators concluded that although diets rich in
monounsaturated fats were associated with lower blood pressures than diets rich in carbohydrates, the difference may not be substantial enough to justify routinely recommending altering monounsaturated fat and carbohydrate content as part of dietary management of hypertension.

Previous population studies had shown inverse relationships between estimated total, plant only, and animal only protein intake and blood pressure; whether these association stem from a BP lowering effect of protein or a BP raising effect of carbohydrates remains unknown. A recent study investigated the impact of modest substitution of carbohydrate intake with animal protein from lean red meats on blood pressure and other cardiovascular disease markers among 60 hypertensive patients (Hodgson, Burke, Beilin, & Puddey, 2006). Participants were randomly assigned to either their usual diet or to replace some of their usual intake from carbohydrates with lean red meat protein. Clinic, 24 hour ambulatory, awake, and sleeping systolic blood pressures were recorded at baseline and at the conclusion of the intervention. Body weight and fat, alcohol, and fiber intake were recorded at the same intervals.

At the conclusion of the intervention, the protein group had significantly higher percent of calories from protein and significantly lower percent of calories from carbohydrates compared to the control group. All measures of systolic blood pressure were significantly lower among the protein group compared to the control group ($p = < 0.05$) and fasting blood glucose readings were higher ($p = 0.008$). There was no significant difference between groups in body weight, consumption of fat, alcohol, or fiber, diastolic blood pressure, heart rate, arterial compliance, blood lipids, or serum
insulin. The results suggest that moderate substitution of animal protein for dietary carbohydrates may be associated with lower systolic blood pressure.

The DASH diet is recommended for patients with cardiac risk factors and those with hypertension; this constitutes a large population. Therefore, the advanced practice nurse should be well equipped with alternative diet choices that can be presented to counterbalance the omission of discouraged foods. The above studies suggest that moderate substitution of dietary carbohydrate with either monounsaturated fat or lean animal protein may have a slight positive impact on blood pressure. However, the evidence is not sufficient to warrant clinical recommendations. Additionally, there is a risk that as a result of a suggestion to increase dietary animal protein, patients could inadvertently increase saturated fat content. Therefore clinicians should continue to recommend the DASH diet without adjustment in carbohydrate content.

**Omega-3 Polyunsaturated Fatty Acids**

A 2007 article examined the association between dietary omega-3 polyunsaturated fatty acids (PFA) and blood pressure using data collected in the International Study of Macro- and Micro-nutrients and Blood Pressure (INTERMAP) which involved 4680 patients aged 40 to 59 years (Ueshima et al.). Based on data from experimental animal studies, the following possible mechanisms for the favorable influence of omega-3 PFA on blood pressure have been hypothesized: enhanced endothelial vasodilation, reduced reactivity of resistant vascular smooth muscle, and increased vascular compliance. In this study, blood pressure was measured 8 times at 4 visits. After controlling for 17 possible confounding variables, the analysis revealed an
inverse relationship between total dietary omega-3 PFA, as determined by percent of caloric intake, and systolic and diastolic blood pressure among hypertensive and non-hypertensive patients. Effect size was relatively small; omega-3 PFA composing 0.67% of dietary calories was associated with a blood pressure reduction of only 0.4 – 0.6 mmHg systolic and 0.5 – 0.6 mmHg diastolic. Dietary content of omega-3 PFA may contribute to the prevention and control of hypertension and may be promoted by health care providers.

Caffeine

It has been hypothesized that caffeine consumption is associated with hypertension (Noordzij et al., 2005). Researchers hypothesize that caffeine antagonizes endogenous adenosine resulting in vasoconstriction and increased peripheral vascular resistance. To investigate this phenomenon, Noordzij and colleagues conducted a meta-analysis of randomized controlled trials published between 1984 and 2000 that examined the relationship between coffee, caffeine, and blood pressure over 7 to 84 days. Studies lasting less than 1 week were excluded due to reported hemodynamic tolerance to caffeine after 1-4 days. Sixteen studies involving 1010 participants met criteria (2005). Daily caffeine doses across coffee trials ranged from 225-798 mg/day and daily dose in caffeine trials ranged from 295-750 mg/day. Analysis of pooled trial data revealed a significant increase of 2 mmHg systolic and 0.7 mmHg diastolic associated with coffee and caffeine intake. When coffee and caffeine intake were analyzed separately, the effect of caffeine on blood pressure was larger for non-coffee caffeine. The study suggests that caffeine intake is associated with an increase in blood pressure that is less when the
Caffeine is consumed in coffee. Advanced practice nurses can incorporate the recommendation to reduce caffeine intake into teaching regarding lifestyle changes for hypertensive patients; they should particularly recommend reductions in sources of caffeine other than coffee.

**Exercise**

It is well known that exercise is beneficial as a component of comprehensive hypertension management; dose-response has been less well researched. In response to this gap in the literature, Ishikawa-Takata, Ohta, and Tanaka (2003) conducted an 8 week exercise intervention with 207 sedentary, untreated patients with stage 1 or 2 essential hypertension. Participants were divided into 5 groups based on frequency and duration of exercise; sedentary, 30-60 min/week, 61-90 min/week, 91-120 min/week, and >120 min/week. Exercise sessions consisted of a short warm up, aerobic exercise such as walking, jogging, or swimming, and conditioning such as sit-ups and stretching. There was no difference in age, gender, height, body mass, BMI, diet, or baseline blood pressure among groups. The sedentary control group demonstrated no change in blood pressure, all exercise groups showed significant decreases in resting systolic and diastolic blood pressure. The 61-90 min/week group showed greater magnitude decrease in blood pressure than the 30-60 min/week group; additional exercise beyond this range did not result in a greater magnitude of blood pressure reduction. These results demonstrate that minimal increases in physical activity may decrease blood pressure making the adjustment to adding beneficial amounts of exercise more feasible for sedentary hypertensive patients.
**Endurance Training**

In 2007, Fagard and Cornelissen conducted a meta-analysis of randomized controlled trials that investigated the relationship between aerobic endurance training. The meta-analysis on endurance training included 72 trials and found that training was associated with significant reductions in resting (3.0/2.4mmHg ($p < 0.001$)) and ambulatory (3.3/3.5mmHg ($p < 0.01$)) blood pressures. Additionally, endurance training was associated with significant reductions in systemic vascular resistance, plasma norepinephrine, plasma renin activity, body weight, waist circumference, percentage body fat, and the homeostasis model assessment index of insulin resistance. Conversely, serum levels of high-density lipoprotein cholesterol were significantly increased. This meta-analysis confirmed the well established knowledge that exercise, specifically endurance training, has a beneficial impact on blood pressure and a number of other cardiovascular risk factors.

**Resistance Training**

Though this form of exercise has been less well studied than the above form, the same authors conducted a meta-analysis of trials that studied the relationship between resistance training and blood pressure (Fagard & Cornelissen, 2007). Nine randomized controlled trials were included. Analysis revealed a net reduction in blood pressure of 3.2 mmHg systolic ($p = 0.1$) and 3.5 mmHg diastolic ($p = < 0.01$) associated with the training. The data suggest that resistance training has a positive impact on blood pressure though it is a less dramatic impact compared to endurance training.
Walking

A 2007 randomized controlled clinical trial investigated the impact of a community-based walking intervention on blood pressure among 202 adults over 60 with mild to moderate hypertension in rural Taiwan (Lee, Arthur, & Davis, 2007). Participants were randomly assigned to the intervention or usual primary care. The intervention consisted of a six-month community-based intervention consisting of support designed to aid participants to increase their walking provided by a public health nurse (both face-to-face and telephone). Systolic blood pressure was reduced 7 mmHg ($p = 0.002$) in the intervention group compared to the control. Intervention group participants were also significantly more likely to demonstrate improved self-efficacy and to report increased walking. Among rural, hypertensive, older persons, a community based walking intervention and increased reported walking were associated with a greater reduction in blood pressure.

Recent literature regarding exercise as an intervention in the management of hypertension is encouraging for the clinician and patient in multiple ways. First, the efficacy of several forms of exercise is well established giving the patient multiple modalities for increasing activity with health benefits. In educational exchanges, providers can collaborate with patients to set mutual goals regarding the best modality for the patient. For example, slowly adding a reasonable amount of resistance training would be ideal for an elderly woman with hypertension and osteoporosis. Secondly, studies imply that a relatively small increase in physical activity has beneficial impact on blood
pressure. Providers can assure patients that any effort they may exert to increase physical activity, even if relatively small, will have lasting health benefits.

Complementary Therapies

Due to the suggestion in the literature that patients with chronic illness use complementary therapies more than the general population and a knowledge deficit regarding the subpopulation of cardiovascular disease patients, a 2006 study used the 2002 National Health Interview Survey to analyze the use of complementary therapies in this population (Yeh, Davis, & Phillips). Data from 10,572 respondents with cardiovascular disease were analyzed. Thirty-six percent of respondents had used complementary therapies, excluding prayer, in the previous year. Herbs and mind-body therapies were the most frequently used complementary therapies. The most common herbal products used were echinacea, garlic, ginseng, ginkgo biloba, and glucosamine with or without chondroitin; the most common mind-body practices were deep breathing exercises and mediation. Only 10% of respondents using complementary therapies were specifically treating cardiovascular conditions; still, a large majority of those utilizing these therapies for cardiovascular conditions believed they were helpful (80% for herbs and 94% for mind-body practices).

The implication is that complementary therapies are common among patients with cardiovascular disease but are not frequently intended to treat the same. Advanced practice nurses need to be aware of complementary therapies being used by their patients and should be up to date on which therapies can be recommended as part of evidence based management of hypertension. Being armed with this knowledge prepares APNs to
provide guidance and empowerment for patients who are interested in more proactively managing their chronic conditions and improving overall well being. Below are recent studies that investigated a few of the common complementary therapies that may be beneficial for hypertensive patients.

Dietary Supplements

Garlic

This supplement has long been touted as an adjunctive treatment for blood pressure with mixed results in the literature regarding efficacy. The effect of garlic on blood pressure is attributed to its stimulation of hydrogen sulphide production and its containing allicin, which inhibits angiotensin II and has a vasodilating effect (Ried, Frank, Stocks, Fakler, & Sullivan, 2008). In 2008, investigators conducted a systemic review and meta-analysis of all randomized controlled trials since which used true placebo groups and garlic-only preparations and reported both systolic and diastolic blood pressures (Ried et al.). Eleven studies qualified for inclusion in the meta-analysis. Garlic groups showed a mean decrease of 4.6±2.8 mmHg systolic compared to placebo; mean reduction in blood pressure among garlic group participants who were hypertensive at baseline compared to placebo was 8.4±2.8 mmHg systolic and 7.3 ± 1.5 mmHg diastolic. Use of garlic supplementation is associated with a statistically and clinically significant drop in blood pressure that is more pronounced among hypertensive patients. This supplement can be recommended to patients based on the evidence.
**Soy Protein**

Observational, epidemiological studies have suggested that vegetable protein intake is inversely related to blood pressure; there are multiple proposed mechanisms for this association. Soybean protein is rich in arginine, a precursor to vasodilating nitric oxide and protein intake induces urinary sodium, water, and dopamine excretion (He et al., 2005). It is hypothesized that increased dietary protein results in increased levels of certain amino acids in areas of the nervous system and vessel walls resulting in vasodilation (He et al., 2005). Lastly, soy protein contains isoflavones, nonsteroidal, plant-derived compounds with affinity for the primary estrogen receptor in the vessel wall; this action is thought to induce vascular benefits observed in some studies (Teede, Giannopoulos, Dalais, Hodgson, & McGrath, 2006).

A randomized, double-blind, controlled trial in 3 communities in China investigated the impact of soybean protein supplementation on blood pressure among 302 participants with prehypertension or stage 1 hypertension (He et al., 2005). Study participants were randomly assigned to either 40 grams of isolated soybean protein supplement or complex carbohydrate control for 12 weeks. Blood pressure was measured at baseline, 6 and 12 weeks. Initial blood pressures were 135 mmHg systolic and 84.7 mmHg diastolic. Compared to the control group, the supplement group had the following changes in pressure: -4.3 mmHg systolic and -2.8 mmHg diastolic. Absolute changes in the intervention group were 7.9 mmHg systolic and -5.3 mmHg diastolic. Changes were greater in those with stage 1 hypertension compared to those with prehypertension.
The trial demonstrated that supplementation with soybean protein compared with complex carbohydrate supplementation is associated with reduced blood pressure. The investigators did not provide insight into whether the reduction was associated with increased protein intake, soybean protein specifically, or isoflavones contained in soy protein. The lack of distinction necessitates further investigation in this area to pinpoint the mechanism of action which will guide interventions. A major limitation is the relatively short duration of the trial; this is important considering the chronic nature of hypertension.

A similar 6 month double-blind, placebo controlled, crossover trial involving 38 hypertensive participants compared the effects soy with isoflavones to gluten protein placebo (without isoflavones) on 24 hours ambulatory blood pressure and arterial function (Teede et al., 2006). Participants received soy cereal with isoflavones (40 grams soy protein, 118 mg isoflavones) or gluten placebo cereal daily for three months, then switched. No difference between 24 hour ambulatory blood pressures or arterial function was noted between supplements. Analyzing the area under the curve of the 24 hours ambulatory blood pressure revealed that soy was associated with 2.3 mmHg higher 24 hour systolic \( (p = 0.003) \), a 3.4 mmHg higher daytime systolic pressure \( (p = 0.0002) \), and a 1.4 mmHg higher daytime diastolic \( (p = 0.008) \). Additionally, the soy group had higher 24 hour heart rates by 3.5 beats per minute \( (p = < 0.0001) \). Overall, soy protein supplementation had no impact on arterial function and significantly raised blood pressure. Therefore, soy protein should not be recommended as a complementary
supplement for the purpose of lowering blood pressure without much greater supporting literature.

The literature regarding soy protein, and isoflavones specifically, remains conflicted. There is not research currently to support either a particular mechanism of action of the purported impact of soy protein on blood pressure. Additionally, there is not consistency among studies regarding whether this impact is beneficial or not. Soy protein is hypothesized to have several beneficial health implications and advanced practice nurses caring for patients with cardiovascular diseases such as hypertension should follow the research as more data becomes available. However, the data does not currently support the recommendation of dietary soy protein supplementation as an adjunct therapy in the management of hypertension.

*Mind-Body Practices*

As discussed above, the benefit of physical activity on blood pressure is well established. More recently, public interest in complementary therapies has grown. Correspondingly, interest has arisen among health care professionals in the physical benefits of mind-body practices, or meditative movement forms, which involve not only physical activity and conditioning, but mental and spiritual components as well. Such interventions would prove particularly relevant and helpful to the older population in whom more strenuous traditional exercise may be difficult and in whom the risk of cardiovascular complications is elevated on account of increasing age and prevalence of comorbidities. Three mind-body practices that have been well studied are included here.
Stress Reduction

In a recent double-blind, randomized trial, the impact of relaxation response training and lifestyle modification were compared over 8 weeks and participants with sufficient initial response were allowed to continue with supervised antihypertensive medication elimination (Dusek, et al., 2008). In the first 8 weeks, relaxation reduced systolic blood pressure 9.4 mmHg, while lifestyle modification reduced it 8.8 mmHg. Among those who continued with the second portion of the study, those in the relaxation response group were significantly more likely to be able to discontinue antihypertensive medication. The greatest limitation of the study is a potential sample bias as only those participants demonstrating positive response to relaxation response training were allowed to continue. Still, the results indicate that both methods are effective and that stress reduction, under the supervision of a health care professional, is a viable option for management of hypertension.

The broadest literature available on this topic is a recent systematic review examining the relationship between stress reduction and blood pressure (Rainforth et al., 2007). The authors completed a meta-analysis of the 17 well designed randomized controlled trials and 23 treatment comparisons involving a total of 960 participants. Blood pressure changes associated with several stress reduction interventions were determined: “biofeedback, −0.8/−2.0 mm Hg (p = NS); relaxation-assisted biofeedback, +4.3/+2.4 mm Hg (p = NS); progressive muscle relaxation, −1.9/−1.4 mm Hg (p = NS); stress management training, −2.3/−1.3 mm (p = NS); and the Transcendental Meditation program, −5.0/−2.8 mm Hg (p = 0.002/0.02)” (Rainforth et al., 2007, p. 520. The
Transcendental Meditation program was unique in being associated with a clinically and statistically significant decrease in blood pressure; it can be recommended to patients desiring to incorporate stress reduction into their care.

These results support the notion that stress reduction has a beneficial effect on blood pressure. The Transcendental Meditation program and relaxation response training in particular have been shown to be effective; however, considering that relaxation is a subjective experience and all relaxation techniques examined had a positive impact on blood pressure, though it was frequently not statistically significant, patients can choose from among the available techniques one which suits their interest or need. From the perspective of the theory of goal attainment, the incorporation of a daily relaxation technique that is satisfactory to the patient can be incorporated into the mutual goals collaboratively established by patient and provider.

Qigong

Qigong is an ancient Chinese practice which involves meditation, controlled breathing, rhythmic movements, and focused attention. In order to quantitatively assess the effects of qigong on hypertension, the authors completed a meta-analysis of 9 appropriate articles involving 908 participants (Guo, Zhou, Nishimura, Teramukai, & Fukushima, 2008). All nine involved intervention studies lasting less than one year. Qigong practice resulted in a 17 mmHg decrease in SBP and a 10 mmHg decrease in DBP compared to non-intervention controls. Data revealed that qigong practice was approximately equally effective compared to pharmaceutical intervention and was less effective than conventional exercise. Guo and colleagues suggest that practice
maintained for longer than one year has added benefit. Based on the above data, qigong can be recommended as an adjunct therapy in the treatment of hypertension. Studies involving qigong as one component of a multifaceted approach would be valuable clinically.

*Tai Chi*

Tai chi is a long-practiced mind-body therapy with roots in ancient Chinese martial arts; it incorporates gentle physical movements with body awareness, imagery, and attention to breathing (Yeh, Wang, & Phillips, 2008). As interest in the practice has grown, research has examined its impact on a number of health conditions, including cardiovascular disease and hypertension.

This year, Rogers, Larkey, and Keller conducted a systematic review of randomized controlled trials investigating the impact of holistic, meditative movement forms, including tai chi, on health outcomes among adults aged 55 and older (2009). The review included seven trials involving the impact of tai chi on cardiovascular health. Those trials utilizing interventions of tai chi practiced three times weekly for 12 weeks reported significant decreases in both systolic (range 7 to 13.2 mmHg) and diastolic (range 2.4 to 4 mmHg) blood pressure. One study did not report a reduction in blood pressure; it utilized measurement immediately before and after tai chi. This review suggests that the regular practice of tai chi is effective in reducing usual blood pressure despite a lack of decreases immediately following a session. As discussed earlier in the background data, regular blood pressure is more determinate of risk than any one time
measurement; blood pressure is elevated during a number of physical activities that have the impact of reducing overall pressures.

A recent systematic review investigated the impact of tai chi on cardiovascular disease and risk factors (Lee, Pittler, Taylor-Piliae, & Ernst, 2007). Literature searches yielded 9 randomized controlled trials addressing the impact of tai chi on blood pressure. Four reported significant reduction in blood pressure among intervention participants compared to controlled participants receiving no treatment. Two studies compared tai chi with aerobic exercise and found no difference in the effect on blood pressure. The conclusion was that while current literature is encouraging with regard to the role of tai chi in the management of hypertensive and cardiovascular patients, no firm conclusions regarding treatment effect can be drawn at this time.

Another systemic review examined studies in English and Chinese regarding the impact of tai chi on blood pressure and cardiovascular risk factors (Yeh et al., 2008). Eight studies looked at tai chi and blood pressure: three randomized controlled trials, four nonrandomized controlled or noncontrolled studies, and one observational study. Duration of interventions ranged from 12 weeks to 3 years. All studies reported a statistically significant reduction in mean blood pressure; reductions were also reported in systolic (range 7 to 32 mmHg) and diastolic (range 2.4 to 18 mmHg) blood pressure. The three randomized controlled trials respectively reported 1) comparable blood pressure reduction between light-intensity tai chi and low-impact aerobic dance 2) significant reductions in systolic and diastolic blood pressure compared to usual care and 3) significantly higher percentage patients with controlled blood pressure with tai chi
compared to pharmaceutical management. The results indicate promising potential for tai chi as an adjunct intervention for blood pressure management. Unfortunately, available studies utilized a wide variety of designs and quality is not uniform throughout which renders large scale conclusions extremely difficult.

All systemic reviews support the hypothesis that tai chi has a positive impact on blood pressure. Additionally, there have been no reported negative side effects. Clinicians can recommend the practice to interested patients. However, due to a relatively small number of studies available to analyze and a lack of clarity regarding how efficacious tai chi is compared to other forms of physical activity, more research is needed to fully understand the impact of the practice and its health benefits. One author reported that inadequately detailed reporting in articles prevented the realization of a meta-analysis she had intended to complete (Yeh et al., 2008); further research should be sufficiently well designed and reported to provide a foundation for future meta-analyses.

Educational Interventions

Patient education is a cornerstone of nursing from care at the bedside to management of care in advanced practice. Patients with chronic conditions are particularly in need of education regarding disease processes, potential long-term complications, and actions that can be taken to reduce the risk of complications. From the perspective of the theory of goal attainment, the process of education is a transaction between provider and patient which enables the two to come to mutual goals for the patient’s health.
Patient and Provider Education

A cluster randomized, controlled trial investigated the effectiveness of educational interventions for providers and essential hypertension patients to improve blood pressure over 6 months (Roumie et al., 2006). From the patient populations of 10 clinics, 1341 eligible veterans with two blood pressure measurements >140/90 within 6 months were identified; these were cared for by 182 providers. The three educational interventions were: 1) an email with a link to the Joint National Committee (JNC) on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure guidelines (provider education), 2) a patient specific computerized alert which notified providers of patient blood pressure above the recommended 140/90 and medication options per the JNC 7 guidelines (alert), and 3) and patient education consisting of a letter encouraging adherence, lifestyle changes, and dialogue with providers (patient education). Participants’ providers were randomly assigned to receive provider education only, provider education and alert, or all three interventions.

Follow-up data from 973 participants revealed that the combination of the three interventions resulted in lower blood pressure (138/75 average) than either provider education only (145/78) or provider education with alerts (146/76). Additionally, 17.5% more patients receiving all three interventions reached the goal of blood pressure ≤140/90. The study demonstrates that the best improvement in blood pressure is achieved when patients are educated and empowered to participate in their own care in addition to providers being knowledgeable.
Cognitive and Behavioral Counseling

A number of studies have shown the efficacy of broad behavioral education programs whose content covers all aspects of hypertension management and lifestyle modification. Such programs are powerful in that they promote self-efficacy among hypertensive patients and empower them to proactively contribute to their care. These programs also do not require intensive individualized patient education from the primary care provider and therefore conserve health care resources.

A recent study explored the impact of a senior center-based behavioral counseling lifestyle intervention on systolic blood pressure among 65 hypertensive minority seniors >60 years old in six community-based senior centers in New York City (Fernandez, Scales, Pineiro, Schoenthaler, & Ogedegbe, 2008). All participants received assessment visits at baseline, 6 weeks, and 14 weeks. Adherence was measured using a well-validated 4-item scale that has been shown to have sensitivity 72% and specificity 74% when adherence is greater than 80% as measured by the Medication Event Monitoring System (MEMS) in separate studies investigating methods of measuring adherence among uncontrolled hypertensives. Intervention group participants received first 6 weekly and then 2 monthly group educational sessions that covered hypertension, adherence promotion, DASH diet, food monitoring, physical activity, problem solving and barriers to change. Control participants were given the option of attending group sessions after completion of the study.

Systolic blood pressure was reduced 13±21 mmHg ($p = 0.004$) in the intervention group and 10.6±30 mmHg ($p = 0.06$) in the control group. Additionally, among the
intervention group, adherence improved 26% ($p = 0.03$) and vegetable intake increased 23% ($p = 0.03$). In this pilot study, a senior center based behavioral counseling lifestyle intervention was associated with significantly decreased systolic blood pressure and significantly increased medication adherence and vegetable intake. It is difficult to extrapolate the individual impact of each component of a multifactoral intervention like this one, but the implication is that such multifactoral interventions are effective.

A randomized, controlled trial examined the effects of a multifactoral lifestyle modification program on antihypertensive pharmaceutical needs among 192 overweight patients taking one or two antihypertensive medications (Burke et al., 2005). The intervention consisted of a 4 month program of weight loss, DASH diet with added fish, physical activity, and moderation of alcohol consumption. If 24 hours ambulatory blood pressure was <135/85 mmHg, antihypertensive medications were withdrawn over one month and home monitoring of blood pressure was implemented. The control group received care as usual.

At 4 months, blood pressure had decreased 1/0.3 mmHg among controls and 4.1/2.1 mmHg ($p < 0.01$) among intervention participants; at 12 month follow-up, changes between the groups were not significant. At 4 months, percentage of patients with drug withdrawal was significant in men but not women; at 12 month follow-up, there were no significant differences between the sexes and 41% in the control group had maintained drug withdrawal compared to 43% in the intervention group. However, net weight loss was 3.3 kg ($p < 0.001$) at 4 months and 3.0 kg ($p < 0.001$) at follow-up in the intervention group; net decreases in waist circumference were 3.3 cm ($p < 0.001$) and 3.5
60 cm ($p < 0.001$). This 4 month lifestyle modification was associated with short term decrease in blood pressure and decreased weight and waist circumference which were sustained over 1 year. Significantly, this study demonstrates sustained changes following a short-term intervention geared towards patient education and empowerment.

Interestingly, the changes in blood pressure specifically were not sustained as was weight loss. Additional research is needed to determine what type and level of educational intervention is required to induce sustained reduced blood pressure.

In Shanghai, there is a large hypertensive population and many cannot afford medical treatment; as a result community based anti-hypertension clubs have been developed to meet the need. A 2008 randomized controlled trial investigated the impact of a manual-based (and therefore not requiring specialized medical personnel) cognitive behavioral, self-management program for hypertension in one of these community anti-hypertensive clubs (Xue, Yao, & Lewin, 2008). Adults with mild to moderate hypertension who were waiting to join community hypertension groups were recruited and randomized to an information only control group or the intervention self-management program. The intervention consisted of lifestyle change goal setting, introduction to exercise, and 4 group education sessions over 5 weeks.

Four months after the end of the intervention, the systolic blood pressure was 10.15 mmHg lower ($p < 0.001$) in the intervention group and diastolic blood pressure was 8.29 mmHg lower ($p < 0.001$). Additionally, weight and total cholesterol were significantly reduced and physical activity and improved quality of life were significantly
increased in the intervention group. The trial demonstrated the effectiveness of a
cognitive-behavioral, self-management program in reducing blood pressure.

These studies indicate that cognitive and behavioral counseling is effective in
inducing lifestyle change and, therefore, improving blood pressure. The primary
limitation of the above body of literature is a lack of data regarding long term results.
Clearly, the educational counseling interventions were effective in the short term.
However, if changes are not lasting, resources and efforts should be exerted in
implementing other, sustained-impact interventions. Certainly, if such counseling
services are available to a patient population, they may be recommended by clinicians.
However, practicing clinicians should first and foremost promote those interventions that
have been shown to have enduring positive impact, such as the DASH diet.

Technology-Based Interventions

Technology is developing at an astounding rate and the population is experiencing
increased access to and familiarity with numerous technologies. Health care, like so
many other industries, is incorporating new technologies into practice in order to harness
this resource. There are a number of recent articles that investigated the impact of
various technologies on the management of hypertension.

Home and Self Monitoring

Blood pressure has traditionally been measured by health care professionals in
clinical settings, but with the increasing availability of home blood pressure monitors,
patients increasingly self monitor. This has a number of benefits including that
ambulatory measurements correlate with end-organ damage better than readings taken at the clinic (JNC, 2003). A number of recent articles examined this practice.

A 2005 randomized, controlled trial sought to determine the impact of patient held targets and self monitoring on blood pressure control in primary care as well as patient health behaviors, anxiety, prescription antihypertensive regimen, patient preferences, and cost (McManus et al.). The study enrolled 441 participants being treated for hypertension who had not achieved target blood pressure <140/80 at one of 8 primary care practices. Participants in the intervention group were given treatment targets and asked to visit their primary care clinic monthly to measure their own blood pressure with electronic sphygmomanometers; they were also advised to visit their practitioner if blood pressure was repeatedly above target. Control group participants received care and monitoring as usual.

Systolic pressures were significantly lower – by an average 4.3 mmHg – among intervention group participants at 6 months; there was no significant difference after 1 year. Intervention participants had greater reductions in body mass index, rated self monitoring above standard care, and consulted less often. No overall difference was noted in diastolic blood pressure, health behaviors, anxiety, prescription antihypertensive regimen, or cost of care. These findings suggest that self monitoring results in significant, though not sustainable, blood pressure reduction, is well received by patients, and does not increase patient anxiety or cost of care. The findings beg the question of whether results would be more dramatic or more sustainable if patients monitored their blood pressure from home or more frequently than monthly.
A recent randomized controlled trial investigated the impact of adding blood pressure telemonitoring to usual care among urban African Americans over a 12 month period (Artinian et al., 2007). Participants were recruited through free blood pressure screenings offered in the community and were randomized to receive usual care only or usual care and telemonitoring. At set appointments, nurses set up the telemonitoring system at participants’ homes, taught them how to take their own blood pressure, and returned for follow-up questions in 24-48 hours. Blood pressures taken with the device were sent to the clinic via telephone line weekly for three weeks and then monthly for the duration of the study. Participants received immediate feedback via telephone call once they had submitted pressures taken during each interval.

At 12 months, the intervention group had statistically significant lower systolic blood pressure and statistically non-significant lower diastolic blood pressure. The study demonstrates that telemonitoring assists in better control of hypertension. Theoretically, this is due to convenience, ease of use, and low patient cost of the intervention. Therefore, this intervention could prove particularly useful for those patients who experience barriers to frequent office visits, such as inability to cover co-pays or limited transportation.

A meta-analysis of 18 randomized, controlled trials included 1359 participants and sought to determine differences in systolic, diastolic, and mean blood pressure among those utilizing home blood pressure monitoring usual care controls (Cappuccio, Kerry, Forbes, & Donald, 2004). The analysis found that among intervention groups, systolic pressure had a standardized mean reduction of 4.2 mmHg, diastolic pressure was 2.4
mmHg lower, and mean arterial blood pressure was 4.4 mmHg lower. Additionally, a greater percentage of self-monitoring patients achieved target pressures in the clinic. The implication is that home monitoring is associated with a small reduction in blood pressure.

These studies indicate that self monitoring and telemonitoring result in reductions in systolic blood pressure with minimal additional cost and are preferred by patients. More research is needed to understand what methodology is associated with the best clinical response in specific subpopulations as well as which interventions can be used in conjunction with home monitoring to achieve better outcomes.

*Internet-Based Patient Coaching*

With the Internet becoming broadly accessible and familiar to a sizeable portion of the population, the question of whether this medium can be harnessed to improve patient care and disease management has been raised.

In a 2008 pilot study based in the Netherlands, investigators sought to determine the feasibility of an internet-based coaching program to improve the risk factors of patients at risk for vascular problems (Goessens et al.). Fifty patients with at least one clinical manifestation of arterial disease and internet access participated; 70% were overweight, 64% hypertensive, 42% hyperlipidemic, and 24% smokers. Participants visited the clinic to establish a personalized action plan and to receive instructions on communication with a specialized nurse via the internet. The nurse practitioner responded to patient questions on working days and offered feedback, support, and recommendations for lifestyle and medical treatment.
During six months of intervention, the individual log-in average was 35 times; the nurse practitioner logged in to the website 23 times per week on average. The percentage of patients who had achieved treatment goals in several areas increased: 58% were at or below target blood pressure compared to 36%, 64% were at or below target LDL compared to 58%, and 82% were at or below target blood glucose compared to 64%. This study demonstrated both the feasibility and utility of internet based interventions to improve risk factors including hypertension. Additionally, it demonstrates the role of the nurse practitioner in patient education, chronic disease management, and risk reduction. Considering that this is a singular pilot study, much more research is needed in the area of internet-based interventions.

Combination Technological Interventions

A recent controlled randomized trial investigated the impact of home monitoring, internet-based patient education, and pharmacist care management via internet communications regarding blood pressure (Green et al., 2008). Participants aged 25 to 75 with uncontrolled essential hypertension – defined as >140/90 – were randomly assigned to one of the following: 1) usual care 2) usual care and home monitoring with internet-based education or 3) usual care, home monitoring with internet-based education and internet communications. Pharmacist care management included evidence-based training for experienced clinical pharmacists, one telephone visit in which the pharmacist introduced an action plan to the patient including instructions for home monitoring, a list of current medications; at least one patient-selected lifestyle goal, recommended medication changes based on stepped medication protocols, and the follow-up plan.
A total of 730 participants completed the study though the 1 year follow-up visit. Participants receiving usual care plus home monitoring and internet-based education showed a nonsignificant increase in percentage of patients with controlled blood pressure (36% compared to 31% at baseline). Participants receiving all three interventions showed a significant increase in the percentage of patients with controlled blood pressure compared to both other groups. Notably, patients with high baseline systolic pressure of >160 mmHg experienced greater net reductions in systolic and diastolic pressures than participants with lower baseline pressures. These findings suggest that the addition of collaborative internet-based pharmacist care management renders home monitoring and internet-based patient education more effective and may be of particular use in the case of patients with high baseline blood pressure.

Summary

A thorough review of available literature reveals a plethora of available, well researched, efficacious interventions that may be used as adjunct therapies in the treatment of hypertension. This gives nearly unlimited flexibility to the advanced practice nurse and patient team to collaboratively negotiate interventions which are the most feasible and most advantageous for a particular patient. It is extremely likely that incorporating more than one intervention results in a synergistic relationship and improved overall outcome; those studies which include multiple interventions simultaneously, or education regarding a number of recommended lifestyle changes, show excellent results. Therefore, it is the professional responsibility of all health care providers to be familiar with the current evidence regarding these various therapies.
Equipped with this knowledge, providers are well prepared to educate and empower patients to actively engage in their own care by participating in, and assuming ownership of, lifestyle changes and health promoting behaviors in order to achieve good blood pressure control and better overall well being.
CHAPTER 4: ANALYSIS AND PRACTICE RECOMMENDATIONS

Method of Analysis

Evidence based practice is the best method of providing safe, efficient, and effective health care and as such is the standard for health care professionals. Evidence should be evaluated using an objective means such that results of a single inquiry are reproducible and thus recommendations for clinical practice are consistent. With this in mind, literature examined in the previous chapter was evaluated using a system that objectively measures the quality of evidence supporting clinical practices. The system utilized was the Oxford Centre for Evidence-Based Medicine Levels of Evidence which classifies evidence based on types of studies by design and consistency of findings in the currently available literature. This classification system is illustrated in Figure 3.
Figure 3. Oxford Centre for Evidence-Based Medicine Levels of Evidence (2001)

Note. SR = systematic review or meta-analysis RCT = randomized, controlled trial
Once literature was classified according to level of evidence, the grade of clinical recommendation was determined based on the level of evidence using a corresponding classification system shown in Table 1. Grade A indicates strongly recommended, grade B indicates recommended, grade C is neutral and the clinician can decide whether the intervention is appropriate for each individual patient, grade D indicates not recommended.

Table 1

\begin{tabular}{|c|c|}
\hline
Supporting Literature & Grade of Recommendation \\
\hline
Consistent Level 1 Studies & A \\
Consistent Level 2 or 3 Studies \textit{or} Extrapolations from Level 1 Studies & B \\
Level 4 Studies \textit{or} Extrapolations from Level 2 or 3 Studies & C \\
Level 5 Evidence or Excessively Inconsistent \textit{or} Inconclusive Studies of any Level & D \\
\hline
\end{tabular}

Clinical Practice Recommendations

Using the Oxford Centre for Evidence-Based Medicine system, each addressed intervention was rated according to supporting evidence and the corresponding grade of clinical recommendation. These results of this evaluation are displayed in Table 2.
Table 2

**Strength of Evidence Supporting Interventions**

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Level of Evidence</th>
<th>Grade of Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaborative interventions</td>
<td>1b</td>
<td>A</td>
</tr>
<tr>
<td>DASH diet</td>
<td>1a</td>
<td>A</td>
</tr>
<tr>
<td>Decreased carbohydrate intake</td>
<td>1b</td>
<td>C</td>
</tr>
<tr>
<td>Omega-3 fatty acid intake</td>
<td>1b</td>
<td>B</td>
</tr>
<tr>
<td>Decreased caffeine intake</td>
<td>1a</td>
<td>A</td>
</tr>
<tr>
<td>Endurance training</td>
<td>1a</td>
<td>A</td>
</tr>
<tr>
<td>Resistance training</td>
<td>1a</td>
<td>A</td>
</tr>
<tr>
<td>Walking</td>
<td>1a</td>
<td>A</td>
</tr>
<tr>
<td>Patient and provider education</td>
<td>1b</td>
<td>B</td>
</tr>
<tr>
<td>Cognitive and behavioral counseling</td>
<td>1b</td>
<td>B</td>
</tr>
<tr>
<td>Garlic</td>
<td>1a</td>
<td>A</td>
</tr>
<tr>
<td>Soy protein</td>
<td>1b</td>
<td>C</td>
</tr>
<tr>
<td>Stress reduction</td>
<td>1a</td>
<td>A</td>
</tr>
<tr>
<td>Qigong</td>
<td>1a</td>
<td>A</td>
</tr>
<tr>
<td>Tai chi</td>
<td>1a</td>
<td>B</td>
</tr>
<tr>
<td>Home and self monitoring</td>
<td>1a</td>
<td>A</td>
</tr>
<tr>
<td>Internet-based patient counseling</td>
<td>2b</td>
<td>B</td>
</tr>
<tr>
<td>Combination Interventions</td>
<td>2b</td>
<td>B</td>
</tr>
</tbody>
</table>
Areas for Future Research

As indicated in Table 2, several of the interventions for hypertension addressed here are supported by meta-analyses of randomized, controlled trials; these include the DASH diet, all three forms of exercise, omega-3 fatty acid intake, decreased caffeine intake, garlic, stress reduction, and home and self monitoring. In the case of these interventions, the most useful future research will focus on the synergistic effect of simultaneous interventions and the impact of long-term therapies. Hypertension is a chronic, complex disease process involving inflammatory processes, not all mechanisms of these processes are fully understood and it is likely that for any given individual multiple etiologies are involved. Therefore, clinicians should be able to titrate adjunct therapies by gradually adding lifestyle changes to the patient’s plan of care until goal is met in much the same way that a prescription antihypertensive regimen is developed. It would be extremely beneficial for the clinician to have knowledge regarding the synergistic relationships among interventions so as to add them the order of effectiveness within the context of the overarching plan of care. Moreover, it would be reassuring to know that benefits of such changes would continue to be effective for the long-term duration of the management of this chronic condition.

Some of the interventions show very promising preliminary results from available randomized controlled studies but lack sufficient quality or quantity of such trials to provide a foundation for decisive meta-analyses. These include collaborative interventions, patient and provider education, cognitive and behavioral therapies, qigong, tai chi, internet counseling, and combination interventions. Based on the encouraging
results to date, these interventions warrant large scale randomized controlled trials to firmly establish associations with blood pressure and also to determine efficacy over longer periods of time than reported thus far. There is great potential within this group of interventions, which are all relatively newly being investigated, for therapies to be dubbed valuable components of hypertension management.

Lastly, two interventions, soy protein intake and decreased dietary carbohydrate content, have not been consistently shown to decrease blood pressure. Additional randomized controlled trials are needed to determine possible mechanisms of action and to evaluate whether these interventions are sufficiently effective to warrant implementation as part of the management plan.

Conclusion

There is a great need to control hypertension among middle aged and older adults in order to prevent the many cardiovascular complications with which it is associated. There is also a wealth of evidence based knowledge regarding the treatment of the condition through non-pharmaceutical interventions which complement and enhance traditional pharmaceutical therapy. Advanced practice nurses managing hypertensive patients should be familiar with the interventions reviewed here and implement them according to their patients’ needs. Future research will guide the development of additional guidelines regarding the management of this important chronic condition.
REFERENCES


