Improving the Detection and Management of Hypertension in Adults in the Primary Care Setting: A Quality Improvement Project Based on the Chronic Care Model using Blood Pressure Monitoring and Clinical Practice Guidelines

Michelle A. Cutler

Follow this and additional works at: https://scholarworks.umass.edu/nursing_dnp_capstone

Cutler, Michelle A., "Improving the Detection and Management of Hypertension in Adults in the Primary Care Setting: A Quality Improvement Project Based on the Chronic Care Model using Blood Pressure Monitoring and Clinical Practice Guidelines" (2016). Doctor of Nursing Practice (DNP) Projects. 122.
Retrieved from https://scholarworks.umass.edu/nursing_dnp_capstone/122
Improving the Detection and Management of Hypertension in Adults in the Primary Care Setting: A Quality Improvement Project Based on the Chronic Care Model using Blood Pressure Monitoring and Clinical Practice Guidelines

Michelle A. Cutler
University of Massachusetts Amherst College of Nursing

Capstone Chair: Jean E. DeMartinis PhD, FNP-BC
Capstone Committee Member: Pamela Aselton PhD, MPH, FNP-BC
Capstone Mentor: Cecilia Vicuna-Keady DNP, FNP-BC
Date of Submission: May 29, 2016
# Table of Contents

Abstract ................................................................................................................................3

Introduction and Background ..............................................................................................4

Theoretical Framework ........................................................................................................9

Review of the Literature ....................................................................................................11

Project Design, Methods, and Implementation..................................................................13

  Settings and Resources ................................................................................................14

  Description of the Project Population ..........................................................................15

  Ethics and Human Subjects Protection .......................................................................16

  Project Actualization ....................................................................................................16

Results................................................................................................................................23

  Outcomes .....................................................................................................................23

    Baseline Characteristics of Participants .....................................................23

    Provider Results .........................................................................................25

    System Results ...........................................................................................31

    Patient Results ............................................................................................34

  Facilitators and Barriers ...............................................................................................39

Discussion/Interpretations..................................................................................................42

Conclusion .........................................................................................................................45

References..........................................................................................................................47

Appendix............................................................................................................................56
Abstract

**Background:** Hypertension (HTN) is a common, costly, and deadly disease that is often under recognized, under diagnosed, and undertreated in the primary care setting. Despite the presence of effective treatment strategies, uncontrolled HTN remains a persistent problem.

**Purpose:** The aim of this Doctor of Nursing Practice (DNP) project was to improve the quality of HTN care delivered to adults in a primary care practice. Goals were targeted to decrease providers’ *clinical inertia* by improving their ability to make better diagnosis and treatment decisions after reviewing more comprehensive objective data.

**Methods:** Using the Chronic Care Model in an independent primary care setting in New Hampshire an ambulatory blood pressure monitoring (ABPM), home blood pressure monitoring (HBPM), clinical practice guidelines, and patient and provider education were used to improve the detection and management of hypertension. Patients were followed over two to three visits including an initial visit for ABPM set-up and up to two subsequent HTN follow-up visits.

**Results/Interpretations:** One hundred percent of patients who underwent successful ABPM had their HTN status assessed and those with uncontrolled HTN had changes made to their medications to improve control. The percentage of patients with uncontrolled HTN decreased by more than half at visit two (44.7%) compared with visit three (20%), which was statistically significantly different, \( t(58) = 2.25, p = 0.028, 95\% \text{ CI } [0.027, 0.466] \).

**Implications:** QI projects addressing provider, system, and patient barriers may be effective at overcoming the barrier of providers’ *clinical inertia* and improving some patients’ self-management of their disease resulting in improved HTN control.

**Keywords:** ambulatory blood pressure monitoring, chronic care model, clinical inertia, home blood pressure monitoring, hypertension, practice guideline, primary care, self-efficacy
Introduction and Background

Hypertension (HTN) is the most commonly treated disease in primary care (Huebschmann, Mizrahi, Soenksen, Beaty, & Denberg, 2012); yet it is one of the most deadly, costly, and poorly managed diseases in the United States (Centers for Disease Control and Prevention [CDC], 2012). According to the CDC (2012), the estimated prevalence of HTN is one in every three adult Americans, with less than half of those diagnosed having attained satisfactory control of their disease. The health care costs associated with HTN totals $131 billion per year (CDC, 2012). Uncontrolled HTN is associated with significant morbidity and mortality including increased risk of stroke, myocardial infarction, chronic kidney disease, heart failure, and death (CDC, 2012). Worldwide, HTN contributes to over nine million deaths per year (James, Dolan, & O'Brien, 2014).

Controlling blood pressure (BP) is crucial in the prevention of cardiovascular disease, especially since, after years of decline, the death rates for coronary heart disease and stroke leveled off and have begun to rise again. Despite the fact that HTN is controllable, in essence, nearly “curable”, control rates vary, with the majority of individuals with HTN remaining uncontrolled or under controlled (DeMartinis, 2009; DeMartinis, Kent, & Uphold, 2013).

Lifestyle modifications and pharmacotherapy treatments can successfully control HTN in more than nine out of ten patients (Yaxley & Thambar, 2015). There are many classes of inexpensive and well-tolerated medications for the treatment of HTN that have been proven to be effective and safe through rigorous clinical trials and over time (Margolis et al., 2012). Modifications such as weight maintenance, a healthy diet, and regular exercise can have a significant impact on HTN (Masuo, 2015). It is estimated that following the Dietary Approaches to Stop Hypertension (DASH) diet has the potential to decrease systolic blood pressure an
average of 8 to 14 mm Hg (Chobanian et al., 2003). A 10 mm Hg decrease in systolic BP can reduce a patient’s risk of dying from a stroke by 40% and from heart disease by 30% (Carter, Bosworth, & Green, 2012).

Improving the quality of HTN care provided is critical to addressing this issue. Most patients with HTN have their HTN managed by their primary care provider (PCP). In the United States, four out of five HTN office visits for patients who have HTN are performed by PCPs, not by specialists (Margolis et al., 2012). Moreover, HTN is the most commonly billed primary care visit type (Egan, Zhao, & Axon, 2010). It is evident the primary care setting is where the quality of HTN care needs to improve.

It is universally agreed that the prevention and management of HTN are essential for good health. For the last three decades, the United States Department of Health and Human Services (DHHS) (2016) has included improving the prevention, detection, and management of hypertension as part of their national goals for improving the health of all Americans. Healthy People 2000, Healthy People 2010, and Healthy People 2020 objectives have included outcomes aimed at increasing antihypertensive medication adherence; decreasing the prevalence of HTN; increasing the proportion of patients following the recommended lifestyle modification guidelines; increasing the percentage of patient who have their BP checked and can recognize the result as normal or HTN; and increasing the proportion of patients with controlled HTN (DHHS, 2016). As we pass the midway point of the 2020 objectives, it appears that HTN control is modestly improving, but there is still much room for progress (DHHS, 2014). More Americans are being diagnosed with HTN each year, yet only 44% of the diagnosed population has achieved satisfactory control of their hypertension (DHHS, 2014). Provider, system, and patient issues all contribute to the under management of this treatable condition.
Many practice gaps are present in healthcare preventing patients from being diagnosed and treated effectively for HTN. A diagnosis of HTN should be considered in any patient with a systolic BP greater than 140 mm Hg or a diastolic BP greater than 90 mm Hg on two separate occasions (James et al., 2014). Despite robust guidelines for the diagnosis and treatment of HTN, many providers fail to recognize repeated abnormal BP measurements (Bosworth et al., 2009).

Even when providers do recognize uncontrolled HTN, they do not always address it during the patient visit (Bosworth et al., 2009; Sutton, Wilson, Kaboli, & Carter, 2010). In a retrospective analysis of patients with uncontrolled HTN, researchers discovered nearly three-quarters of patients with uncontrolled HTN had at least two health care visits within the last year for various health issues, in which their HTN was not addressed (Frieden, King, & Wright, 2014). Experts agree the main provider-related contributor to the issue of uncontrolled HTN is clinical inertia, as evidenced by the extensive failure of providers to start, intensify, or adjust HTN treatment when management goals are unmet (Huebschmann et al., 2012).

Factors reported by providers that contribute to this phenomenon of clinical inertia include knowledge deficits, fear of medication side effects, difficulty keeping up with treatment recommendations, and lack of time and resources (Khatib et al., 2014). Providers also question the reliability of the BP readings upon which they base their treatment decisions (Lebeau et al., 2014). At times, providers see a high BP reading and ignore it in disbelief, attributing the elevated reading to pain or stress, not uncontrolled HTN. On occasion, providers recognize that patients are not below their treatment goal but will not act because they are close to their treatment goal (Lebeau et al., 2014). More often, many providers do not order the appropriate antihypertensive medications despite substantial evidence supporting specific drug classes as
first-line therapy (Markidakis & DiNicolantonio, 2014). The phenomenon of clinical inertia
does not only include diagnostic and pharmacologic inaction; it also involves the failure of
providers to include important lifestyle modification education to support patients’ self-
management of their disease (Lebeau et al., 2014).

Another potential barrier in controlling HTN is the reliability of BP readings on which
providers must base diagnosis and treatment decisions. Hypertension is a “silent killer”; many
patients have no signs or symptoms of their disease, until the chronically increased BP affects
other organ systems and end organ damage reveals the HTN diagnosis. This makes the need for
accurate BP measurements essential for providers to make effective diagnosis and treatment
decisions. One of the main contributors to the actual and perceived inaccuracy of in-office BP
readings in predicting the presence of HTN is the “white coat” effect. For approximately one out
of three patients, the anxiety and/or stress of going to a provider causes a temporary increase in
blood pressure that is not observed outside the clinical environment (Cobos, Haskard-Zolnierek,
& Howard, 2015). In addition to the white coat effect, in-office BP measurements are also
subject to errors in technique.

Myers, Kaczorowski, Dawes, and Godwin (2014) performed a review of the literature on
the accuracy of various blood pressure monitoring techniques used in primary care offices. They
concluded that routine manual office BP (MOBP) monitoring is subject to many factors that limit
the reliability of readings including selecting the incorrect cuff size, deflating the cuff too
rapidly, taking a reading too soon after activity, and individual office staff idiosyncrasies.
Manual BP readings in routine clinical practice are 9 mm Hg systolic and 6 mm Hg diastolic
higher than readings measured in a controlled research setting. Studies using automated office
BP (AOBP) have shown that it is more accurate than MOBP, and it decreases the ‘white-coat’
effect. However, it is still subject to many of the same limiting factors as MOBP. The main limitation of both manual and automated office BP monitoring, is that it is just one reading, at one point in time. Factors such as pain, illness, and the white coat effect make in office BP readings unreliable.

There are also many patient-related factors contributing to the high number of Americans walking around with undiagnosed or uncontrolled hypertension. Non-adherence to antihypertensive medications is suggested as a leading cause of uncontrolled HTN in the U.S. (Dave et al., 2013). Many patients do not adhere to their HTN medications and do not adhere to recommended lifestyle modifications aimed at lowering their BP (Hacihasanoglu & Gözüm, 2011). For example, patient-related factors include: suboptimal medication adherence related to cost, fear of side effects, mistrust of providers, denial of diagnosis, pill burden, and patients’ beliefs (Polinski et al., 2014). Patient capability is also an issue (Khatib et al., 2014). Many patients do not have the baseline knowledge about HTN and lifestyle risk factors to make healthy choices (Khatib et al., 2014). Additionally, many patients lack the motivation, resources, and supports needed to make meaningful lifestyle modifications directed at improving BP (Khatib et al., 2014). The asymptomatic nature of HTN also contributes to patients’ perceived lack of need for personal transformation (Mafutha & Wright, 2013).

Patients’ non-compliance and providers continued ignorance to prescribe and manage HTN through multifaceted holistic treatment protocols are the two major factors contributing to the persistent lack of effective BP management in the US population (DeMartinis, 2009; DeMartinis, et al., 2013). DeMartinis argues that providers must appreciate the need for refinement in their exiting diagnosis and treatment protocols, based on current practice
guidelines and quantifiable BP data readily available through non-invasive assessment devices that measure hemodynamic and BP parameters over time.

**Theoretical Framework**

The purpose of this DNP project was to design and implement a quality improvement (QI) project to address some of the provider, system, and patient issues that contribute to suboptimal hypertension detection and management. Hypertension is a chronic condition and patients require a coordinated approach to adequately manage this lifelong disease.

The Chronic Care Model (CCM) was an appropriate model to choose for the design and implementation of this project as it integrates all aspects of the healthcare system. The CCM (see schema in Appendix A) is a theoretical model that was designed to outline a process for improving the management of chronic illnesses within healthcare systems (Wagner, Davis, Schaefer, Von Korff, & Austin, 1999; Wagner et al., 2001). The model has six components. The first four elements center around the practice environment- the organizational design of the healthcare system, clinical information systems, delivery system design, and the use of decision supports. The last two components are patient-centered and include self-management support and utilization of community resources. The complex nature of chronic illnesses require a multifaceted approach. This model is ideal as it breaks down complex care into a multi-factorial approach that allows for analysis of the various systems and person-environment transactions within a particular healthcare system.

Using this framework, a review of the current HTN detection and management workflow at the large practice with two office sites was examined by the DNP student, the practice owner, and the offices’ practitioners. Strong points and weak points in each of the domains were identified. Weak areas were targeted as areas to introduce change. Under the domain of
organizational design of the system, identified strengths included involved leadership, an environment that encourages QI efforts, and incentives to improve the quality of chronic care including third-party insurance payments. The main weakness identified was a lack of a chronic care current strategy. In the domain of delivery system design, identified areas of strength included flexible practice hours outside of regular working hours, monthly staff meetings to improve the delivery of care, and the practice’s high value on continuity of care. An area of improvement identified was to develop a plan of care for patients with HTN, including regular care, targeted interventions, and self-management support.

Under clinical information systems, the electronic medical record (EMR), which allows reporting and trending of patient information were identified as a strength. Using the EMR in new ways to help communicate the course of hypertension care was identified as an area for improvement. Improving the accuracy of BP measurement was also targeted for improvement in this model domain. In looking at decision support systems it was determined that practitioners independently make use of many decisions supports, such as clinical guidelines, but the practice does not provide them. Identifying evidenced-based guidelines for HTN and supporting them with provider education were identified as two areas of potential improvement. Current strengths identified in the area of patient self-management support included close follow-up of chronic conditions. Areas for improvement that were targeted included increasing patient support and education. Under the domain of utilization of community resources, practice strengths included the practice’s many partnerships with various community organizations. An identified weakness was a lack of follow up to make sure patients are utilizing these resources.

Through the application of the CCM, specific areas of improvement targeting the providers, system, and patients were identified. The model helped identify resources to address
the practice’s gaps in the management of their hypertensive patients. A review of the literature based on the appraisal of the strengths and weaknesses of the primary care setting was executed to identify resources that could be used to target these areas of chronic HTN care in need of improvement. Specific search criteria were identified during the process of the healthcare system appraisal.

**Review of the Literature**

Clinical practice guidelines (CPGs) are one source of evidence-based recommendations outlining how to improve the quality of care delivered, including HTN management. According to the Institute of Medicine (IOM) (2011), CPGs are evidence-based recommendations intended to improve the quality of patient care. They are informed by systematic reviews and include an assessment of the risks and benefits of treatment options. Healthcare experts believe that CPGs have the potential to decrease inconsistencies in care and improve healthcare outcomes (Etxeberria et al., 2013). Several HTN guidelines are widely accepted and used in primary care settings.

In 2014, the Eighth Joint National Committee (JNC-8) published its latest version of evidence-based guidelines for the management of hypertension in adults (James et al., 2014). The JNC-8 guidelines are considered a much-anticipated improvement over the previously widely accepted JNC-7 guidelines. Experts agree following its recommendations can help improve the quality of HTN care, although experts are still debating a few details of the recommendations for the treatment of HTN in elders (Kovell et al., 2015). The guideline was developed after a systematic review of the literature and the collaboration of hypertension experts, to ascertain which of the broad range of antihypertensive drugs should be implemented, at what BP threshold, and with what goals in mind (Hernandez-Vila, 2015). The guideline is
based on the highest levels of evidence to date from randomized, controlled clinical trials (Hernandez-Vila, 2015). Each recommendation is discussed at length and accompanied by a grade based on its level of evidence.

Experts agree that almost all patients with HTN can benefit from pharmacotherapy (Markidakis & DiNicolantonio, 2014). The JNC-8 guideline provides medication therapy recommendations based on the patient’s race, age, and other comorbid factors. The guideline also provides specific BP goals for HTN treatment. Moreover, the guideline provides specific recommendations about how to adjust or escalate therapy.

In addition to consideration of effective pharmacotherapies, the management of hypertension should also include patient education about lifestyle modifications intended to improve BP (Chobanian, 2003). The AHA/ACC Guideline on Lifestyle Management to Reduce Cardiovascular Risk: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines is another CPG that is potentially helpful in informing and improving the quality of HTN management in the primary care setting (Eckel et al., 2014). This guideline provides evidenced-based recommendations on lifestyle modifications patients can make to improve their BP as part of overall heart health. Each recommendation is graded based on the strength of the evidence supporting it. Like the JNC-8 guidelines, these guidelines are devised by leading experts and are designed to support clinical decision-making yeast, are not a substitute for providers own clinical judgment (Eckel et al., 2014; James et al., 2014). Both these guidelines meet the IOM (2011) standards to be considered trustworthy, high-quality CPGs.

A review of the recent literature was performed to explore how different blood pressure measurements techniques are being used in the treatment of HTN in the primary care setting.
Home or ambulatory blood pressure measurement (ABPM) has been studied extensively over the past twenty years (Andalib et al., 2012; Myers et al., 2014). Numerous studies have shown the ABPM can help to predict an individual’s likelihood of future cardiovascular diseases (Stergiou, Siontis, & Ioannidis, 2010; Verdecchia, Angeli, & Cavallini, 2007). According to Boggia et al. (2014), part of the problem for providers in using BP measurements to guide treatment decisions is the natural variations in BP—(e.g.- circadian, day-to-day, reading-to-reading, visit-to-visit). Ambulatory BP monitoring helps cut through the confusion by offering a greater number of readings over time that are free from the white coat effect (Boggia et al., 2014). Ambulatory BP monitoring is widely accepted as a more accurate and diagnostic method of monitoring BP over time than office methods (Andalib et al., 2012; Boggia et al., 2014; Myers et al., 2014). The European Society for Hypertension (Mancia et al., 2013) and the National Institute for Health and Clinical Excellence (McManus, Caulfield, Williams, & National Institute for Health and Clinical Excellence, 2012), the U.S. Preventative Services Task Force (2015) all recommend ABPM as the preferred method for diagnosing and managing HTN.

**Project Design, Methods, and Implementation**

A quality improvement (QI) project design using provider education, clinical practice guidelines, two types of home-based blood pressure monitoring, and evidence-based patient education to improve the quality of standard HTN management delivered in one primary care practice was used. Quantitative and qualitative methods data were collected from BP monitors, patient and provider questionnaires, and communications with providers and patients. The activities included educational sessions at staff meetings, as well as one-on-one provider and staff education. Patient-centered interventions including BP monitoring and patient education were provided over the course of several office visits.
Setting and Resources

The project took place in the offices of a privately-owned primary care practice in New Hampshire. The practice employs three nurse practitioners, one licensed practical nurse and four medical assistants as well as three secretaries and several office managers. The providers and staff work on assignment across two office sites and patients may be seen at either office for an appointment. The two offices of the practice have a combined patient panel of approximately 4,000 patients from birth to ninety years of age and older. Nearly half of the patients have private insurance, and the other half have Medicare. About 1% of patients have no insurance or Medicaid. The exact number of patients and the demographics of the desired population of adult patients diagnosed hypertension were undefined.

Both practice locations reside in a rural county as do the majority of the practice patients. This county is comprised of 14 towns and one city (The State of New Hampshire, n.d.). According to the United States Census Bureau (2015), the county had a 2013 population of 42,984 residents. 96.9% of the residents are White alone, 1.5% are two or more races, 1.4% are Hispanic or Latin, 0.6% are Black or African American, 06.% are Asian, and 0.3% are American Indian or Alaska Native. 18.3% of the population are elderly (65 years and older), and 19.9% are under the age of 18 years. The 2009-2013 median household income is below the state average of $64,916 at $54,463 and slight above the U.S. median household income of $53,046. In 2011-2013, 9.9% of the County residents lived below the poverty line. The state average is 8.7%, and the U.S. average is 15.4% for the same timeframe.

Two types of monitors were used during the project. The first type of monitor used was the Welch Allyn’s ABPM 7100© monitor and its companion CarioPerfect Workstation© software. This monitor was designed to be worn for at least 24 hours and as long as several
days. It takes BP measurements automatically at specific intervals over the 24-hour period and stores all of the information for easy retrieval. The software that goes with the monitor generates a report on BP trends over time that the provider can review. The second type of monitors were the typical home blood pressure monitors (HBPM), which are inexpensive monitors that can be purchased at any drug store or large retailer. This type of monitor takes a blood pressure measurement and shows a reading when a button is pushed. These monitors are not designed to be worn throughout the day. They are used primarily by patients to track their own BP measurements at home as directed by their PCP.

**Description of the Project Population**

The target patient population for this QI project was all adult patients aged 19 to 74 years who had suspected HTN, prehypertension, or an established diagnosis of HTN. The sample contained both newly diagnosed HTN patients and patients with existing HTN. The initial goal was to recruit 50 patients and forty-eight patients were ultimately recruited into the QI project. Patients were already current practice patients, English-speaking, literate, and had either private or public health insurance. All patients were physically able to measure their BP at home. They also had an upper arm circumference that was matched with an appropriately sized ABPM cuff. Exclusion criteria for patient participation in the QI project included pregnancy, hypertension that was already managed by a specialist, cognitive impairment, presence of a non-sinus heart arrhythmia, and the presence of an implanted defibrillator or pacemaker. Patients who had any medical contraindication to repeated BP measurement in their non-dominant upper arm, including, but not limited to a history of mastectomy, poor circulation, the presence of a wound, or arteriovenous shunt, were excluded.
Ethics and Human Subjects Protection

Since the DNP project was a QI initiative, it was determined that submitting for and obtaining Institutional Review Board approval was not required. All participants were protected by the Health Insurance Portability and Accountability Act of 1996 (HIPAA) which, among other guarantees, protects the privacy of patients’ health information (Modifications to the HIPAA Privacy, Security, Enforcement, and Breach Notification Rules, 2013). Additionally, the DNP student and practice personnel who carefully conducted this project followed the Standards of Care for practice in a primary care office. All information collected as part of evaluating the impact of this project was aggregated data from the project participants and did not include any potential patient identifiers. The risk to patients participating in this project was no different from the risks of patients receiving standard HTN care. Participant confidentiality was assured by coding the participants using individual identification numbers. The list of participants and their identifying numbers were kept in locked filing cabinets each practice office, only accessible to the project coordinators. All electronic files containing identifiable information were password protected to prevent access by unauthorized users and only the project coordinators had access to the passwords.

Project Actualization

Over a four-month period, patients with suspected or diagnosed HTN were followed over several visits. During the first visit, patients were fitted with an ABPM for 24-hours to gain a reliable assessment of their HTN status. During the second visit, patients received their ABPM results, any necessary testing, medication changes as appropriate, and education about HBPM and recommended lifestyle modifications (LM) as deemed appropriate by their primary care provider. Patients who were determined to have white coat hypertension (WCH) via ABPM,
without a co-diagnosis of prehypertension, did not receive HBPM instructions and LM education and were not followed on their next visit. All other patients were seen for a third hypertension follow-up visit to review HBPM results, reassess hypertension control, and reinforce LM education.

The first phase of this project was pre-project implementation, which consisted of staff training, patient recruitment, gathering equipment, and figuring out the logistics of the project. The DNP student first introduced the project to providers and staff at the practice’s monthly staff meeting. Practice staff were educated about the planned interventions, the goals of project, their role in the project, and what to expect. Staff education included teaching ancillary staff about methods to obtain accurate measurements of office BP. The correct procedure included waiting until the patient had been seated for at least 5 minutes in a chair with their back supported and their feet flat on the floor. Staff members were instructed to take a reading in both arms using office AOBP unless contraindicated, and record these readings in the electronic medical record (EMR).

The DNP student investigated ABPM, presented the practice owners with option, and the practice owner purchased two ABPMs. The DNP student also examined reimbursement and billing for monitoring HTN using ABPMs from various insurance companies. Using the Process Theory (Issel, 2014) the student calculated the project’s cost and created a budget based on potential reimbursement. The practice owner purchased two Welch Allyn 7100 ABPMs and the CarioPerfect Workstation software to run the monitors as an in-kind contribution to the project. The DNP student and the practice’s staff member in charge of the practice’s EMR, computers, and network system installed all the ABPM software. Prior to implementation, the DNP student became familiar with using the Welch Allyn 7100 ABPM and its software. Prior
to implementation, a staff volunteer wore the monitor for 24-hours and the data was downloaded using the CarioPerfect Workstation © to ensure functionality and accuracy of the system. This was also done to elicit the tolerability of the monitoring process before placing the device on any patients.

In preparation for the project, the DNP student also met with the providers as a group and again with each provider one-on-one. The DNP student provided copies of the JNC-8 guidelines and AHA/ACC guidelines and reviewed them with each practitioner. Providers were also educated about the diagnosis requirements for white coat hypertension (WCH), masked HTN, controlled HTN, uncontrolled HTN, resistant hypertension, and how to distinguish patients’ nocturnal dipper status and its clinical significance. The student reviewed the functioning of the ABPM and how to run and interpret the reports. The student also educated the providers about ICD-10 and CPT codes for billing. Provider feedback was solicited and incorporated into the project design. The practice owners and the DNP student’s chairperson and mentor signed off on the proposed project prior to implementation.

Patient recruitment was done by the DNP student and practice providers based on the project’s inclusion and exclusion criteria. Providers identified patients with questionable BP control including patients with suspected undiagnosed hypertension, suspected WCH, patient whose HTN control was questionable based on variable in-office and/or home readings, patients with elevated BP readings suggestive of uncontrolled HTN on antihypertensives, and patients who were resistant to starting an antihypertensive for previously diagnosed HTN. After speaking with the patient about the need for ABPM to clarify their hypertensive status, the provider created a telephone encounter for the DNP student in the EMR, which was electronically linked to the patient’s record.
Next, the DNP student called identified patients to schedule them to be set up with ABPM. During the phone call, the DNP student explained the purpose of the monitor, why their provider had recommended it for them, and what to expect. The DNP student also reviewed the list of inclusion and exclusion criteria to ensure each patient was eligible. Patients were instructed to schedule at a time when wearing the ABPM will not cause unnecessary inconvenience. Patients were advised that they could not shower with the monitor on or get it wet, they should not use power tools while wearing the monitor, and that driving should be kept to a minimum while they were wearing the monitor. Patients were also advised that they should come to their appointment wearing loose clothing under which the monitor could fit. Interested patients were scheduled for an office visit with their provider during a time when the DNP student was expected to be present. Recruitment of patients was planned to cease after 50 patients had undergone ABPM or at the end of the four-month project implementation timeframe, whichever came first.

The selected patients’ first visit for ABPM ‘set-up’ included a standard HTN follow-up visit including a history and physical exam as deemed appropriate by each patient’s provider. During the scheduled visit, the healthcare providers and the DNP student reviewed the inclusion and exclusion criteria and signed off on a document created to ensure the participants met selection criteria for participation in the QI project (see Appendix B for patient eligibility checklist). For each patient, the provider measured the arm circumference of the patient’s non-dominant upper arm and matched the patient with the correct cuff size per ABPM 7100 © specifications.

The providers then reviewed the manufacture’s patient instructions from the user manual with their patients (see instructions in Appendix C). A copy of these instructions was signed by
the patients and scanned into the patients’ charts. Each patient was also given a condensed version of these instructions provided by the manufacturer to take home for reference (see a copy in Appendix D). Patients also received an additional set of printed instructions written by the DNP student in response to monitoring issues encountered during the first few patient visits (see a copy in Appendix E). Patients were also asked to sign a borrower’s agreement, designed by the DNP student and the practice manager (see the contract in Appendix F). They also received a business card and number to reach someone should they have any issues during the monitoring period. The DNP student was available by phone the entire 24-hours of each patient’s monitoring period.

Next, BP measurements were performed via AOBP or manually, per provider preference, on both arms to assess a typical office baseline. Each patient was then fitted with the Welch Allyn 7100 ABPM©. The monitor was turned on and the provider confirmed that the battery was ample for the duration of the monitoring. Obese patients were given a fresh set of batteries and instruction regarding how to replace the batteries since the larger cuffs required more power to inflate fully. The first ABPM reading was then taken. The providers compared this measurement with the earlier two in-office readings for plausibility and comparability to the office BPs. Measurements were repeated if there was a discrepancy between the ABPM and the office measurements of more than 20 mm Hg systolic or diastolic. The patients were given a journal and instructed to write down when they went to bed and when they woke up for the purpose of determining dipper status, and when they took their antihypertensive(s), if any (see copy of journal in Appendix G).

Patients were also instructed to write down any information they deemed pertinent to monitoring including symptoms and activities. Patients were instructed to wear the monitor for a
full 24 hours continuously, and to return the monitor and journal to the same office during business hours as soon as possible after completion. The monitor was programmed to take measurements automatically every 15 minutes during the day (07:00 to 19:59) and every half an hour at night (20:00 to 06:59). The BP readings were blinded to the patient when the monitor was programmed. An alternative program was used for patients who worked second or third shift. The same timing intervals were used, just with different timeframes. Once this initial set-up visit was completed and the monitor was functioning, patients were scheduled to have a follow-up appointment within the next week to receive their monitoring results. Patients were instructed to bring their HBPM to the next appointment if they had one.

Once the monitor was returned, the DNP student downloaded the readings from the monitor and generated a report for the providers to interpret. The monitor report and the patients’ journals were scanned into their EMR by the office staff. A designated staff member was responsible for cleaning the monitoring equipment per manufacturer’s instructions and getting it ready to be used on the next patient. An area was designated for the monitors, BP cuffs, manuals, and accessories to be stored.

At the second visit, the providers reviewed the results of the ABPM with the patients. Each patient received a personalized treatment plan based on the ABPM results. All patients, except those diagnosed with only WCH, received education on recommended lifestyle modifications, including a handout on the DASH diet (National Heart, Lung, and Blood Institute, 2015) (see a copy in Appendix H). Patients were asked to complete a three-day diet diary and log an activity or exercise on a form that is part of the DASH diet handout (the log page of the handout was duplicated so each patient had three blank records). The patients also received a
handout with logs from the American Heart Association (AHA) about HBPM (see a copy of AHA handout in Appendix I).

If patients brought in their HBPMs, they were tested for accuracy against the office measurements. Verification of the accuracy of the patients’ HBPMs was documented in each patient’s EMR. If a patient did not bring it, he/she was instructed to bring it to the next appointment. Patients who did not have a HBPM or who had a HBPM deemed inaccurate, were provided with a handout created by the DNP student with information about purchasing a new one (see a copy in Appendix J). Patients who stated that they could not afford a HBPM were provided with a validated monitor by the practice.

Patients were instructed to check their BP once in the morning and once in the evening, three times per week or more depending on provider preference, and to record these readings on the AHA log provided to them. The patients’ providers then made a plan for follow-up per usual standards of HTN care and JNC-8 recommendations. Any patients who were identified as having WCH, and not having pre-hypertension or HTN, did not continue in the project. The DNP student provided the patients’ providers with a questionnaire at each of their second office visits to assess their early feedback. Patients were also asked to voluntarily complete a questionnaire about their confidence in managing their HTN and about their lifestyle choices.

At the third visit, for prehypertension or HTN follow-up, patients were asked to give their providers their HBPM logs and DASH dairies to review. Standard HTN care, using the JNC-8 guidelines as a reference, was provided. Reinforcement of lifestyle modifications per the AHA/ACC guidelines were again provided as part of standard care. After each patient’s third visit, the DNP student asked the providers to complete a questionnaire soliciting late feedback.
Patients were also requested to complete the same questionnaires as they did on their second visit.

During the entirety of the QI project, information about HTN diagnoses, medication changes, BP readings, heart rates, weights, and other quantitative data deemed pertinent to their standard HTN care was collected by the office staff and providers and remained confidential. The DNP student had access to aggregated data for analysis to determine the impact of the project on HTN management and office practices. Other information such as demographic data, insurance information, and medical record numbers were kept anonymous throughout the process.

Results

Outcomes

The aim of this QI project was to follow 50 patients through two to three PC HTN visits. A total of 48 patients participated in at least one visit but due to patient dropout and time constraints, 32 patients were followed to completion. Of the original 48 patients, twelve patients had their third visit scheduled after the end of the project. Only four patients failed to follow-up. Of the 32 completers, twenty-five patients with prehypertension or hypertension completed three visits. Seven patients who were diagnosed with WCH were seen for two visits as planned.

Baseline characteristics of participants. The baseline characteristics of all 48 participants who took part in the QI project were collected at their first visit as shown in Table 1.
Table 1

Baseline Characteristics of Participants (N=48)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>M±SD or %*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years</td>
<td>52.15±11.65</td>
</tr>
<tr>
<td>Female Sex</td>
<td>64.6</td>
</tr>
<tr>
<td>Caucasian Race</td>
<td>100</td>
</tr>
<tr>
<td>Height in inches</td>
<td>66.17±3.51</td>
</tr>
<tr>
<td>Weight in pounds</td>
<td>199.16±52.49</td>
</tr>
<tr>
<td>BMI kg/m²</td>
<td>31.79±7.30</td>
</tr>
<tr>
<td>Positive smoker status</td>
<td>10.4</td>
</tr>
<tr>
<td>Hypertension diagnosis</td>
<td>52.08</td>
</tr>
<tr>
<td>On hypertensive drugs</td>
<td>47.9</td>
</tr>
<tr>
<td>Number of antihypertensives</td>
<td>0.81±0.98</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>64.6</td>
</tr>
<tr>
<td>Diabetes</td>
<td>14.6</td>
</tr>
<tr>
<td>Chronic Kidney Disease</td>
<td>0.0</td>
</tr>
<tr>
<td>Heart Disease</td>
<td>14.6</td>
</tr>
<tr>
<td>Office SBP mm Hg</td>
<td>142.67±14.91</td>
</tr>
<tr>
<td>Office DBP mm Hg</td>
<td>84.54±8.34</td>
</tr>
</tbody>
</table>

[*Mean (M)± Standard Deviation (SD) or Percent (%)]

Sixty-five percent (n = 31) of the participants were female. The participants ranged in age from 20 years old to 74 years old; the mean age was 52.15 years (SD = 11.65). Their body mass index (BMI) ranged from 20.90 kg/m² to 58.50 kg/m², mean 31.79 kg/m² (SD = 7.30). Fifty-two percent of the population (n = 25) had a pre-existing diagnosis of hypertension; 48% were on one or more antihypertensives (n = 23). The participants’ BP was measured in each arm at the first visit unless contraindicated. The two measurements were averaged, and the average was used as their first visit BP. The participants’ systolic BP ranged from 111 mm Hg to 180 mm Hg; the mean was 142.67 mm Hg (SD = 14.91). Diastolic BP ranged from 68 mm Hg to 106 mm Hg with a mean of 84.54 mm Hg (SD = 83.4).

*Provider, System, and Patient goals and objectives are listed with results’ metrics, measures, and analysis of outcomes for each immediately following.*
Provider results.

Goal one. Providers will use data from ABPM to guide HTN diagnosis and treatment decisions.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Expected outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Providers will find the ABPM readings were influential in making decisions regarding HTN diagnoses</td>
<td>Providers will rate the ABPM readings as very influential or extremely influential in making decisions regarding HTN diagnoses</td>
</tr>
<tr>
<td>2. Providers will find the ABPM readings were influential in making decisions to not start, start, stop, or change antihypertension medications</td>
<td>Providers will rate the ABPM readings as very influential or extremely influential in making decisions regarding to not start, start, stop, or change antihypertension medications</td>
</tr>
<tr>
<td>3. Providers will be satisfied with the implementation of ABPM</td>
<td>Providers will provide positive feedback about the use of ABPM in diagnosing and managing patients with HTN</td>
</tr>
</tbody>
</table>

Goal two. Providers will use data from HBPM to guide HTN diagnosis and treatment decisions.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Expected outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Providers will find the HBPM readings were influential in making decisions regarding HTN diagnoses</td>
<td>Providers will rate the HBPM readings as very influential or extremely influential in making decisions regarding HTN diagnoses</td>
</tr>
<tr>
<td>2. Providers will find the HBPM readings were influential in making decisions to not start, start, stop, or change antihypertension medications</td>
<td>Providers will rate the HBPM readings as very influential or extremely influential in making decisions regarding to not start, start, stop, or change antihypertension medications</td>
</tr>
</tbody>
</table>

Goal three. Providers will use data from CPGs to guide HTN diagnosis and treatment decisions.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Expected outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Providers will use JNC-8 guidelines as part of their decision-making process in making HTN diagnoses</td>
<td>Providers will rate the JNC-8 guidelines as very influential or extremely influential in making decisions regarding HTN diagnoses</td>
</tr>
<tr>
<td>2. Providers will use JNC-8 guidelines as part of their decision-making process in not starting, starting, changing, or stopping antihypertensive medication</td>
<td>Providers will rate the JNC-8 guidelines as very influential or extremely influential in making decisions regarding to not start, start, stop, or change antihypertension medications</td>
</tr>
<tr>
<td>3. Providers will use the AHA/ACC guidelines in forming lifestyle modification recommendations for their patients</td>
<td>Providers will rate the AHA/ACC guidelines as very influential or extremely influential in making decisions regarding to not start, start, stop, or change antihypertension medications</td>
</tr>
</tbody>
</table>

Goal four. The QI project will have a positive impact on providers.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Expected Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Providers will be satisfied with the quality improvement project</td>
<td>1. Providers will report on surveys that the QI project has been moderate to extremely influential in managing HTN in their patients</td>
</tr>
<tr>
<td></td>
<td>2. Providers will provide positive feedback about the elements of the project</td>
</tr>
<tr>
<td></td>
<td>3. Providers will express a desire to continue using elements of the QI project in the future</td>
</tr>
</tbody>
</table>
Providers were asked to complete an “early” questionnaire (see a copy in Appendix K) and a “late” questionnaire (see a copy in appendix L) after each QI project participants’ second and third visit, respectively. Providers were asked to rate how influential the various elements of the QI project were in the diagnosis and treatment of their patients. Items were rated on a 5-point Likert scale, 1-not at all influential, 2-slightly influential, 3-moderately influential, 4-very influential, 5-extremely influential. Thirty-seven out of 44 questionnaires after visit two were completed which is a response rate of 84.1%; 25 of 26 questionnaires were completed after the third visit which is a response rate of 96.2%. The results of the early questionnaire are detailed in Table 2, and the results of the late questionnaire are detailed in Table 3.

Table 2.
Early Provider Feedback (N = 37)

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>How influential were the patient’s ABPM readings in making a diagnosis regarding their BP?</td>
<td>4.70</td>
<td>0.88</td>
<td>5</td>
<td>1-5</td>
</tr>
<tr>
<td>How influential were the patient’s ABPM readings in the decision to not start, start, or change an antihypertensive medication?</td>
<td>4.70</td>
<td>0.88</td>
<td>5</td>
<td>1-5</td>
</tr>
<tr>
<td>How influential were the JNC-8 guidelines in making a diagnosis regarding their BP?</td>
<td>4.86</td>
<td>0.35</td>
<td>5</td>
<td>4-5</td>
</tr>
<tr>
<td>How influential were the JNC-8 guidelines in the decision to not start, start, or change an antihypertensive medication?</td>
<td>4.89</td>
<td>0.31</td>
<td>5</td>
<td>4-5</td>
</tr>
<tr>
<td>How influential were the AHA/ACC guidelines in forming lifestyle recommendations for the patient?</td>
<td>4.76</td>
<td>0.64</td>
<td>5</td>
<td>2-5</td>
</tr>
</tbody>
</table>

Table 3.
Late Provider Feedback (N=25)

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>How influential were the patient’s HBPM readings in making a diagnosis regarding their BP?</td>
<td>4.67</td>
<td>0.87</td>
<td>5</td>
<td>2-5</td>
</tr>
<tr>
<td>How influential were the patient’s HBPM readings in the decision to not start, start, or change an antihypertensive medication?</td>
<td>4.67</td>
<td>0.87</td>
<td>5</td>
<td>2-5</td>
</tr>
<tr>
<td>How influential were the JNC-8 guidelines in making a diagnosis regarding their BP?</td>
<td>4.67</td>
<td>0.76</td>
<td>5</td>
<td>2-5</td>
</tr>
<tr>
<td>How influential were the JNC-8 guidelines in the decision to not start, start, or change an antihypertensive medication?</td>
<td>4.75</td>
<td>0.68</td>
<td>5</td>
<td>2-5</td>
</tr>
<tr>
<td>How influential were the AHA/ACC guidelines in forming lifestyle recommendations for the patient?</td>
<td>4.75</td>
<td>0.61</td>
<td>5</td>
<td>3-5</td>
</tr>
<tr>
<td>Overall, how influential has this QI project been in how you manage hypertension in your patients?</td>
<td>4.83</td>
<td>0.08</td>
<td>5</td>
<td>4-5</td>
</tr>
</tbody>
</table>
Providers found both types of blood pressure monitors to be influential in their decision making. Based on early provider feedback after visit two, the providers found the ABPM readings *very influential to extremely influential* in making a diagnosis regarding patient’s BP based on a mean Likert score of 4.70 (SD = 0.88). They also found the ABPM readings *very influential to extremely influential* in making medication changes, based on a mean Likert score of 4.70 (SD = 0.88).

Based on late provider feedback after visit three, the providers found the HBPM readings *very influential to extremely influential* in making a diagnosis regarding patient’s BP based on a mean Likert score of 4.67 (SD = 0.87). They also found the HBPM readings *very influential to extremely influential* in making medication changes, based on a mean Likert score of 4.67 (SD = 0.87). The two CPGs were also rated as influential in HTN management decision-making process. The providers rated the JNC-8 guidelines as *very influential to extremely influential* in making a BP diagnosis (M = 4.86, SD = 0.35) and in making treatment decisions (M = 4.89, SD 0.31) at the early visit.

The responses to the late questionnaire were similar to the early questionnaire. Providers rated the JNC-8 guidelines *very influential to extremely influential* in making a diagnosis regarding BP (M = 4.67, SD 0.76) and in making medication changes (M = 4.75, SD = 0.68). Providers rated the AHA/ACC guidelines as *very influential to extremely influential* in forming lifestyle modification recommendations for their patients on both the early questionnaire (M = 4.76, SD = 0.64) and late questionnaire (M = 4.75, SD 0.61). Overall, the providers found the quality improvement project to be *very influential to extremely influential* in managing HTN in their patients (M = 4.83, SD = 0.08).
Space was left at the bottom of each survey and marked “recommendations/ feedback” to solicit qualitative provider feedback. The practitioners gave the following feedback about the ABPM, “great for detecting white coat hypertension” and “I found the patient's BP readings very helpful when determining the best time to dose medications. This helped to avoid hypotension episodes”. One provider liked using ABPM because she was “able to see the data and speak with the patient with the actual results in front of us, makes the problem real”. Another provider wrote, “Patients realized that their blood pressure was an important topic, they felt that we cared. Most of the time we just ask them to ‘keep track of your blood pressure’ and ‘call us’, but this time they actually got to wear a monitor for 24 hours, ‘it was amazing’ they said.” In another comment, the provider wrote, “Being able to analyze the data and make changes: start or discontinue a medication based on the results were satisfying and I consider good patient care.”

Providers gave the following feedback about the AHA/ACC guidelines, including the education packet on the DASH diet, “Education patients received after diagnosis of hypertension was extremely beneficial. Patients made numerous lifestyle changes to effectively manage blood pressure. Numerous patients reported better understanding and compliance with DASH diet”. One practitioner wrote, “the DNP student spent almost 1 hour with each patient, this education/time is invaluable. Usually in a busy primary care practice we don't have 1 hour to spend with each patient, it was nice to have this resource.”

**Goal five.** The QI project will decrease clinical inertia.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Expected outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Project patients who have suspected HTN, prehypertension, or an established diagnosis of HTN will have their HTN status addressed</td>
<td>Patients will receive a diagnosis regarding their HTN status after ABPM</td>
</tr>
</tbody>
</table>
| 2. Medication changes will be made if patients are not meeting recommended goals of HTN therapy | 1. Medication changes will be made in response to ABPM results which show uncontrolled HTN  
2. Medication changes will be made in response to HBPM results which show uncontrolled HTN |
This project was successful at combating clinical inertia. All the patients who returned for follow-up had their HTN status addressed. Table 4 outlines the diagnoses made at visit two.

**Table 4**

Diagnosis at Visit Two (n=47)

<table>
<thead>
<tr>
<th>Item</th>
<th>n or %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension controlled on antihypertensive</td>
<td>11</td>
</tr>
<tr>
<td>Hypertension uncontrolled on antihypertensive</td>
<td>9</td>
</tr>
<tr>
<td>New diagnosis of uncontrolled HTN</td>
<td>12</td>
</tr>
<tr>
<td>White coat hypertension</td>
<td>7</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>6</td>
</tr>
<tr>
<td>Episodic hypotension on antihypertensive</td>
<td>1</td>
</tr>
<tr>
<td>Episodic bradycardia on antihypertensive</td>
<td>1</td>
</tr>
<tr>
<td>Percent of patients with a change in hypertensive status at visit 2</td>
<td>76.6</td>
</tr>
<tr>
<td>Percent of patients with a change in antihypertensive medication at visit 2</td>
<td>51.1</td>
</tr>
<tr>
<td>Percent of patients with newly diagnosed HTN or uncontrolled HTN with a change in antihypertensive medication at visit 2</td>
<td>100</td>
</tr>
<tr>
<td>Medication changes made</td>
<td></td>
</tr>
<tr>
<td>No change made</td>
<td>23</td>
</tr>
<tr>
<td>New antihypertensive class added or started</td>
<td>18</td>
</tr>
<tr>
<td>Dose of current antihypertensive changed</td>
<td>4</td>
</tr>
<tr>
<td>Antihypertensive discontinued</td>
<td>1</td>
</tr>
<tr>
<td>Drug class changed</td>
<td>1</td>
</tr>
</tbody>
</table>

At the second visit, patients had their HTN status reevaluated based on their ABPM results. The ABPM manufacturer’s suggested cutoff of either SBP $\geq 135$ mm Hg or DBP $\geq 85$ was used as the cutoff for new diagnosis of HTN. The JNC-8 guideline goals for HTN control were used for patients already on an antihypertensive. For patients with unsuccessful ABPM results, HTN status was evaluated based on the available ABPM readings, the patients’ recent in-office BP measurements, and the clinical judgment of each provider. Forty-seven of the 48 patients (97.9%) who underwent ABPM had their HTN status addressed at their second visit. One patient with unsuccessful ABPM failed to follow-up.

A total of 21 patients were found to have uncontrolled HTN; 12 patients were newly diagnosed with HTN and nine patients were found to have uncontrolled HTN on their current antihypertensive regimen. All of the patients with uncontrolled HTN had antihypertensive medication added or intensified. Two patients were found to be having side effects from their
antihypertensive therapy. In one case, a patient with controlled BP who showed episodes of hypotension on his ABPM report was able to come off his antihypertensive. In another case, a patient with intermittent bradycardia had her dose of beta blocker switched to another drug class.

Based on the ABPM results seven patients were diagnosed as having white coat hypertension (WCH). Some patients had elevated BP averages in the prehypertensive range and were diagnosed as prehypertensive rather than WCH. Eleven patients who underwent ABPM to assess their HTN control on antihypertensives were found to have controlled BP and no changes were made to their medication regimen.

At visit three, patients’ HBPM and/or the patient’s in-office BP readings were used to evaluate their BP control. Of the twenty-five patients who were seen for a third visit, 20 had controlled BP and five had uncontrolled BP. Table 5 outlines the medication changes made.

**Table 5.**

<table>
<thead>
<tr>
<th>Item</th>
<th>n or %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent of patients with hypertension controlled on antihypertensive</td>
<td>80</td>
</tr>
<tr>
<td>Percent of patients with hypertension uncontrolled on antihypertensive</td>
<td>20</td>
</tr>
<tr>
<td>Patients with a change in antihypertensive medication at visit 2</td>
<td>5</td>
</tr>
<tr>
<td>Medication changes made</td>
<td></td>
</tr>
<tr>
<td>New antihypertensive class added</td>
<td>1</td>
</tr>
<tr>
<td>Dose of current antihypertensive increased</td>
<td>1</td>
</tr>
<tr>
<td>Antihypertensive discontinued</td>
<td>1</td>
</tr>
<tr>
<td>Drug class changed</td>
<td>2</td>
</tr>
</tbody>
</table>

One-hundred percent of the patients with uncontrolled BP at visit 3 had their antihypertensives addressed. Two patients who were started on an angiotensin converting enzyme inhibitors were switched to angiotensin II receptor blockers at their third visit after they developed a cough.

Timely follow-up is also important in decreasing clinical inertia. The mean time between appointment one for ABPM set-up and appointment two was 7.64 days (SD = 9.33). This is close to the planned timeframe of within a week. The mean time from visit two to visit three was
31.92 day (SD = 11.18). Patients who had a change in their medication at visit two had a slightly faster time to follow-up with a mean of 29.30 days (SD = 8.41). The mean time between visit one and visit three was 38.14 days (SD = 10.91). Moreover, in each second and third patient visits, the patient’s HTN status and medications were addressed. At visit two more than half of all patients (51.5%) had a medication change made based on their ABPM results.

**System results.**

**Goal five.** Patients will undergo ABPM to ascertain hypertension status.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Expected outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Patients who meet the inclusion/exclusion criteria will undergo 24-hours of ABPM</td>
<td>1. Patients will wear the monitor for 24 hours.</td>
</tr>
<tr>
<td></td>
<td>2. The device will successfully capture $\geq 70%$ of attempted readings</td>
</tr>
</tbody>
</table>

**Goal six.** Patients with HTN will monitor their BP at home.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Expected outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Patients will use a validated HBPM to monitor their HTN at home.</td>
<td>1. Patients will bring their monitor to their second or third appointment to have it checked by the provider for accuracy</td>
</tr>
<tr>
<td></td>
<td>2. Patients will use a validated HBPM to measure their BP at home</td>
</tr>
<tr>
<td></td>
<td>3. Patients will complete a BP log as directed by their provider</td>
</tr>
<tr>
<td></td>
<td>4. Patients will bring their BP log to their third appointment</td>
</tr>
<tr>
<td></td>
<td>5. Patient compliance with this will be documented in their medical record</td>
</tr>
</tbody>
</table>

All 48 patients who met the inclusion/exclusion criteria presented to their first visit for set-up of ABPM to assess their hypertensive status. A total of 37 patients went on to have successful 24-hour ABPM, which was defined as wearing the monitor for a minimum of 20 hours and $\geq 70\%$ success rate in the total number of attempted BP measurements. A total of 10 patients had unsuccessful ABPM. Overall, 77% of patients successfully underwent ABPM. The characteristics of the unsuccessful and successful ABPM reports are displayed in Tables 6 and 7, respectively.
Table 6.
Characteristics of Unsuccessful AMBP

<table>
<thead>
<tr>
<th>Item</th>
<th>M±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall SBP mm Hg (n=9)</td>
<td>130.7±13.2</td>
</tr>
<tr>
<td>Overall DBP (mm Hg) (n=9)</td>
<td>78.8±10.0</td>
</tr>
<tr>
<td>Awake SBP (mm Hg) (n=9)</td>
<td>134.2±12.2</td>
</tr>
<tr>
<td>Awake DBP (mm Hg) (n=9)</td>
<td>81.7±8.7</td>
</tr>
<tr>
<td>Asleep SBP (mm Hg) (n=8)</td>
<td>121.9±18.0</td>
</tr>
<tr>
<td>Asleep SBP (mm Hg) (n=8)</td>
<td>71.8±14.9</td>
</tr>
<tr>
<td>Dipper status (n=9)</td>
<td></td>
</tr>
<tr>
<td>Percentile classified as non-dipper</td>
<td>33.3</td>
</tr>
<tr>
<td>Percentile classified as dipper</td>
<td>33.3</td>
</tr>
<tr>
<td>Unable to determine</td>
<td>33.3</td>
</tr>
<tr>
<td>Time worn (hours: minutes) (n=9)</td>
<td>19:23±5:02</td>
</tr>
<tr>
<td>Total number of readings (n=9)</td>
<td>43.2±14.5</td>
</tr>
<tr>
<td>Percentile of successful readings</td>
<td>60.3±19.5</td>
</tr>
</tbody>
</table>

Table 7.
Characteristics of Successful AMBP (n=37)

<table>
<thead>
<tr>
<th>Item</th>
<th>M±SD or %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall SBP (mm Hg)</td>
<td>132.2±11.7</td>
</tr>
<tr>
<td>Overall DBP (mm Hg)</td>
<td>82.3±9.3</td>
</tr>
<tr>
<td>Awake SBP (mm Hg)</td>
<td>136.2±12.4</td>
</tr>
<tr>
<td>Awake DBP (mm Hg)</td>
<td>85.0±10.0</td>
</tr>
<tr>
<td>Asleep SBP (mm Hg)</td>
<td>119.3±12.1</td>
</tr>
<tr>
<td>Asleep SBP (mm Hg)</td>
<td>70.4±13.1</td>
</tr>
<tr>
<td>Dipper status</td>
<td></td>
</tr>
<tr>
<td>Percentile classified as non-dipper</td>
<td>61.1</td>
</tr>
<tr>
<td>Percentile classified as dipper</td>
<td>38.9</td>
</tr>
<tr>
<td>Time worn (hours: minutes)</td>
<td>23:46±: 03:00</td>
</tr>
<tr>
<td>Total number of readings</td>
<td>73.0±9.4</td>
</tr>
<tr>
<td>Percentile of successful readings</td>
<td>90.0±7.5</td>
</tr>
</tbody>
</table>

Two patients were unable to tolerate the monitoring. One patient was unable to tolerate the monitor before leaving the office, stating that her arm hurt and felt numb between readings. The symptoms stopped once the monitor was discontinued. No data was recorded from her monitor. Another patient with pre-existing shoulder pain discontinued the monitoring after 15 hours because it was increasing her pain. She reported that her shoulder returned to baseline after discontinuation. Two patients discontinued their monitoring earlier than the 20-hour mark because they were getting multiple error messages.
An additional six patients did not reach the 70% successful readings cut-off because of various measurement errors. None of these nine patients with measurement issues called the on-call number to troubleshoot the monitor as instructed. Eight of the patients knew they were having errors but didn’t call the on-call person because they did not think it was necessary or they did not want to bother the on-call person. One patient was unaware the device was having errors, which occurred while he was asleep. Four patients with successful ABPM reports also reported multiple measurement errors. In each case they called the DNP student and the issues were able to be addressed over the phone. Overall, 24 patients reported tolerating the monitoring without any issues. Three patients reported difficulty sleeping with the monitor, three reported that the monitoring caused them mild anxiety, and three patients reported that it interfered with their daily activities. One patient reported a mild rash under the BP cuff that resolved once the BP cuff was removed.

Of the 47 patients who were seen for a second visit, 34 patients had either a pre-existing diagnosis of HTN or new diagnosis of HTN. All of these patients were asked to monitor their BP at home with a validated HBPM. These patients were also asked to bring their monitor in to have it validated as accurate by their provider. Of the 26 patients who were seen for a third visit, 21 patients (80.8%) had brought in a HBPM, had its accuracy validated, and the check of the monitor was documented in their EMR. Twelve patients had not yet brought in a monitor for validation as documented in their EMR. One patient had no documentation about the status of their HBPM. Eighteen of the 26 patients (69.2%) brought in the completed log of their HBPM readings. Of the eight patients who did not, six of them stated they forgot to bring it in (23.1%) and two patients (7.7%) stated they had not yet acquired a HBPM. All completed HBPM logs were scanned into the patient’s EMR.
Patient results.

**Goal seven.** Patients will experience greater self-efficacy in the management of their hypertension.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Expected outcomes</th>
</tr>
</thead>
</table>
| 1. Patients will receive lifestyle modification education aimed at improving BP control as part of their visit(s) with provider | 1. Lifestyle modification education will be provided and documented at each patient encounter  
2. Patients will complete three days of food and activity journaling between visit two and three |
| 2. Patients will report confidence in managing their prehypertension/HTN.    | 1. Patients will report high to complete confidence in their ability to manage the self-efficacy tasks associated with their prehypertension/hypertension after their third visit  
2. Patient will report increased confidence in their ability to manage their BP at visit 3 compared to visit 2 |
| 3. Over the course of the project, patients will adopt one or more lifestyle modifications aimed at improving BP control | Patients will report adopting lifestyle modifications during visit three |

**Goal eight.** Patients will experience improved health outcomes.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Expected outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Patients will experience improved BP control</td>
<td>The number of patients with undiagnosed or uncontrolled HTN will be reduced</td>
</tr>
<tr>
<td>2. Overweight patients will experience weight loss if overweight or obese</td>
<td>Some overweight patients will lose weight at visit three compared to visit one</td>
</tr>
</tbody>
</table>

**Goal nine.** The project will have a positive impact on the practice and its patients.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Expected outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Patients will be satisfied with their HTN management</td>
<td>Patients will state satisfaction with their HTN care during visits</td>
</tr>
</tbody>
</table>

One hundred percent of patients who were determined to be prehypertensive or hypertensive had lifestyle modification (LM) education aimed at reduced BP documented as part of their second and third visits. These patients also all received the DASH diet handout and the American Heart Association BP log as planned. Patients were asked to journal three days of food intake and activity on the log provided in the DASH diet handout. Patient were instructed to choose any three days between visit two and visit three to complete this activity. Half of the patients seen for a third visit completed the DASH diet logs as requested. Thirteen patients either did not complete it or forgot to bring it with them to their appointment. Several patients
commented that tracking their daily food intake helped them identify sources of sodium in their diet. Two patients completed more than the requested three days’ worth of logs.

To assess patients’ self-efficacy in managing their HTN, patients classified as pre-hypertensive or hypertensive were asked at their second and third visit to complete a questionnaire. The questionnaires were identical except the questionnaire given during the second visit was labeled “early” and the questionnaire given during the third visit was marked “late”. The Self-Efficacy to Manage Hypertension scale (see scale and details in Appendix M) has been used in previous studies and is considered to be valid tool for measuring patient’s levels of self-efficacy (Warren-Findlow, Seymour, & Brunner Huber, 2012) The response rate after the second visit was 68.2%. The rate of reply after the third visit was 53.8%. Table 8 displays the results after visit two. The results of the late questionnaire are shown in Table 9.

Table 8.
Early Patient Confidence (n=30)

<table>
<thead>
<tr>
<th>Item</th>
<th>M±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Having high blood pressure often means doing different tasks and activities to manage your condition. How confident are you that you can do all the things necessary to manage your high blood pressure on a regular basis?</td>
<td>3.7±1.2</td>
</tr>
<tr>
<td>How confident are you that you can judge when changes in your high blood pressure mean you should visit a doctor?</td>
<td>4.0±1.0</td>
</tr>
<tr>
<td>How confident are you that you can do the different tasks and activities needed to manage your high blood pressure so as to reduce your need to see a doctor?</td>
<td>3.8±1.0</td>
</tr>
<tr>
<td>How confident are you that you can reduce the emotional distress caused by your high blood pressure so that it does not affect your everyday life?</td>
<td>3.2±1.2</td>
</tr>
<tr>
<td>How confident are you that you can do things other than just taking medication to reduce how much your high blood pressure affects your everyday life?</td>
<td>3.8±0.9</td>
</tr>
</tbody>
</table>
Table 9.
Late Patient Confidence (n=14)

<table>
<thead>
<tr>
<th>Item</th>
<th>M±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Having high blood pressure often means doing different tasks and activities to manage your condition. How confident are you that you can do all the things necessary to manage your high blood pressure on a regular basis?</td>
<td>4.2±0.7</td>
</tr>
<tr>
<td>How confident are you that you can judge when changes in your high blood pressure mean you should visit a doctor?</td>
<td>4.4±0.6</td>
</tr>
<tr>
<td>How confident are you that you can do the different tasks and activities needed to manage your high blood pressure so as to reduce your need to see a doctor?</td>
<td>4.2±0.8</td>
</tr>
<tr>
<td>How confident are you that you can reduce the emotional distress caused by your high blood pressure so that it does not affect your everyday life?</td>
<td>3.7±1.1</td>
</tr>
<tr>
<td>How confident are you that you can do things other than just taking medication to reduce how much your high blood pressure affects your everyday</td>
<td>4.3±0.7</td>
</tr>
</tbody>
</table>

At the end of visit two and again at the end of visit three, patients were asked to rate their confidence in managing the variables that affect their BP management using the Self-Efficacy to Manage Hypertension scale. A five-item Likert scale was used with the following responses 1-no confidence, 2-slight confidence, 3-moderate confidence, 4-high confidence, and 5-complete confidence. For the purpose of this QI project, a score of 4 or greater was considered to constitute good self-efficacy.

Patients were found to have good self-efficacy in one of the five areas. Patients reported high confidence (M = 4.0, SD 1.0) to the question, “How confident are you that you can judge when changes in your high blood pressure mean you should visit a doctor”. After the third visit, patients reported increased confidence on all five items compared to visit two although the differences did not reach the level of statistical significance. On the late questionnaire patients reported having good self-efficacy in four of the five items. Patients’ lowest self-efficacy scores on both late and earlier questionnaires was in response to the question, “How confident are you that you can reduce the emotional distress caused by your high blood pressure so that it does not affect your everyday life”. 
Six self-care behaviors have been identified as being associated with improved blood pressure control, especially when two or more of these behaviors are used together (Chobanian et al., 2003). The six practices are maintaining a healthy weight, adopting a healthy eating plan such as the DASH diet, restricting dietary sodium, engaging in regular physical activity, limiting alcohol consumption, and avoiding tobacco exposure (Chobanian et al., 2003). Lifestyle modification teaching was provided at each of the visits. As part of their care, patients were also asked about these self-care behaviors at each of their visits. At the third visit, 53.8% of patients (n = 14) reported that they had adopted one or more of these self-care behaviors since visit two. Eight patients reported actively trying to lose weight, including one patient who joined a medically-supervised weight loss program. Ten patients reported that they had decreased their sodium intake. Eight patients reported adopting a healthy eating plan. Four patients reported adopting the DASH diet plan specifically. One of the patients reporting seeing a nutritionist to help her assume the DASH diet. Another of the patients reporting that she liked the information given to her about the DASH diet and it prompted her to buy a book about the DASH diet to learn more. Five patients reported that they had increased their level of physical activity. One patient reported decreased alcohol consumption. One patient reported smoking cessation. Another two patients reported reducing the number of cigarettes they smoked. Both patients made plans to quit and started medications to help them quit smoking.

A greater than 50% reduction in the rate of uncontrolled HTN was observed. The results are displayed in Table 10.
Table 10.

Two-sample T-Test and Confidence Interval of Difference in Percentage of Uncontrolled Blood Pressure at Visit 2 and Visit 3

<table>
<thead>
<tr>
<th>Item</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncontrolled blood pressure -visit 2</td>
<td>47</td>
<td>0.447</td>
<td>0.503</td>
<td>0.073</td>
</tr>
<tr>
<td>Uncontrolled blood pressure -visit 3</td>
<td>25</td>
<td>0.200</td>
<td>0.408</td>
<td>0.082</td>
</tr>
<tr>
<td>t(58) = 2.25, p = 0.028, 95% CI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>95% CI for difference [0.027, 0.466]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

During the QI project a statistical significant decrease in the percentage of patients with uncontrolled HTN was observed. A two-sample T-test showed that the proportion of patients with uncontrolled HTN at visit two (44.7%) versus the proportion of patients with uncontrolled HTN at visit three (20%) was statistically significantly different, $t(58) = 2.25$, $p = 0.028$, 95% CI [0.027, 0.466].

The patients who participated in the QI project did not lose a statistically significant amount of weight. The patients’ weights at each visit are compared in Table 11.

Table 11.

Comparison of Weights in Pounds at Visit 1 and Visit 3

<table>
<thead>
<tr>
<th>Value</th>
<th>Visit One</th>
<th>Visit Three</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>48</td>
<td>26</td>
<td>n/a</td>
</tr>
<tr>
<td>M</td>
<td>199.16</td>
<td>202.6</td>
<td>2.12</td>
</tr>
<tr>
<td>SD</td>
<td>52.49</td>
<td>58.8</td>
<td>6.86</td>
</tr>
<tr>
<td>Min</td>
<td>118</td>
<td>126.2</td>
<td>-14.80</td>
</tr>
<tr>
<td>Max</td>
<td>396.2</td>
<td>396.2</td>
<td>16.80</td>
</tr>
</tbody>
</table>

A two sample T-test of the patients’ weights at visit one (n = 48, M = 199.16 pounds, SD = 52.49) and visit three (n = 26, M = 202.6 pounds, SD = 58.8) showed that the patients’ weights did not significantly between the visits; $t (44) = -0.25$, $p = 0.807$, 95% CI [-31.6, 24.7].

Many of the participants in the QI project stated satisfaction with their HTN care. One patient who recently joined the practice stated, “my other doctor always told me not to worry about my BP readings. I am glad I switched because you are telling me I do have HTN and I do need treatment”. Another patient also expressed appreciation for the provider’s attention to
elevated BP readings, “I didn’t think anything of my BP readings, I am happy that you decided to have me wear the monitor so I could be diagnosed correctly”. Patients also expressed satisfaction with the lifestyle modification teaching. One patient stated, “no one has ever taken the time to explain how I can improve my BP without medication. Thank you”. Another patient stated, “no one has ever shown me how to read the label to find out how much salt is in my food. I will be checking this from now on”. Another patient stated, “I loved the packet you gave me about healthy eating. I have been trying to follow it every day”. Patient also stated satisfaction with the use of ABPM and HBPM readings in making treatment decisions. One patient stated, “I feel better having my medication increased now that I know what my readings at home are”. Another stated, “I like that my medication is based more than one reading”. Several patients who were diagnosed with WCH stated satisfaction that they could prove they did not have HTN, one stated, “I know my BP is only elevated when I go to the doctor”. One patient who was diagnosed with WCH stated he was very pleased he had the opportunity to wear the ABPM because it allowed him to get his Department of Transportation card renewed for two years instead of one year.

**Facilitators and Barriers**

The providers and the practice site offered few barriers to implementation of this QI project. The practice owner is also one of the practitioners in the practice and was vested in the outcome of this project. She was also intimately involved in the development and implementation of this project. Additionally, as an independently owned and operated practice, with no physician oversight or complex organizational structure, there were few obstacles to implementing the project. In New Hampshire, nurse practitioners have full, independent practice and prescriptive authority (New Hampshire Board of Nursing, n.d.). Additionally, the DNP
student used provider and staff feedback to make ongoing adjustments to plan as necessary. There were no barriers or resistance from the providers. Each seemed to welcome the project, and they were all open to the changes implemented.

The biggest barrier, from a system’s perspective, was purchasing and learning to use the ABPM machines. It was hoped that the companion CarioPerfect© software would allow for integration of the reports seamlessly into the practice’s electronic medical record (EMR). Despite technical support from both Welch Allyn and the EMR company, the systems could not be integrated. This barrier was overcome by generating the ABPM reports, printing them and scanning them into each patient’s EMR.

Another barrier was the recruitment of patients who fit the desired sample. Initially recruitment was slow as the project started right before the holiday season and patients were reluctant to schedule additional appointments. This obstacle was overcome by time and by the providers’ active involvement in identifying patients who would benefit from ABPM. Once the providers received the results of the first few patients’ ABPM, they perceived the benefit and were eager to have more of their patients undergo the monitoring. The practice also had many ways of reaching out to patients- in person, phone calls, and through electronic patient portals.

It was anticipated that arm size could also be a barrier to implementing ABPM. There was a concern with having two monitors and only two cuffs for each would limit the ability to match patients to the appropriately sized cuff. Ahern and colleagues (2012) solved this issue by restricting participants in their study to those with an arm circumference of 9 to 17 inches. It was determined that excluding participants because of arm circumference could be problematic, since if obese patients might be excluded, and they may be most likely to benefit from targeted interventions. This was overcome by buying additional BP cuffs so that two cuffs of every size
from small adult to large adult were always available. This added additional expense and delayed the launch of the project by a few days.

There were also barriers to the implementation of HBPM. Many patients did not have a HBPM or had one that was not reliable. Some patients were resistant to having to monitor their BP at home. This was overcome by explaining the benefits of having multiple BP readings on which to make decisions about their medications. Many patients were eager to know what types of HBPM they should purchase. It was for this reason a handout was created with information about buying HBPM. Another potential issue with HBPM that was not foreseen was the reliability of patient-reported BP measurements. One study found that more than 30% of patients underreported blood pressure readings (Mengden, 1998). There is no way to know if the readings the patients reported at their third visit were an accurate representation of their home BP. This can be overcome with newer automated HBPMs, which will store readings. Clinicians could have had the patients bring their monitor to each visit and directly retrieved the readings from the device to avoid BP misreporting.

Patient barriers included failure to report or recognize ABPM measurement errors. It was anticipated that not all patients would tolerate the ABPM. To maximize the number of patients who would, detailed instructions were given both verbally and in written form. Additionally, someone was available 24 hours a day by phone. Patients were encouraged during monitor set-up to call with any issues. Despite this, several patients were unable to undergo successful ABPM because of measurement errors that were avoidable or correctable such as errors caused by frequent movement, kinked tubing, or loose connections.
Discussion/Interpretations

The benefits and obstacles of implementing ABPM observed during the DNP project were similar to those expressed in the literature. Overall, the providers and the patients expressed satisfaction with the process. Patients reported some irritation with wearing the monitors but most felt that the temporary inconvenience was outweighed by the results provided. Patients and providers both reported satisfaction and confidence in knowing exactly what the patients’ HTN status was based on the many readings and results furnished by the monitor. The providers reported increased comfort in making medication changes based on the results. Patients also seemed more confident in the diagnosis they were receiving. Many of them expressed the sentiment that they couldn’t argue the results.

The DNP project was also successful in overcoming clinical inertia. The providers expressed increased confidence in their diagnosis and treatment decision-making abilities with the added information gleaned from the ABPM reports, patients’ HBPM logs, and clinical practice guidelines. Improving the believability of the BP readings upon which providers base their diagnosis and treatment decisions may be a key component combating clinical inertia. This QI project was successful in overcoming many provider, system, and patient barriers. The main component of the project that was completely new to the practice was the implementation of ABPM.

The practice had already been using HBPM as a means for assessing patients’ HTN status. Through this QI initiative, HBPM and logging were able to be used in a more structured way that seemed to improve the usefulness of the readings in making diagnosis and treatment decisions. First, having all the patients bring their monitors in for validation of their accuracy likely increased the providers’ belief in the home readings provided. Second, the AHA blood
pressure handout provided directions and a structured format for measuring and recording BP. Also, patients were informed that their HBPM reading would be used to inform future treatment decisions. It is believed that increasing the use of HBPM increases the patients’ involvement in the management of their disease and can improve patients’ sense of empowerment (Filippi et al., 2013).

While AMPB may be superior to HBPM, HBPM is still of particular importance in treating HTN over the long-term as it is an inexpensive, readily available, and convenient method of measuring BP for most patients. HBPM also eliminates the white coat effect and it has the potential to trend BP across longer periods of time than office monitoring or ABPM (Jones et al., 2013). Using HBPM as an adjunct to ABPM, and through the standardization of the HBPM process achieved during this QI initiative, the reliability of HBPM readings were increased. This increased the usefulness of the HBPM readings to the providers in making diagnosis and treatment decision regarding patients’ HTN. This project shows that patients benefit from specific instructions regarding HBPM- what monitors to use, how to correctly take a measurement, how often to take measurements, and how to create a log. Telling patients to “measure your BP” is likely not enough direction.

The DNP project results also highlighted the need to address patients who fall into the category of being prehypertensive. It is estimated that nearly one in three American adults fall into this category (Mozaffarian et al., 2016). Several patients included in the project had ABPM readings that were too low to be considered HTN but too high to call WCH in the providers’ clinical judgment. The course of action proved to be provider dependent, which is hard to standardize. Some providers noted the patient’s pre-hypertensive status but arranged no further
follow-up. While other providers had the patient begin monitoring their BP at home and provided the patients with lifestyle modification education.

Prehypertension is linked to an increased risk of cardiovascular events and the development of HTN (Kaplan, 2016). As such, an important part of improving the quality of HTN care should include identifying and initiating nonpharmacological treatment for patients who fall into this category. It may also be beneficial to stratify prehypertensive the patients who are at greater HTN risk. Instituting clinical tools such as the Framingham Hypertension Risk Prediction Score may be useful in identifying the patients who are most likely to develop HTN (Parikh et al., 2008). Additionally, this project showed that future QI endeavors aimed at HTN should include standardizing the care of patients who fall into this category.

Self-management is an important factor in controlling BP as HTN is a treatable, manageable disease (Crowley, Gruber, Olsen, & Bosworth, 2013). Many patients who participated in this project made positive lifestyle modifications aimed at improving their HTN. The timeframe of this QI project was too short to know if any of the lifestyle modification education and patient supports provided will have a long-term positive impact. The patients who participated in this program varied considerably in their participation in the six self-care activities described in the JNC-7 guidelines (Chobanian et al., 2003).

Patients reported many personal barriers to implementing lifestyle modifications including the cost of fresh fruits and vegetables, the difficulty of exercising in the winter, the resistance of their spouse to changing eating patterns, and lack of desire to change behaviors. For example, some patients liked the DASH diet handout and made lifestyle modification based on its contents. Other patients did not find it helpful at all. This observation underlines the need for providers to individualize patient education and treatment strategies aimed at lifestyle
modification. Future research exploring methods that can be used to tailor patient education to maximize patients’ self-management of their HTN is recommended.

This QI project had the unexpected result of picking up problems that might have gone unnoticed. The DNP student and providers checked to make sure each patient had a recent electrocardiogram (EKG) and recent labs (6 to 12 months depending on the provider). Forty percent of patients had no EKG on record within last year. Nineteen EKGs were performed at visit two. Three EKGs were abnormal. Stress tests were ordered and completed. Two were positive; both were referred to cardiology for further workup. Twenty-three percent of patients did not have recent labs; full panels were ordered for these patients. This project was designed to provide comprehensive HTN management. Multifaceted QI projects aimed at HTN have the potential to improve overall cardiovascular care.

The results of this QI project may not generalizable to other populations. First, patients were individually selected by the providers based on a questionable HTN status, which may have led to the high percentage of patients who had a new diagnosis or medication change. Second, the population was specific to this practice consisting of only Caucasian patients with insurance. Third, the project timeframe was limited to only four months. Some results such as weight loss and adherence to lifestyle modifications are best observed over longer periods of time. However, this project does reinforce the benefits of careful blood pressure monitoring of at risk patients in the primary care system.

**Conclusion**

Using the Chronic Care Model as a framework, the DNP student was able to complete a complex, multifaceted QI project that spanned four months and was able to overcome some of the provider, system, and patient barriers to improving HTN detection and management in one
The DNP student was successful in overcoming *provider clinical inertia* by improving the amount and quality of the evidence practice providers used in making diagnosis and treatment decisions. The addition of ambulatory blood pressure monitoring in the primary care setting proved to be beneficial in helping providers make determinations about patients’ HTN status. Increased patients’ education and involvement in the management of their HTN proved useful for some patients. As a result, more than half of the patients who participated in the project obtained control of their hypertension.

This DNP project helped to identify some of these barriers that can be addressed in future HTN QI endeavors and future research. Based on the results of this project, it is evident a comprehensive, multifaceted approach addressing all domains of the healthcare system must be used to improve the quality of HTN care in the United States. Future hypertension quality improvement efforts must address all the aforementioned facets within each of the provider, system, and patient domains that contribute to the continuing health crisis of uncontrolled high blood pressure in the United States.

The large primary practice where this project was implemented plans to continue the project as implemented. This project write-up using the Doctor of Nursing Practice Scholarly Project framework will be shared via student presentation at UMass and published via ScholarWorks© at the UMASS Amherst library. Additionally, the abstract of this project will be submitted for inclusion at several national conferences including the 2017 DNP conference and the 2017 International Council of Nurses Congress.
References


James, P. A., Oparil, S., Carter, B. L., Cushman, W. C., Dennison-Himmelfarb, C., Handler, J., ... Ortiz, E. (2014). 2014 evidence-based guideline for the management of high blood pressure


Modifications to the HIPAA Privacy, Security, Enforcement, and Breach Notification Rules Under the Health Information Technology for Economic and Clinical Health Act and the Genetic

doi:10.1161/CIR.0000000000000366 [doi]


Appendix A

Schema of the Chronic Care Model

Figure 1. The Chronic Care Model (Improving Chronic Illness Care, 2016).
Patient name:

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Meets (check mark indicates that patient meets criteria)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aged 19 to 74 years</td>
<td></td>
</tr>
<tr>
<td>Suspected hypertension, prehypertension, or established diagnosis of hypertension</td>
<td></td>
</tr>
<tr>
<td>Existing practice patient</td>
<td></td>
</tr>
<tr>
<td>English speaking</td>
<td></td>
</tr>
<tr>
<td>Literate</td>
<td></td>
</tr>
<tr>
<td>Private or public health insurance</td>
<td></td>
</tr>
<tr>
<td>Physically able to measure their blood pressure at home</td>
<td></td>
</tr>
<tr>
<td>Upper arm circumference able to be matched with an appropriate-sized ABP monitor cuff</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exclusion criteria</th>
<th>Does Not Meet (Check mark indicates the absence of exclusion criteria)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pregnancy</td>
<td></td>
</tr>
<tr>
<td>Hypertension managed by a specialist</td>
<td></td>
</tr>
<tr>
<td>Cognitively impaired</td>
<td></td>
</tr>
<tr>
<td>Heart arrhythmia</td>
<td></td>
</tr>
<tr>
<td>Implanted defibrillator/pacemaker</td>
<td></td>
</tr>
<tr>
<td>Medical contraindication(s) to repeated blood pressure measurement in the patient's non-dominant upper arm such as a history of mastectomy, poor circulation, the presence of a wound, or arteriovenous shunt</td>
<td></td>
</tr>
</tbody>
</table>

Provider signature

DNP student signature

*DNP student created document
Appendix C

Manufacturer's Patient Instructions

---

**Safety instructions**

**Warning**
- Risk of strangulation posed by the shoulder strap and cuff tubing.
  - If the patient has limited cognitive abilities, the device may only be used under supervision.
  - Do not place the shoulder strap and cuff tubing around the patient's neck.
  - Always place the cuff tubing under the outer clothing (even at night).
  - Switch off and remove the device immediately and inform the doctor in the event of experiencing any pain.
  - Measurement can be interrupted at any stage by pushing a random button. This deflates the cuff, and the device can be removed.

---

**Caution**

Risk of injury caused by incorrect application of the cuff.
- If the patient has limited cognitive abilities, the device may only be used under supervision.
- Ensure that neither the shoulder strap nor the cuff tubing can ever wrap around the patient's neck.
- Always place the cuff tubing and the outer clothing (even at night).
- Pressure, haemorrhages or subcutaneous haematomas may occur in some patients.
- Switch off and remove the device immediately and inform the doctor in the event of experiencing any pain.

---

**Attention**

Damage to device:
- Do not open the casing. Once the device is opened, all warranties will lapse.

---

**Attention**

Damage to device:
- Do not wear the ABPM 7100 while showering. If you suspect that the device has entered the washer, or if it has been used, it should not be used on the patient.
- If the device was exposed to moisture, switch off the device and remove the batteries.
- The device may not be operated around MRI scanners or in the immediate vicinity of other medical electrical equipment.
- During a defibrillator discharge, the device shall not be in contact with the patient. Such a discharge may damage the ABPM 7100 and cause it to display incorrect values.
- Measurement can be interrupted at any stage by pushing a random button. This deflates the cuff and the device can be removed.

---

**Attention**

Measurement errors:
- Although the ABPM 7100 fulfills all BMA standard requirements, it should not be exposed to any strong electromagnetic fields, as this may lead to malfunctions outside the limit values.
- The cuff tubing between the ABPM 7100 and the cuff may not be twisted, compressed or pulled apart.
- The cuff connection must always engage with an audible "CLICK". A loose connection between the tubing and the device leads to measurement errors.

---

**Note**

Severe malfunctions are indicated by a continuous beep.
- In the event of a continuous beep, switch off the device, remove the cuff and inform your doctor.

---

**24-hour measurement**

1. Before a 24-hour measurement, go through these instructions together with your doctor.
2. Let your doctor explain possible hazards in detail on the basis of the warnings above.
3. Ensure that you have understood all functions and observable points.

---

**Safety**

For your own safety during the following steps, please observe the safety instructions at the start of this chapter.
33 - Patient Information - operation of the ABPM 7100

Position of the cuff
It is imperative that the artery symbol is positioned on the brachial artery. If the cuff is aligned correctly, the metal bar will lie on the outside of the upper arm (on the elbow side), whereby the fabric bag must cover the skin under the metal bar.

The Buttons

ON/OFF
The ON/OFF button turns on and off the ABPM 7100 when the button is pressed for more than 3 seconds.

START
The START button serves to
• initiate the automatic protocol.
• trigger a measurement in addition to the automatic protocol.

DAY/NIGHT
The DAY/NIGHT button is used to differentiate between waking and sleeping phases during the measurement. Press the DAY/NIGHT button immediately before going to bed and upon waking.

EVENT
Press the EVENT button to record an event which may affect the blood pressure and to trigger an additional measurement. Note the reason for pressing the EVENT button in the event log.

Measurement process
During the first measurement, the cuff is inflated in increments, to determine the cuff pressure required to measure the systolic blood pressure value. This maximum required inflation pressure is stored and applied by direct inflation during the subsequent automatic measurements. The patient should stay calm during the measurement process, until the measurement is completed. Allow your arm to hang loose, or place your lower arm loosely on the table or on a support whilst sitting. Avoid any movement! In the event of a failed measurement a new measurement is performed automatically according to the measurement process described above.

Cancelling a measurement
A measurement will be cancelled by pressing any buttons during the measurement process causing the cuff to be quickly deflated automatically. The LCD display will then show “Stop” and the ABPM 7100 will beep 5 times. This cancellation will be stored in the measurement value table under Cancel.

These are the patient instructions from the ABPM manual that were reviewed with the patient by the provider (Welch Allyn, 2014a).
Appendix D

Written Patient Instructions

PATIENT INFORMATION

Ambulatory blood pressure monitoring (ABPM) takes numerous readings of your blood pressure over a 24-hour period or longer. It provides accurate and reliable information and can give you and your doctor a truer picture of your blood pressure than occasional visits and readings taken at your doctor’s office.

DEVICE BUTTONS

Press Event to start a measurement if you are feeling an unusual event.
Press Start to start a measurement if instructed to do so by your doctor.
Press Day/Night immediately before going to sleep and upon waking.

If you are feeling or experiencing pain, swelling, redness or numbness in the limb where the cuff is placed, remove the cuff immediately and notify your doctor.

PATIENT DO’S & DON'TS

DO
- Position the device in such a way that the tube cannot be compressed.
- Record time, symptom/mood and activity/position in the patient diary.
- Keep cuff arm motionless during readings.
- Keep vehicle driving and travel to a minimum.
- Bring the patient diary with you upon return to your doctor.

DON'T
- Remove the cuff unless you are experiencing pain, swelling, redness or numbness in the limb where the cuff is placed, or unless you are instructed to do so by your doctor. (It is expected that you may experience some mild to moderate discomfort during a blood pressure measurement.)
- Get the device wet.
- Swim, shower, or bathe during recording.
- Remove batteries from the device.
- Operate equipment or power tools. Vibrations may disrupt the device reading.

This is a copy of the written instructions provided to the patient (Welch Allyn, 2014b).
Appendix E

Additional Ambulatory Blood Pressure Monitoring Instructions*

- Please make sure to write down the name, dose, and time of any antihypertensive medications you are taking in your Patient Diary
- If you enter any activity or symptoms into the Patient Diary, or hit the monitor event button, make sure to write down the time, including AM or PM so we can match the events to your blood pressure at the time
- Someone will be available by phone at all times during your monitoring, do not hesitate to call if you are experiencing any issues or concerns during the monitoring process
- If you are getting frequent error messages or more than two error messages in a row, please call so we can trouble shoot the monitor over the phone and avoid having to repeat the test
- When you return the monitor, please make sure to return your folder and Patient Diary, along with the monitor and its components
- It is extremely important to push the day/night button when you are going to bed (to sleep), and again upon waking
- The monitor must be worn for a full 24 hours
- Please return the monitor at the arranged time and location
- Please bring your home blood pressure monitor (if you have one) to your next appointment

*DNP student created
Appendix F

Borrower’s Agreement*

OWNER:

BORROWER:

Contact number:

Date lent:

Date due for return:


TERM AND CONDITIONS:

1. The borrower shall keep the equipment in a good state of repair, normal wear and tear excepted. The borrower shall read and follow manufacturer’s instructions for use and care of the device prior to borrowing the device. The borrower will use the device in accordance with the manufacturer’s specifications and operation instructions.

2. The borrower shall pay the owner full compensation for replacement and/or repair of any equipment which is not returned because it is lost or stolen or any equipment which is damaged and in need of repair to put it into the same condition it was in at the time of rental, normal wear and tear excepted.

3. The equipment shall be returned to owner at the borrower’s risk, cost, and expense. If the equipment is not returned during or at the end of the term, the borrower will be responsible for the replacement cost of the equipment.

4. The borrower indemnifies and holds the owner harmless for all injuries or damage of any kind related to the use of this device.

5. The borrower shall pay all reasonable attorney and other fees, the expenses and costs incurred by owner in protection its rights under this agreement and for any action taken owner to collect any amounts due the owner under this agreement.

6. The practice takes responsibility to ensure the borrower understands how the equipment works, how to operate it safely, signs of malfunction, and how to prevent damage to the equipment as outlined by the manufacturer’s operating instructions. Someone from the practice will be available by phone at all times for the duration of monitoring.

Date:

Borrower:

DNP student created
Appendix G

Patient Journal

(Welch Allyn, 2014b)
Appendix H

DASH Diet Handout

How Do I Make the DASH?

The DASH eating plan requires no special foods but has no hard-to-follow recipes. It simply calls for a certain number of daily servings from various food groups.

The number of servings depends on the number of calories you're allowed each day. Your calorie goal depends on your age and, especially, how active you are. Think of this as an energy balance system—if you want to maintain your current weight, you should take in only as many calories as you burn by being physically active. If you need to lose weight, eat fewer calories than you burn or increase your activity level to burn more calories than you eat.

What is your physical activity level? Are you mostly:
- Sedentary? You do only light physical activity that is part of your typical day-to-day routine.
- Moderately active? You do physical activity equal to walking about 1 to 3 miles a day at 3 to 4 miles per hour, plus light physical activity.
- Active? You do physical activity equal to walking more than 3 miles per day at 3 to 4 miles per hour, plus light physical activity.

Use the chart below to estimate your daily calorie needs:

Your Daily Calorie Needs

<table>
<thead>
<tr>
<th>Activity Level</th>
<th>Female</th>
<th>Calorie Needs</th>
<th>Male</th>
<th>Calorie Needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEDENTARY</td>
<td>1400-1600</td>
<td>2000-2400</td>
<td>1800-2100</td>
<td>2500-3000</td>
</tr>
<tr>
<td>MODERATELY</td>
<td>1800-2000</td>
<td>2500-3000</td>
<td>2100-2500</td>
<td>3000-3500</td>
</tr>
<tr>
<td>ACTIVE</td>
<td>2200-2400</td>
<td>3000-3500</td>
<td>2500-3000</td>
<td>3500-4000</td>
</tr>
</tbody>
</table>

Next, compare DASH with your current eating pattern. Fill in the “What’s on Your Plate and How Much Are You Eating?” chart on page 4 for 1 or 2 days to compare what you usually eat with the DASH eating plan—and note how active you are. This should help you decide what changes you need to make in your food choices and in the sizes of the portions you eat.

A Day With the DASH Eating Plan on page 6 shows a sample menu based on about 2,200 calories a day. Increase or decrease the serving sizes for your own calorie level. This chart also shows the two levels of sodium, 2,300 and 1,500 milligrams, that DASH allows each day. Because foods and beverages are naturally lower in sodium than many other foods, DASH makes it easier to eat less sodium. Try it at the 2,300 mg level (about 1 teaspoon of table salt). Then, talk to your doctor about gradually lowering it to 1,500 mg a day. Keep in mind: The less sodium you eat, the more you may be able to lower your blood pressure.

Choose and prepare foods with less sodium and salt, and don’t bring the salt shaker to the table. Be creative—try herbs, spices, lemons, lime, vinegar, wine, and salt-free seasoning blends in cooking and at the table. And, because most of the sodium that we eat comes from processed foods, be sure to read food labels to check the amount of sodium in different food products. Aim for foods that contain 5 percent or less of the Daily Value of sodium. Foods with 20 percent or more Daily Value of sodium are considered high. These include baked goods, cereals, soy sauce, and some snacks—\textit{the range is wide}.

DASH Tips for Gradual Change

Make these changes over a couple of days or weeks to give yourself a chance to adjust and make them part of your daily routine:

- Add a serving of vegetables at lunch one day and dinner the next, and add fruit at one meal or as a snack.
- Increase your use of fat-free and low-fat milk products in those servings a day.
- Limit salt means no s ounces a day—\textit{no salt, the amount of the sodium that is in the diet—1 teaspoon of table salt. If you usually eat large portions of meats, cut them back over a couple of days—by half or a third at each meal.}
- Include two or more vegetarian-style, or meatless, meals each week.

Now that you know how many calories you’re allowed each day, find the closest calorie level to yours on the chart on page 3 called “Following the DASH Eating Plan.” This shows roughly the number of servings from each food group that you can eat each day.
### Following the DASH Eating Plan

Use this chart to help you plan your menus—or take it with you when you go to the store.

<table>
<thead>
<tr>
<th>Food Group</th>
<th>Servings Per Day</th>
<th>Serving Sizes</th>
<th>Examples and Notes</th>
<th>Significance of Each Food Group in the DASH Eating Plan</th>
</tr>
</thead>
</table>
| Vegetables | 3–4              | 4–5           | 6–8               |维他命类蔬菜（例如：甜菜、胡萝卜、甜洋葱、番茄） | 丰富的来源于维生素A和维生素C \n| Fruits     | 4–5              | 5–8           | 6–8               | 苹果、桃子、香蕉、橙子、草莓、西瓜、梨子 | 丰富的来源于维生素C和维生素B \n| Grains     | 0–1              | 10–12         | 10–12             | 100%全麦面包、燕麦片、糙米、全谷物 | 丰富的来源于维生素和矿物质 \n
### What's on Your Plate and How Much Are You Moving?

Use this form to track your food and physical activity habits before you start on the DASH eating plan or to see how you're doing after a few weeks. To record more than 1 day, just copy the form. Total each day's food groups and compare what you ate with the DASH eating plan at your calorie level.

<table>
<thead>
<tr>
<th>Date</th>
<th>Number of Servings by DASH Food Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Meat</td>
</tr>
<tr>
<td></td>
<td>Milk products</td>
</tr>
<tr>
<td></td>
<td>Whole grains</td>
</tr>
</tbody>
</table>

### Day's Totals

2,000 calories; extend example

<table>
<thead>
<tr>
<th></th>
<th>2,000 or 1,500 kcal per day</th>
<th>30–60 min per day</th>
<th>90–150 min per day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2–30 kcal</td>
<td>Moderate walking</td>
<td>Moderate running</td>
</tr>
</tbody>
</table>

### Physical Activity Log

Record your minutes per day for each activity.

| Time | Type of activity |
|------|-----------------|------------------|
|      |                 | 30 min           | Moderate walking   |

* Whole grains are recommended for most grain servings as a good source of fiber and nutrients.
* Serving sizes vary by 1/4 cup and 1/3 cup, depending on serving size. Check the product's Nutrition Facts label.
* Because sugar is high in caloric value, use when appropriate. When planning, 1 tsp of sugar equals 50 calories or 1 tsp of sugar equals 50 kcal.
* For current changes serving amount for tea and coffee, see serving.

Abbreviations: * b/c = because; Tbsp = tablespoon; tsp = teaspoon
Increase servings of vegetables, brown rice, whole wheat pasta, and cooked dry beans. Try casseroles and stir-fry dishes which have less meat and more vegetables, grains, and dry beans.

For snacks and desserts, use fruits or other foods low in saturated fat, trans fat, cholesterol, sodium, sugar, and calories—for example, unsalted nuts, unsalted sun or sesame raisins, graham crackers, fat-free, low-fat, or frozen yogurt; popcorn with no salt or butter added; or raw vegetables.

Use fresh, frozen, or low-sodium canned vegetables and fruits.

**DASH Hints**

- Be aware that the DASH eating plan has more servings of fruits, vegetables, and whole grains than you may be used to eating. These foods are high in fiber and may cause some bloating and diarrhea. To avoid these problems, gradually increase the amount of fruits, vegetables, and whole grains that you eat over several weeks.

- If you have trouble cutting milk products, try taking lactase enzyme pills (available at drug stores) and gradually with milk products. Or buy lactose-free milk, which includes the lactase enzyme.

- If you don’t like or are allergic to nuts, use seeds or legumes (pinto beans or peas).

- If you take medicines that control your blood pressure, keep taking them. But tell your doctor that you are now eating the DASH way.

**Other Lifestyle Changes**

Making other lifestyle changes while following the DASH eating plan is the best way to prevent and control high blood pressure.

**Loss Weight, If Necessary, While Following DASH**

DASH is rich in lower-calorie foods, such as fruits and vegetables, so it easily can be changed to support weight loss. You can reduce calories even more by replacing higher-calorie foods, such as sweets, with more fruits and vegetables. The best way to take off pounds is to do it slowly, over time, by getting more physical activity and eating fewer calories. To develop a weight-loss or weight-maintenance program that’s tailored for you, talk to your doctor or a registered dietitian.

Be Physically Active While Following the DASH Eating Plan

Combining DASH with a regular physical activity program, such as walking or swimming, will help you shed pounds and stay trim for the long term. Start with a simple 15-minute walk during your favorite time of day, and gradually increase the amount of time you are active. You can do an activity for 30 minutes at one time, or choose shorter periods of at least 10 minutes each. The important thing is to total at least 2 hours and 30 minutes per week of activities at a moderate intensity level. For more health benefits, gradually increase to 5 hours per week.

**Make the DASH for Life**

DASH can help you prevent and control high blood pressure. It also can help you lose weight, if you need to. It meets your nutritional needs and has other health benefits for your heart. So get started today, and make the DASH for a healthy life.

**To Learn More**

Contact the National Heart, Lung, and Blood Institute (NHBLI) for information on heart disease and heart health.

NHBLI Health Information Center
P.O. Box 30105
Bethesda, MD 20824-3010
Phone: 301-592-8573
TTY: 240-623-2015
Fax: 301-592-8563

Also check these heart health resources:

NHBLI Website: http://www.nhlbi.nih.gov


DASH Health Topic: http://www.nhlbi.nih.gov/health-topics/dash


NHBLI Delicious Heart Healthy Recipes: http://nhlbi.nih.gov/dash/recipe

(National Heart, Lung, and Blood Institute, 2015)
Appendix I

Home Blood Pressure Monitoring Handout

**Blood Pressure Tracker - Instructions**

- You should have your monitor's accuracy tested once a year by a healthcare professional.
- Make sure the cuff fits, measure around your upper arm and choose a monitor that comes with the correct size cuff.
- It's important to take the readings at the same time each day, such as morning and evening, or as your healthcare professional recommends.

- Don't smoke, drink caffeinated beverages or exercise within the 30 minutes before measuring your blood pressure.
- Sit with your back straight and supported (on a dining chair, for example, rather than a sofa). Your feet should be flat on the floor; don't cross your legs. Your arm should be supported on a flat surface (such as a table) with the upper arm at heart level. Make sure the middle of the cuff is placed directly over your brachial artery as shown in the picture or your monitor's instructions, or have your healthcare provider show you how.
- Each time you measure, take two or three readings, one minute apart, and record all the results. Your doctor can calculate your average blood pressure from all of your readings, tell you what category you fall into, look at all your risk factors and give you a blood pressure goal.

**American Heart Association recommended blood pressure levels**

<table>
<thead>
<tr>
<th>Blood Pressure Category</th>
<th>Systolic (mm Hg)</th>
<th>Diastolic (mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>less than 120</td>
<td>less than 80</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>120–139</td>
<td>or 80–89</td>
</tr>
<tr>
<td>High</td>
<td>140–159</td>
<td>or 90–99</td>
</tr>
<tr>
<td>Stage 1</td>
<td>160 or higher</td>
<td>or 100 or higher</td>
</tr>
</tbody>
</table>

Blood pressure higher than 180/110 mm Hg is an emergency. Call 9-1-1 immediately. If 9-1-1 is not available, have someone drive you to the nearest emergency facility immediately.

Heart rate or pulse is the number of times your heart beats per minute. The average resting heart rate is 60–80 beats per minute, but it's generally lower in physically fit people and it usually rises with age.
IMPROVING HYPERTENSION MANAGEMENT

(American Heart Association, 2012)
Appendix J

Home Blood Pressure Monitor Purchasing Guide*

AHA Recommendation

The American Heart Association recommends an automatic, cuff-style, bleep (upper-arm) monitor. Wrist and finger monitors are not recommended because they yield less reliable readings.

Here are some other tips to follow when shopping for a blood pressure monitor.

- Choose a validated monitor.
  Make sure the monitor has been tested, validated and approved by the Association for the Advancement of Medical Instrumentation, the British Hypertension Society and the International Protocol for the Validation of Automated BP Measuring Devices.

- Ensure the monitor is suitable for your special needs.
  When selecting a blood pressure monitor for the elderly, pregnant women or children, make sure it is validated for these conditions.

- Make sure the cuff fits.
  Children and adults with smaller or larger than average-sized arms may need special-sized cuffs. They are available in some pharmacies, from medical supply companies and by direct order from companies that sell blood pressure cuffs. Measure around your upper arm and choose a monitor that comes with the correct size cuff.

*DNP student created with information from American Heart Association (2016)
Appendix K

Early Provider Survey

<table>
<thead>
<tr>
<th></th>
<th>Not at All Influential</th>
<th>Slightly Influential</th>
<th>Moderately Influential</th>
<th>Very Influential</th>
<th>Extremely Influential</th>
</tr>
</thead>
<tbody>
<tr>
<td>How influential were the patient’s ABPM readings in making a diagnosis regarding their BP?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>How influential were the patient’s ABPM readings in the decision to not start, start, or change an antihypertensive medication?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>How influential were the JNC-8 guidelines in making a diagnosis regarding their BP?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>How influential were the JNC-8 guidelines in the decision to not start, start, or change an antihypertensive medication?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>How influential were the AHA/ACC guidelines in forming lifestyle recommendations for the patient?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Recommendations/feedback:
Note: This is the DNP student created provider questionnaire given to each provider after each patient’s second visit. The providers were asked to rate how influential each part of the quality improvement project were in their decision-making process with that particular patient on a 5-point Likert scale with 1- not at all influential, 2- slightly influential, 3- moderately influential, 4- very influential, 5- extremely influential. Providers were instructed to write any recommendations or feedback about the project in the blank space at the bottom of each survey.
Appendix L

Late Provider Survey

<table>
<thead>
<tr>
<th></th>
<th>Not at All Influential</th>
<th>Slightly Influential</th>
<th>Moderately Influential</th>
<th>Very Influential</th>
<th>Extremely Influential</th>
</tr>
</thead>
<tbody>
<tr>
<td>How influential were the patient’s ABPM readings in making a diagnosis regarding their BP?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>How influential were the patient’s ABPM readings in the decision to not start, start, or change an antihypertensive medication?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>How influential were the JNC-8 guidelines in making a diagnosis regarding their BP?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>How influential were the JNC-8 guidelines in the decision to not start, start, or change an antihypertensive medication?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>How influential were the AHA/ACC guidelines in forming lifestyle recommendations for the patient?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Overall, how influential has this QI project been in how you manage hypertension in your patients?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Recommendations/feedback:
Note: This is the DNP student created provider questionnaire given to each provider after each patient’s third visit. The providers were asked to rate how influential each part of the quality improvement project were in their decision-making process with that particular patient on a 5-point Likert scale with 1-notch at all influential, 2-slightly influential, 3-moderately influential, 4-very influential, 5-extremely influential. Providers were instructed to write any recommendations or feedback about the project in the blank space at the bottom of each survey.
### Appendix M

**Self-Efficacy to Manage Hypertension**

<table>
<thead>
<tr>
<th>No Confidence</th>
<th>Slight Confidence</th>
<th>Moderate Confidence</th>
<th>High Confidence</th>
<th>Complete Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Having high blood pressure often means doing different tasks and activities to manage your condition. How confident are you that you can do all the things necessary to manage your high blood pressure on a regular basis?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2. How confident are you that you can judge when changes in your high blood pressure mean you should visit a doctor?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3. How confident are you that you can do the different tasks and activities needed to manage your high blood pressure so as to reduce your need to see a doctor?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. How confident are you that you can reduce the emotional distress caused by your high blood pressure so that it does not affect your everyday life?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. How confident are you that you can do things other than just taking medication to reduce how much your high blood pressure affects your everyday life?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Note: This self-efficacy scale was adapted from Warren-Findlow, Seymour, and Huber (2012). At the end of visit two and again at the end of visit three, patients were asked to rate their confidence in managing the variables that affect their blood pressure management. A five item Likert scale was used with responses ranging from 1- *no confidence* to 5- *complete confidence*.