IMPROVING DIAGNOSIS AND TREATMENT OF HYPERTENSION IN A FAMILY PRACTICE CLINIC FOLLOWING THE IMPLEMENTATION OF AN EDUCATIONAL INTERVENTION

By

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30 October 2019

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The DNP Project committee for Julianne Owen certifies that this is the approved version of the following DNP Project:

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Problem: Hypertension (HTN) affects over a third of all American adults, 20% of which are undiagnosed and untreated. HTN leads to greater morbidity and mortality, placing a person at a significantly greater risk for cardiovascular events and chronic kidney disease. The majority of those 13 million people with undiagnosed HTN visit their healthcare provider two or more times a year. Many patients presenting with elevated blood pressure (BP) measurements in primary care clinics in Kansas City often remain undiagnosed for HTN, which is likely to lead to poorer health outcomes. No facility-specific protocols exist to encourage follow-up in patients at high risk for HTN to address this problem.

Project Aim: The aim for this quality improvement (QI) project was to determine the effectiveness of an educational intervention on the rates of diagnosis and treatment of HTN in a primary care clinic in Kansas City.

Project Method: This QI project used the plan-do-study-act (PDSA) model to determine if diagnosis of HTN increased after eight weeks of the implementation of an instrument that encouraged follow-up in patients found with a BP of 130/80 or greater. The handout to patients with high BP consisted of four components: (1) brief education related to HTN, (2) lifestyle changes to decrease BP, (3) instructions for obtaining self-measured BPs, and (4) instructions to make a follow-up clinic appointment if their BP remains elevated. Data were gathered to evaluate if there was a reduction in the amount of undiagnosed HTN and in the average BPs of those seen in the clinic after the intervention. The patients included in this project were required to be English-speaking, between the ages 18 and 65, and had to have visited a specific primary care clinic in Olathe, Kansas, between May 20 and August 9, 2019.

Findings: A total of 635 patient records were reviewed during the pre- and post-intervention phases. The number of undiagnosed HTN patients before the intervention was 91 of 301 participants, for a total of 30.2%. The number of undiagnosed hypertensive patients after the intervention was 120 of 334 participants, for a total of 35.9%. An estimated 424 patients had undiagnosed HTN during the eight-week intervention period, but only 233 educational handouts were provided. The fact that only 55% of eligible patients received the intervention can be explained by patient refusal and lack of staff consistently offering the handout to eligible patients. There was no improvement in the pre-intervention means of systolic and diastolic BPs to the post-intervention BPs (121.1 mm Hg, 122.3 mm Hg) and (76.3 mm Hg, 78.6 mm Hg) respectively.

Conclusion: Primary care providers will frequently observe undiagnosed HTN. Thus, more structured protocols need to be developed to provide more consistent diagnosis and treatment for HTN in order to prevent the long-term consequence of HTN. This DNP project did not demonstrate a statistically significant improvement in BP measurements or the rate of undiagnosed HTN. However, the data indicated a significant proportion of patients seen during the project timeline had undiagnosed HTN, suggesting this is a practice problem at this clinic and future education and assessment of HTN needs to be implemented.

Hypertension (HTN) is a major health problem in the United States, affecting over a third of American adults. Of those affected, nearly 20%, over 13 million people, are unaware they have HTN and are therefore not being treated for it (Centers for Disease Control [CDC], 2016; Park et al., 2018). Some studies estimate up to 36% of hypertensive patients are unaware of their condition (Wall, Hannan, & Wright, 2014). HTN greatly increases an individual's morbidity and mortality, with an increased risk for heart attacks and strokes, as well as other debilitating diseases such as chronic kidney disease and heart failure (CDC, 2016). Most individuals with undiagnosed high blood pressure (BP) visit their healthcare providers at least twice a year (CDC, 2016). With the rise in HTN, the CDC, Centers for Medicare & Medicaid Services, and Healthy People 2020 have made HTN control a national health priority goal (U.S. Department of Human Health & Services, 2016).

The rates of HTN prevalence and control in Kansas continue to fail to meet the national Healthy People 2020 goals of $\leq 26.9\%$ and $\geq 61.2\%$, respectively (CDC, 2016). Better detection and diagnosis of HTN is paramount in order to improve these numbers, as treatment of HTN is necessarily preceded by awareness of the problem. A review of 49 studies recently completed by the Agency for Healthcare Research and Quality (AHRQ) found strong evidence that self-measured BP monitoring (SMBP) with additional educational support is more effective than routine care in detecting and lowering BP of patients with HTN (U.S. Department of Human Health & Services, 2016). No evidence-based protocol for high BP follow-up to increase diagnosis and control of HTN currently exists in the Olathe Health Family Clinic – Hedge Lane in Olathe, Kansas, a suburb of Kansas City. The purpose of this quality improvement Doctorate of Nursing Practice (DNP) project is to increase follow-up of those at risk for undiagnosed HTN and thereby improve HTN diagnosis and BP control in a family practice clinic in a suburb of

Kansas City.

Problem Statement

Hypertension is a significant public health concern. Nearly 75 million Americans have HTN. It is the most common cardiovascular disease (CVD) risk factor that leads to end-organ damage and life-threatening complications, most notably heart attack and stroke, when untreated (Shrivastava, Shrivastava, & Ramasamy, 2014). CVD events account for nearly one of every three deaths in the U.S. each year, nearly half of which are preventable (CDC, 2017). HTN also results in countless hospital admissions from complications such as heart failure and kidney disease (Whelton et al., 2017). In addition to the profound impact HTN has on quality of life, it is a significant financial burden on our nation. The annual cost of HTN exceeds $50 billion, over $47 billion of which is from direct medical expenses (CDC, 2017).

National HTN prevalence is a growing problem; 31.6% of Americans had HTN in 2013-2014 compared to 27.4% in 2001-2002 (CDC, 2016). BP control in those with HTN is equally dismaying, with marginally greater than half (54%) attaining sufficient control (CDC, 2016). The landscape in Kansas is similar. In 2017, 32.8% of Kansas's residents reported they had been told they have high BP by a health care professional at some point (CDC, 2017).

Although proper control in those with HTN remains a serious problem, proper detection and diagnosis of the disease is a major contributor to the problem of insufficient control. Approximately 20% of those who have high BP remain undiagnosed, although the majority of them see their health care provider regularly, many twice a year (CDC, 2016). This indicates a gap in proper recognition and diagnosis. The first step in improving HTN control is identifying all patients eligible for management and having a systematic approach for follow-up of patients for the initiation and intensification of therapy (Go et al., 2014). Clear, evidence-based, follow-

up protocols need to exist for providers to identify those commonly missed (Go et al., 2014). One study found that implementation of a protocol to re-evaluate those with high BP resulted in a follow-up rate of 65%, nearly a third of which resulted in a HTN diagnosis (Meador, Osheroff, & Reisler, 2018). This emphasizes how imperative it is for organizations to have evidence-based guidelines in place for BP follow-up to improve diagnosis and treatment of HTN. No formalized structure or process currently exists in the Olathe Health Family Medicine facilities. An intervention that requires little extra time, personnel, and financial resources is of utmost importance in order to be feasible for implementation in busy primary care facilities. A protocol for BP follow-up may result in increased diagnosis and treatment of HTN, decreasing high BPs, and improving the health outcomes of the patients seen at the Olathe clinic.

Project Aims

The aim of this DNP project was to determine the effectiveness of an educational intervention on the rates of diagnosis and treatment of HTN in a primary care clinic in a suburb of Kansas City. The purpose of the intervention was to improve BP control for adult patients seen at the Olathe Health Family Medicine Clinic by improving follow-up of those at risk for undiagnosed HTN. The Project Director created a protocol to encourage patients with high BP to follow-up to receive diagnosis and treatment for HTN. The protocol was then assessed to determine its effectiveness in increasing the rates of HTN follow-up and control on adults seen in a suburban family practice setting within three months when compared to current practice. BP measurements were evaluated pre- and post-intervention. The expected outcome was for HTN follow-up rates to increase resulting in improved BP measurements after the intervention was implemented.

Literature Review

Hypertension

Hypertension in its simplest terms is when BP, the force of blood pushing against the vessel walls of the circulatory system, is consistently too high (American Heart Association [AHA], 2016). The BP measurement is made up of two numbers; the top number, the systolic BP (SBP), is the pressure in the circulatory system when the heart is pumping blood. The lower number, the diastolic BP (DBP), is the pressure in the circulatory system when the heart is in-between beats.

In 2017, the American College of Cardiology and American Heart Association (AHA), together with nine other professional associations, published updated HTN guidelines, which were authored by Paul K. Whelton, M.D. and numerous other medical experts. The first comprehensive update since 2003, the new guidelines lowered the limits for HTN diagnosis. Under old guidelines, HTN began with BP >140/90; new guidelines now define HTN as beginning at 130/80. The lower limits for HTN diagnosis are a result of the review of over 900 studies, which revealed that cardiovascular complications double when BP remains elevated above 130/80. As a result, the 2017 guidelines now define elevated BP as a SBP of 120-129 and DBP < 80, stage 1 HTN as SBP of 130-139 or DBP 80-89, stage 2 HTN as SBP >140 or DBP > 90 and hypertensive crises as SBP >180 and DBP >120 (Whelton et al., 2017).

Hypertension is diagnosed as either primary or secondary. Secondary HTN is rare, accounting for about 5% of HTN cases, and is caused by identifiable disease such as hyperaldosteronism, pheochromocytoma, or Cushing's disease (Garfinkle, 2017; Noel, 1994). While the pathophysiology for secondary HTN has a clear, specific mechanism, the cause of primary, or essential, HTN is multifactorial, affected by genetic, environmental, and behavioral

factors, as well as the failure of inherent control mechanisms (Bolívar, 2013). Some of the proposed mechanisms of essential HTN include increased sympathetic nervous system (SNS) activity which can be caused by obstructive sleep apnea, obesity, insulin resistance, metabolic syndrome, uric acid elevation, and vitamin D deficiency (Saxena, Ali, & Saxena, 2018) Other causes include vascular alterations such as endothelial cell dysfunction and disruptions to the nitric oxide pathway, and renal system dysfunction including disruptions of to the renin-angiotensin-aldosterone system (RAAS) as well as excess dietary salt intake resulting in increased pressure for natriuresis (Saxena, Ali, & Saxena, 2018).

HTN is associated with increased sympathetic tone and it is now believed that autonomic dysfunction, characterized by impaired parasympathetic tone and increased sympathetic function, plays an important role in the development of HTN. The sympathetic nervous system (SNS), whose functions are often characterized by the "fight or flight response," is responsible for the release of the powerful vasoactive neurotransmitters epinephrine, norepinephrine, and dopamine. The effect on α-, ß-, and dopaminergic receptors leads to increased cardiac output and systemic vascular resistance (SVR), that increases BP. Furthermore, the SNS has a complex interaction with renal sodium excretion and the RAAS, which are also critical to BP regulation (Grassi & Ram, 2016).

Some of the most common antihypertensive medications prescribed by clinicians for the treatment of HTN are angiotensin II receptor blockers (ARBs) and angiotensin-converting-enzyme (ACE) inhibitors, which work by affecting the RAAS. Renin is a circulating enzyme that breaks down angiotensinogen into angiotensin I, which is then further reduced by ACE into angiotensin II, a powerful vasoconstrictor. Angiotensin II increases BP in a multitude of ways, which can be viewed in Figure 1. It causes vasoconstriction of arteries, raising SVR, and affects

the kidneys, influencing multiple ion transporters throughout the tubules, leading to increased sodium retention. It also causes increased aldosterone release from the adrenal glands, which leads to further sodium and water reabsorption by the kidneys (Saxena, Ali, & Saxena, 2018).

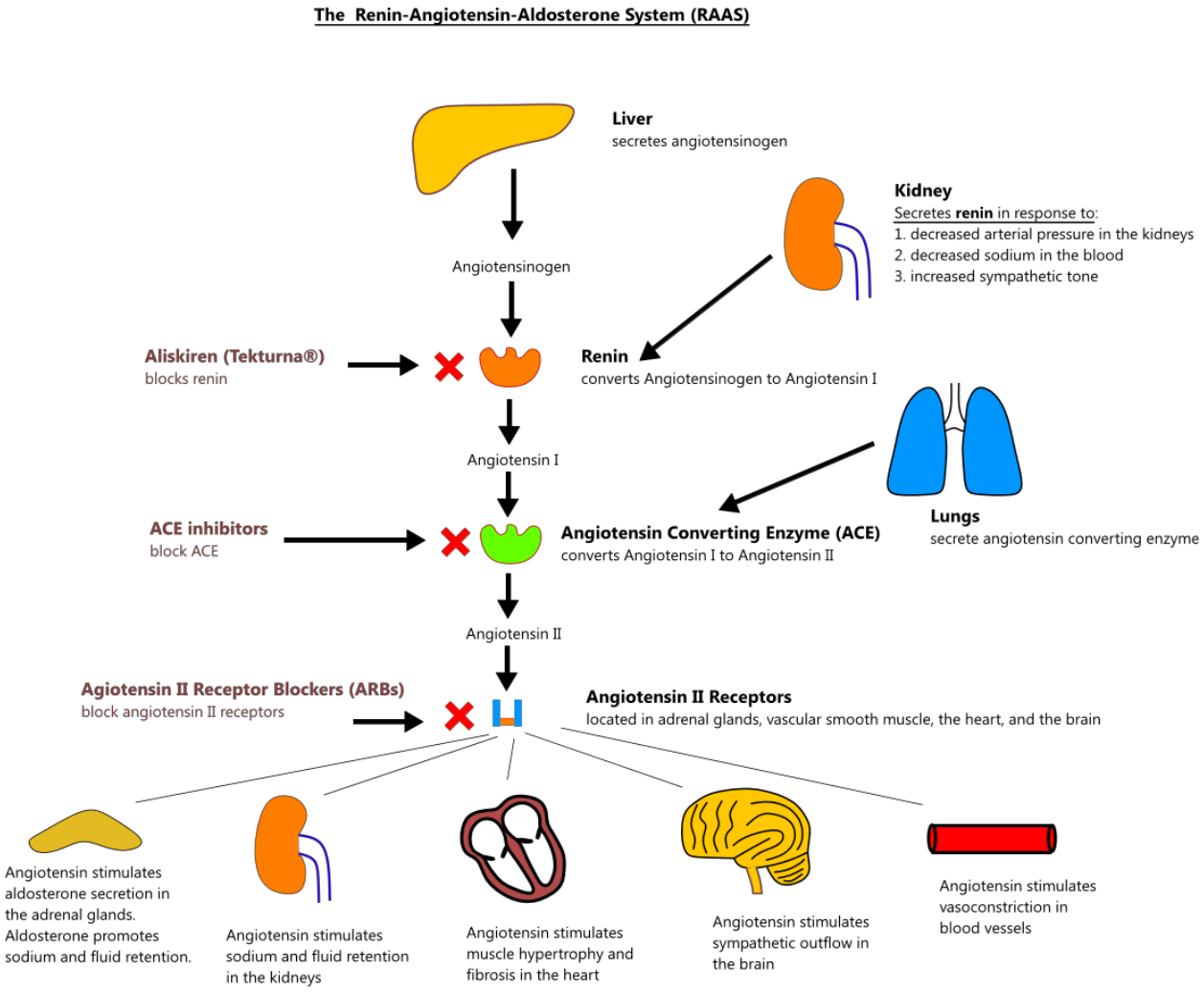

Figure 1. The RAAS is a complex multi-organ system that regulates BP and fluid retention (StraightHealthcare, 2018).

Endothelial cell dysfunction is another key contributor to the pathogenesis of HTN. Endothelial cells line the inner surface of blood vessels in the circulatory system and produce many enzymes important for BP control. Nitric oxide (NO) is one of the more important enzymes released by endothelial cells and the disruption of its normal function is a contributor to

the development of HTN. NO is a potent vasodilator which causes relaxation of vascular tone and inhibits the proliferation of vascular smooth-muscle cells. Its constant release is responsible for maintenance of reduced vascular tone. Endothelin (ET) is another potent vasoactive product of endothelial cells. It stimulates basal NO release by endothelial cells and acts on the smooth-muscle cells of the circulatory system with both constricting and dilatory effects (Majumder & Wu, 2014). In hypertensive vasculature NO's dilatory activity is decreased and ET activity increases resulting in vasoconstriction and the remodeling and hypertrophy of vascular smooth muscle which both contribute to increased SVR (Saxena, Ali, & Saxena, 2017). Figure 2 shows how these enzymes affect the blood vessels and cause hypertrophy and vasoconstriction of the vessels, resulting in HTN over time.

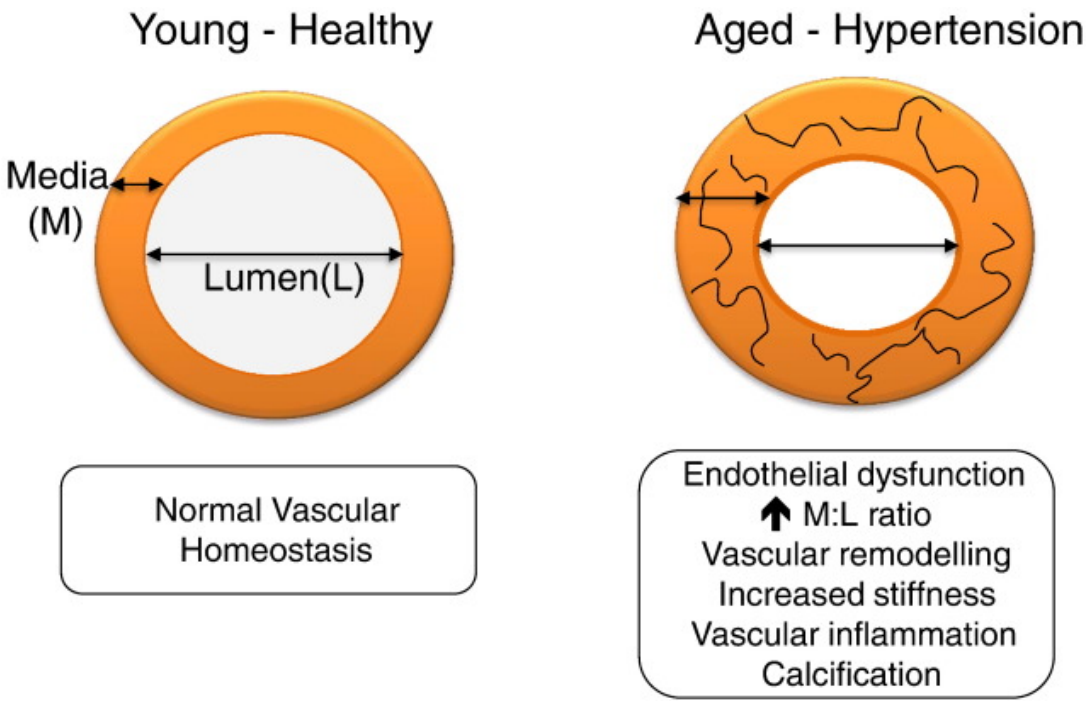

Figure 2. Endothelial dysfunction including decreased NO activity, resulting in decreased vessel tone relaxation, and increased ET, causing vasoconstriction, remodeling, and hypertrophy of vessels, results in vascular changes which lead to HTN (Harvey, A., Montezano, A. C., Touyz, R. M., 2015).

There are multiple other mechanisms in the body, which may also be implicated in HTN development but by which exact mechanisms are not yet clearly understood. For the sake of thoroughness and brevity they will only be mentioned here. For example, there is evidence of impairment of reflex mechanisms including arterial baroreceptor reflexes, cardiopulmonary reflexes, and chemoreceptor receptors, in the setting of HTN. Other humoral systems may also contribute to the development of HTN, including vasopressin, leptin-melanocortin system, atrial natriuretic peptides, and brain natriuretic factors (Grassi & Ram, 2016). In addition, oxidative stress has an important role; the up regulation of oxidants, or reactive oxygen species (ROS), has been connected to activation of angiotensin II and decreased NO activity (Majumder & Wu, 2014). The diagram in shown in figure 3 outlines the cascade of changes that contribute to the development of HTN.

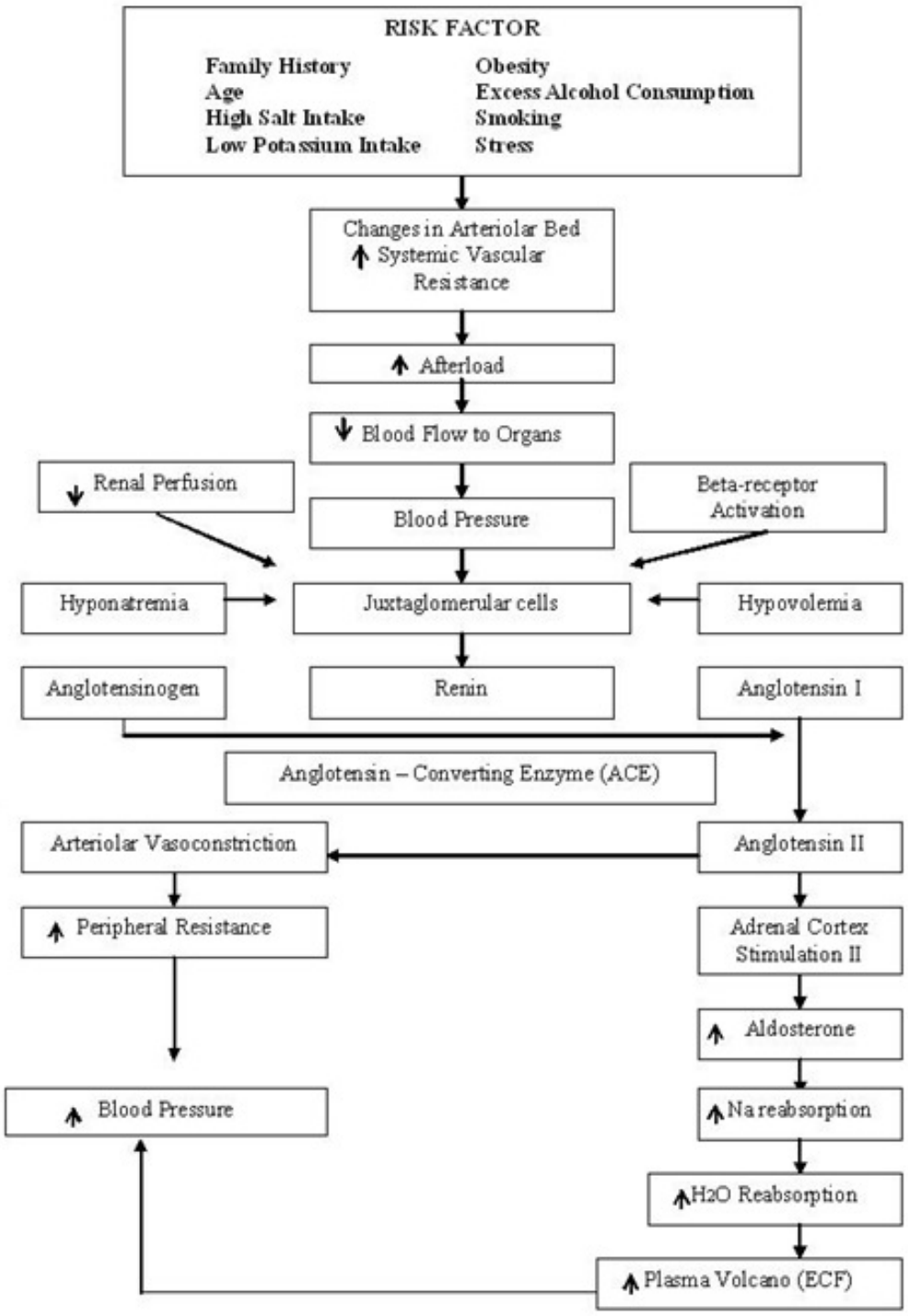

Figure 3. A diagram of the many factors leading to HTN (Pathophysiology of Hypertension, 2008).

Burden of Hypertension

Affecting over a third of all American adults, HTN is undiagnosed and untreated in approximately 20-36% afflicted (CDC, 2016; Wall, Hannan, & Wright, 2014). HTN, which increases the risk for a multitude of debilitating health problems such as chronic kidney disease and heart failure, is the leading cause of heart disease and strokes (CDC, 2016). It is one of the top ten most costly diagnoses in the U.S., with stroke and heart disease, its two most common complications, ranking number one and number four, respectively (Kamal, 2017).

Improving HTN control is a national health priority and was selected as the only Leading Health Indicator for Healthy People 2020's Heart Disease and Stroke improvement goals (Park et al., 2018). In addition, the CDC and the Centers for Medicare & Medicaid Services jointly launched a large-scale initiative in 2012, titled Million Hearts, aimed at encouraging healthcare organizations to develop protocols to reduce HTN with the goal of preventing one million strokes and heart attacks over five years. BP control is one of the four core recommendations of their "ABCS", which stands for Aspirin when appropriate, BP control, Cholesterol management, and Smoking cessation (U.S. Department of Human Health & Services, 2016).

Need for Hypertension protocols

Whelton et al. (2017) found that only 15.8% of patients with undiagnosed HTN received a prescribed medication to control their BP whereas 92.6% of those with diagnosed HTN received treatment. This demonstrates that a diagnosis of HTN is an important aspect of improved BP control. Although protocols exist for titrating anti-hypertensive medications to control BP, very few organizations have standardized processes that outline a follow-up process for patients with high BP without a diagnosis of HTN. Re-evaluation of patients with a high BP on one occasion is important, as current recommendations necessitate two or more high BP on two or more occasions to diagnose HTN (Whelton et al., 2017). Meador et al. (2018) found that

implementation of a protocol to re-evaluate those with HBP resulted in a follow-up rate of 65%, nearly a third of which resulted in a HTN diagnosis.

Another large randomized trial highlights the issue of providers' conservative approach to HTN treatment and the importance of protocols. Hyman et al. (2012) found that although 90% of healthcare providers reported they sought a BP goal of 130/80 most providers did not intensify treatment until SBP was 150 or greater. This study proposed that three factors affect providers' decisions to not intensify BP treatment; providers' uncertainty of patients' out of office BPs, their medication adherence, and their follow-through with lifestyle modifications. One way to address this is to improve the number of patients who monitor their BP outside of the clinic using home BP monitoring systems.

Home BP monitoring systems

Home BP monitoring (HBPM) has been found by many studies to be more closely correlated with the "golden standard" 24-hour ambulatory BP monitoring (ABPM), than in office blood pressure monitoring (OBPM) (Breaux-Shropshire, Judd, Vucovich, Shropshire, & Singh, 2015). The AHA, the American Society of Hypertension, and the Preventive Cardiovascular Nurses Association support HBPM being incorporated into usual care (Breaux-Shropshire, Judd, Vucovich, Shropshire, & Singh, 2015). In fact, the AHA has recommended the routine use of HBPM for over a decade (Pickering et al., 2005). This is unsurprising, as HBPM is a better predictor of cardiovascular mortality (Breaux-Shropshire, Judd, Vucovich, Shropshire, & Singh, 2015). Another part of the benefit of HBPM may be due to its patient-centered approach. Self-monitoring encourages patients to claim their role in improving their health; as many authors have noted, certainly by serving as a reminder to improve medication adherence, but perhaps also by increasing consciousness and encouraging healthy lifestyle changes. This is further

supported by the fact that patients randomized into a HBPM group, without any antihypertensive medication adjustments, demonstrated improved BP control to those receiving routine OBPM (Fuchs et al., 2012).

Furthermore, HBPM overcomes some of the failures of OBPM, including its low sensitivity, as well as its inability to detect white coat HTN and masked HTN (Breaux-Shropshire, Judd, Vucovich, Shropshire, & Singh, 2015). This is important, as white-coat and masked HTN both increase a patients' cardiovascular risk (Mancia, Facchetti, Bombelli, Grassi, & Sega, 2006). Lastly, another significant benefit conferred by HBPM that should not be overlooked, is that it increases the number of BP readings a provider on which to base treatment decisions, bolstering their confidence in the accuracy of their patients' typical BP and increasing their likelihood of properly treating.

Accurate BP measurements

Although HBPM is important, OBPM will always remain a critical part of diagnosing and managing HTN. The new 2017 guidelines stress the importance of ensuring accurate measurements, for both at home and in clinic BP measurements. These guidelines include directions that the patient sit quietly for at least five minutes before measurement, remain still during the reading, avoid smoking, caffeine, or exercise for the 30 minutes prior to the reading, empty their bladder beforehand, and sit comfortably with legs uncrossed, both feet on the floor. Further measures include support of the limb used to measure BP, appropriate arm and cuff position (arm resting so that cuff is at heart level), and use of the correct BP cuff size, placed on bare arm, not over clothing. The 2017 recommendation is to take two to three readings in both arms and using the higher reading to provide the most accurate estimate. Lastly, proper calibration of the device used for BP measurement is vital. For HBPM, patients should be

advised to validate their home instrument by bringing it to the office to be calibrated with the office BP measurement. Patients taking HBPM should also be educated that the ideal time to measure BP is in the morning before medication and in the evening before supper, a minimum of two readings one minute apart. Either using a device that has memory capability or keeping fastidious records of these BP readings is obviously an essential part of utilizing HBPM as well (Whelton et al., 2017).

Patient education on lifestyle changes

Although lifestyle change is the first recommended treatment for HTN, the education a patient receives regarding lifestyle changes varies greatly from one provider to the next. This education is paramount if a patient is to succeed with reducing their BP through lifestyle changes. Recent 2017 guidelines enumerate the lifestyle changes which should be recommended to patients and cite that these changes can reduce hypertensive patients SBP by 4 to 11 mm Hg. The DASH diet, with increased potassium and magnesium intake from fruits, vegetables, whole grains, and low-fat dairy products, is a core dietary recommendation, as is sodium restriction (Wheton et al., 2017). Salt restriction is an important aspect of HTN control since BP rises in response to a high dietary salt intake, in order to effectively excrete sodium through the kidneys (Garfinkle, 2017; Bolívar, 2013). Another recommendation for HTN is for an individual to exercise, 90 to 150 minutes a week. These diet and exercise changes should also help overweight and obese patients lose weight. A decrease in BP by 1 mm Hg in SBP can be expected for every 1 kg of weight loss. Education on alcohol restriction should be no more than two drinks per day for men and no more than one drink per day for women. Lastly, resources should be provided to smokers to aid them in smoking cessation (Wheton et al., 2017).

Definitions

Hypertension

Conceptually, HTN is defined as a higher than normal BP caused by increased cardiac output and/or SVR (AHA, 2016). Operationally, the new 2017 guidelines for HTN will be used, and anyone presenting to the clinic with a systolic BP of 130 mm Hg or greater or a diastolic BP of 80 mm Hg or greater will be given the handout for patients who are hypertensive (Whelton et al,, 2017).

Educational Intervention

Conceptually, an educational intervention is a change process in a healthcare system with a goal of improving quality of care and patient outcomes (Evidence-based Practice Center Systematic Review Protocol, 2012). An educational intervention is specifically using education of patients and/or staff to effect those changes. Operationally, in this project the intervention is the education provided to the providers, the guidelines for HTN diagnosis, and the recommendations for follow-up, as well as the education included in the handout to patients (see Appendix C).

Family Practice Clinic

A family practice clinic is an outpatient setting in which patients across the lifespan receive general medical, or "primary" care. In this DNP project the family practice clinic is the Olathe Health Family Medicine (Hedge Lane) in Olathe, Kansas, a suburb of Kansas City. It consists of both a primary care side, in which a physician sees patients with an appointment only, and an urgent care side, in which nurse practitioners have same-day appointments available and see walk-in patients.

Project Design

Conceptual Model

This quality improvement (QI) project utilized the Plan-Do-Study-Act (PDSA), which is a well-known, highly recommended tool for improving patient care in clinic settings (Agency for Healthcare Research and Quality, 2013). The Million Hearts Change Package for Clinicians specifically recommends the PDSA cycles method for implementing the new evidence to improve HTN control. Studies indicate that a systematic approach to HTN management can significantly improve HTN-related care processes and outcomes (CDC Hypertension Control Change Package for Clinicians, 2015). The PDSA format provides that systematic approach to follow. It allows for rapid testing and determination of whether a new change results in improvements in a particular setting (CDC Hypertension Control Change Package for Clinicians, 2015). It is essentially a method for testing a change in the real work setting; it is "action-oriented learning" (Agency for Healthcare Research and Quality, 2013). The four parts are as follows: (1) Plan: define the objective, questions, and predictions and plan data collection to answer these questions. (2) Do: Carry out the plan, collect the data, and begin analysis of the data. (3) Study: Compare the analysis of the data, compare data with predictions, and summarize what was learned. (4) Act: Plan the next cycle; decide whether the change can be implemented (Morelli, 2016). Please see appendix A for the PDSA cycle diagram customized to this DNP project.

Applying the PDSA to this QI project, the "plan" portion is accomplished by outlining the plan in this proposal and discussing the project with the clinic healthcare providers. The "do" aspect was accomplished over the three-month period where the Project Director conducted the QI project in a local family medicine clinic. The Project Director collaborated with the statistical

department to analyze pre- and post-intervention data and compared with expected findings. The data were evaluated to determine the effectiveness of the intervention and to summarize those findings, completing the "study" piece of the PDSA cycle. To fulfill the "act" portion, the information regarding findings will be disseminated to the staff at the clinic site. The educational resources that were used in the QI project will be provided to the administration at Olathe Health for continued use in that clinic. In addition, the Project Director will disseminate the findings at the DNP Public presentation.

The creator of the PDSA, the Institute for Healthcare Improvement, adds three recommended questions when implementing an intervention: (1) What are we trying to accomplish? (2) How will we know that a change is an improvement? and (3) What changes can we make that will result in improvement (CDC Hypertension Control Change Package for Clinicians, 2015)? To answer those three questions, the goal of this DNP project was to improve HTN control by increasing diagnosis and treatment of undiagnosed HTN through improved follow-up by implementation of a protocol to increase follow-up of patients with high BP. The evaluation to determine if the implemented protocol is effective at improving this goal in the clinic is whether or not it results in improved patient follow-up for HTN, demonstrated by increased diagnosis of HTN and decreased BPs in the patients.

Setting

The setting for this project is an Olathe Health Family Medicine clinic in the suburbs of the Kansas City metropolis. This family practice clinic has approximately 1,500 clinic visits a month and sees patients across the lifespan with all types of payment, including all insurances, Medicaid and Medicare, and self-pay. The clinic includes a walk-in side with an advanced practice registered nurse or physician assistant seeing those patients and an appointment only

primary care side with a physician. All patients in the clinic were included, whether scheduled for a primary care visit with the physician or nurse practitioner in the "walk-in" clinic. After the patient checks in at the clinic desk, the registered nurse (RN) places the patient in a clinic room before the healthcare provider enters. The RN obtains BP, respiratory rate, temperature, and completes other screening questions. If the patient's BP is 130/80 or greater, the nurse offered the project handout on HTN to the patient. The handouts were distributed to the patient if they have HTN regardless of whether they have a diagnosis of HTN. The handout consisted of a one-page document with patient education on HTN, as well as a place for the nurse to write their OBPM from that visit, and instructions on obtaining a minimum of two additional BPs at home or at a local pharmacy.

Sample Population

A convenience sample was utilized for this project. All patients between 18 and 65 years of age seen in the clinic for any reason, a scheduled appointment on the primary care physician side or an acute visit on the walk-in side, who have a BP of 130/80 or greater, was offered the intervention. Only non-English speaking patients or those with cognitive or physical disability that prohibits their ability to understand the educational intervention were excluded from participation. All adult patients at the clinic sit for all reasons, whether an annual physical, an acute visit, or general follow-up visit, were included. The clinic averaged 159 patients a week with 53 of those presenting without a diagnosis of HTN but with a BP $\geq$ 130/80, which came to a third of all patients seen. A total of 233 educational handouts were given during the 8-week intervention period to an estimated 424 eligible patients. The fact that about 55% of eligible patients received the intervention can be explained by patient refusal and a lack of staff identifying eligible participants and offering the educational handout.

Implementation

The intervention was implemented into standard workflow in the follow way. When the RN roomed the patient they obtained a BP following guidelines for accuracy in Appendix B. If the SBP was ≥ 130 or DBP ≥ 80 the RN would ask the patient if they have ever received a diagnosis of HTN. If they answered no, they were offered the handout (as in Appendix C), and were asked to schedule a follow-up appointment within the next 4 weeks when they checked out to encourage a return visit.

The handouts given to patients, as shown in Appendix C, include a definition of high BP, its common signs and symptoms, and the complications of uncontrolled HTN. They include a place for the nurse to write in the patient's BP measurement taken that day and have instructions for obtaining a minimum of two BPs before their next visit and a place to record those. The handouts also include instructions on lifestyle changes to improve BP and encourage patients to schedule a follow-up appointment within 4 weeks. The handouts state that if home BPs are less than 130/80 the patient can cancel their appointment and continuing monitoring BP at home with lifestyle changes. The reverse of that sheet has more details on the AHA endorsed DASH diet, which is the acronym for Dietary Approaches to Stop Hypertension (Whelton et al., 2017). Two hundred sheets were initially printed, and the supply was checked periodically during the intervention, additional were printed as needed and a total of 233 were given to patients. The handouts were stored by the nurses' desk to serve as a reminder, since the nurses use their laptops for intake assessments. The nurses took a handout with them every time they roomed a patient, and left it with the patient if their BP was 130/80 or greater.

The nurses and providers were provided education on the intervention during their staff meeting May 31, 2019. The education consisted of reviewing the dangers of undiagnosed,

untreated HTN, the reliability of HBPM, the importance of patient education, as well as specific details regarding the timeline of the intervention and the aims of the project. The PowerPoint presentation used for the education of staff is included in Appendix D. The staff meeting presentation took approximately 15 minutes total and then the providers and nurses were met with individually after the meeting for no more than 5 minutes each to address any additional questions. In the individual meetings with the nurses a quick review on the elements necessary for an accurate BP reading were reviewed, using Appendix B, BP Accuracy and Variability Quick Reference, as a guide. Laminated copies of the quick reference were left at both of the nurses' station for consultation and reinforcement. The infographic in Appendix E, which describe what high BP is and enumerate lifestyle changes to improve HTN, were hung on the wall in every patient room at that time as well.

Data Collection Method & Protected Health Information

The Project Director completed an Electronic Medical Record (EMR) review on all patient visits over two two-week periods, pre- and post-intervention. The only data collected was BP measurements and the patients' status of a HTN diagnosis or treatment. For all patients seen during those two-week periods, their BPs and their HTN diagnosis status were recorded in an Excel software program on a secure laptop computer. The data obtained was organized into one of four categories: (1) Those with a normal BP and no diagnosis of HTN; (2) Those with a diagnosis of HTN receiving treatment; (3) Those with a high BP and a diagnosis of HTN; and (4) Those with a high BP but no diagnosis of HTN. The BPs collected during those two-week periods was then averaged to determine the mean BP of all patients seen during those two periods. The pre- and post-intervention means was then compared to determine if this QI project was effective in improving BPs of patients at this clinic.

The data regarding patients BPs and HTN diagnosis status are located within the Olathe Health Family Medicine clinic's EMR and was gathered at the clinical site and stored electronically on a password protected laptop. The Project Director will be the only one responsible for data collection. The information recorded was de-identified being sure to exclude names, birth dates, account numbers, or any other identifying information. No protected health information (PHI) will be stored.

Timeline

This DNP project was conducted over a three-month period and was reevaluated monthly to ensure the project was being completed as planned. The initial data collection period occurred prior to the intervention period, from May 15th thru May 29th, 2019 (Phase 1). The next data collection period was eight-weeks later to allow adequate time for the educational intervention to be implemented and patients given time to reassess their BP and return to the clinic for treatment if indicated (Phase 2). The final data collection occurred July 29th through August 9th, 2019. The DNP project was actively conducted over the course of three months, with preparation, evaluation, and dissemination work occurring before and after for a total of 30 weeks (Table 1),

Table 1: Timeline for DNP Project

Stage	Activity	Estimated Duration	Start Date	End Date
Project Preparation	▪ Finalize project design & protocol ▪ Hold staff training meetings ▪ Disseminate educational information	2 weeks	5/17/19	5/31/19
Phase I Data Collection	Measure pre-intervention BPs	2 weeks	5/20/19	5/31/19
Implementation	Provide handout to every patient with BP $\geq$ 130/80	8 weeks	6/3/19	7/26/19
Phase II Data Collection	Measure post-intervention BPs	2 weeks	7/29/19	8/9/19

Data Analysis Dissemination	▪ Analyze data results ▪ Complete DNP project paper with evaluation of findings ▪ Share results with clinic staff and public	17 weeks	8/12/19	12/9/19

Ethical Considerations

A Quality Improvement Determination was submitted to the Human Subjects Committee for review at the University of Kansas Medical Center. The Human Subjects Committee ensures that the rights, safety, and welfare of all subjects who are included in the DNP project are maintained. There are no physical, social, or financial risks anticipated for the participants. Patients' participation is voluntary, based on their decision to receive the handout, so signed consent will not be necessary. Patient identifiers will not be used in the data collection or analysis period, and those who chose not to participate will still receive standard clinic care.

Evaluation

Pre- and post-intervention data were compared and evaluated for two specific variables. First, the mean pre- and post-intervention BPs were compared to assess for any improvement in BP measurements after the educational intervention. Secondly, the number of patients sorted into the fourth category of having a hypertensive BP without a diagnosis of HTN was compared to assess for a decrease in the number of undiagnosed hypertensive patients. The pre- and post-intervention means were then compared to determine if this QI project was effective in improving BPs of patients at this clinic.

Results

The total number of eligible patients evaluated in both pre- and post-intervention phases was 635 adults, including 301 in the pre-intervention phase and 334 in the post-intervention

phase. Average BP prior to intervention was 121.1/76.3 mm Hg. The average BP after intervention was 122.3/78.6 mm Hg. The number of undiagnosed HTN patients before intervention was 91 of 301 participants, for a total of 30.2%. The number of undiagnosed hypertensive patients after the intervention was 120 of 334 participants, for a total of 35.9%. This increase in undiagnosed HTN patients is the opposite of the expected outcome. Consultation with the department of biostatistics revealed that not all data groups met the Shapiro-Wilk test for normality. Due to this, the Wilcoxon rank sum test with continuity correction was not determined to be valid either. The systolic BP had no significant difference between pre and post intervention and the diastolic BP had a slight decrease post intervention compared to pre, which is opposite of the expected outcome (B. Liu, personal communication, October 18, 2019).

Limitations

The design of this project does have limitations that affect the reliably of result interpretation. The most significant limitation to this project is the inability to determine if the patients who were included in the pre-intervention phase were included in the post-intervention group evaluation. The patients in the first phase were not required to reschedule an appointment during the second phase comparisons, thus the differences between the two groups is severely limited. Additionally, this DNP project was conducted in one clinic and as such is not statistically generalizable.

Another consideration in the limitations of this project is the extremely variable nature of a BP measurement even when comparing the same patient group. Many factors effect BP measurement, including BP measurement technique. Control of the variable of technique was attempted by completion of education with the nurses regarding proper technique before the project began. The education of nurses regarding BP measurement techniques prior to the start of

the eight-week intervention period may have led to more accurate BPs. However, increased accuracy of BP by nurses is more likely to have led to a decrease in BP measurements as opposed to an increase, which was observed in this project. BP techniques such as allowing time for the patient to rest before obtaining measurement, having their back and feet supported, placing the cuff on an unclothed, supported arm, should provide more accurate BP measurements. There are other variables that could have also influenced BP readings, such as patient stress, pain, and bladder fullness that are known to increase BP and are difficult variables to control.

Lastly, the time period is also a limitation in this project. The intervention was implemented for a total of 8 weeks with 2 weeks before and 2 weeks after being used for pre- and post-intervention data collection periods. A longer project runtime would allow for more data collection points that could increase the likelihood of statistically significant results. Also, only a little more than half of the eligible participants were provided the intervention, suggesting that perhaps the staff did not consistently offer the handout to eligible patients. Although the Project Director had a couple visit sites for check-ins to ensure the project was being conducted properly and to answer any questions from staff, more frequent check-ins might have improved the number of eligible patients given the intervention. This could also be impacted by possible use of float nursing staff as well, who were not trained in the intervention. The Project Director did find that several handouts were provided to patients and they refused them.

Application

Although the analyzed data post-intervention did not demonstrate the intended aims of this DNP project, it provided valuable information, particularly about the prevalence of undiagnosed HTN seen in patients at this clinic. Of all patients assessed during the pre- and post-

intervention phases, an average of 33.3% of the patients had high BP (≥130/80 mm Hg) without a diagnosis of HTN. This rate is much higher than the CDC's estimate that 20% of the population is unaware and untreated for HTN (CDC, 2016). However, this estimate has been cited in the literature, with some studies estimating up to 36% of HTN patients being unaware of their condition (Wall, Hannan, & Wright, 2014).

This DNP project also provides valuable information to begin a standardized follow-up protocol for patients with high BP without a HTN diagnosis. Although more research is needed to determine what educational intervention leads to the greatest impact on HTN diagnosis and treatment, this project contributes to the practice by providing one method of intervention for comparison. In addition, this project increased provider and nurse awareness of the problem of undiagnosed HTN. However, frequent re-education is necessary to reinforce the importance of treating this disease. Education on evidence-based practice for HTN diagnosis and treatment should be provided to the staff every few months.

Dissemination

Dissemination is an important aspect of any scholarly project (Chism, 2016). As discussed, this project provides insight into the necessary components of a protocol for high BP follow-up. It also presents challenges and areas future projects may be able to address with improved, statistically significant outcomes, and will hopefully assist with design of future protocols for high BP or other chronic diseases. Dissemination will occur by sharing the project's results with the clinic's staff at their monthly staff meeting, as well as being presented at a public forum for DNP projects attended by fellow DNP students and faculty.

Conclusion

Since primary care providers will frequently observe undiagnosed HTN, more structured

protocols should be in place to provide more consistent diagnosis and treatment for HTN in order to prevent the long-term consequences (Go et al., 2014). This project was conducted since there was no such protocol to encourage follow-up for patients at high risk of HTN in the Olathe Health family medicine clinics. The intervention implemented consisted of two educational pieces: (1) Education of providers on the high rates of undiagnosed HTN, the guidelines for HTN diagnosis, and the recommendations for follow-up of patients with a high BP reading and (2) an educational handout offered to eligible patients to encourage follow-up for high BP with the goal of improved diagnosis and treatment of HTN. Although the results of this DNP project were not statistically significant, the data indicated a significant proportion of patients seen during the project timeline had undiagnosed HTN (> 33%), suggesting this is a practice problem that requires continued attention and should be the focus of future DNP projects.

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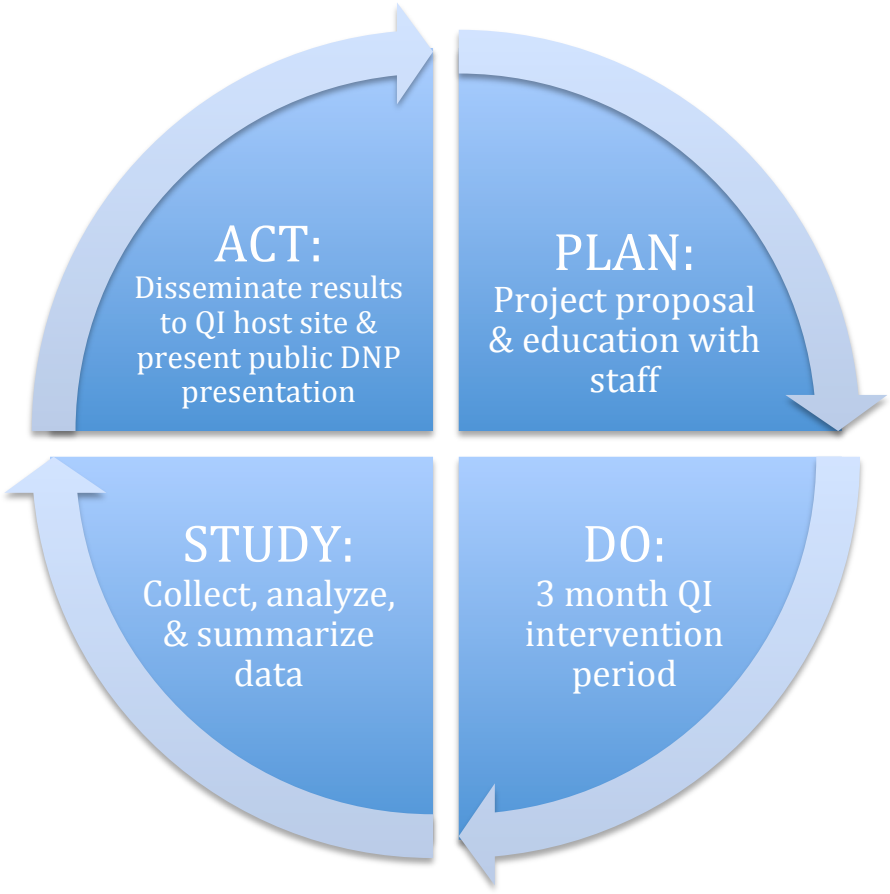
Appendix A

PDSA Cycle



Appendix B

BP Accuracy Quick Reference

Blood Pressure Accuracy and Variability Quick Reference

Essentials for Accurate Blood Pressure Measurement

- Have the patient sit quietly for a few minutes (Ask rooming questions before taking BP).
- Place the cuff on a ***bare arm***.
- Use the ***proper size cuff***; if two cuff sizes fit, use the larger one.
- Place the artery marker over the ***brachial artery***.
- Apply the cuff carefully, allowing room for no more or no less than ***two fingers*** underneath.
- Make sure the patient's ***back is supported and relaxed***.
- Make sure the patient's ***feet are supported and legs uncrossed***.
- Keep the ***upper arm supported, relaxed and at heart level***.
- Ask the patient the keep the ***arm still and not talk*** during the measurement cycle.

Blood Pressure Variability

The following activities affect a blood pressure reading.

Activity	Systolic (mm Hg)
Cuff too small (2,4,6,7,8,10,12,14,16,18,19)	10 to 40 ⇑
Cuff over clothing (10,16,18)	10 to 40 ⇑ or ⇓
Back/feet unsupported (3,18)	5 to 15 ⇑
Legs crossed (1,5,9,16,17,18)	5 to 8 ⇑
Arm extended and unsupported (21)	Diastolic ⇑ 10%
Patient arm tense (21,16)	15 ⇑
Not resting 3 to 5 minutes (2,10,16,18,19,20)	10 to 20 ⇑
Anxiety raises blood pressure/White Coat Hypertension. (18, 21)	As much as 30 ⇑
Patient talking (2,10,11,16,17,18)	10 to 15 ⇑
Labored breathing (1,6,18)	5 to 8 ⇑
Full bladder (13,16,18)	10 to 15 ⇑
Pain (16)	10 to 30 ⇑
Arm below or above heart level (2,10,13,16,17,18)	10 ⇑ or ⇓ For every 1 cm above or below heart, BP varies by 0.8 mm Hg

Nursing Staff BP Education & Auditing Process
CDS Shared Library – Nursing Education – Blood Pressure & Auditing Document

March 2013
HPMG Clinics
Nursing Education

Appendix C

High BP Handout

High Blood Pressure

What is high blood pressure?
Blood pressure (BP) is a measurement of the force of blood pushing against the walls of your blood vessels. The top # is the systolic, bottom # is the diastolic pressure. When BP is ⬆ than normal it is known as hypertension (normal BP is <120/80, BP ≥ 130/80 requires treatment).

Your blood pressure today is _____/_____ ★

Why is that a problem?
The worry with high BP is that it usually has no signs or symptoms, but it can cause many health problems like heart attack, stroke, heart failure, and chronic kidney disease. ♥ Although it is usually asymptomatic, it may cause headaches, chest pain, and swelling in your legs. It must be treated because high BP contributes to nearly 1,000 deaths a day.

What can I do to control my blood pressure?
- Maintain a **healthy weight**: If you are overweight, you can expect to drop your top BP # by 1 point for every 2 lbs. of weight loss.
- **Stop smoking**: If you smoke, quit as soon as possible. Talk to your provider for help, or visit Smokefree.gov or KanQuit.org for help quitting.
- **Healthy diet: Lower sodium** intake to < 2,300 mg (1 teaspoon salt) a day, <1500 mg is best. Follow the **DASH diet** (See reverse)
- Increase **physical activity** to at least 2 hour & 30 min of aerobic activity a week, the more days a week you exercise the better
- **Limit alcohol** to no more than 1 drink a day for women, no more than 2 drinks a day for men. One drink equals a 12 oz. beer, 4 oz. of wine, or 1.5 oz. of liquor. 🍷
- **Take your medicine** – If you're prescribed BP medication, remember to take it every day.

Check your BP regularly ♥
- Check your BP a minimum of twice before the next visit with your provider.
- If you don't have a home BP monitor, visit your local pharmacy. Most CVS, Walgreens, & Wal-Marts have a BP machine near the pharmacy.
- Before taking your BP: Rest for at least 5 min. Sit with arms supported at heart level, feet flat on the floor, & back supported. Do not smoke or have any caffeine for 30 min before.

Follow-up
- Schedule a follow-up appt within 4 weeks (913-356-8300).
- Bring your 2 BP checks in with you to your next clinic visit _____/_____ _____/_____ ★
- If your BPs are < 130/80, you can cancel your appt & continue monitoring at home.
- See Heart.org for more information on your BP and how to live heart healthy ♥

DASH Diet

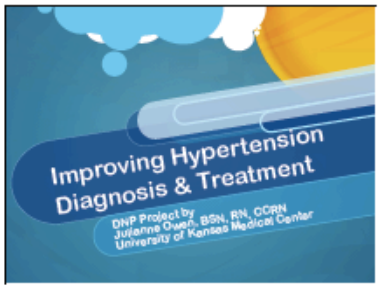
DASH stands for "Dietary Approaches to Stop Hypertension". Following the DASH diet along with ⬇ your sodium intake is an important part of lowering your blood pressure (BP).

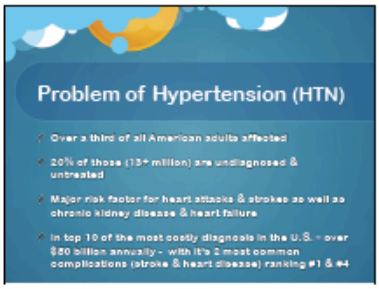
The DASH diet focuses on eating foods in calcium, potassium, and magnesium. These nutrients can ⬇ BP. The foods highest in these nutrients are fruit, vegetables, low-fat dairy products, nuts, seeds, and beans. Taking supplements instead of eating whole foods high in those nutrients does not have the same effect on lowering BP.

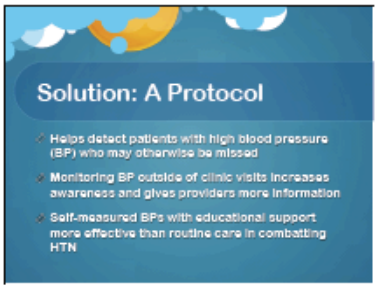
Food group	**Servings per day or week**	**Examples**
Vegetables	4-5 servings per day	1 cup raw leafy greens ½ cup chopped or cooked vegetables
Fruit	4-5 servings a day	1 medium fruit ½ cup fresh or frozen fruit ¼ cup dried fruit
Low-fat dairy products	2-3 servings per day	1 cup skim or 1% milk 1 cup low fat yogurt 1 ½ ounces part-skim cheese
Lean meat, poultry, & fish	6 ounces or less a day	2, 3-oz servings (deck of cards) Fish high in omega-3s: salmon, herring, tuna
Nuts, seeds, & beans	4-5 servings a week	1/3 cup of nuts 2 Tablespoons of seeds ½ cup cooked beans or peas
Fats & oils	2-3 servings a day	1 teaspoon butter or margarine 1 Tablespoon mayonnaise 2 Tablespoons salad dressing
Grains	6-8 servings a day	1 slice whole-wheat bread 1 ounce dry cereal ½ cup cooked cereal, rice, or pasta
Sweets	5 servings or fewer a week	1 Tablespoon sugar, jelly, or jam ½ cup sorbet 1 cup of lemonade

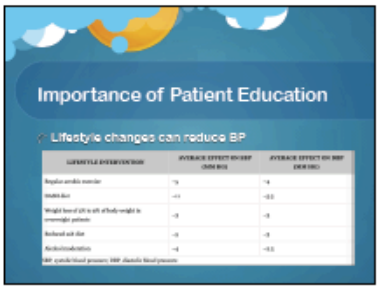
Appendix D

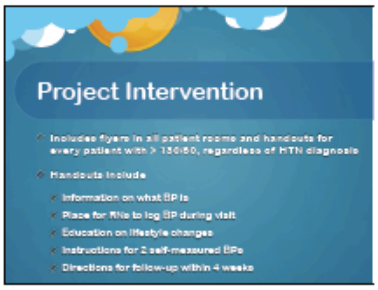
PowerPoint Slides for Educational Intervention for Staff

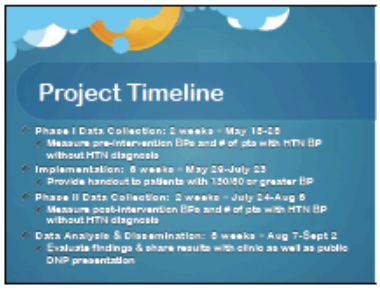


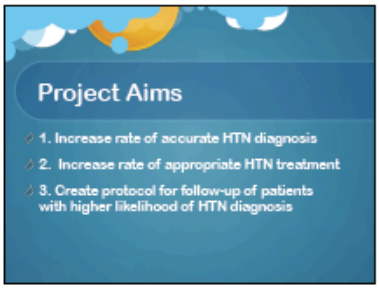


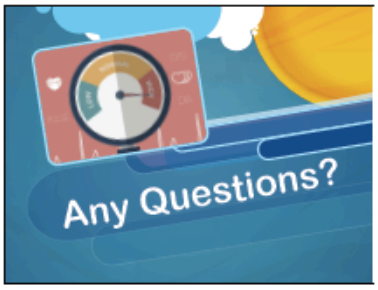






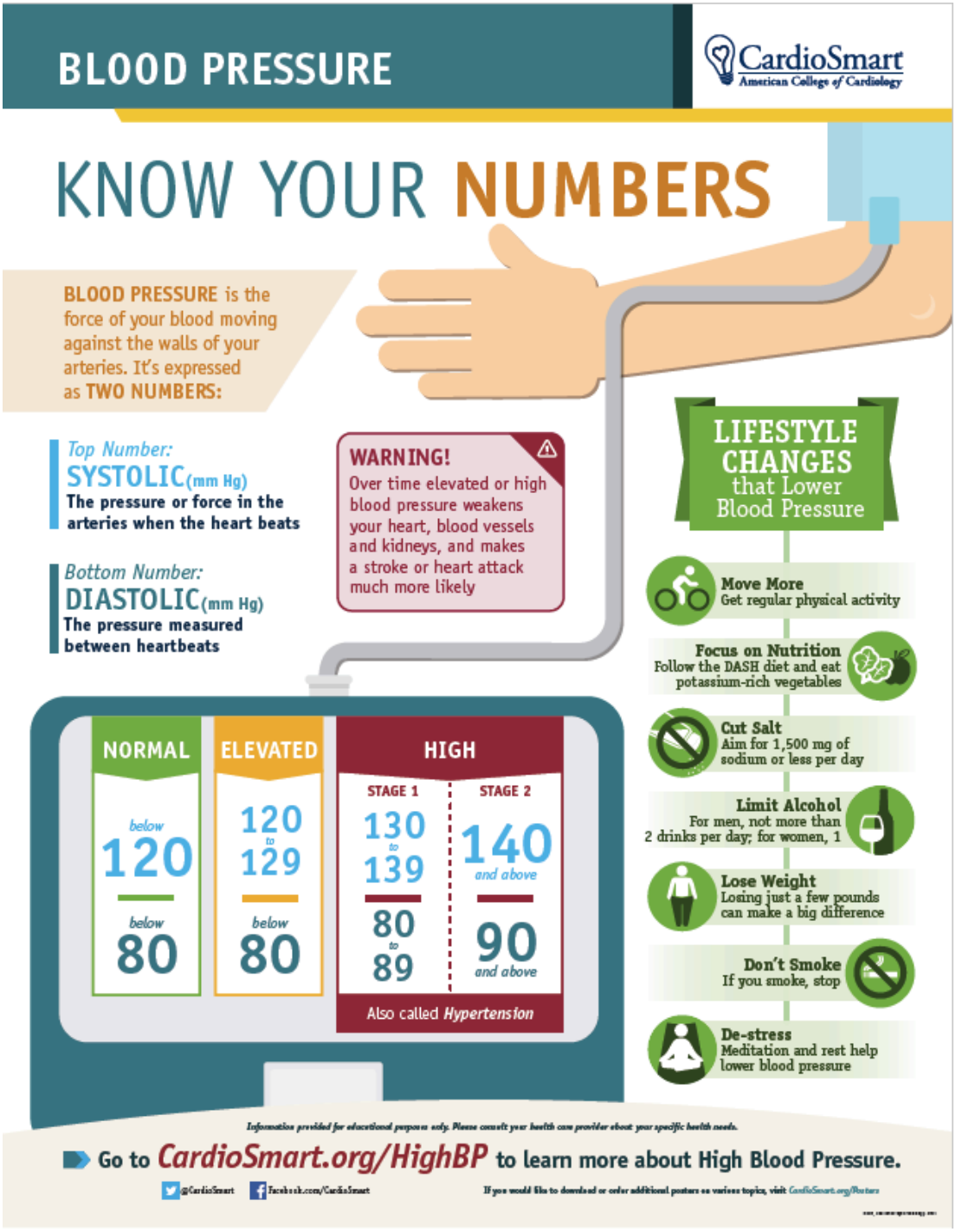






Appendix E

BP Infographic



Note. From "High blood pressure," by J. D. Bisognano, & K. C. Ferdinand, 2017, CardioSmart American College of Cardiology.