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Utilization of Home Blood Pressure Monitoring in Adult Patients with Hypertension

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Abstract

Hypertension is one of the most prevalent conditions in the United States, affecting roughly 45% of adults in the country (Centers for Disease Control and Prevention [CDC], 2020). The CDC (2020) reports that only an estimated 24% of patients have controlled blood pressure, which is defined as blood pressure less than 130/80 mm Hg. In 2017, the American Heart Association (AHA) and American College of Cardiology (ACC) released a comprehensive set of guidelines that aimed to assist providers with hypertension management. The Measure Accurately, Act Rapidly, and Partner with Patients (MAP) protocol was formulated as an evidence-based strategy to improve blood pressure measurement accuracy, minimize time preceding treatment initiation, and involve patients in their blood pressure care (AHA, 2016). Home blood pressure monitoring (HBPM) has been identified as an effective method for assisting both patients and providers in the blood pressure control efforts. This project focused on implementing strategies for increasing the utilization of HBPM in the treatment of adult patients with hypertension at a rural primary care clinic in West Michigan. Within this quality improvement project, medical assistants provided patients with education regarding evidence-based measurement techniques. Providers were responsible for delivering a HBPM log to patients for recording home blood pressures. The DNP student also piloted the use of health coaching visits in patients ≥ 60-years-old. Of the 147 eligible patients, 64.62% received the medical assistant-delivered education and 68% received the HBPM log. Patient blood pressure measurement technique had statistically significant improvements following the health coaching visits. Patients also reported increased likelihood of lifestyle modification after the health coaching. These results suggest a similar process for hypertension management may assist with promoting partnerships with patients and providers.

Keywords: hypertension, blood pressure, MAP protocol, home blood pressure monitoring, health coaching, blood pressure measurement technique

Table of Contents

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According to the American Heart Association (AHA, 2020) nearly half of adults in the United States have hypertension (HTN). According to the Center for Disease Control and Prevention (CDC, 2020), only 24% of patients have controlled blood pressure (BP), which is considered BP less than 130/80 mm Hg. Sustained high BP has consequences that are well documented. In 2017 alone, nearly half a million deaths in the U.S. included HTN as either a primary or contributing cause (CDC, 2020). Of all modifiable risk factors, HTN accounts for more cardiovascular disease (CVD) deaths than any other, and is second only to smoking for any causes of death that are preventable (Carey & Whelton, 2018).

In 2017, the American College of Cardiology (ACC) and AHA, in partnership with numerous other professional societies, collaborated to update guidelines addressing the prevention, detection, evaluation, and management of HTN in adults (Whelton et al., 2018). The purpose of this endeavor was to deliver an exegesis on the current evidence related to BP management, and to facilitate shared decision-making between patients and providers. Most notable in the guidelines was the reconfigured BP classification system. Greatly influencing the updated classification system were results obtained from the Systolic Blood Pressure Intervention Trial (SPRINT), which was a large randomized control trial (RCT) involving 9,361 participants (Wright et al., 2015). The study compared the outcomes of individuals treated to a systolic BP < 120 mm Hg with those treated to < 140 mm Hg. The outcomes of the trial demonstrated lower rates of fatal and non-fatal cardiovascular events and death, and death from any cause in those treated more intensely than the < 140 mm Hg group (Wright et al., 2015). As a result of this evidence, the ACC/AHA guidelines (Whelton et al., 2017) recommended tighter parameters for BP control. The updated classifications include:

- Normal: < 120/80 mm Hg
- Elevated: 120-129/< 80 mm Hg
- Stage I: 130-139/80-89 mm Hg
- Stage II: ≥ 140/90 mm Hg

The implications stemming from this new classification system included a nearly 15% increase in the prevalence of high BP in the United States (CDC, 2020; Muntner et al., 2018). Under the previous of BP classification regime, the prevalence of HTN in the U.S. was 31.9%; under the updated guidelines the rates spiked to 45% of the population (CDC, 2020; Muntner et al., 2018).

In addition to the BP classification changes presented in the ACC/AHA guidelines, the collaborators lowered and simplified BP aims for patients with HTN regardless of accompanying comorbidities, recommended the consideration of underlying cardiovascular disease (CVD) risk when determining treatment, and emphasized the importance of targeting lifestyle behaviors to improve BP control (Whelton et al., 2018). Furthermore, the task force also issued a strong emphasis on promoting accurate BP measurement and utilization of out-of-office BP measurement (Whelton et al., 2018; Jeffrey, 2017).

In alignment with the recommendations provided within the ACC/AHA guidelines (Whelton et al., 2018), the AHA and American Medical Association (AMA) collaborated to launch a BP initiative known as “Target:BP” (AHA, 2016). This national initiative aimed at assisting health care organizations and care teams improve BP control rates through an evidence-based quality improvement (QI) program (AHA, 2016). The Measure Accurately, Act Rapidly, and Partner with Patients (MAP) protocol is an evidence-based program which seeks to assist care providers with addressing common challenges faced in the care of patients with HTN. The

MAP protocol (AHA, 2016) emphasizes the importance of incorporating quality BP measurement techniques into practice to promote swift therapy initiation, and partnering with patients to engage them in lifestyle changes and self-management through the use of home BP monitoring (HBPM). The inclusion of HBPM into practice encourages patients to be active participants in their care. While HBPM is not a new concept in the management of HTN, its inclusion in HTN guidelines is (Jeffrey, 2017). This addition points not only to HBPM's ability to grant providers with valuable data regarding a patient's BP control outside the office setting, but also to its ability to engage patients in their care and promote the incorporation of healthy lifestyle behaviors (Whelton et al., 2018).

Problem Statement

In the face of the increasingly prevalent problem of HTN, and the growing body of knowledge surrounding its harmful implications, it is evident that the methods for addressing the issue need to be multidimensional. The traditional methods of determining HTN treatment solely on office-obtained BP readings, which misrepresent the "true BP" in nearly a third of patients, and issuing treatment through pharmacologic means alone, is antiquated and misaligned with the current literature (Liyanage-Don, Fung, Phillips, & Kronish, 2019). The MAP protocol (AHA, 2016) suggests that action be taken by both the provider and patient to control the problem of HTN. However, in the U.S. only 20-50% of providers utilize HBPM to assist with the management of HTN (Liyanage-Don et al., 2019). In light of the call to broaden the strategies to manage HTN, the following question was raised to be answered through a Doctor of Nursing Practice (DNP) project: Will adaptations to the current Measure Accurately and Partner with Patients quality improvement initiatives, and piloting of health coaching (HC) visits, assist in increasing provider and patient utilization of HBPM in adults with HTN within a primary care

practice? To answer this question, the DNP student conducted a continuation project built upon a previous DNP project implemented by Apriliando (2020). The DNP project presented in this paper included the identification of an opportunity to further improve the partnering with patients aspect of the MAP protocol within a primary care practice. To do so, the DNP student conducted a review of the evidence regarding the impact of HBPM as well as facilitators and barriers to its use. The DNP student implemented strategies to promote utilization of the HBPM by providers and adult patients with HTN. In addition, the student examined strategies to promote proper BP measurement techniques by patients, and piloted health coaching visits for adult patients with HTN ≥ 60 years old. Data gathered in this project included staff compliance with providing measurement technique education and distribution of HBPM logs, and office BP readings. Data gathered related to the HC visits included patient knowledge of BP measurement techniques, device validation, and impact of the BP education provided by the staff and DNP student.

Organizational Assessment

The site of this DNP project was an unaffiliated primary care clinic (PCC) in rural West Michigan. In an effort to better understand the needs of the project site, a theoretical framework was utilized to provide structure to the organizational assessment (OA). The selected model was the Universalia Institutional and Organizational Assessment Model (IOA), which is designed to assist an organization with defining and improving its overall performance through analyzing the organization's environment, motivation, and capacity (Universalia, 2020) [Appendix A]. The IOA model assisted with providing a broad understanding of the operations within the PCC, while also simultaneously elucidating the central focus of this project, which is the HTN management of the practice. Discussions with the organization's provider and staff members, as

well as with the previous DNP student, signaled that further BP management improvements could still be of benefit to the practice and the target of a QI project. As part of the assessment, consideration for the organization's strengths, weaknesses, opportunities, and threats (SWOT) was also performed (Appendix B).

The IOA model is comprised of three central concepts, which include an organization's external environment, motivation, and capacity (Universalia, 2020). These concepts are comprised of factors, which interact to influence an organization's performance (Universalia, 2020). Broadly, performance can be defined by an organization's ability to obtain the mission or goals it seeks to achieve (Luthaus, Adrien, Anderson, Carden, & Montalvan, 2002). Through the lens of the IOA model, the interacting elements making up this PCC were illuminated. Furthermore, the prism through which this OA was conducted helped to identify aspects that could be the target of a QI project. One notable aspect that stood out, and was addressed recently by a previous DNP student, was the PCC's approach to the management of HTN in adult patients. The previous DNP student [Apriliando, 2020] conducted a doctoral project aimed at improving the PCC's methods of both diagnosing and managing adult HTN, through the implementation of aspects of the AHA's MAP protocol (AHA, 2016). Both through the OA and discussions with Apriliando it was determined that this aspect of care could be improved upon, and a possible target for a continuation project.

Initiation of MAP Protocol

Apriliando's (2020) QI project initiated the use of evidence-based BP measurement techniques by the medical assistants (MA) within the organization, and encouraged the utilization of HBPM through the development of a HBPM log that was to be distributed to patients (Apriliando, 2020). The MAs were provided with education regarding quality BP

measurement techniques, that included giving patients ample time to rest and relax in the exam room, using the correct sized cuff and not placing it over clothing, having the patient sit in a chair with their back supported, legs uncrossed and feet flat on the ground, avoiding talking during the measurement, and instructing patients to avoid caffeine and nicotine several hours before the measurement. The HBPM log that was provided to patients was adapted from a log provided by the AHA.

Over a three-month period, Apriliando (2020) compared the BPs of patients with diagnosed HTN taken from their most recent visit prior to the implementation period with those taken after initiation of evidence-based BP techniques used by the MAs. Apriliando (2020) found that MA utilization of the evidence-based measurement techniques produced statistically significant reductions in both systolic and diastolic BP measurements. To determine the effects of the HBPM logs, a comparison was made between office obtained BPs gathered at the patient's initial visit and the follow up visit. Eligibility for this comparison required that patients were given the HBPM log and returned it at their subsequent visit in order to demonstrate home monitoring. In these eligible patients, Apriliando (2020) found statistically significant reductions in office obtained BP at follow up when compared to initial visit office BP, and a mean decrease of about 12 mm Hg for systolic BPs (Apriliando, 2020). There was not a statistically significant decrease in diastolic BP associated with HBPM.

Further analysis regarding HBPM showed that of the 217 patients seen in the clinic for BP management during Apriliando's (2020) project implementation period, 130 patients were given the HBPM log and 87 were not. Apriliando (2020) theorized that these finding may have been influenced by the Hawthorne effect, whereby providers may have been more likely to distribute the HBPM logs when the DNP student was present in the exam room assessing for

provider compliance. Additionally, review of the HBPM logs demonstrated that home measurement frequency ranged from 9.3% to 100% of the days in between the initial visits and follow-up visits, with the mean of 74.1% (Apriliando, 2020). Qualitative data gathered in those receiving the HBPM logs suggested that the twice-a-day, 7-days-a-week measurement requests presented on the logs was too demanding and burdensome, and there were mixed reviews regarding whether the home monitoring had a favorable impact on their lifestyle behaviors (Apriliando, 2020).

Continuation Opportunity

As part of the OA, discussions with the PCCs providers and staff members were conducted regarding the impact of Apriliando's (2020) work. These discussions suggested that despite the favorable results, the utilization and distribution of the HBPM was poorly sustained following the conclusion of Apriliando's (2020) project. In light of this observation, barriers and facilitators to continuing Apriliando's (2020) work were identified to help guide the formation of future innovations (Powell et al., 2015).

Organization barriers. Through observation and interviews with individual staff members, several reasons were identified that contributed to diminished use of the HBPM logs. Staff reported that many patients viewed the recommended frequency of the HBPM log to be burdensome. It was viewed more as chore rather than a strategy for health promotion and health prevention. This perception incited diminished compliance, which in turn led to a reluctance of the providers to emphasize HBPM and distribute the logs. An additional barrier was from the perspective of the providers. Questions frequently arose regarding discrepancies between the HBPM results and office-obtained BP readings. For instance, if a patient's home BP results were primarily normotensive but office BP readings were hypertensive, appropriate therapy may

be difficult to determine. Moreover, not all patients have access to a home BP device, and for those that do, there may be uncertainty regarding whether the device is valid and the patient is using it correctly. Another barrier was that the PCC did not have an existing standard practice procedure for ensuring that the interventions introduced by Apriliando (2020) were sustained. Consequentially, the PCC was at risk for regressing back to the habits formed preceding Apriliando (2020).

Organization facilitators. Factors facilitating the continuation of a HTN management improvement efforts were also identified. As previously mentioned, the PCC has past experience with DNP students and DNP projects. The PCC offers support to student led initiatives and the QI efforts seeking the betterment of the practice, as seen with Apriliando (2020). With the recency of the previous project, the PCC was familiar with the goals and strategies of the MAP protocol. Numerous observations of BP measurement techniques by the staff demonstrated retention of the Measure Accurately intervention previously initiated (Apriliando, 2020). When obtaining office BPs, both the MAs and providers displayed competency and utilization of the evidence-based techniques. Despite the challenges maintaining the use of the HBPM logs, the PCC remained motivated to problem-solve and continue striving to improve their HTN management practice. While the PCC was motivated to rejuvenate the use of HBPM logs as a means for health promotion and health prevention purposes, it had financial incentives as well. Performance figures from Priority Health revealed the practice was at risk for missing out on $3,555 dollars for not achieving BP benchmarks of < 140/90 mm Hg. Of this amount, $2,340 dollars was for Priority Medicare patients alone. At the time the OA was being conducted, performance figures were not available from other insurance companies. However, it was possible that efforts to improve BP control could result in

additional reimbursement. Given the successful results of interventions implemented by Apriliando (2020), the PCC was agreeable to considering methods of building upon the previous strategies. From the viewpoint of the DNP student, the PCC was well-suited to participate in a QI project. With the PCC being unaffiliated with any large health care organizations, efforts by the DNP student might be less encumbered by regulatory constraints that are seen with large health care systems. This notion, along with the smaller scale of the PCC, could enable a more rapid instillation of HTN management interventions. The culture and patient-centered approach to practice was consistent with a QI project aimed at enhancing the partnering with patients to improve BP control.

Stakeholders

Stakeholders are thought of as the individuals who play a role in the implementation and sustainability of the innovations making up a project (Moran, Burson, & Conrad, 2017). Key stakeholders within the PCC include the medical doctor (MD) who is the owner and primary clinician at the practice, a nurse practitioner (NP), two medical assistants (MAs), a care manager registered nurse (RN), and a office manager. More minor stakeholders include the front desk staff. Lastly, in a project targeting the use of HBPM, are the patient's with HTN who occupy a significant stakeholder position.

Strengths-Weaknesses-Opportunities-Threats (SWOT) Analysis

As part of the OA, a SWOT analysis was conducted by the DNP student (Appendix B). Several strengths and opportunities within the PCC were identified. One strength is that the PCC has a clearly defined organizational vision and mission. In order to remain relevant over the course of several decades, the PCC has committed to values it holds. Staff members are committed to the practice and tenures span between 2-30 years. The extensive experience of the

staff members and little turnover of roles has led to a highly productive practice with employees committed to the mission. Additionally, the small scale of the PCC, and lack of affiliation with a large organization, simplifies an attempt to integrate changes to practice. The team members have monthly meetings and daily huddles which enable effective communication between the staff. Lastly, the staff was familiar with the recent BP management project of Apriliando (2020), which would help with revivifying some of the innovations. Significant opportunities included the potential to obtain incentive reimbursement from insurance companies for meeting BP control benchmarks. For instance, to meet the benchmark set at 81% percent of the Priority Medicare patients with controlled BP, the PCC had 52 patients who could be the target of interventions. Additionally, the electronic health record (EHR) had the potential to assist with identifying individuals with poorly controlled BP using a patient registry.

Notable weaknesses and threats were also identified. One such weakness was that the PCC lacked any written policies related to practice delivery. Many of the policies that did exist were related to employee conduct. At the time of the OA, there was no written procedure or policy for staff to follow to assist with the management of HTN. There was also hesitancy from the providers to fully commit to utilizing HBPM for directing HTN management practices. This played a role in the poor sustainability of the previously implemented interventions. Also, the infrequent distribution of HBPM logs and minimal patient education regarding its purpose and use was an identified weakness. This fact threatened the impact of HBPM log interventions as patient's were less likely to comply with the recommendations for home monitoring. Similarly, it was understood that not every patient would have access to a home BP device or may not have the means to purchase one. This threatened to limit the reach of a HBPM initiative. Additionally, the PCC was not utilizing the EHR to its full extent, such as the patient registry

function. Lastly, a significant threat to the student's DNP project was COVID-19. Due to safety concerns, there was a substantial amount of uncertainty relating the number of patients who would be accessible for the project. Patients may have been reluctant to come into the office for fear of contracting COVID-19. Spikes in cases could at any moment halt the DNP student's ability to implement the interventions.

Review of Literature

Method

The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) framework was used to guide this literature review (Appendix C; Moher, Liberati, Tetzlaff, & Altman, 2009). Keywords related to the topic of interest were searched within the electronic databases CINAHL and PubMed. This rapid systematic review examined articles published between the dates of January 1, 2015 and July 30, 2020. The keywords included "home blood pressure monitoring OR self-monitored blood pressure", "primary care office OR primary care clinic", and "blood pressure management". These keywords were each combined with "hypertension OR high blood pressure". Subject headings were utilized to assist with defining the search keywords. Reference lists of articles were also reviewed for the purpose of finding ancestry studies pertinent to the topic of interest.

Inclusion and Exclusion Criteria

Population. Studies included in the review were those with the primary focus on HTN or high BP in adults (> 18 years of age). Excluded studies were those that included children, adolescents, and pregnant women, did not include HTN, and were conducted outside the realm of primary care. Additionally, studies that examined the use of HBPM for the purpose of

managing patients with secondary conditions (i.e. atrial fibrillation, chronic kidney disease [CKD], stroke) were also excluded.

Interventions. Included in this review were studies investigating the use of HBPM alone or with co-interventions. Co-interventions were limited to patient education or life-style counseling and anti-hypertensive medication titration by providers. Studies excluded were those examining the use of HBPM along with antihypertensive titration by patients, pharmacist-led interventions, specific antihypertensive drugs, and exercise programs.

BP outcomes. Studies containing outcomes related to the effects of HBPM on BP vs. usual care; compared office BP monitoring (OBPM) with HBPM and/or ambulatory BP monitoring (AMBP). Measurement outcomes included change in systolic or diastolic BP, rates of uncontrolled BP (≥140/90 mm Hg), usage of antihypertensive agents, and CVD risk reduction.

Miscellaneous. Studies were excluded if full-texts were not available. Periodicals or opinion pieces were also excluded from the literature review, as well as though not written in English. Lastly, studies were excluded that were published more than 5 years ago.

Search Outcomes

Following the insertion of keywords within the electronic databases, selection of subject headings, and parameter setting for the publish date, age, and English language, the search yielded 266 articles, including 151 from CINAHL and 115 from PubMed. Ancestry review from additional sources was also conducted and produced 3 articles. After the removal of duplicates 214 articles remained. Each article was then screened for inclusion and exclusion criteria in accordance with the PRISMA framework (Moher et al., 2009; Appendix A). Review of article titles and abstracts led to the subsequent exclusion of 168 articles. Of the remaining 46 articles, 39 were excluded based on not meeting criteria regarding the population, interventions,

outcomes, or full-text unavailability. The remaining articles included systematic reviews (n=4), randomized controlled trials (RCT [n=3]), and a scoping review, for a total of 8 to be included in this literature review (see Appendix D).

Evidence to be Used for Project

The impact of HBPM (or self-monitoring) on BP control and patient outcomes. Aekplakorn, Suriyawongpaisal, Tansirisithikul, Sakulpipat, and Charoensuk (2016) conducted a 12-month RCT in Thailand examining the effectiveness of self-monitored BP (SMBP) compared to usual care for lowering BP in adults (≥ 35 years of age) with systolic BP ≥ 140 mm Hg or diastolic BP ≥ 90 mm Hg. Patients were randomly allocated to SMBP (n=111) and usual care (n=113) groups. Clinic BPs were measured at 6 months and 12 months for both groups. Aekplakforn et al., (2016) reported both groups had improved clinic BP measurements at 6 months and 12 months. The authors reported that at 12 months, the SBMP group had lower systolic and diastolic BP, 2.5 and 1.2 mm Hg respectively, than the usual care group, but the findings were not deemed statistically significant. For patients ≥ 60 years old, however, Aekplakorn et al. (2016) found that systolic BP was decreased by 8.9 mm Hg (95% CI: -15.1 to 2.7) compared to the usual care group at 12 months. Also, the proportion of participants ≥ 60 years of age with uncontrolled BP at baseline was reduced from 90.0% to 38.2% at month 12 (P= 0.02).

Breaux-Shropshire, Judd, Vucovich, Shropshire and Singh published a systematic review (n= 19 articles) in 2015 that aimed to evaluate the effectiveness of out-of-office BP measurement strategies on BP control and patient outcomes. Both HBPM and 24-hour ambulatory BP monitoring (ABMP) were examined in comparison to office BP monitoring (OBPM). The study found that in individuals ≥ 60 years of age, HBPM was as good or better than ABPM when

predicting mortality in older adults (Breaux-Shropshire et al., 2015). In patients with CKD or end-stage-renal disease, ABPM was superior for predicting mortality. The authors found that only prolonged elevation in BP assessed by HBPM and ABPM was associated with all-cause mortality. In the general population, sustained elevated BP, regardless of measurement type (OBPM, HBPM, ABPM), contributes to cardiovascular risk. However, the correlation between HBPM and ABPM is stronger than that of OBPM and ABPM for determining BP control (Breaux-Shropshire et al., 2015). In this study, HBPM was noted to be simple for patients to perform, reliable, and reproducible. It also had the potential for reducing treatment costs, office visits, and the number of prescribed antihypertensives. Breaux-Shropshire et al. (2015) reported that barriers associated with ABPM included the fact that ABPM is often not directly available to patients and its high cost presents a barrier to both initial and repeated testing. Additionally, individuals may find wearing the device for 24-hours unappealing as it interferes with daily activity and sleep. The cost and inconvenience associated with ABPM, and comparable accuracy of measurements with HBPM, led the authors to recommend that HBPM be utilized more frequently in the diagnosis and management of HTN. Breaux-Shropshire et al. (2015) noted that using HBPM to titrate antihypertensive medication produces the same level of control as using ABPM and thus is a quality tool to consider when managing BP control in patients.

Another systematic review, published by Reboussin et al. (2018), examined the impact of self-measured BP for achieving better BP control in adults compared to usual care methods. This systematic review included RCTs (n=13) that studied the use of self-measured BP alone, without augmentation or additional interventions, and compared BP change against those from usual care. Studies included had to have a minimum of 6 months for the intervention period. Reboussin et al. (2018) found that results in BP change varied among the RCTs, but meta-

analysis revealed that self-measured BP was associated with a 4.9 mm Hg (95%: CI 1.3 to 8.6 mm Hg) greater reduction in office systolic BP at 6 months compared with usual care. At 12 months however, the effect was diminished to 0.1 mm Hg (95% CI: -2.54 to 2.8 mm Hg), which was not statistically significant. However, Reboussin et al. (2018) theorized that the study design, rather than diminished effect of self-measured BP over time, was likely responsible for the modest effect only at 6 months and not at 12 months.

A systematic review and meta-analysis published by Mills et al. (2018) investigated the effectiveness of HBPM, along with additional strategies, for improving BP control in adults with HTN. This systematic review included 100 articles and a collective 121 total comparisons. The trials were organized into 8 groups based on intervention type: health coaching, HBPM, provider training, audit and feedback, electronic decision support systems, multilevel strategies without team-based care, team-based care with physicians titrating medications, and team-based care with non-physician providers titrating medications. The authors sought to compare the implementation strategies against usual care for the reduction of BP in adults with HTN (Mills et al., 2018). The meta-analysis found that strategies such as team-based care with medication titration by non-physician providers (-7.1 mm Hg [95% CI: -8.9, -5.2]), team-based care with medication titration by a physician (-6.2 mm Hg [95% CI: 8.1, -4.2]), and multilevel strategies without team-based care (-5.0 mm Hg [95% CI: -8.0, -4.2]) were most effective for systolic BP reduction. Health coaching (-3.9 mm Hg [95% CI: -5.4, -2.3]) and HBPM (-2.7 mm Hg [95% CI: -3.6, -1.7]) also showed an ability to reduce systolic BP, with similar trends being observed for diastolic BP reduction (Mills et al., 2018). These findings suggest that multiple implementation strategies can be utilized to lower BP in patients with HTN.

In a scoping review published by Liyanage-Don, Fung, Phillips, and Kronish (2019), the authors sought to examine available data regarding the use of HBPM and its relation to clinical practice. This review included 30 recently published articles (within the last 5 years) that were relevant to the implementing of HBPM for the use of managing patients with HTN. The findings of this review suggested that HBPM offers a more accurate reflection on cardiovascular event risk than OBPM. The authors reported that HBPM tends to be more accessible and acceptable to patients, is more reproducible than OBPM and AMBP, and is relatively inexpensive to utilize (Liyanage-Don et al., 2019). There was good correlation between HBPM and ABPM for diagnosing sustained normotension, white-coat HTN, and masked HTN in treated and untreated patients, with the sensitivity and specificity ranging from 60-90%.

Liyanage-Don et al. (2019) noted that HBPM is often underutilized due to barriers from the patient, provider, and healthcare system level. At the patient level, the authors argued that compliance with HBPM is often low, with one study reporting that only 13% of participants enrolled in a HBPM program were sufficiently complaint with BP measurement guidelines to ensure reported measurements were reliable. Concerns regarding patient measurement techniques were also noted, such as appropriate arm and body positioning, frequency of readings, timing of readings, cuff size and placement, voiding prior to measurement, and ensuring proper rest prior to measurement and the avoidance of other activities during measurement. Liyanage-Don et al. (2019) suggested that patients commonly fail to record measurements and inconsistently provide logbooks for provider review. Consequently, the authors noted that providers are often skeptical about patient abilities to correctly carry out HBPM. Additionally, the authors reported that the majority of providers continue to make treatment decisions based on office BP readings even if HBPM readings are available. Provider insecurity for how to properly

interpret HBPM readings and incorporate them into practice was noted as a significant barrier resulting in underutilization of HBPM. Additional barriers noted included concerns regarding time commitment and reimbursement. At the healthcare system level, Liyanage-Don et al. (2019) reported that HBPM device coverage is variable among private insurers. The authors report devices are not covered by Medicare Part B, and only within some supplemental plans under Medicare Part C.

Despite these barriers, Liyanage-Don et al. (2019) reported that formal, in-office patient training of HBPM techniques can help reduce concerns surrounding inaccurate measurements. Encouraging patients to bring their devices to the office for comparison and patient training were suggested. This study found that patients who received formal training were more likely to purchase a HBPM device and adhere to monitoring recommendations. Livanage-Don et al. (2019) noted that validated BP devices can be purchased for as little as $30 and that organizations could consider purchasing devices to be distributed for patient loan. The authors also suggested that providers educate themselves on updated HTN guidelines and best practices in order to increase their comfort with initiating and titrating antihypertensives. The authors conclude that HBPM is a valuable adjunct to OBPM for the purposes of diagnosing HTN and providing guidance with antihypertensive therapy

Discussion

Efficacy of HBPM. The 2017 ACC/AHA guidelines for HTN (Whelton et al., 2018) recommend the use of HBPM in adult patients to assist in making the diagnosis of high BP, as well as for continued monitoring in patients diagnosed in HTN. In cases where there is concern for WCH or masked HTN, the guidelines (Whelton et al., 2018) recommend that either HBPM and ABPM be used to confirm the diagnosis. However, HBPM may be preferred as it is much

more readily available for use and less costly than that of ABPM (Breaux-Shropshire et al., 2015). It is also easily reproducible and can be used to continually gauge to effects of HTN therapy efforts. HBPM correlates closely with AMBP, which has long been considered the gold-standard for out-of-office BP measurement (Liyanage-Don et al., 2019; Breaux-Shropshire et al., 2015). According to Liyanage-Don et al. (2019), office BP readings are elevated in many patients and may lead to the incorrect diagnosis of HTN in an estimated 15-30% of patients. WHC demonstrates no increased risk for cardiovascular events (Cohen & Cohen, 2016). In contrast, masked HTN doubles the risk of cardiovascular events and mortality compared to those with true, normal office BP, and is present in roughly 30% of individuals with normal office BP (Cohen & Cohen, 2016). Correct diagnosis is critical for ensuring that the proper treatment is initiated. As BP is considered to be a modifiable risk factor for CVD, timely and appropriate treatment is of high importance (AHA, 2016). Both HBPM and ABPM offer a more accurate depiction of a patient's true BP measurements than OBPM (Breaux-Shropshire et al., 2015). Slowly, this fact appears to be becoming more widely accepted among providers. Despite the fact that providers most often make treatment decisions based on office BP readings, Liyanage-Don et al. (2019) noted a decline in this practice in recent years. In the U.S., an estimated 20-50% of providers utilize HBPM to guide treatment decisions (Liyanage-Don et al., 2019).

HBPM can help overcome therapeutic inertia and tailor medical management for each patient in order to avoid over- or under- treatment (Jackson, Ayala, Tong, & Wall, 2019). Along with the ability to accurately diagnose the presence of HTN in adults, and having the potential to provide valuable data that can be used for antihypertensive therapy decision-making, there is evidence that HBPM can assist with patient engagement in their BP control. When used alone or in conjunction with interventions, such as individualized health coaching, educational classes, or

telemonitoring support tools, HBPM can raise patient awareness of their BP control and promote active participation in healthy lifestyle behaviors (Jackson et al., 2019; Aekplakorn et al., 2016). Apart from additional interventions, HBPM alone showed the ability to produce a modest reduction in systolic BP (Mills et al., 2018; Roboussin et al., 2018). These effects may be even greater when HBPM is combined with additional, more comprehensive interventions (Cuffee et al., 2019; Reboussin et al., 2018; Tucker et al., 2017). Therefore, providers should strongly consider including HBPM as a part of the care provided to patients diagnosed with HTN.

Barriers to HBPM. The literature provides insight into the many factors influencing the use of HBPM. Liyanage-Don et al. (2019) note that limited understanding regarding the use of HBPM and proper measurement techniques has hindered the use of HBPM by both providers and patients. HBPM places considerable responsibility within the hands of patients, which may be worrisome to some providers. Without education and device validation, providers may be skeptical of the results gathered by patients. Yet methods of ameliorating these concerns require additional time and effort. Moreover, there may be uncertainty about which care provider is best suited to deliver education to patients (Liyanage-Don et a., 2019; Jackson et al., 2019). Without proper education, patients may be less likely to comply with HBPM recommendations. Also, patients may view HBPM as a chore, and may be reluctant to obtain a home device if it means paying for it out of pocket (Liyanage-Don et al., 2019).

Facilitators to HBPM. In light of these concerns there are also many facilitators that assist with overcoming these barriers. With regard to patient education, Liyanage-Don et al. (2019) argues that MAs and RNs are well-suited to educate patients on evidence-based measurement techniques. These staff members can provide this education verbally and through demonstration while obtaining office BP measurements. In addition, the staff members can also

assist with home device validation through comparisons in the office. These strategies can assist with reducing the burden placed on the clinicians and may increase confidence in the home results that are reported. With this confidence, providers can tailor BP treatment in accordance to a patient's home BP measurements. Breaux-Shropshire et al. (2015) found that HBPM can produce the same level of control as ABPM when used to titrate antihypertensive medications in adults. Provider education regarding the most recent ACC/AHA guidelines (Whelton et al., 2018), and the evidence supporting the titration of antihypertensives based on HBPM, is important for promoting proper treatment initiation and subsequent titration. Targeting strategies to increase provider awareness on evidence-based practices may help to increase provider investment in HBPM. The 2017 ACC/AHA guidelines (Whelton et al., 2018) recommend clinical decision-making be based on the average of readings taken on ≥ 2 occasions, while Liyanage-Don et al. (2019) suggests collecting readings across 3-7 days. Provider understanding and acceptance of these recommendations may help to reduce therapeutic inertia and promote better BP control (Jackson et al., 2019).

The concern of patient compliance can be addressed through provider's emphasizing the use of HBPM and providing opportunities for education. This may be due to the ability of HBPM to provide patients with a sense of empowerment and promote engagement in their care. By encouraging patients to obtain their own device, providers can frame HBPM not only as a way for patients to track how their lifestyle may impact their BP, but also as a well to assist their provider in optimizing their care.

Limitations

Limitations to this review were identified. For instance, comparison methods among the different studies varied for determining baseline status. Cuffee et al. (2019) determined baseline

BP through the use of 24-hour ABPM on every participant, while Aekplakorn et al. (2016) did so through clinic readings. Also, the small sample sizes of two RCT could have contributed to the non-statistically significant results of those studies (Aekplakforn et al., 2016; Cuffee et al., 2019). Cuffee et al. (2019) had a study period of 3-months, which may not have been sufficient time to determine the true impact of the intervention. Similarly, the intervention periods of many of the studies was ≤12 months. Therefore, determining the impact of HBPM on long-term BP control and the occurrence of adverse clinical events was limited.

Phenomenon Conceptual Model

Guiding the innovations of this DNP project was Albert Bandura's (1994) Theory of Self-Efficacy (Appendix E). This theory helped to provide a theoretical foundation on which the interventions were grounded. Bandura (1994) argued that perceived self-efficacy is a person's beliefs about their capabilities to produce designated levels of performance that exercise influence over the events that affect their lives. Possessing a strong sense of self-efficacy suggests that an individual looks upon a given situation and believes within themselves that they are capable of influencing it. This theory can be appropriately considered in the care of patients with HTN. Bandura's (1994) theory is divided into main concepts relating to the development of perceived self-efficacy. These concepts include experience, vicarious experience, social persuasion, and physiological feedback.

Experience

Bandura (1994) argues that the most effective way of creating a strong sense of self-efficacy is through mastery experiences. In other words, past success with conducting certain tasks or achieving goals can help to build a robust belief in one's ability to have future success. As it relates to HBPM, patients have the opportunity to track and witness potential improvements

in their BP. For those taking steps to monitor their diet, partake in regular exercise, and adhere to taking antihypertensive medications, HBPM can provide tangible evidence of improvements in BP control associated with these behaviors. With recognition of these improvements, an individual perceived self-efficacy can be strengthened and patients can gain a sense of accomplishment (Bandura, 1994). Experiential success helps to form the notion that a patient's actions matter.

Vicarious Experience

Just as experiential success can help embolden an individual's perceived self-efficacy, so can the successes of others. Vicarious experience is the concept that the successes of others in similar situations can raise a person's self-belief that they too can achieve success (Bandura, 1994). In terms of HBPM, patients may hear of friends or family members who are tracking their home BP. As a result, this may initiate the patient to commit to doing so also. Additionally, within a care practice, the understanding that other patients are utilizing the same methods for controlling their BP can facilitate a normalization of the behavior. Through the normalization of behaviors, patients may get the sense that HBPM is not an arduous task, but rather a reasonable and purposeful method of improving their BP control.

Social Persuasion

Social persuasion is the idea that encouragement from others can help bolster a person's belief in their ability to achieve success. Bandura (1994) suggests that people who are persuaded verbally that they possess the capabilities to master given activities are likely more likely to mobilize greater effort and sustain it. With HBPM, encouragement from providers and clinic staff that a patient has what it takes to not only conduct HBPM, but also achieve BP improvements, can help to persuade an individual into acting and committing to the behavior.

Physiological Feedback

The last concept in Bandura's (1994) theory relates to physiological, or objective feedback. Bandura (1994) suggests this plays a vital role in building of one's self-efficacy. He suggests that the reduction of people's stress reactions and the altering of negative emotional proclivities and misinterpretations of their physical state can help with modifying one's self-belief. For many individuals, health care visits are associated with a certain degree of stress and anxiety. Patients sensing this stress may be led to dismiss a high BP reading obtained in the office, asserting that the reading was simply a result of the stress inducing visit. On the other hand, some patients may view some BP lowering behaviors as futile if office BPs are still high, despite adhering to their BP medication regimens, regularly exercising, or limiting their sodium intake. Therefore, HBPM offers the opportunity for patients to record their BP in an environment of lower stress. This can perhaps provide the realization that a patient's BP is not as well controlled as they perceived, which may then motivate them to address the issue. In addition, HBPM can provide confirmation that an individual's lifestyle habits are in fact producing improved BP results, and thus should be continued. The objective feedback gathered through HBPM can elucidate information that may otherwise not be gained until a return to the office.

Project Plan

Purpose of Project and Objectives

The purpose of this QI project was to enhance the utilization of HBPM within a PCC in order to promote both provider and patient buy-in. In doing so, this project aimed to facilitate improved BP control among adults, and lead to greater reimbursement by insurance companies. This project also sought to promote the use of evidence-based measurement techniques,

providing education to ensure accurate, reliable home BP results. Lastly, this project piloted the use of HC visits in patients with HTN ≥ 60-years-old in order to provide patient tailored strategies for reducing BP.

Evidence-based Initiative Design

The framework chosen to assist in the execution of this project was the Plan-Do-Study-Act (PDSA) cycle (Agency for Healthcare Research and Quality, 2018; Appendix F). As a continuation of the work started by Apriliando (2020), the efforts of this project were considered to be the subsequent steps in the PDSA cycle. Prior to the initiation of the QI project, the DNP student submitted an Institutional Review Board (IRB) application to Grand Valley State University's (GVSU) Human Research Review Committee. The project received approval as a QI project that did not involve human subject research. Following IRB approval for the QI project, the student was granted a letter of approval by the physician owner to conduct the QI project at the PCC.

Setting and Participants

The setting of this project was a PCC in rural West Michigan. Stakeholders included a multidisciplinary team which included a physician owner, MAs, a care manager RN, an NP, and an office manager, and adult patients with diagnosed HTN. Additional members in the project included two front desk staff who assisted in scheduling and distributing surveys. Inclusion criteria included individuals over the age of eighteen with the diagnosis of HTN. All patients scheduled for a HTN-related visit or annual visit meeting this criteria between January 12 and March 31, 2021 were included in the MA measurement education and HBPM log distribution aspects of the project. Inclusion criteria for the HC visits with the DNP student included individuals ≥ 60-years-old with the diagnosis of HTN. The HC group also had to have a

scheduled HTN-related visit or annual visit between January 12 - March 31, 2021, and were agreeable to meet with the DNP student for a 15-30-minute HC session. Individuals excluded from the project included those under the age of eighteen and persons physically, cognitively, or financially unable to gather home BP readings.

Model Guiding Implementation: PDSA

This QI project was structured as a subsequent PDSA cycle building off the work conducted by Apriliando (2020). The interventions within this project sought to improve utilization of HBPM by providers and patients, and pilot the use of HC visits in adults over the age of 60-years-old.

Plan

The proposed QI project was formulated to strengthen the partnership between adult patients and the PCC for improving the management of HTN care. Methods of doing so were derived from evidence gathered through the review of current available literature. Synthesis of the evidence and a plan for implementation was presented to the clinic staff prior to the implementation period start date. The DNP student conducted one group briefing for the primary stakeholders, and a separate briefing for a staff member who was not present for the group session. The DNP student also provided a written procedural outline that aligned with the practice's workflow, and could be available for reference. The outline was to be placed in a high-traffic location of the practice to allow for easy visualization and accessibility. The procedural outline included: the MAs' process for assessing if the patient was currently measuring their home BP and providing evidence-based measurement technique education to individuals with a positive response; placing the folder containing the HBPM logs on the computer desk for provider awareness when addressing the patient's HTN during visit; and

HBPM distribution responsibilities of the provider as part of conducting a plan of care. The DNP student identified eligible patients by conducting chart reviews of patients scheduled for HTN-related visits and annual visits between the period of January 12 and March 31, 2021.

Do

MA education. Following receiving approval from the IRB and the PCC to proceed with the QI project, the "Do" portion, or implementation phase was initiated. Patient eligibility for the project's interventions was denoted as "HTN*", which was placed in the notes section of the EHR by the DNP student. This signaling was designed to trigger both MA and provider awareness to provide the interventions of the project. Upon arrival to the clinic, all eligible patients were roomed and prepared for the visit in a manner similar to the standard methods of the practice. During this process, the MAs inquired whether the patient was monitoring their blood pressure at home. Individuals that reported home monitoring were provided with evidence-based measurement technique education. The MAs provided this education through a verbal description of the techniques with an accompanying demonstration while obtaining the office BP. The techniques included the following: allowing ample time for rest prior to the measurement, correct cuff size and not placing the cuff over clothing, resting the arm in a relaxed position at heart level, being seated in a chair with the back supported with the legs uncrossed and firmly on the floor, avoiding talking during the measurement, and avoiding caffeine and nicotine 30 minutes prior to measuring (Kallioinen et al., 2017). Documentation of smoking status and the patient's most recent use was noted in the chart for provider awareness. These evidence-based techniques reflected those also provided on the HBPM log (Appendix G). The MAs documented the whether or not the patient was measuring their home BP and whether the education was provided in the EHR in the current visit note.

HBMP log distribution. For every patient in which HTN was addressed during the visit, the MAs placed the HBPM log folder on the computer desk. Each exam room had a designated folder containing the HBPM logs. The act of displaying the HBPM log folder on the computer desk provided recognition to the provider to pursue a conversation regarding HBPM and to distribute the logs. The HBPM logs were a modified "My Blood Pressure Log" (Appendix G) based on recommendations from the AHA (2016). While forming a plan of care, the provider would educate the patient on the value of HBPM and recommend that it be utilized. Patients were then instructed to return their HBPM logs at their subsequent visit for review. Review of the home BP results could then be utilized by the provider to make treatment decisions in future visits. For example, if a patient's home BPs readings were consistently elevated, the provider could consider initiating or titrating antihypertensive medications in order to improve BP control.

HC visits. For patients 60 years of age and older with the diagnosis of HTN, the provider offered patients the opportunity to participate in a 15-30-minute HC session with the DNP student as a means of improving BP control. Patients were informed that the HC visits would consist of home BP device validation, evaluation of BP measurement techniques, and individualized education regarding lifestyle modifications for improving BP control. The HC sessions would be scheduled to take place in between the patient's initial visit and their subsequent follow up visit with the provider. This timeline was crafted in order to provide the clinician with an elevated level of confidence with the results provided on the HBPM log. With the home device being validated and the patient's measurement techniques being evaluated and corrected if necessary, the provider could be reassured that the home readings accurately reflected the patient's true BP. For patients electing to pursue the HC visits, the DNP student provided the front desk staff with a number of dates the student would be present at the clinic,

from which patients could schedule a visit. While scheduling the visit, the front desk staff asked the patients to bring their home BP device and HBPM log with them to the visit. The front desk staff also issued these reminders via phone call when confirming the visit a few days before the scheduled appointment.

As part of the HC visits, the DNP student developed a tool for evaluating BP measurement technique and for BP device validation (Appendix H). BP measurement technique was evaluated through the use of the checklist adapted from Kallioinen et al. (2017), and included pre- and post-education demonstrations. The device validation tool was adapted from strategies formulated by the AHA (2018) which required a comparison of the mean BP measurements obtained through both the patient's home device and those obtained using a manual sphygmomanometer. Home devices producing comparable measurements were deemed valid for continued home use. Comparison parameters for validation were determined by the recommendations from the AHA (2018). Devices that did not meet validity standards were discouraged for further use. The DNP student also provided patients with education regarding lifestyle behaviors that may be targeted for improving BP control. Patients were provided with a "What can I do to improve my high blood pressure?" handout (Appendix I; AHA, 2019) to help facilitate discussion and goal setting. At the conclusion of the visit, the DNP student composed a summary of the HC visit in the EHR to allow for provider review.

To evaluate patient satisfaction and the impact of the HC visits, the DNP student created an anonymous survey (Appendix J). The survey was distributed to HC visit participants upon their arrival for their follow-up visit with the provider. Patients were instructed to answer the questions honestly and to not record their name or include any identifiable information on the paper. While checking out of the office at the conclusion of the visit, the participants would

return the survey to the front desk staff to be placed in a designated folder for later review by the DNP student.

During the implementation phase of the project, the DNP student conducted chart reviews and observations to determine staff compliance. Compliance was determined through the delivery and documentation of measurement technique education by the MAs, and distribution of the HBPM by the providers.

Study

Data was collected from January 12, 2021 to March 31, 2021. The expected number of patients that met the inclusion criteria and were seen in the office for an HTN-related visit or annual visit was 120 patients. Data gathered included the patient's initial visit BP, the delivery of the MA education, and the distribution of the HBPM log. BPs were also collected for those attending a follow-up visit related to HTN during the implementation period. The number of readings for patient's returning an HBPM log was also collected. HC visit metrics included pre/post demonstration technique and if the home BP device was valid. Whether or not pharmacologic therapy alterations were made at the initial provider visit was recorded for those HC visit participants. Descriptive statistics were used to analyze patient demographic data, BP improvement, MA education delivery, HBPM log distribution, HBPM log use, and patient satisfaction data. Chi-square analysis was conducted to identify the presence of statistically significant improvements in HBPM log distribution compared to Apriliando (2020). Fisher's exact test was used to analyze improvements in BP at follow-up visit for those participating in the HC visits and those who did not. Lastly, Wilcoxon signed-rank test was used to evaluate pre/post BP demonstration technique. No patient identifiers were collected in this project.

Act

Based on the data gathered, opportunities to continue the efforts were identified. For instance, the care manager RN could be well-positioned to deliver the interventions provided in the HC visits. Adaptations to the initiatives of this PDSA cycle could be made upon the retrieval of additional BP control data in the future.

Implementation Steps and Strategies

The primary objective of this DNP project was to enhance the utilization of HBPM by both providers and patients of a rural PCC in an effort to improve BP control in patients with HTN. The piloting of HC visits in patients ≥ 60-years-old with the diagnosis of HTN was designed with the intent of providing additional efforts to those at greater risk for complications related to HTN, as well as obtain insurance reimbursement money for meeting BP benchmarks. Organization of the project was facilitated through the creation of a timeline (Appendix L). The timeline consisted of a go-live date for the project's interventions, a data collection and analysis period, a presentation of the results to staff members, and the DNP student's project defense. The objectives facilitating the progress of this project were achieved through the following implementation strategies:

1. Educate the clinic staff on the HTN management interventions by January 11, 2021. Powell et al. (2015) recommends conducting meetings with stakeholders to inform them about the clinical innovations. In order to optimize adoption of the proposed interventions, the clinic needed to be informed of the project's intentions, strategies for execution, and potential results.
    a. The DNP student conducted two education sessions to the clinic staff prior to the implementation period. The primary education session took place on January 7, 2021 from noon to 1:00 PM during the staff's break for lunch. Present members of

the first session included the physician, care manager RN, and one MA. During this session, the DNP student presented evidence supporting the proposed interventions.

b. Staff were then provided with a description of the interventions and the planned methods of execution, including the roles of each staff member. The MAs were informed of their role in providing measurement technique education to patients during the visit preparation process. This also included their role in placing the HBPM log folder on the computer desk at the conclusion of the visit. The physician was then asked to distribute the HBPM logs, and recruit patients with HTN ≥ 60 years old for the HC visits. The physician was also asked to provide education regarding the value of HBPM. The DNP student provided a detailed explanation of the HC visits and the potential for care manager RN to assume this responsibility once the project was concluded.

c. The staff was informed of how to identify eligible patients. The DNP student informed the staff that eligibility was denoted through "HTN*" which could be seen on the "sticky note" in the eligible patient's chart. Necessary documentation of MA education delivery and HBMP log distribution were also addressed

d. The DNP student provided handouts of the tools that were created, including the reconfigured HBPM log, the HC visit demonstration and validation tool, the "What can I do to lower my high blood pressure" (AHA, 2018) education handout, and the anonymous patient survey. The HBPM log, education handout, and anonymous survey were intended to be written at a fifth-grade reading ability (Powell et al., 2015)

e. A written description outlining the workflow process for addressing HTN was provided to the staff. The document outlined the roles and responsibilities of each staff member. The procedural outline was intended to be used as a reference tool and was to be placed in an easily accessible location.

f. Questions were encouraged and a summary of the project was conducted at the conclusion of the meeting. The second educational session was provided to a staff member that could not be present for the first session with the larger group of stakeholders. The DNP student conducted this meeting with the MA the following week and in the same manner as the primary session.

g. Additional informal educational sessions were conducted to ensure staff compliance. Staff huddles conducted at the start of each workday provided an opportunity for the DNP student to inquire if there were questions or concerns from staff members. Supplemental education was also determined through staff observation and chart reviews. Concerns identified by the DNP student were identified and inquired about with staff members and re-education was provided if necessary.

h. Prior to beginning the HC visits, the DNP student informed the front desk staff about their role in assisting with the scheduling of these visits. These team members were provided with a list of dates that the DNP student would be available to conduct the HC visits. The intended length of the visits was 15-30 minutes. The front desk staff was also provided with the anonymous patient survey that was to be completed by HC patients after their follow-up visit with the provider. This survey was intended to assist with obtaining and using patient feedback for future improvements (Powell et al., 2015)

2. Initiate the MA education delivery and provider distribution of the HBPM logs to patients scheduled to address HTN management beginning January 12, 2021. To address this objective, the following actions occurred:
    a. Patients with the diagnosis of HTN scheduled for an HTN-related or annual visit where asked if they were monitoring their BP at home by the MA. Patients measuring their BP were provided with a detailed explanation of the evidence-based techniques by the MAs during the appointment. The MAs would demonstrate these techniques while obtaining the patient's office-measured BP. Documentation of technique delivery was recorded within the visit progress note as "BP technique education provided and patient verbalized understanding."
    b. At the conclusion of the visit, the MAs would place the HBPM log folder on the desk of the computer to be visible to the provider during the visit.
    c. The providers and DNP student practicing at the site would provide education regarding the value of HBPM and its role in health promotion and prevention. When creating a plan of care, the providers would distribute the HBPM log and educate on the frequency of use. Patients would be encouraged to reference the measurement technique instructions provided on the log. The clinicians would then request that patients return the log with them at their subsequent visit for review. Follow-up was determined based on patient care needs, although providers were encouraged to try to have patients return for follow up in 1-3 months.
    d. Patients with the diagnosis of HTN not measuring their BP were still given a HBPM log and encouraged to invest in a home BP device by the provider. Provider education regarding the benefits of home BP monitoring was still provided to

patients. Documentation of the log distribution was recorded under the plan of care. Directions to monitor home BPs by recording them on the paper and returning it measurements at the subsequent visit for review was done in the same location.

e. Patients ≥ 60-years-old and monitoring their BP at home were encouraged to participate in an HC visit with the DNP student to validate their home device, evaluate their measurement technique, and discuss lifestyle behaviors to improve BP control. The HC visits would take place in between the patient's initial appointment with the provider and their follow-up visit. Individuals willing to participate in the HC visits were instructed to make their appointment with the front desk staff and to bring their BP device and HBPM log with them to their appointment with the DNP student.

3. Begin health coaching visits for patient's ≥ 60-years-old to evaluate BP technique, validated home BP devices, and provide lifestyle education for lowering BP. Steps taken to achieve this objective included:

   a. Participants in the HC visits were called by the front desk staff a day or two before the scheduled visit to confirm the appointment time process of entering the building upon arrival. The front desk staff provided a reminder for the patient to bring their home BP device and HBPM log with them to the visit.

   b. The DNP student conducted the HC visits in an examination room at the PCC to allow for privacy and limit distractions. The visits were anticipated to take between 15-30 minutes. At the beginning of the HC visits, the DNP student would provide the patient with a brief overview of the appointment, confirm the patient had their BP device and log, and inquire about the patient's perceived degree of BP control. After

2-5 minutes, the DNP student would ask the patient to demonstrate their technique for measuring their BP at home. The patient was encouraged to replicate their home technique as best as possible, which could include moving their chair around or adjusting the table to rest their arm. Prior to delivering any BP technique education, the DNP student assessed the patient's technique using the demonstration and validation tool created by the student (Appendix H). Each of the 6 variables on the checklist could be checked as either "yes" or "no." The patient's performance was graded by the total number of the 6 criteria the patient met. The patient was then provided with education regarding proper BP measuring technique, and any necessary corrections. The process of intervening and providing education is a strategy recommended by Powell et al. (2015). This tactic allowed the DNP student to assist with problem solving and promote adherence with the proper BP techniques. Later in the visit, the patient was then asked to demonstrate their BP technique once again. Using the same criteria as the prior assessment, the patient was given a performance grade out of 6. The post-education demonstration was then analyzed with the patient and further correction was provided as necessary. The post-education demonstration allowed for the patients to "teach back" in a sense and apply the knowledge they had gained.

c. The home BP device validation process included comparing the patient's home BP results with the results obtained with a manual sphygmomanometer. Included in the tool used for the HC visits (Appendix H) was a method of validating home devices recommended by the AHA (2018). The process included recording at least 2 home BP device readings and 1 manual reading. The two home readings were averaged

and if mean was within 5 mm Hg of the manual reading the device was deemed valid. If the average was not within 5 mm Hg, 1 additional home device BP was obtained and 1 manual reading was obtained. If the average of the two manual readings were within 10 mm Hg of the last obtained home reading, the device could be deemed valid. Home devices outside the parameter were deemed invalid and the DNP student discouraged further use for home monitoring.

d. Lifestyle education was provided by the DNP student using the "What can I do to lower my blood pressure?" handout provided by the AHA (2019). The education took place in between the pre- and post-education technique demonstrations by the patient. Education and discussion revolved around the recommendations provided on the handout. The recommendations included maintaining a normal body weight, consuming a diet rich in fruits, vegetables, and reduced-fat dairy products, limiting sodium intake to < 1500mg per day, partaking in 90-150 minutes of moderate intensity exercise per week, and limiting alcohol intake to 2 drinks/day for males and 1 drink/day for females. The DNP student encouraged the patient to identify at least one of the recommendations that they could target prior to the follow-up visit with the provider. The patient was also encouraged to ask any additional questions that had not yet been addressed related to their BP control. Powell et al. (2015) recommends preparing patients to be active in their care, to ask questions, and to inquire about clinical decisions and treatments. The HC visits fulfilled this strategy by providing patients with the opportunity to grow in their knowledge regarding HTN management. At the conclusion of the HC visit, the patient was given the HBPM log to take home to reference. A visit summary, including the patient's BP

technique performance, device validation, and goals for lifestyle behaviors were written and sent to the physician as a telephone encounter within the EHR.

e. Upon the HC visit participant's return to the office for follow-up, the participant completed the anonymous survey to evaluate the impact of the education, and their satisfaction with the BP technique education provided by the MAs (Appendix J). The survey sought to quantify the likelihood of these individuals incorporating the recommendations offered during the visit into daily living (Mularcik, 2010). In addition, patients were asked to rate whether the education they received from the MAs was beneficial on a scale from strongly disagree to strongly agree. This information was intended to reveal the impact of the education delivered by the MAs and DNP student.

4. The DNP student began the data collection, in addition to ascertaining innovation effectiveness and considering modifications to the project (Powell et al., 2015). The process for data collection involved conducting chart reviews, observations, and the health coaching visits.

   a. Metrics of the project were collected beginning January 12, 2021 and concluded on March 31, 2021. Patients over the age of 18 with the diagnosis of HTN were included as eligible targets for the project. Weekly or biweekly chart reviews were performed to gather data from visits occurring during the implementation period. Patients with the diagnosis of HTN who were listed on the schedule for an annual visit or HTN-related visit were identified during the "plan" portion of the project. The date of the visit, the patient's age, and gender were recorded in a spreadsheet as part of the planning. "HTN*" was recorded in the notes section of the chart to make

the staff aware of their eligibility for the project. The frequent chart reviews also included searching for visits that could be included in the project but were not on the schedule during the initial planning. Previous encounters were reviewed on every eligible patient to ensure no duplication.

b. Along with age and gender, patient BP at the initial visit was recorded in the spreadsheet. Additionally, the DNP student reviewed the visit note to determine if BP technique education was conducted and documented, and whether the clinician provided and documented the distribution of the HBPM log.

c. Compliance with the interventions was primarily done through chart reviews. However, the DNP student did conduct periodic observations to ensure staff compliance with the interventions and feasibility with integrating the interventions into the workflow.

d. Device validation was recorded in the spreadsheet along with pre/post demonstration performance for the HC visit participants. Additionally, any antihypertensive medication changes, whether a new drug or dose titration, was noted for the HC patients due to the potential for being a confounding variable.

e. BP measurements for patients returning for their follow-up visit with the provider during the implementation period were recorded for comparison with the initial office-obtained reading. Also, if an HBPM log was returned at the follow up visit, the number of BP readings recorded was calculated and entered into the spreadsheet.

f. At the conclusion of the implementation period, the anonymous surveys from HC participants were collected from the front desk staff. The information was manually inserted into an electronic template by the DNP student.

g. All data was stored in a password protected computer to prevent data tampering. The DNP student did not collect any patient sensitive material for this project.

5. Present the final report of the QI project to the staff within the PCC, educational institution, and community. Required steps to achieve this will include:
    a. The DNP student will defend the DNP project on April 23, 2021 via Zoom (Appendix L)
    b. The DNP student will present the results to the organization's staff by May 1, 2021. Include future recommendations regarding the project and its sustainability (Powell et al., 2015).
    c. The DNP student will upload a copy of the final project defense to Scholarworks by May 15.

Measures

Quantitative measures included office-obtained BP readings from initial visit and follow-up (if available), MA compliance with providing BP technique education, and provider distribution of the HBPM log. Additional quantitative metrics included pre- and post- BP technique demonstration, device validation, frequency of BP readings reported on HBPM log, and the impact of the education initiatives delivered by the MAs and DNP student. No qualitative metrics were collected.

Office-obtained BP. Every eligible patient seen during the implementation had their BP measured by the MAs per the standards of practice of the PCC. BPs were documented within the "Vital Signs" flowsheet of the EHR. The DNP student was able to obtain the BP reading for eligible patients through accessing the "Vital Signs" flowsheet. Patient vital signs, including BP, were also pulled through from the flowsheet into the visit progress note. The DNP student

manually recorded the initial visit BP measurement, along with the associated patient's age and gender. Systolic and diastolic BP were both recorded as whole numbers. Patients returning for a follow-up visit to address HTN care during the implementation period also had their follow-up visit recorded in the spreadsheet. Records of the patient's age, gender, initial visit date and associated BP helped to ensure that the follow-up visit BP corresponded with the correct patient in the spreadsheet. Collecting both the initial visit BP and follow-up visit BP allowed for determining if improvements were made. Improvements in office-obtained BP were measured as "yes" or "no".

Staff compliance. The primary goal of this DNP project was to investigate methods of improving the utilization of HBPM by both patients and providers. Two of the main measures included the delivery of BP technique education by the MAs and distribution of the HBPM log by the providers. Compliance data for these interventions was obtained through chart reviews. The DNP student evaluated compliance by viewing visit progress notes for eligible patients. Compliance with the BP technique education by the MAs was determined through their documentation of "BP technique education provided and patient verbalized understanding" within the visit progress note. Non-compliance of this intervention was determined by the absence of this documentation. Similarly, the providers confirmed the distribution of the HBPM log through documentation under the plan of care section within the progress note. Compliance with HBPM log distribution was determined through the visualization of the instructions to monitor home BPs, record on the paper, and return the log at the subsequent visit for review. The absence of these instructions in the progress note indicated that the log was not distributed. Compliance with each intervention was recorded in an Excel spreadsheet as "yes" or "no" for each eligible patient.

BP technique and device validation. The DNP student collected these metrics during the HC visits. These measures were obtained using the tool created by the student (Appendix H). BP technique demonstration performance was conducted by each HC visit participant. Patient performance was observed prior to and after BP technique education was delivered by the DNP student during the HC visit. Performance was measured through observation of the 6 technique behaviors associated with proper technique. Each of the 6 behaviors were recorded as either "yes" or "no" for being met. The maximum score was 6 out of 6 if all the behaviors were conducted; the minimum score was 0 out of 6 if no behaviors were conducted. The pre- and post- demonstration scores were recorded in the spreadsheet for the associated patient.

Home BP devices were deemed valid or invalid using the device validation procedure from the AHA (2018). The DNP student recorded "yes" or "no" for device validation for the associated patient.

Number of home measurements recorded on HBPM log. The DNP student documented the number of home BP readings recorded on the HBPM log for patients who returned the log at follow-up. Collected HBPM logs were scanned and uploaded into the "Patient documents" section of the EHR. While gathering follow-up visit BP data, the DNP student accessed the document and counted the number of home BP readings recorded on the log. Each reading recorded on the log was given a numerical value of 1, with the total being documented in the spreadsheet.

Impact of MA and DNP student education. The impact of the MA and DNP student education was measured using an anonymous survey created by the DNP student (Appendix J). HC visit patients were asked the quantify the "chance" of them partaking in the lifestyle behaviors recommended by the AHA (2019). The "chance" was measured using categorical

data. Answers were reported as no chance, some chance, neutral, a good chance, and a complete chance. These categories were represented by 5 percentages which were equated with the categorical answers. The frequency of each reported percentage for a given category was totaled for the each of the 5 recommendations provided by the AHA (2019).

In addition, the HC visit participants were asked to evaluate the helpfulness of the MA education for improving their BP measurement technique. Patients rated the helpfulness using categories that included strongly disagree, disagree, neutral, agree, and strongly agree. The frequency of responses was collected and totaled.

Data Collection

The DNP student collected data on a weekly or biweekly bases. Chart reviews were done regularly to gather data related to MA education delivery, HBPM log distribution, office-obtained BP readings, and HBPM log measurement counts. Pre- and post- BP technique demonstration scores and device validation metrics were collected during the HC visits. Data gathered from the anonymous surveys were collected at the end of the implementation period.

Data Management and Analysis

Sensitive and secure patient data was obtained through permitted access to the organization's EHR by the physician/owner. Only data relevant to the project was accessed by the DNP student. Manual logging of the approved data was conducted by the DNP student alone. No identifiable patient material was collected throughout the entirety of this project. The data spreadsheet was stored on a private, password protected computer. The spreadsheet was shared with a statistician for assistance with the statistical analysis portion of the project using Statistical Analysis Software (SAS).

Analysis of the data included in this QI project was represented by either percentages or frequency counts, and illustrated through bar graphs. Descriptive statistics were utilized for demographic data, and MA and provider compliance with the BP technique and HBPM log distribution, respectively. Office-obtained BP improvement, number of home BP readings, and patient reported impact the education endeavors were also determined through descriptive statistics. To determine the presence of a statistically significant improvement in the frequency of HBPM log distribution between the previous student's (Apriliando, 2020) project and the current project, a Chi-square test was conducted. For all patients returning for an HTN-related or annual visit, where a follow-up BP was obtained, Fisher's exact test allowed for comparison between those who received the HC visit and those solely receiving the MA education and HBMP log. Lastly, a Wilcoxon signed-rank test was used to evaluate whether significant improvements were made comparing the pre-education demonstration and post-education demonstration.

Ethics and Protection of Human Subject

Ethical considerations were deliberated prior to implementing this QI project. The DNP student submitted an application to GVSU's Human Research Review IRB for project approval. No formal IRB existed at the project site, so approval for the project was sought from the DNP student's institution. Following approval from IRB, approval was also granted by the clinic to proceed with the project at the PCC.

This QI project targeted possible avenues to improve the HTN management of the consenting organization. No identifiable patient material was collected or utilized within this project. This includes information such date of birth, medical reconciliation number, address, telephone number, social security number, insurance information, driver's license, or the like.

The student's actions and intentions were aligned with the Health Insurance Portability and Accountability Act throughout the project's entirety. The DNP student and members of the student's project advisory team had completed the Collaborative Institute Training Initiative's (CITI) human subject training prior to the formation of the project. No identifiable physical, social, emotional, economic, or legal threats to patients were within the scope of this QI project. The data collected within this project was only accessible while the student was within the confines of the PCC.

Resource and Budget

As part of this QI project, the DNP student considered the financial implications of the project (Appendix K). Projection of the requirements for the project included the amount of staff time and necessary materials for the interventions. The human resources required for this project centered primarily around the MAs and physician. These team members were necessary for conducting the BP technique education and distribution of the HBPM logs. Material resources needed included copies of the HBPM log, the "What can I do to lower my high blood pressure?" (AHA, 2019) handout, HC visit tool, and anonymous survey. The DNP student obtained approval from the physician/owner to make copies of the materials. A necessary resource in this project was a BP device. The PCC was already in possession of a BP device prior to the project; therefore, this was not included in the budget. Staff time consumed by the project was also considered. The monetary cost of this time was analyzed based on the total loss of productivity (in hours) consumed during the staff education sessions prior to the implementation period. The EHR was a technological resource necessary for the DNP student to conduct the chart reviews.

Results

Demographic Data

Over the course of the implementation period, a total of 147 (N) adults with HTN ≥ 18 years of age were seen in the office for an HTN-related or annual visit from January 12, 2021 to March 31, 2021. The range of patient ages spanned from 27 to 95-years. The mean of the participants was 69.2 years, with the median age being 70-years-old. Gender representation of the population consisted of 58 females (39.5%) and 89 males (60.5%) (see Appendix M for patient demographic details). Of the 147, only 15 patients returned for a follow-up visit related to HTN. Of the 15 patients returning for an HTN-related follow-up visit, 8 patients returned their HBPM log for review and upload to the EHR. There were 12 participants in the HC visits provided for patients with HTN ≥ 60 years of age. Ages of HC visit participants ranged from 65 to 90-years-old, with the mean age being 74.8 years. Of the 12 participants, 6 were females and 6 were males.

Office-obtained BP and follow-up BP improvement.

For the 147 eligible patients included in the study, each patient had their office-BP obtained during the initial visit. Mean systolic and diastolic BP for the initial visits were 131.33 ± 14.78 mm Hg and 74.36 ± 10.94, respectively (Appendix N). Of the 15 patients who returned for an HTN-related follow-up, 7 patients demonstrated a reduction in their office-obtained BP, and 8 did not.

Independent analysis of the follow-up BP data examined the impact of the HC coaching visits against the MA education and HBPM log interventions alone. The presence of correlation for BP reduction was assessed in those individuals participating in the HC visits and those not. The number of HC visit participants who returned for follow-up during the implementation

period was 7. Of the 7 HC visit participants, follow-up measurements demonstrated BP reductions in 3 individuals and no reduction in 4. Analysis of the remaining 8 patients who returned for follow up, but did not participate in the HC visits, demonstrated BP reductions in 4 patients and no reductions in 4. Fisher's Exact test was used to assess the difference in BP outcome for those receiving the HC visit education and those that did not. The analysis revealed no significant difference on BP outcomes for those receiving the HC visit education compared to the MA education and HBPM log distribution interventions alone, p=1.00 (see Appendix O).

Additionally, chart reviews on those conducted on 12 visit participants revealed antihypertensive medication initiation, additions, or dose titration occurred in only 3 participants. Among these 3 participants, 2 returned for a follow-visit, with reductions in BP being observed in both.

MA Education Delivery

Documented delivery of the BP measurement techniques by the MAs was reported in 95 of the 147 patients. 52 patients did not receive the evidence-based techniques by the MAs. The percentage of total patients receiving the education was 64.62%. Among the 12 participants in the HC visits, 2 were identified as having not received the MA-delivered BP technique education.

HBPM Log Distribution

Of the 147 total patients, documented distribution of the HBMP log and instructions for use were reported in 100 patients, and 47 patients did not receive the HBPM log. Collectively, 68% of the total eligible patients received the HBPM log. Of those receiving the HBPM log, the average systolic BP was 134.47 ± 15.56 mm Hg, and the average diastolic BP was 75.28 ± 11.12 mm Hg. Patients not receiving the HBPM log presented with a systolic and diastolic BP average

of 124.47 ± 10.31 and 72.40 ± 10.39, respectively (see Appendix P for HBPM log distribution data).

Comparison of HBPM log utilization by the provider within this project was evaluated with data reported by Apriliando (2020). The previous DNP student (Apriliando, 2020) reported that 130 of the 217 patients seen in the previous project cycle received the HBPM log, while 87 did not. The percentage of patients receiving the log in the previous project was 60%. Chi-square test revealed that the rates did not differ between the two cycles χ^2 (1, N= 364) = 2.4837, p = 0.1150 (see Appendix Q for Chi-square test data).

Number of Recorded Home Readings on HBPM log

A total of 8 patients from the 15 who returned for an HTN-related visit with the clinicians returned their HBPM log. Of the 8 returnees, the mean number of recorded home readings between the initial visit and follow-up visit was 19.88, with a median of 20.5. Reductions in follow-up office BPs were evident in 4 of the patients who returned the HBPM log, and no improvement in follow-up BPs were shown in the other 4 patients who returned their log.

BP Technique Demonstration at HC visits

A total number of 6 BP measurement technique behaviors were assessed during the HC visits (Appendix H). Analysis of the data from the 12 HC visit participants revealed the median number of evidence-based measurement techniques to be 5.0 in the pre-education demonstration. After receiving technique correction, the post-education demonstrations resulted in a median number of 6.0 for the proper technique behaviors being performed. To test for the significance of this improvement, Wilcoxon signed-rank test was utilized due to necessary assumptions not being met for a parametric test. Analysis demonstrated that the median post-education scores

were statistically significantly higher than the pre-education scores Z=14, p= 0.0156 (see Appendix R for HC demonstration technique data).

Home BP Device Validation

Using the home BP device validation procedure recommended by the AHA (2018; Appendix H), 10 of the 12 HC visit participants had devices that met the necessary criteria for home monitoring. Only two home devices that were compared with the manual sphygmomanometer used during the HC visit did not produce comparable readings. Of the two devices that failed, one was a wrist measured BP device.

Reported Impact of HC Visit Education and MA Technique Education

Analysis of the responses provided on the anonymous survey was conducted through the use of frequency counts for the patient likelihood of behavior modifications (see Appendix S for lifestyle modification data). The chance of patient-reported behavior modifications was totaled for each of BP improvement recommendation provided by the AHA (2019). Of the 7 participants completing the survey, alcohol use in moderation received the greatest number of "complete chance" responses while weight loss reduction received the least, with 4 and 1 respectively. All 7 participants indicated at least a "small chance" or greater likelihood for each of the 5 recommended lifestyle behaviors; there were zero "no chance" responses recorded.

The reported helpfulness of the BP technique education provided by the MAs at the initial visit were reported using frequency counts (see Appendix T for MA technique education helpfulness data). Of the HC visit participants (N=7), 5 patients either agreed or strongly agreed that the BP technique education provided by the MAs was helpful for understanding the evidence-based measurement strategies. The remaining two respondents reported strong

disagreement with the helpfulness of the MA education. Neutral and disagree stances both received zero responses.

Discussion

Incorporation of the MA Technique Education and HBPM Log

This DNP project sought to improve the partnership between providers and adult patients with HTN at a PCC to improve HTN management. The appointment of HBPM by the most recent HTN guidelines (Whelton et al., 2018), as being a beneficial method to improve HTN management strategies, suggests the need for greater collaboration between those issuing the care and the recipients. The DNP student's efforts to translate this notion into practice at the PCC required that patient education be a vital component of the interventions. Two of the education strategies incorporated within this project included the BP technique education provided by the MAs, and distribution of the HBPM logs by the providers.

Obtaining the benefits and promoting sustainability of HBPM utilization required that patients be informed of the proper BP measurement techniques. As evident in the OA and literature review, the MAs were well-positioned to provide the measurement technique education to patients. Patients who reported monitoring their BP at home were provided the technique education. Compliance with the delivery of education by the MAs was conducted through patient chart reviews, which revealed that MAs provided the education to eligible patients 64.62% of the time. Of the 52 patients who did not receive the education, it is possible that a portion of these patients reported they were not measuring the BP at home. These compliance figures may not entirely reflect the MA's failure to provide technique education to those monitoring at home. The outcome data for this measure could be cofounded by the fact that if patients denied monitoring their BPs at home, the MAs did not provide the technique education.

In this sense, it is possible that the MAs were more compliant with the intervention than reflected by the data.

The MAs reported that incorporating the BP technique into their workflow was not burdensome. According to the MAs, integration of the BP technique education fit seamlessly when the MA was obtaining the visit vital signs. A verbal description of the process accompanied by demonstration while gathering the office BP did not consume a considerable amount of time.

Provider distribution of the HBPM log and accompanying education regarding its use showed statistically similar rates as was previously demonstrated by Apriliando (2020). The proportion of patients who received the HBPM log in the current study was 68%, compared to 60% from the previous project (Apriliando, 2020). Despite the relative increase in the percentage of patients who received the HBPM log, statistical analysis determined this difference to be non-significant due to the lower sample size of available patients in the current project compared to the previous project (N=147, N=217, respectively). However, rates of utilization likely did increase from the period of time between the two QI projects. Anecdotal observations and discussions with the staff during the OA conducted by the DNP student suggested a scarcity of HBPM log distribution prior to the current implementation period. Within the current project, analysis of the data suggested that the providers were less likely to recommend HBPM for individuals whose office BP suggested adequate control. The mean systolic BP of patients who did not receive the HBPM at the initial visit was well under the 130 mm Hg mark, which is now considered systolic definition of HTN. Similarly, the group not receiving the HBPM log had a mean diastolic BP well under 80 mm Hg. In contrast, recipients of the HBPM log had a mean systolic BP 134.47 ± 15.56 mm Hg. In review of every patient included in this project who did

not receive a HBPM log, the DNP student found that none of them had an office-obtained BP ≥ 140/90 mm Hg. Collectively, the data metrics suggest that clinical judgement was exercised among the providers when electing to forgo the distribution of the HBPM logs in individuals with seemingly adequate BP control.

Given the fact that the implementation period spanned just under 3 months, it is possible that a longer implementation period would have resulted in greater rates of HBPM log distribution. It is curious whether an equivalent sample size to Apriliando (2020) would have contributed to statistically significant difference in the proportion of patients being encouraged to utilize the HBPM log. It is possible that with a greater sample size, the strategies of having the MAs conduct the BP technique education and making visible the HBPM log folder, would have shown a greater ability to facilitate a conversation about HBPM between the patient's and provider.

Impact of Piloted HC Visits

In addition to the MA education and HBPM log distribution, the piloting of HC visits for patients with HTN ≥ 60-years-old was used as a means to improve BP control. Mill et al. (2018) argue that patient-level strategies for BP control, such as HBPM and health coaching visits, produces statistically significant results for BP reduction. In addition, there were several reasons for targeting this specific population of patients.

First, risk for substantial consequences stemming from sustained HTN, including heart disease, go up with increasing age (CDC, 2019). The increased risk, therefore, requires more targeted strategies to address the problem.

Second, the use of HBPM in patients ≥ 60-years-old has been demonstrated to be as good or superior than ABPM for predicting mortality in older adults, with both being superior to

office-obtained BP (Breaux-Shropshire et al., 2015). Not only does it provide a more accurate depiction of a patient's "true BP," treatment decisions in accordance to HBPM measurements has been demonstrated to help optimize BP control (Breaux-Shropshire et al., 2015).

Lastly, Aekplakorn et al. (2016) found that HBPM increased the adoption of lifestyle behavior modifications in patients ≥ 60-years-old compared to younger individuals. The authors suggest that HBPM may facilitate lifestyle modifications in patients 60 years and older due to the potential increase in availability of time, and motivation to adopt non-pharmacologic BP control efforts (Aekplakorn et al., 2016).

Considering these factors, it seems reasonable to conclude that this population is well-suited to receive the HC visit education, and most likely to benefit from it.

Patient BP technique performance.

Of the 12 participants in the HC visits, the vast majority of patients performed all or nearly all of the BP techniques on the checklist during the pre-education demonstration. The most common errors included participants not sitting with their back supported, not resting the arm in a relaxed position at heart level, and placing the cuff over clothing. It is possible that the commonly observed errors could reflect the need for greater emphasis of these behaviors by the MAs during the initial coaching. It is also possible that participants simply had difficulty trying to replicate their home technique in a different environment than they were accustomed to. One patient also reported having a few cups of coffee within 30 minutes prior to the HC visit, and one patient placed the BP cuff over clothing.

Following the education and the delivery of any necessary corrections by the DNP student, all but two participants met every recommended BP technique behavior. The two participants not meeting every behavior performed 5 out of the 6. This included the participant

who drank coffee prior to the HC visit, and the participant who placed the cuff over clothing. The latter individual reported not having an item of clothing underneath their shirt and could not pull the sleeve high enough to place the cuff directly on the arm. In both individuals not meeting every behavior, the participants were reinforced on the purpose of meeting these behaviors when measuring at home.

The demonstration results gathered during the HC visits indicated that in most cases, the education provided by the MAs enabled patients to have a solid foundation of the proper technique behaviors. The improvements gained from the DNP student's education during the HC visit also produced statistically significant improvements for meeting all of the behaviors. Together, the findings suggest that patient performance with home measurement techniques likely benefitted from both the MA education and DNP student education. This notion suggests that continuing the technique education and assessments in the future may be beneficial for patients. Given the limited number of HC coaching visit participants, it was challenging to deduce whether there were any glaring deficiencies in the education provided by the MAs at the initial visits. Continuation of the HC visits by the care manager RN may help to identify areas of the MA's technique education that needs further improvement.

Validation of home BP devices.

The HBPM device validation procedure recommend by the AHA (2018) helped to identify that of the 12 participants, 10 of the home devices were valid. One of the two devices not producing measurements comparable with the manual device used by the DNP student was a wrist BP measuring device. The AHA (2016) recommends that wrist BP measurement devices only be used to provide BP "estimation." This language suggests that for the purposes of HBPM, as presented in the HTN guidelines (Whelton et al., 2018), upper arm BP measurement

devices are the preferred tool for producing accurate measurements. It is unclear how many patients within the PCC, that are monitoring the BP at home, are using a wrist device. However, with the continuation of the device validation intervention in the future, the prevalence may be elucidated. This could be valuable to determine, and would allow for the opportunity to encourage the patient to obtain an upper arm device. Furthermore, ensuring that devices are valid can aid in bolstering provider confidence with regard to recommending home monitoring. While the sample size was small, the vast majority of the home devices demonstrated the ability to produce accurate BP measurements. These results should be encouraging to the providers and give confidence when deciding treatment regimens and antihypertensive medication titration. With this in mind, a future project could investigate the impact of HBPM on clinician prescribing.

Lifestyle behaviors and patient satisfaction.

Of the 7 HC visit participants who completed the anonymous survey, all of them indicated at least some chance of implementing BP lowering lifestyle behaviors. Since no data was collected prior to the lifestyle education delivered by the DNP student, it is hard to know precisely how much the chances of participants adopting the BP lowering behaviors differed following the education. However, it does appear that the participants would consider all of the BP improving lifestyle recommendations, in varying degrees. Due to not every HC visit participant being able to return for a follow-up visit with the provider while the project was being conducted, the impact of the lifestyle education could not be fully assessed. Should the HC visits be continued and expanded to patients of all ages with the diagnosis of HTN, it would be interesting to compare the likelihood of behavior modifications in individuals above and below 60 years of age. In the group 60-years and older, it may be that the chances of weight loss and

exercise would be less likely, due to potential mobility restrictions. Therefore, increased attention could be given to dietary habits when providing education to these patients.

As for the patient-reported helpfulness of the MA education on home BP measurement techniques, 5 of the 7 respondents agreed or strongly agreed that it was useful. Two respondents strongly disagreed that the technique education provided by the MAs was helpful. Although it is difficult to know for certain due to anonymity, it may be the case that these individuals did not receive the technique education at the initial visit. Two of the 12 HC visit participants did not receive the MA technique education at the initial visit. If these two participants were among the 7 survey respondents, this could explain the strong disagreement responses related to the helpfulness of the MA technique education.

Limitations

There were several limitations to this QI project. These limitations could have impacted the ability to implement the interventions and associated outcomes. Identifying the limitations of this project can aid in improving the generalizability of the innovations. One significant limitation was the demographic diversity of the patients included in this project. The mean age of the eligible patients was 69.2-years and there was a greater number of males than females. In addition, the vast majority of patients were white/non-Hispanic Americans. While this in some ways represents the population of the community being served, it may limit the transferability of the interventions to more diverse practices. Another limitation was that not every patient had access to a home BP device. This could have contributed to some patients not receiving the MA education and HBPM log. Additionally, due to the short data collection period (January 12, 2021 to March 31, 2021), only a fraction of patients were able to return for their follow-up visit with the provider. As a result, rates of utilization and frequency of home monitoring, determined

by data recorded on the HBPM log, was unclear for the majority of patients. Also, the impact of the interventions on BP control was also limited by the small follow-up numbers. Studies that have found favorable results associated with HBPM for reducing BP often spanned 6 – 12 months (Aekplakorn et al., 2016; Breaux-Shropshire et al., 2015; Reboussin et al., 2018).

The COVID-19 pandemic played a significant role in limiting aspects of the project. Both the planning of the project and initiation of the interventions were delayed by challenges presented by COVID-19. Additionally, some patients were reluctant to schedule and attend an office visit. This, perhaps, contributed to the limited number of patients who were willing to attend the HC visit with the DNP student. With the target population of the HC visits being individuals with HTN ≥ 60-years-old, this age group is at an increased risk for serious complications should they contract COVID-19.

The last limitation of the project was the presence of confounding variables affecting the project's results. For instance, the project did not consider medication titration by the providers for the entire group. Consideration was given for the HC visit participants, of which 3 had medication regimen changes. For the rest of the eligible patients this was not examined. Although change in BP from initial visit to follow-up was not a primary outcome, this may have been helpful when assessing for BP reductions in those returning for follow-up. Additionally, other confounding variables that were not considered included patient co-morbidities, pain level, caffeine intake, smoking status, time of day, and exercise. Also, lack of a standardized time between initial visit, HC visit, and follow-up may have impacted the findings of the project.

Stakeholder Support and Sustainability

This QI project set out to incorporate strategies to improve the HTN management of the practice. Aspects of this project were implemented to build upon the foundation constructed by

Apriliando (2020). Certain features of the previous student's (Apriliando, 2020) project were poorly sustained by the PCC. Efforts for sustainability were supported by the physician/owner, as well as other stakeholders. The PCC was motivated for patient outcome purposes, as well as financial incentives associated with improved BP control of patients. As a result, the current project sought to implement strategies to promote sustainability.

The DNP student identified that the PCC did not have a written process for HTN management. To address this, the DNP student composed a procedure outline that was specific to the organization's workflow. This included the responsibilities of both the MAs and providers when caring for patients with HTN. The standard work document was placed in a high traffic location where it could be easily accessible for reference. As a result, the PCC staff will have access to this practice procedure beyond the conclusion of the student's time at the PCC.

The second sustainability effort was through education provided to the clinic staff. Prior to implementation, the DNP student provided a comprehensive overview of the guidelines for HTN (Whelton et al., 2018). This included not only the new BP classification system, but also the guideline's (Whelton et al., 2018) emphasis on HBPM.

Third, the DNP student implemented several strategies to divide the HTN management responsibilities to the staff at the site. This included the MA technique education and HBPM log education and distribution of the providers. Furthermore, the HC visits also provided an opportunity to include the care manager RN in the management process. Previously, the care manager RN had little role in HTN management. With the incorporation of the HC visits however, the care manager has the potential to assist with ensuring proper measurement techniques are being utilized at home, that BP devices are valid using the AHA (2018) procedure, and lifestyle behavior education is delivered.

Implications for Practice and Further Study in the Field

The project conducted by the DNP student has implications for the practice. Unfortunately, due to the challenges of conducting the project in the midst of the COVID-19 pandemic, a complete picture of the impacts stemming from this project could not be obtained. However, the structure provided by this project may allow for further growth and development of the HTN care issued by the practice.

The results gathered from the analysis of the available data showed that the staff maintained compliance with interventions included within this project. Patients also appeared to benefit from the information provided in the HC visits. While the immediate impact on BP control was difficult to determine, this was not unexpected due to limited time of the implementation period. Additional time is needed to properly evaluate the impact of the interventions on BP control, as previous studies have shown may require 6 – 12 months (Aekplakorn et al., 2016; Breaux-Shropshire et al., 2015; Reboussin et al., 2018). A future project aimed at further improvements would do well to extend the project period so to maximize the number of participants and observe follow-up outcomes. Future considerations could also look at patient satisfaction with the HBPM log that was adapted from the previous student's project (Apriliando, 2020).

One benefit of using the PDSA framework to guide implementation of QI initiatives includes the fact that it is structured to promote adaptations (Agency for Healthcare Research and Quality, 2018). For instance, the PCC could look to incorporate younger individuals into the HC visits. Similarly, the care manager RN and office manager inquired the DNP student about possibly holding a group session for HC visit participants of this project. Through the group session, they hoped to gain some insight into the benefits of the BP education and potential areas

for improvement. It was determined that if the group session could be conducted safely, and with proper COVID-19 precautions, this could be of great benefit for the patients and for the staff. Furthermore, it would also allow the practice to collect reimbursement for care manager services that are provided to participating patients. The care manager RN is well-positioned to conduct the HC visits, as she has extensive experience with chronic disease management and lifestyle strategies for improving wellness. Coordination between the providers and care manager RN could allow for the delivery of comprehensive, multi-dimensional care. Ideally, the evidence from the literature review, and initial data from this project, will positively impact the provider's behaviors in terms of accepting HBPM as a valid and valuable tool for the management of HTN. This acceptance is indispensable for the sustainability of the interventions and promotion of improved BP control within the practice.

Another important implication related to the PCC, and which had a role in motivating this project, is the financial incentives. Following the conclusion of the project, it was too early in the fiscal year to determine the PCC's status with meeting insurance BP benchmarks for 2021. As previously mentioned, the PCC was at risk for losing out on several thousands of dollars in reimbursement from insurance companies. While conducting the OA, the DNP student was informed that insurance providers measure a practice's BP performance using the patient's last office-obtained BP for a given year. This presents a problem. If the guidelines (Whelton et al., 2018) recommend providers base treatment decisions off of HBPM, practices run the risk of forfeiting money if office BPs are elevated despite HBPM reflecting adequate control. This reflects a disconnect between the most recent evidence and the methods of determining incentive reimbursement. Ultimately, the initiatives of this QI project may aid the practice through promoting comprehensive efforts to improve BP control.

Conclusion

The aim of this QI project was to implement multi-dimensional strategies to improve the management of HTN in adults at a rural PCC. The strategies targeted improving the partnership between patients and providers through utilization of HBPM. The 2017 ACC/AHA guidelines for HTN (Whelton et al., 2018) emphasize the value of HBPM for the diagnosis and monitoring of HTN in adults. Several studies and reviews indicate that HBPM offers a more accurate depiction of a patient's BP control than office-obtained readings, and is more practicable, affordable, and reproducible than ABPM (Breaux-Shrophshire et al., 2015, Reboussin et al., 2018; Liyanage-Don et al., 2019). HBPM can also be effective for promoting patient empowerment and engagement in their care, while also assisting providers when determining treatment decisions (Liyanage-Don et al., 2019; McManus et al., 2018). Multi-dimensional HTN management, through the use of HBPM and individualized health coaching, can enable collaboration between patients and their providers to better address their HTN needs. This DNP project found that the involvement of MAs for providing proper BP measuring techniques can assist with facilitating accurate home measurements in patients. Through efforts to ensure evidence-based measurement techniques and home device validation, providers can be granted confidence for basing treatment decisions on HBPM results. These pragmatic, evidence-based methods for improving HTN management may be useful for bolstering patient and provider partnerships for the goal of improving BP control.

Dissemination Plan

The DNP student will present the final project defense on April 23, 2021 through the virtual meeting platform Zoom. This event was open to community members including other DNP students, faculty members at the university, family members. The physician/owner at the

project site was also provided with an invitation. The outcome of this QI project was also presented to the staff at the PCC. The staff learned of key results related to the project efforts, as well as limitations and recommendations for going forward. Involvement of multiple team members within the PCC may help to ensure that the strategies included in this project are sustained. The results of this project will also be submitted to ScholarWorks.

Reflection on DNP Essentials

The American Association of Colleges of Nursing ([AACN], 2006) state that the DNP Essentials are the foundational competencies that are at the core of all advanced nursing roles. A total of 8 Essentials make up the outcome competencies, which are deemed essential for all graduates of a DNP program, regardless of specialty or functional focus. Each DNP Essential was enacted during the implementation of this project.

Essential I: Scientific Underpinnings for Practice

Science is a fundamental concept in nursing. The AACN (2006) states that DNP graduates be informed on fields of science that include human biology, genetics, the science of therapeutics, the psychological sciences, as well as the science of complex organizational structures. Central to this DNP project was the drive to incorporate evidence from existing literature into practice. This project involved determining the significance of the issue and translating practice improvement strategies to assist with enhancing, alleviating, and ameliorating the phenomenon, and evaluating outcomes (AACN, 2006). Additionally, nursing theory was applied to help frame the problem and the resolutions. These foundations helped initiate practice change, and thus satisfy this DNP Essential.

Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking

The AACN (2006) calls upon doctoral level nurses to apply knowledge and skills within health organizations and systems for the elimination of health disparities and to promote patient safety and excellence in practice. This project required the DNP student to assess the organization, identify nuances and areas of concern, and facilitate practice change. Through this project the DNP student developed an understanding of practice management, and conceptual and practical strategies for conducting productive, quality care (AACN, 2006). The DNP student developed skills to understand and apply cost effective care strategies to ensure economic viability within the organization.

Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice

DNP graduates must display the ability to translate research into practice and disseminate and integrate new knowledge for the betterment of nursing, and health care as a whole (AACN, 2006). Nursing practice epitomizes the scholarship of application by straddling the ground where the sciences, human caring, and human needs meet and new understandings emerge (AACN, 2006). The DNP student satisfied this Essential though a critical appraisal of the current evidence, development of practice strategies, and dissemination of the results to promote further improvements within the PCC and beyond.

Essential IV: Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care

The AACN (2006) states that DNP graduates separate themselves by displaying abilities to use information systems/technology to support and improve patient care and healthcare systems, and provide leadership within the areas they reside. To meet this Essential, the DNP student learned and utilized the EHR system within the organization for the purposes of data

collection related to BP control and staff compliance. The EHR system was used appropriately and responsibly to extract data and develop understanding related to the project.

Essential V: Health Care Policy for Advocacy in Health Care

Competency for this Essential requires that DNP graduates demonstrate the ability to design, influence, and implement health care policies in order to frame health care financing, practice regulations, access, safety, quality, and efficacy (AACN, 2006). To meet this Essential, the DNP student developed a procedure that was specific for the practice and could be integrated into the workflow. This procedural outline provided a framework for the implementation of evidence-based techniques. The DNP student recognized the need for a standard operating procedure, and developed a process to ensure a delivery of the evidence-based interventions.

Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes

According to the AACN (2006), DNP graduates are team-members with advanced preparation in the interprofessional dimension of health care that enable them to facilitate collaborative team functioning to overcome impediments to interprofessional practice. Graduates are prepared to be effective team leaders that empower other members to achieve a collective goal. This DNP project allowed the student the opportunity to collaborate with a physician, DNP prepared NP, care manager RN, and MAs. The student demonstrated leadership ability by designing care strategies and delegating tasks to help to project succeed. These tasks required the student to develop an understanding of the different team-member roles and strategies to optimize these members performance with the tasks.

Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health

DNP graduates have a foundation in clinical prevention and population health (AACN, 2006). Doctorly-prepared nurses are called upon to strive for implement clinical prevention and health promotion activities for the betterment of the population. Graduates demonstrate this through the analysis of epidemiological, biostatistical, environmental data, as well as data related to individual, aggregate, and population health (AACN, 2006). This project sought to develop, implement, and evaluate interventions to address the health promotion/disease prevention efforts related to HTN within this PCC. In the execution of this project, the DNP student applied skills to assist the PCC with improving their methods of addressing HTN as a means of clinical prevention and health promotion.

Essential VIII: Advanced Nursing Practice

According to the AACN (2006), this Essential specifies the foundational practice competencies that cut across specialties and are seen as requisite for DNP practice. All DNP graduates are expected to demonstrate refined assessment skills and base practice on the application of biophysical, psychosocial, behavioral, sociopolitical, cultural, economic, and nursing science within their arena of practice (AACN, 2006). The DNP student displayed competency in this Essential through the development, implementation, and evaluation of therapeutic interventions. Additionally, the student aimed to develop and sustain therapeutic relationships and partnerships with patients and other professionals to facilitate optimal care delivery and patient outcomes. The strategies in this project were initiated to bolster the partnership between HTN care recipients and providers. Incorporation of the selected evidence-based HTN care strategies was executed to promote collaboration between patients and staff. Education was foundational to this project, as seen through the delivery of MA technique education, HBPM utilization, and lifestyle education provided in the HC visits.

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Appendix A

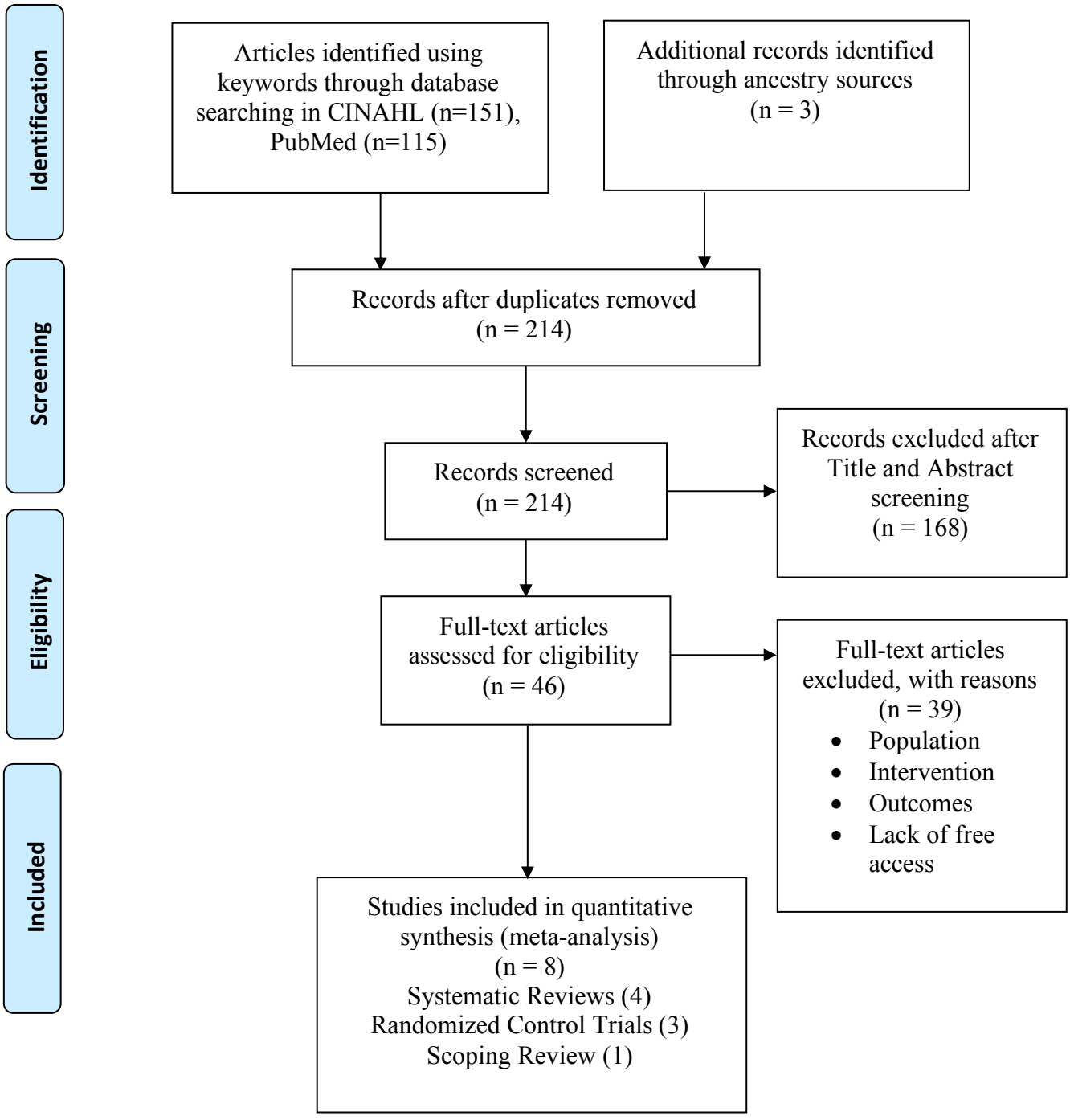
https://www.universalia.com/en/services/institutional-and-organizational-performance-assessment

Appendix B

<table>
<tr><th colspan="2">SWOT Analysis</th></tr>
<tr><th>Strengths</th><th>Weaknesses</th></tr>
<tr><td>Clearly defined organizational vision and mission.
Staff is familiar with recent BP management project, as well as numerous other DNP projects from past students within the organization.
Committed employees who have years of experience within this organization and have clear understanding of its functioning.
Utilization and competency of the staff with conducting evidence-based BP measurement techniques
Small number of staff members enables ability to communicate and evaluate compliance with the project's interventions.
Monthly staff meetings to allow for discussion of policies.</td><td>Lack of staff knowledge on quality measures.
Majority of existing policies are related to employee conduct and not clinical management; policy and procedure changes often reported via word-of-mouth during monthly meetings.
No existing policies related to BP measurement methods of MAs or distribution of HBPM logs.
Lack of provider utilization of organization's HBPM log and patient education regarding its purpose and use.
Limited staff knowledge regarding sophisticated capabilities within the EHR.</td></tr>
<tr><th>Opportunities</th><th>Threats</th></tr>
<tr><td>Incentive/reimbursement from insurance companies for meeting BP control benchmarks
The PCC currently has 52 patients within Priority Health Medicare who have uncontrolled HTN (>139/89).
Full utilization of the tools available in the EHR to help identify patients who need greater attention.
On-site care manager RN to provide more comprehensive patient education and problem-solving.</td><td>A large health care organization has all but monopolized the county and reduced the number of private physicians within the county.
Provider hesitancy with fully committing to utilizing HBPM for treatment decisions
Not all patients have access to a home BP monitor.
Patient non-compliance to HBPM log and measurement strategies.
COVID-19 could limit student's access to project site.</td></tr>
</table>

Appendix C

PRISMA Flow Diagram of Literature Search



Appendix D

Author (Year) Purpose	Design (N)	Inclusion Criteria	Intervention vs Comparison	Results	Conclusion
Aekplakorn et al. (2016). The objective of this study was to examine the effectiveness of self-monitoring blood pressure (SMBP) in a randomized controlled trial with 12 months of follow-up.	RCT N= 224 eligible patients with hypertension were randomly allocated to the SMBP (n=111) and usual care (n=113) groups. Each patient in the SMBP group was provided with a BP monitor for home BP measurement and instructed to measure BP once in the morning after waking up (after urination), before breakfast and medication, after 5 minutes of resting, and another in the evening before bed. Participants in both groups received education from a nurse prior to the intervention period to continue normal medication and lifestyle habits. Changes in BP was compared at 6 and 12 months between the two groups. Subgroup analysis was also	Inclusion criteria: Participants with systolic BP ≥140 mm Hg or diastolic BP ≥ 90 mm Hg based on the average of prior readings within the past 12 months. Exclusion criteria: < 35 years of age, immigrants, or participants who had deficiencies or disorder in communication skills.	SBMP vs usual care	"The systolic BP in both groups decreased at 6 months and slightly further decreased at 12 months. At 12 months, the SMBP group had systolic BP and diastolic BP less than the usual care group by 2.5 mm Hg and 1.2 mm Hg respectively, with no significant difference" (p. 59). There was no difference in subgroups except for ≥ 60 years of age, which was statistically significant and decreased by 8.9 (95% CI: -15.1 to 2.7) compared to the usual care group at 12 months. The proportion of individuals ≥60 years of age in the SMBP with uncontrolled BP at baseline deceased from 90.0% to 38.2% at month 12 (*P*=0.02). "In the SMBP group, 84.1% of the subjects recorded their BP measurements with an average of 123.94 recorded days, and 54.7% of the subjects recorded their daily BP measurements more than 135 days" (p. 60).	"The advantage of SMBP includes the practicality, high reproducibility, and rules out "white coat" HTN. However, use of SMBP needs cooperation of the patient and his/her ability to judge whether the BP was too high. SMBP measurement might be appealing to patients and increase their awareness of high BP and possibly lead them to better control their BP" (p. 61).

	conducted for age (< 60 and ≥ 60 years), sex (male and female), BMI status (<25 and ≥25 kg/m^2, and high systolic BP at baseline (≤ 145 and > 145 mm Hg).				
Breaux-Shropshire et al. (2015). The aim of this study was to compare the clinical effectiveness of HBPM and 24-hour ABPM on BP control and patient outcomes.	Systematic review N= 19 relevant studies. The authors thematically grouped the included studies into categories based on themes including: mortality, target organ damage, and BP control.	Inclusion criteria: Studies containing both HBPM and ABPM in adults > 18 years of age, with outcomes related to BP control, myocardial infarction, diabetes mellitus, CKD, stroke, and all-cause mortality. Exclusion criteria: non-English language, BP monitor validation trials, untreated hypertension, or study size < 50 participants, simple correlation studies.	Clinical effectiveness of HBPM and 24-hour ABPM on control and patient outcomes	In patients with CKD or end-stage-kidney-disease, ABPM was superior predictor of mortality. In individuals ≥ 60 years of age, HBPM was as good or better than ABPM when predicting mortality in older adults. With regard to the general population, additional BP information regardless of measurement type (OBPM, HBPM, ABPM) contributes to cardiovascular event risk. However, the authors found that only BP assessed by HBPM and ABPM is associated with all-cause mortality. "Targeting OBPM for control is limited by the low sensitivity of office BP to detect optimal control defined by either HBPM or ABPM (50% and 53.4%, respectively) [p. 45]. The correlation between HBPM and ABPM is stronger than that of OBPM and ABPM. Using HBPM to titrate antihypertensive medication	The findings of the study support the guideline recommendations to include the use of HBPM in the management of HTN. HBPM encourages patient-centered care in order to improve BP control and patient outcomes.

				produces the same level of control as using ABPM.	
Cuffee et al. (2019). The purpose was to determine the effectiveness of HBPM combined with health education for reducing blood pressure and improving medication adherence in adults with HTN.	RCT with a 2x2 factorial design N= 213 participants. Method: 3-month study with patients randomized into two groups with the intervention group receiving HBPM and a control group (usual care). Every patient underwent 24-hour ABPM prior to the intervention period. The HBPM group were instructed to record morning and evening BPs 3x a week within the HBPM's memory system and on a written document. All of the participants in the study also received BP management education, either in the form of a pamphlet or a computer-based module.	Inclusion criteria: (i) participants must be fluent in English; (ii) 21-80 years-old; (iii) diagnosed with HTN; (iv) prescribed antihypertensive; (v) BP ≥ 140/90 or 130/80 (for individuals with diabetes) Exclusion criteria: (i) pregnant or planning to become pregnant; (ii) diagnosis of major kidney, heart, or liver failure; (iii) diagnosed with cancer recently; (iv) were planning to relocate.	The study participants were randomized into 1 of 4 groups: group 1 received usual care and educational pamphlets; group 2 received usual care and computer-based education modules; group 3 received HBPM and educational pamphlets; group 4 received HBPM and computer-based education modules. The primary outcome of the study was the average change in mean arterial pressure (MAP) readings from the 24-hour ABPM. Secondary outcomes included improved adherence to antihypertensive medication, which was measured using the 4-item Morisky Medication Adherence Scale, and prescription refills of	203 of the 213 participants completed the 3-month study. Both the intervention and control groups had statically significant reductions in ABPM measurements from screening to follow-up. However, there was not a statistically significant difference between groups when comparing the mean changes of ABPM variables. The average reduction in 24-hour MAP between screening and follow-up was -5.1 mm Hg for the intervention group and -4.3 for the control group (P= 0.561). The researchers did not detect a statistically significant difference in medication adherence in the comparison of the HBPM group and the usual care group.	HBPM and educational session did not result in a statistically significant reduction in BP or improve medication adherence. The authors note that coupling HBPM with a more robust intervention for promoting behavioral change could produce a greater reduction in BP in future studies.

			antihypertensive using purchase receipts.		
Liyanage-Don et al. (2019). "The purpose of the article was to review data supporting the use of HBPM and offer practical guidance to providers wishing to incorporate HBPM in their practice" (p. 1).	Scoping review N=30 articles published within the last 5 years relevant to the implementing of HBPM. Included articles were classified as (1) identifying patient, clinician, or healthcare system barriers to HBPM implementation; (2) examined effects of HBPM on clinical outcomes; (3) described guidelines or consensus statements regarding optimal HBPM protocol; (4) evaluated strategies for successful HBPM implementation	Inclusion criteria: articles published within the last 5 years, full text review. Exclusion criteria: articles not relevant to HBPM or were not viewed as sufficiently high impact to be included.	Comparison between HBPM and ABPM	"HBPM tends to be more accessible and acceptable to patients, relatively inexpensive to implement, and potentially more reproducible than either OBPM or ABPM" (p. 13). "There is strong evidence to support that HBPM can lead to clinically significant reductions in BP among hypertensive patients" (p. 14). HBPM is an acceptable alternative for when ABPM cannot be performed. "Multiple studies have demonstrated good correlation between HBPM and ABPM for accurately diagnosing sustained normotension, white coat hypertension, and masked hypertension in both treated and untreated patients, with sensitivity and specificity ranging from 60 to 90%" (p. 14). HBPM more accurately reflects the risk of cardiovascular events than OBPM. However, HBPM use remains low due to barriers from the patient, clinician, and healthcare system level.	HBPM is a valuable adjunct to OBPM for the diagnosis of HTN and guidance with antihypertensive therapy. Utilizing MAs and RNs to provide education can help reduce burden of work place on providers. Education on proper BP measurement techniques, and ensuring use of valid devices can help to facilitate reliable results. Offices can make loaner HBPM devices available to patients if they cannot obtain their own. HBPM can lead to more opportunities for clinicians to uptitrate medications and feel more confident that they are treating "true" blood pressure rather than white coat effects. "Following recommended best practices can facilitate the successful implementation of HBPM and impact how HTN is managed in the primary care setting" (p. 1).
McManus et al. (2018).	Parallel RCT	Inclusion criteria: participants included were those > 35 years	Self-monitoring alone vs. self-monitoring	"After 12 months, systolic blood pressure was lower in both intervention groups compared	"Self-monitoring, with or without telemonitoring, when used by GPs to titrate

This study examined whether general practitioners (GPs) using self-monitored BP to titrate antihypertensive medication in people with treated but inadequately controlled HTN, resulted in lower systolic BP than usual care and whether telemonitoring resulted in lower BP than self-monitored alone.	N=1182 participants were randomly assigned to 1 of 3 groups: self-monitoring, telemonitoring, and usual care. 1003 participants were included in the final analysis. The primary outcome was clinic measured BP at 12 months following randomization. Secondary outcomes included adverse events, antihypertensive medication prescription, adherence, weight and waist circumference, lifestyle factors, and quality of life. In the intervention groups, patients were instructed to record their BP twice in the morning and twice in the evening for the first week of each month. The self-monitored only group submitted a document with measurements to the GP via mail and antihypertensives were titrated accordingly. The telemonitoring group submitted	of age, diagnosed with HTN, taking no more than three antihypertensives agents, and clinic blood pressures not controlled below 140/90 mm Hg. Exclusion criteria: participants were excluded if they were on an antihypertensive < 4 weeks, had orthostatic hypotension, atrial fibrillation, dementia, CKD stage 4 or worse, or CKD with proteinuria.	with telemonitoring vs. usual care.	with usual care (self-monitoring 137.0 [SD 16.7] mm Hg and telemonitoring 136.0 [SD 16.1] mm Hg vs usual care 140.4 [SD 16.5])" (p.949). There was no statistically significant difference between the self-monitored group and telemonitored group (adjusted mean difference -1.2 mm Hg [95% CI: -2.5 to 1.2], *P*= 0.3219). "After 12 months, individuals for whom self-monitoring and telemonitoring was used to titrate antihypertensives were prescribed additional medications compared with usual care (self-monitoring 1.63 [SD 0.89]), telemonitoring 1.70 [0.88], usual care 1.55 [0.85] antihypertensives)" (p. 954). There were no significant differences in other secondary outcomes between the groups.	antihypertensive medication in individuals with poorly controlled BP, leads to significantly lower BP than titration guided by clinic readings" (p. 949).

	readings through a secure SMS text-based service that had incorporated algorithms notifying participants if readings were high or low and. GPs then titrated antihypertensives accordingly. Neither participants nor investigators were masked.				
Mills et al. (2018). The purpose of this study was to assess the comparative effectiveness of implementation strategies for BP control in adults with hypertension.	Systematic review and meta-analysis N=100 articles with a total of 121 comparisons were included. Trials were divided into eight implementation strategy categories including: 1) health coaching, 2) HBPM, 3) provider training, 4) audit and feedback, 5) electronic decision support systems, 6) multilevel strategies without team-based care, 7) team-based care with physicians titrating medications, 8) team-based care with non-physician providers titrating medications.	Inclusion criteria: studies were included if: 1) it was a RCT; 2) study participants were adults with HTN defined as systolic BP ≥ 140 mm Hg, average diastolic BP ≥ 90 mm Hg, and/or use of antihypertensive medication; 3) a main trial outcome was net change in systolic BP or diastolic BP; 4) the trial intervention targets barriers to HTN control at one or more of the patient, provider, and health systems levels; 5) the control group received usual care or	Implementation strategies vs. usual care on BP reduction in adults with HTN	"Multilevel, multicomponent strategies, such as team-based care with medication titration by non-physician (-7.1 mm Hg [95% CI: -8.9, -5.2]), team-based care with medication titration by physician (-6.2 mm Hg [8.1, -4.2]), and multilevel strategies without team-based care (-5.0 mm Hg [-8.0, -2.0]) were most effective for systolic BP reduction. Patient level strategies also resulted in significant systolic BP reductions of -3.9 mm Hg (-5.4, -2.3) for health coaching and -2.7 mm Hg (-3.6, -1.7) for HBPM. Similar trends were observed for diastolic BP reduction" (p.1).	"Multilevel, multicomponent implementation strategies with and without team-base care are most effective for BP control among patients with HTN. In addition, health coaching and HBPM targeting barriers at the patient level are also effective. These strategies should be disseminated and scaled up in clinical practices and public health programs to improve HTN control in communities" (p. 10).

	"For each trial the net change in mean BP and associated standard error was calculated from available data and defined as the difference (intervention minus control) in changes of mean values (follow-up minus baseline)" (p.4).	minimal education; 6) the trial duration was at least 6 months; 7) variance of BP changes (or data to calculate it) was reported; 8) if a trial was cluster-randomized, clustering must be accounted for in the analysis. There was no language restriction for articles included in the review. Exclusion criteria: Studies were excluded if it was not conducted on an adult population or if it was a non-human study.			
Reboussin et al. (2018). The objective of this article was to determine if there is evidence that self-measured BP without other augmentation is superior to office-measured BP for achieving better BP	Systematic review and meta-analysis N= 13 RCTs from January 1, 1966 to February 12, 2015 that compared self-measured BP alone to usual care in adults who were being evaluated and/or treated for HTN. "The prespecified primary outcome was change in systolic BP at 6 months	Inclusion criteria: Studies had to have a minimum of 6 months follow-up, and published in English. Exclusion criteria: Studies were excluded if they included participants with end-stage-renal-disease and pregnant women. Also	Self-measured BP alone vs. usual care	The association of self-measured BP with systolic BP varied across the studies. "Effect size ranged from 7.4 mm Hg worsening of systolic BP to 6.5 mm Hg improvements in systolic BP with self-measured BP compared to office-measured BP (p. 2181). "In the full meta-analysis, self-measured BP was associated with a 4.9 mm Hg (95% CI: 1.3 to 8.6 mm Hg) greater reduction in office systolic BP at 6 months compared with office-measured	The authors found "a modest but significant improvement in systolic BP in RCTs of self-measured BP versus office-based BP. However, improvement was not sustained for longer than 6 months. Well-run studies of self-measured BP in conjunction with additional support, have demonstrated more substantial improvements in BP control, but study design

control, as well as preventing adverse clinical outcomes related to elevated BP.	and 12 months. Additional outcomes that were measured included the proportion of the study population whose office-measured BP was controlled (<140/90), medication adherence, number of medications prescribed or mean dose of medication, and incidence rates of myocardial infarction (MI), stroke, acute decompensated heart failure, and coronary or peripheral revascularization" (p. 2179).	excluded were studies that augmented the self-measured BP intervention with additional support, and studies in which ABPM was the only form of self-monitoring.		BP. However, the effect was diminished by 12 months to 0.1 mm Hg (95% CI: -2.54 to 2.8 mm Hg), which was not statistically significant" (p. 2181). The authors theorized that study design, rather than diminished effect of self-measured BP over time, was the primary explanation for finding a modest effect only at 6 months and not at 12 months. There was no significant difference in the proportion of participants whose BP was controlled between the self-measured BP and office-measured BP arms. "No conclusion could be made regarding clinical events. For medication requirement, data from 4 studies indicated no effect on the mean number of medications at 6 months. The data for adherence were not reported in a way that allowed reliable quantitative assessment" (p. 2182).	is highly variable. Our results suggest that, for selected patients and their providers, self-measured BP may be a helpful adjunct to routine office care" (p. 2184).
Tucker et al. (2017). The purpose of this study was to better understand the effect of self-monitoring on	Systematic review and individual patient data (IPD) meta-analysis N= 25 articles, including 1 unpublished study were reviewed by the authors. Data from the	Inclusion criteria: patients with hypertension being managed as outpatients using an intervention that included self-measurement of BP,	N/A	Self-monitoring was associated with reduced clinic systolic BP between baseline and 12 months follow-up compared to usual care (systolic -3.2 mm Hg, 95% Cl -4.9 to -1.6 mm Hg). However, this effect was influenced by the intensity of co-intervention	Self-monitoring may be recommended to lower BP when combined with additional interventions involving individually tailored support. Self-monitoring alone does not seem to lower BP but may

BP lowering and BP control and examine the effect of self-monitoring in conjunction with various co-interventions, and in different groups of people.	articles was used to perform IPD meta-analysis to evaluate the effect of self-monitoring on BP levels and in the control of hypertension using 1 year of follow-up as the primary end point.	without medical professional input, use of a validated monitor, with or without other co-intervention, and where are comparator group had no organized self-measurement of BP. Exclusion criteria: studies with < 100 patients, followed up < 24 weeks, and not published before 2000.		ranging from no effect with self-monitoring alone (-1.0 mm Hg [-3.3, 1.2]), to a 6.1 mm Hg (-9.0, -3.2) reduction when monitoring was combined with intensive support. Self-monitoring was most effective in individual taking few antihypertensive medications and higher baseline systolic BP up to 170 mm Hg. 4 trials examined ambulatory BP data at 12 months to assess self-monitoring with little or no co-intervention. These studies showed no association between self-monitoring and either lower clinic or ambulatory systolic BP (clinic -0.2 mm Hg [-2.2, 1.8]; ambulatory 1.1 mm Hg [-0.3, 2.5]). Results for diastolic BP were similar.	be useful for other reasons such as engaging with patients or reducing clinician workload.

Appendix E

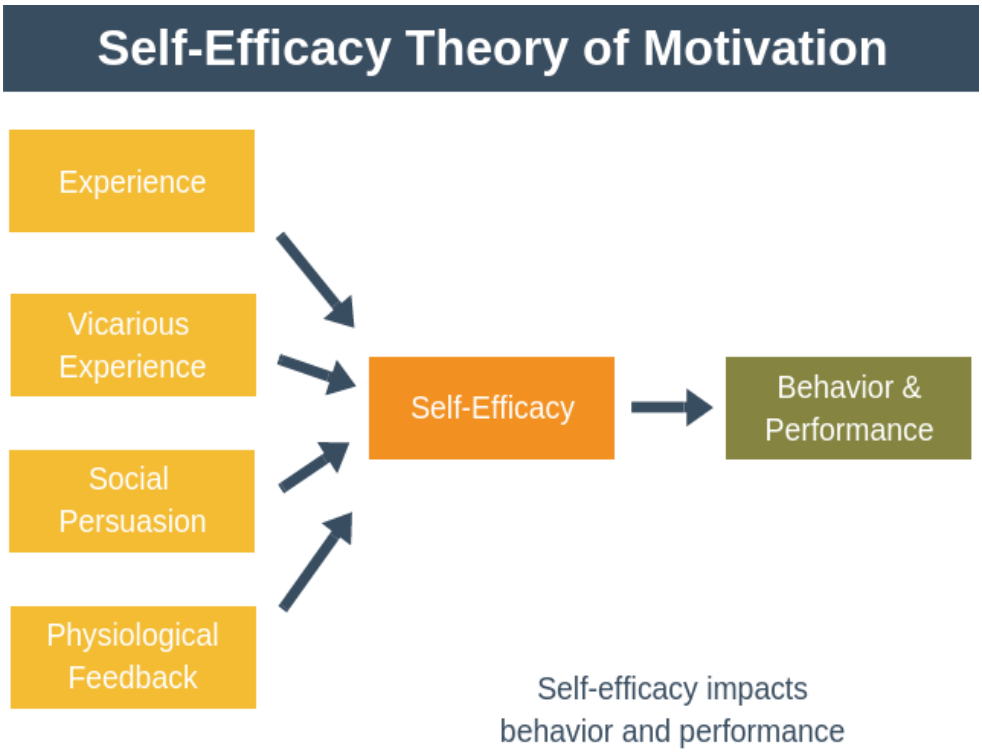


Figure 1. Bandura, A. (1994). *Self-efficacy.* Retrieved from https://www.uky.edu/~eushe2/Bandura/BanEncy.html

Appendix F

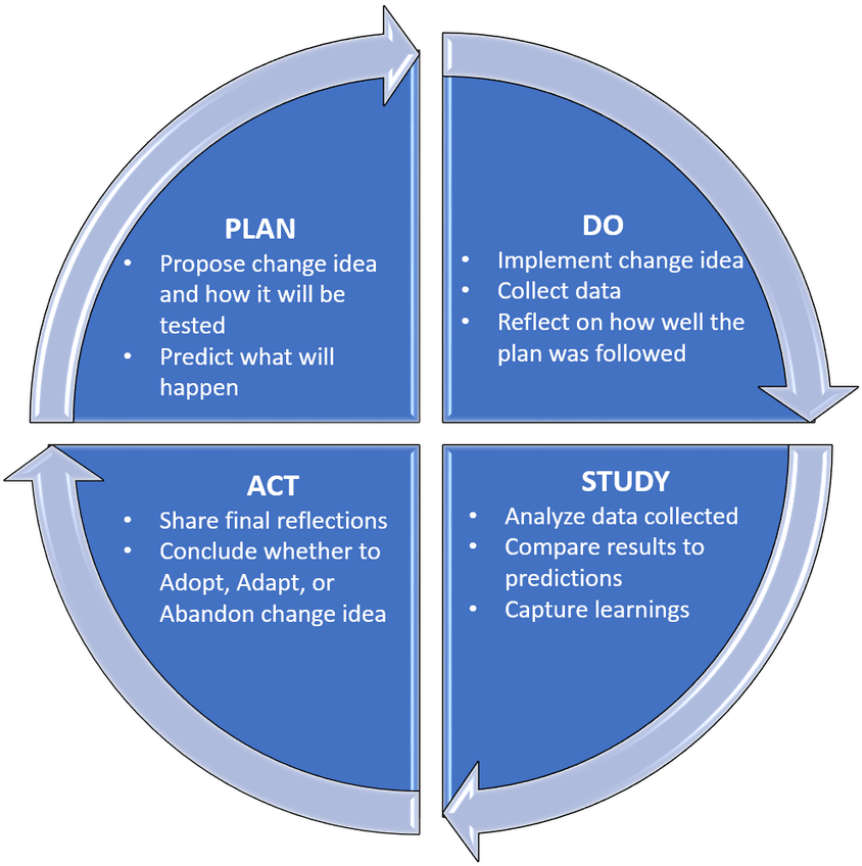


Figure 1. Agency for Healthcare Research and Quality. (2018). *PDSA cycle*. Retrieved from: https://innovations.ahrq.gov/qualitytools/plan-do-study-act-pdsa-cycle

Appendix G

Name:_____DOB:_____/_____/_____

Date log provided: _____ Date log returned: _____

My Home Blood Pressure Log

My Blood Pressure Goal _____mm Hg

Adequate blood pressure control can reduce and prevent development of end-stage kidney disease and cardiovascular diseases such heart attack, stroke, coronary artery disease, and congestive heart failure.

Instructions

- Measure your blood pressure 3-4 times a **week**, preferably on separate days.
- Record your blood pressure on this sheet and show it to your doctor at every visit.
- If your blood pressure readings suddenly exceed 180/120 mmHg, wait 5 minutes and then test your blood pressure again. If it is still unusually high, contact the primary care provider's office immediately as you may be experiencing a hypertensive crisis.

Measurement Techniques

- Sit comfortably in chair with back resting against support and feet on the ground if possible
- Avoid crossing legs
- Use the restroom beforehand if needed
- Rest arm on table so that it is at the level of your heart
- Avoid talking while the device is measuring your BP
- Avoid exercising, using tobacco products, or caffeine 30 minutes prior to recording BP

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Appendix H

Blood Pressure Measurement Technique Demonstration and Device Validation

Pre-education BP technique demonstration:

Patient has rested 2-5 minutes before recording BP	Yes____ No_____
Correct size and placement of cuff (not over clothing)	Yes____ No_____
Seated upright in chair with back supported	Yes____ No_____
Feet planted on ground, legs uncrossed	Yes____ No _____
Arm resting on support at level of heart	Yes____ No_____
Patient denies smoking or drinking caffeine in last 30 mins	Yes____ No_____
	Yes total_____/6

Post-education BP technique demonstration:

Patient has rested 2-5 minutes before recording BP	Yes____ No_____
Correct size and placement of cuff (not over clothing)	Yes____ No_____
Seated upright in chair with back supported	Yes____ No_____
Feet planted on ground, legs uncrossed	Yes____ No _____
Arm resting on support at level of heart	Yes____ No_____
Patient denies smoking or drinking caffeine in last 30 mins	Yes____ No_____
	Yes total_____/6

Home BP Device Validation:

1st Home BP device result _____/_____

2nd Home BP device result _____/_____Home BP device average _____/_____

1st Office BP device result _____/_____

Is the average of the two Home BP device results within 5 mm Hg of the Office BP device result? If yes, the device can be used for HBPM.

Yes_____ No_____

If no, obtain ONE additional Office BP device measurement, and ONE additional Home BP device measurement. Then, average the two Office BP device measurements and compare the average to the most recent Home BP device measurement.

1st Office BP device result _____/_____ 2nd Office BP device result____/_____

Office BP result average_____/_____

3rd Home BP device result _____/_____

Is the average of the two Office BP results within 10 mm Hg of the 3rd Home BP device result? If yes, the home device can be used for HBPM. If no, the device should not be used for HBPM

Yes_____ No_____

Note: Demonstration checklist based on recommendations by Kallioinen et al., 2017; Device validation based on recommendations by American Heart Association, 2018

Appendix I

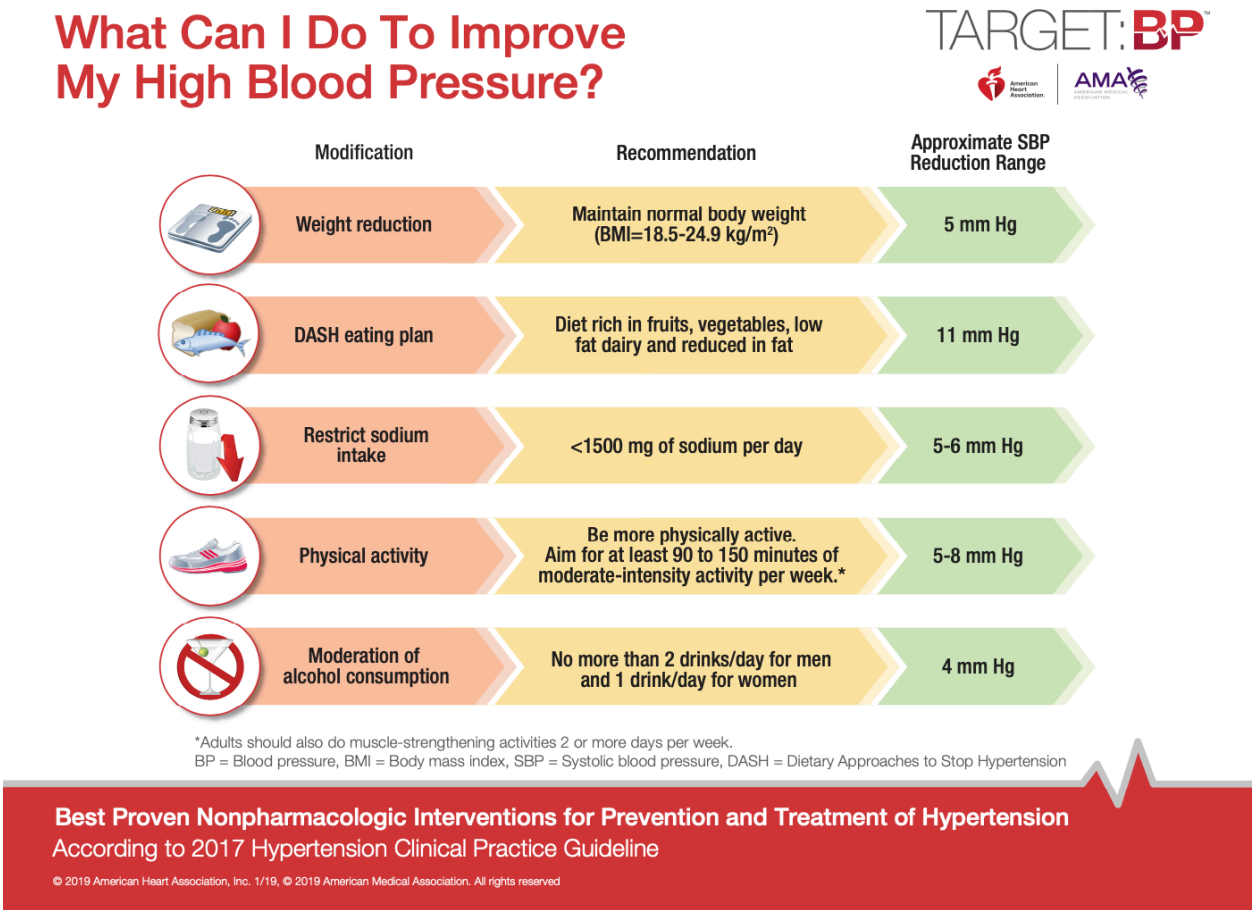


Figure 1. American Heart Association. (2019). What can I do to improve my high blood pressure?. In *Target:BP*. Retrieved from https://targetbp.org/tools_downloads/what-can-i-do-to-improve-my-blood-pressure/

Appendix J

Follow-up Blood Pressure Management Appointment Questionnaire

This is an anonymous survey aimed to determine whether the blood pressure health coaching visit with the nurse practitioner (NP) student helped you make changes to your lifestyle.

Instructions:
Please **DO NOT** include your name or other identifying information on this paper. This questionnaire is meant to be anonymous.

Question 1: Since meeting with the nurse practitioner student, what are the chances you do the following to improve your blood pressure?

Please write one of the estimated percentages (%) below for each of the following.

- No chance at all = 0%
- A small chance = 25%
- A 50/50 chance = 50%
- A good chance = 75%
- Complete chance= 100%

1. Try losing weight: _____% chance

2. Eat more fruits, vegetables, and low-fat foods: _____%

3. Cut down on salt: _____%

4. Exercise regularly: _____%

5. Completely avoid or drink alcohol in moderation: _____%

Question 2: The blood pressure measurement technique education provided by the medical assistant was helpful for when I was taking my blood pressure at home.

Please mark your answer by writing an X on the line next to your selection

Strongly disagree: _____

Disagree: _____

Neutral: _____

Agree: _____

Strongly agree: _____

Note: Questionnaire adapted from survey tool by Mularcik (2010).

Appendix K

Doctor of Nursing Practice Project Financial Operating Plan

Revenue	
Project Manager Time (in-kind donation) *Note.* Based on the DNP student hourly rate over three semesters	$15,500.00
Incentive Payments from Insurance Companies: $3,555.00 incentive payments *Note*. $3,555.00 ~ the amount potential money received for meeting a benchmark for one insurance company *Note*. Revenue from additional insurance companies not yet available	$3,555.00
Total	$19,055.00
Expenses	
Project Manager Time (in-kind donation)	$15,500.00
Productivity Loss due to Staff Education: 1. Medical assistants (MAs): $17.00/hour wage x 2 hours x 2 MAs 2. Primary care physician: ~$125/hour wage x 1 hour 3. DNP prepared NP: $45/hour wage x 1 hour 4. Care manager RN: $30/hour wage x 1 hour	$68.00 $125.00 $45.00 $30.00
Copies of handouts $0.05 x 100 copies of handouts Note. $0.05 is the average cost of printing a black and white paper. Copies of handouts include all needed printed documents for this project.	$5.00
Total	$15,773.00
Net Operating Plan	$3,282.00

Appendix L

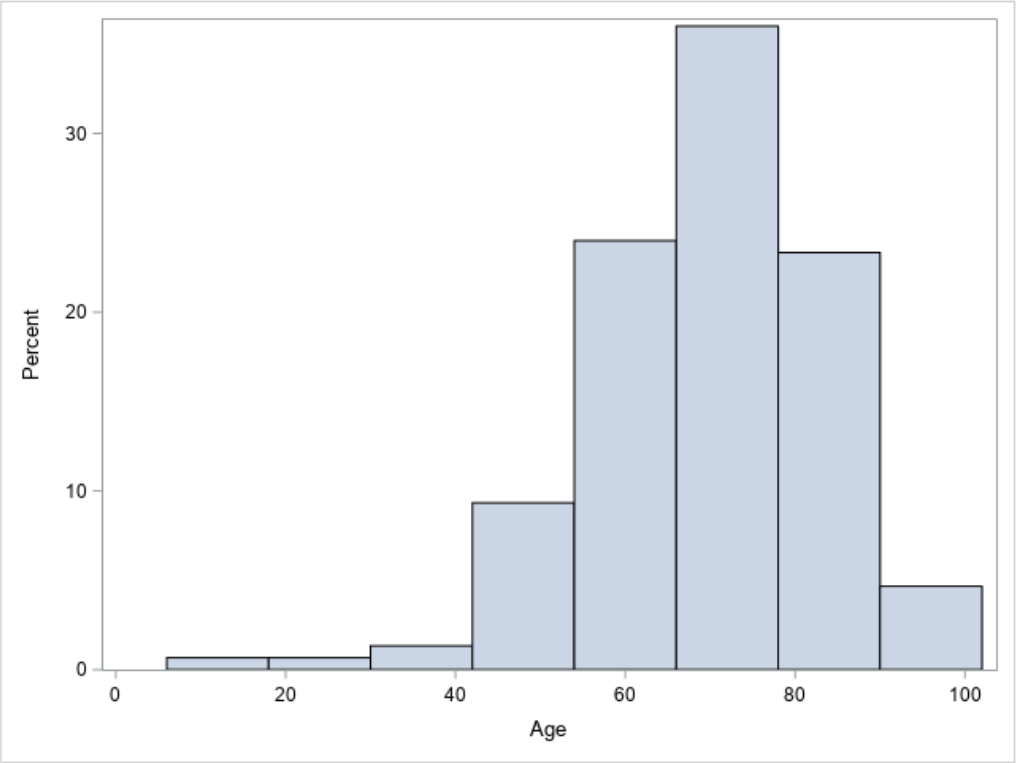
Timeline of Implementation

November 2020	December 2020	January 2021	February 2021	March 2021	April 2021
Project proposal 11/25/20	IRB application submission 12/17/20	Staff education session 1/7/21	Health coaching visits	Health coaching visits	Determine sustainability with stakeholders
	IRB approval 12/28/20	Go-live 1/12/21	Weekly chart reviews and observation visits	Weekly chart reviews and observation visits	Project Defense 4/23/21
		Begin weekly chart reviews and observation visits		Initiate distribution of follow-up questionnaire	Present findings to clinic staff
				Conclude quantitative data collection	Upload to Scholarworks

Appendix M

Patient Demographic Tables and Graph (*N*= 147)

Variable	N	Mean	Standard Deviation	Min	Max
Age	147	69.19	13.021	27	95



Variable	Count	Percent
Gender		
Male	89	60.5%
Female	58	39.5%

Appendix N

Initial Visit Blood Pressure Table *(N*= 147*)*

Parameters	**Initial visit average**
Systolic pressure (mmHg)	131.33 ± 14.78 mm Hg
Diastolic pressure (mmHg)	74.36 ± 10.94 mm Hg

Appendix O

Fisher's Exact Test Table for BP Improvement with and without HC Visit Education

Table of coaching by bpimproved				
		bpimproved		
		no	yes	Total
coaching				
no	Frequency	4	4	8
	Percent	26.67	26.67	53.33
	Row Pct	50.00	50.00	
	Col Pct	50.00	57.14	
yes	Frequency	4	3	7
	Percent	26.67	20.00	46.67
	Row Pct	57.14	42.86	
	Col Pct	50.00	42.86	
Total	Frequency	8	7	15
	Percent	53.33	46.67	100.00

Statistics for Table of coaching by bpimproved

Statistic	DF	Value	Prob
Chi-Square	1	0.0765	0.7821
Likelihood Ratio Chi-Square	1	0.0766	0.7819
Continuity Adj. Chi-Square	1	0.0000	1.0000
Mantel-Haenszel Chi-Square	1	0.0714	0.7893
Phi Coefficient		-0.0714	
Contingency Coefficient		0.0712	
Cramer's V		-0.0714	
WARNING: 100% of the cells have expected counts less than 5. Chi-Square may not be a valid test.			

Fisher's Exact Test	
Cell (1,1) Frequency (F)	4
Left-sided Pr <= F	0.5952
Right-sided Pr >= F	0.7855
Table Probability (P)	0.3807
Two-sided Pr <= P	1.0000

Sample Size = 15

Appendix P

HBPM Log Distribution (*N*= 147)

Variable	Count	Mean systolic BP at initial visit	Mean diastolic BP at initial visit
Received HBPM log	100	134.47 ± 15.56	75.28 ± 11.12
Did not received HBPM log	47	124.47 ±10.31	72.40 ± 1039

Appendix Q

Chi-Square Test for HBPM Log Utilization Between the Current and Previous (Apriliando, 2020) Interventions (*N=147)*

Table of student by log				
		log		
		no	yes	Total
student				
current	Frequency	47	100	147
	Percent	12.91	27.47	40.38
	Row Pct	31.97	68.03	
	Col Pct	35.07	43.48	
previous	Frequency	87	130	217
	Percent	23.90	35.71	59.62
	Row Pct	40.09	59.91	
	Col Pct	64.93	56.52	
Total	Frequency	134	230	364
	Percent	36.81	63.19	100.00

Statistics for Table of student by log

Statistic	DF	Value	Prob
Chi-Square	1	2.4837	0.1150
Likelihood Ratio Chi-Square	1	2.5027	0.1137
Continuity Adj. Chi-Square	1	2.1469	0.1429
Mantel-Haenszel Chi-Square	1	2.4768	0.1155
Phi Coefficient		-0.0826	
Contingency Coefficient		0.0823	
Cramer's V		-0.0826	

Fisher's Exact Test	
Cell (1,1) Frequency (F)	47
Left-sided Pr <= F	0.0711
Right-sided Pr >= F	0.9546
Table Probability (P)	0.0257
Two-sided Pr <= P	0.1223

Sample Size = 364

Appendix R

Pre- and Post-Education BP Technique Demonstration (*N*=12)

Median values of the behaviors performed during the pre-education and post-education BP technique demonstrations from the 6 scored behaviors.

Variable	Label	Median
Preeducation	Preeducation	5.0000000
PostEducation	PostEducation	6.0000000

Wilcoxon signed-rank test for significance:

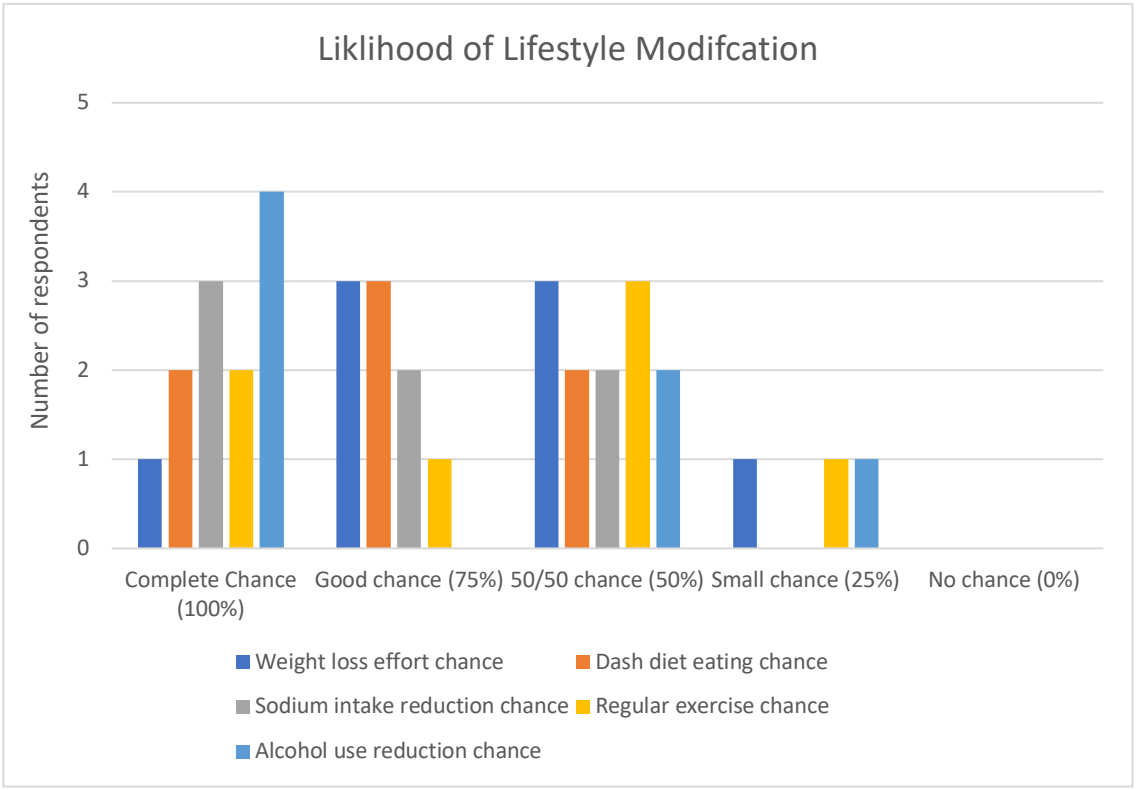
Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	3.45782	Pr > |t|	0.0054
Sign	M	3.5	Pr >= |M|	0.0156
Signed Rank	S	14	Pr >= |S|	0.0156

Appendix S

Survey Responses for Lifestyle Behavior Modification Likelihood and MA Education Benefit

	Likelihood in number of responses (*N*= 7)				
Lifestyle Behavior	Complete chance 100%	Good chance (75%)	50/50 chance (50%)	Small chance (25%)	No chance (0%)
Weight loss effort chance *	1	3	3	1	0
Dash diet eating chance	2	3	2	0	0
Sodium intake reduction chance	3	2	2	0	0
Regular exercise chance	2	1	3	1	0
Alcohol use reduction chance	4	0	2	1	0

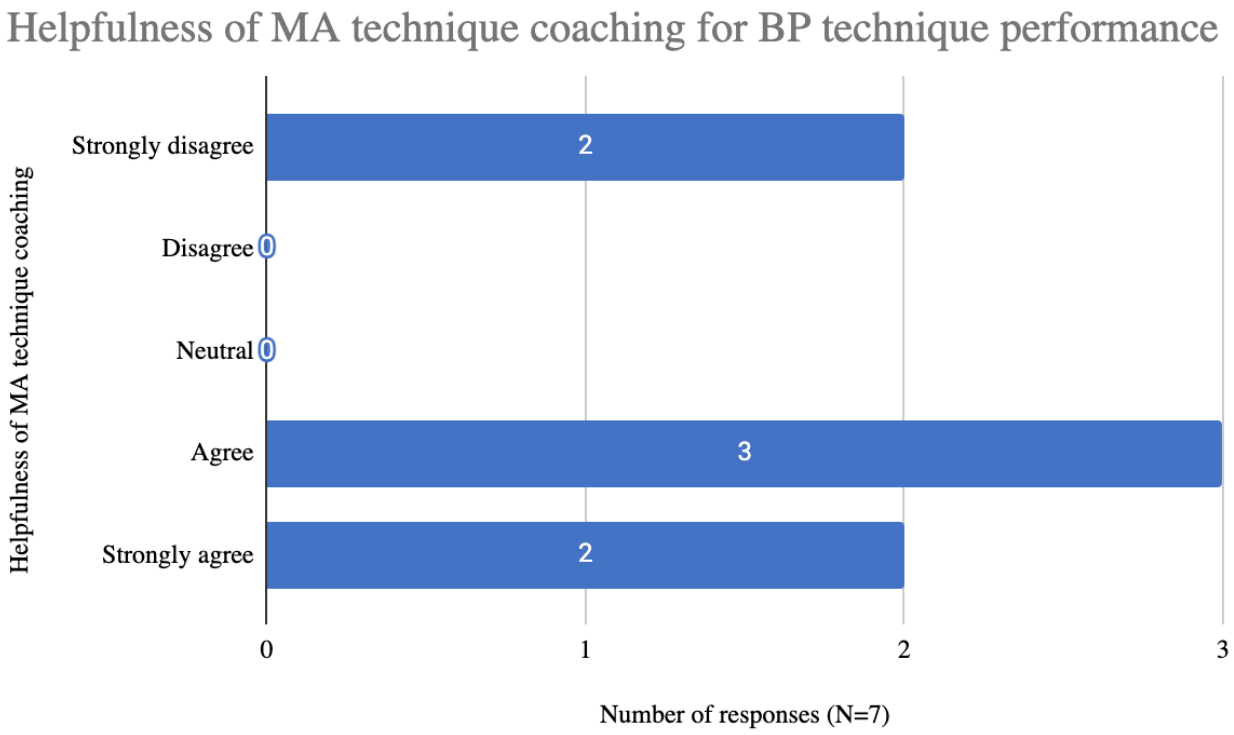
* a single respondent answer was provided as a range (i.e. 25-50%); both answers counted for this behavior



Appendix T

Helpfulness of BP Measurement Technique Education Provided by MAs at Initial Visit (*N*=7)

Helpfulness of MA technique coaching	Number of responses
Strongly disagree	2
Disagree	0
Neutral	0
Agree	3
Strongly agree	2



Utilization of Home Blood Pressure Monitoring in Adult Patients with Hypertension

Justin R. Crow, BSN, RN

DNP Project Defense

April 23, 2021

Acknowledgements

- Faculty Advisors:
  Primary: Dr. Anne McKay DNP, ANP-BC
  Secondary: Dr. Donna Rinker DNP, FNP-BC

- Site mentor:
  Dr. Thomas Hoffman MD

- Statistician:
  Emily Dorn, Graduate Assistant

Objectives for Presentation

1. Discuss and examine the blood pressure (BP) management strategies used in adult patients with hypertension (HTN) at a primary care clinic (PCC).
2. Identify the organizational needs and review literature in support of partnership efforts for improving HTN management.
3. Describe the quality improvement (QI) project design, data collection, and implementation strategies.
4. Review project results and implications
5. Discuss Doctor of Nursing Practice (DNP) Essentials utilization during project

Background

- Nearly half of all American adults have HTN (AHA, 2020)
- HTN is second only to smoking for all-cause deaths that are preventable (CDC, 2020)
- 2017 American College of Cardiology (ACC) and American Heart Association (AHA) guidelines for HTN (Whelton et al., 2018):
  - BP goal < 130/80
  - Out-of-office BP measurements

Organizational Setting

- PCC in rural West Michigan
- Independently owned and operated
- Apriliando (2020) implemented aspects of the AHA's Measure Accurately, Act Rapidly, and Partner with Patients (MAP) protocol for BP management (AHA, 2016)

Organizational Setting cont.

- Aspects of MAP protocol implemented by previous DNP student for adult patients with HTN included:
  - Evidence-based BP measurement techniques for MAs obtaining office vital signs
    - Adequate time to rest
    - Feet on floor, legs uncrossed
    - Back supported in chair
    - Arm at heart level
    - BP cuff directly on arm
    - Avoid talking
  - Utilization of home BP monitoring (HBPM) logs

Organizational Setting cont.

Apriliando's (2020) findings:

- Medical assistant (MA) application of evidence-based techniques produced statistically significant reductions in systolic (SBP) and diastolic (DBP) blood pressure
- Use of HBPM log produced a statistically significant reduction in SBP
  - There was not a statistically significant change in DBP

Organizational Setting cont.

Apriliando's (2020) findings:

- Out of 217 qualified patients, 130 were given the HBPM log and 87 were not
- Patients reported mixed reviews for the impact of HBPM on their lifestyle behaviors
  - Twice-a-day monitoring was burdensome

Organizational Assessment Findings

Universalia Institutional and Organizational Assessment Model (Universalia, 2020)

- Under-utilization of HBPM log
- Lack of policy/procedure for educating on behavioral strategies for lowering BP
- $3,555 loss for not meeting insurance BP benchmarks;
  - $2,340 from Priority Health Medicare alone

https://www.universalia.com/en/services/institutional-and-organizational-performance-assessment

SWOT Analysis

Strengths

- Clearly defined organizational vision and mission
- **Staff is familiar with recent BP management project, as well as other DNP projects from past students within the organization**
- Committed employees who have years of experience within this organization and a clear understanding of its function
- **Utilization and competency of the staff with conducting evidence-based BP measurement techniques**
- **Small number of staff members enables ability to communicate and evaluate compliance with the project's interventions**
- **Small scale of PCC**
- Monthly staff meetings allow for discussion of policies

Weaknesses

- Lack of staff knowledge on quality measures
- Majority of existing policies are related to employee conduct and not clinical management; policy and procedure changes are often reported via wor—of-mouth during monthly meetings.
- **No existing policies are related to BP measurement methods of MAs or distribution of HBPM logs**
- **Lack of provider utilization of organization's HBPM log and patient education regarding its purpose and use**
- Limited staff knowledge regarding sophisticated capabilities within the EHR

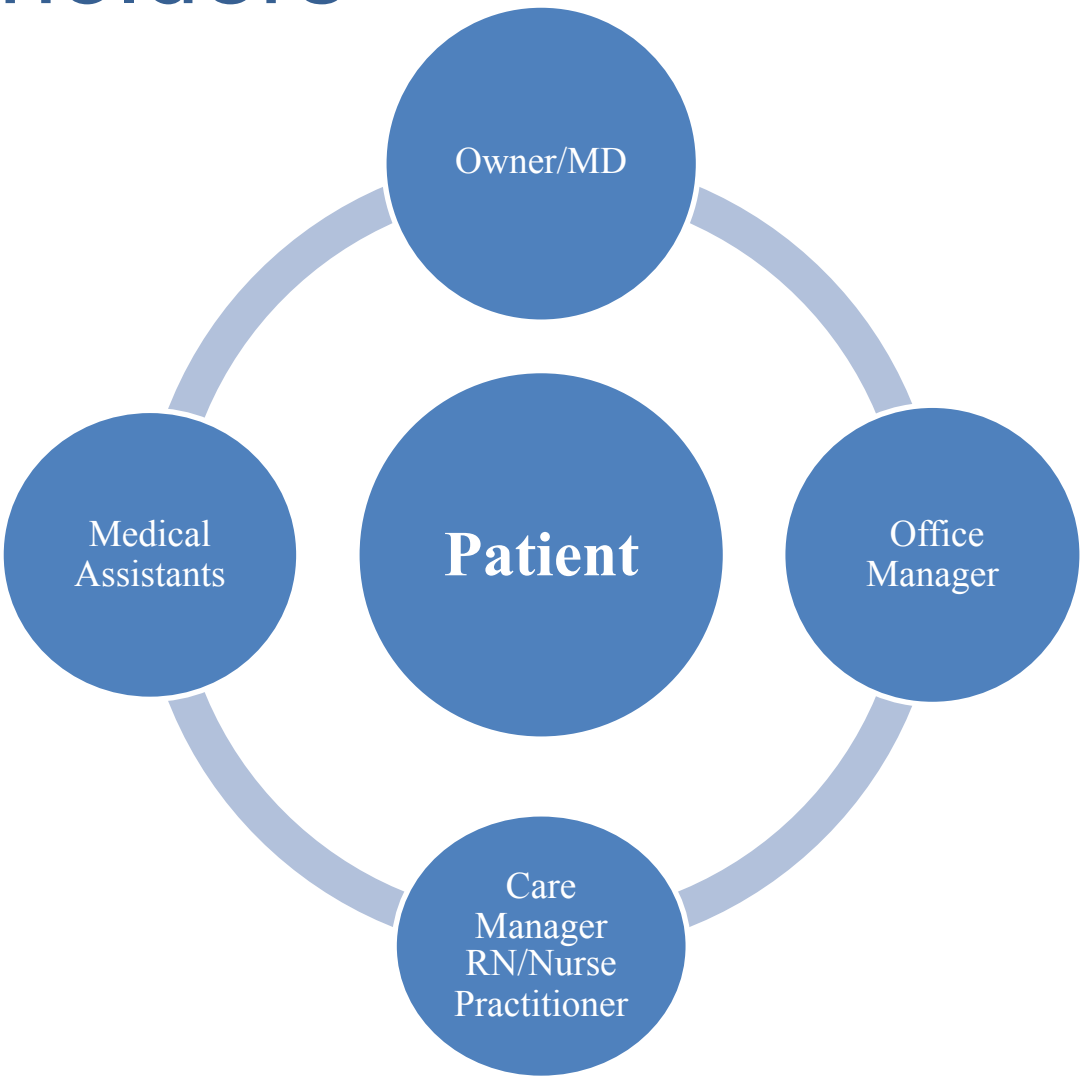
Opportunities

- **Incentive/reimbursement from insurance companies for meeting BP control benchmarks**
- The PCC currently has 52 patients within Priority Health Medicare who have uncontrolled HTN (>139/89)
- Full utilization of the tools available in the EHR to help identify patients who need greater attention
- On-site care manager to provide more comprehensive patient education and problem-solving

Threats

- A large health care organization has has all but monopolized the county and reduced the number of private physicians within the county
- Provider hesitancy with fully committing to utilizing HBPM for treatment decisions
- **Not all patients have access to a home BP monitor**
- Patient non-compliance to HBPM log and measurement strategies
- COVID-19 could limit student's access to project site

Stakeholders



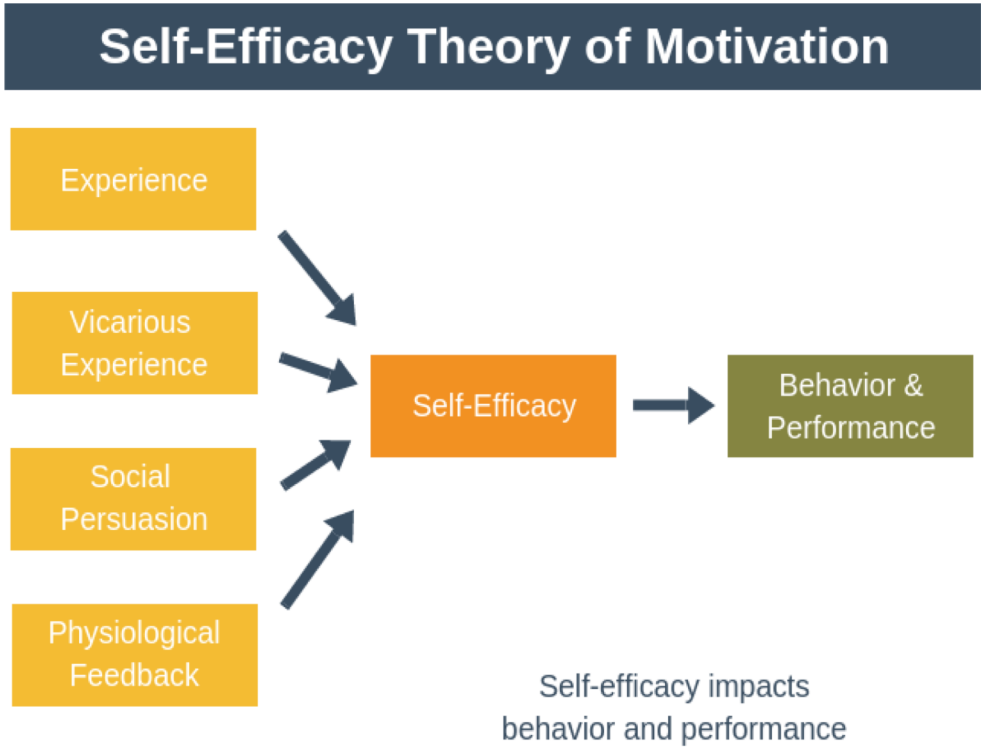
Clinical Phenomenon

- Utilization of HBPM monitoring diminished following the conclusion of Apriliando's (2020) time at the site due to:
  - Patient's feeling burden by frequency of HBPM log requirements
  - Uncertainty for both patient and providers for how to interpret home BP readings
  - Provider skepticism for the validity of home BP results

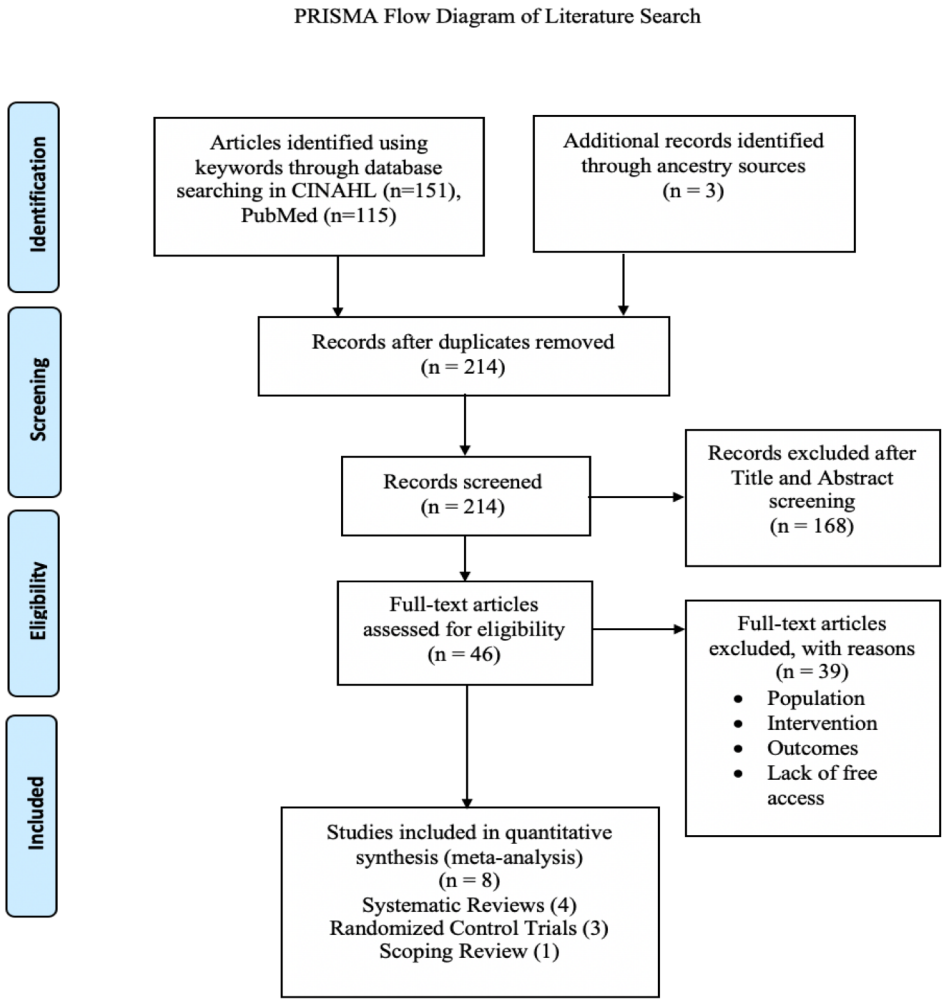
Framework/Conceptual Model for Phenomenon

Self-efficacy theory **(Bandura, 1994)**

- Experiential success
- Normalization of behaviors
- Verbal encouragement
- Objective feedback



Literature Review Methods & PRISMA



Evidence for Project

Efficacy of HBPM:

- Valid and accurate method of BP measurement (Breaux-Shropshire et al., 2015; Liyanage-Don et al., 2019)
- More accurate reflection of BP than office measurements (Breaux-Shropshire et al., 2015)
- Reductions in BP; greater when combined with health coaching (HC) (Cuffee et al., 2019; Mills et al., 2018; Roboussin et al., 2018; Tucker et al., 2017)
- Substantial BP improvements in individuals ≥ 60-years-old.

Evidence for Project cont.

Barriers to HBPM:

- Uncertainty with result interpretation (Liyanage-Don et al., 2019)
- Patient understanding of measurement techniques (Liyanage-Don et al., 2019)
- Time commitment related to providing education to patient regarding BP measurement recording (Liyanage-Don et al., 2019; Jackson et al., 2019)
- Not all patients will have home BP device (Liyanage-Don et al., 2019)

Evidence for Project cont.

Facilitators of HBPM:

- MAs and RNs are well-positioned to provide BP measurement technique education (Liyanage-Don et al., 2019)
- Formal education is associated with increased likelihood of home BP device purchasing and adherence to regular testing (Liyanage-Don et al., 2019)
- Valid BP devices can be purchased for $30-150 dollars (Liyanage-Don et al., 2019; Jackson et al., 2019)

Clinical Practice Question

In a small, rural PCC, will adaptations to the current Measure Accurately and Partner with Patients quality improvement initiatives and addition of health coaching visits:

- Increase provider utilization of HBPM
- Increase patient engagement with HBPM
- Improve BP control in patients with diagnosed HTN

Project Methodology

Methods

Project type: QI

Setting: Rural PCC

Implementation Method: Utilization of HBPM program and piloting of HC visits

Participants:

- Adult patients (≥ 18 years of age) with active diagnosis of HTN
- Health coaching session: Adult patients ≥ 60 years of age with HTN
- Clinic staff: Providers, MAs, DNP student, front desk staff

Outcome Measures: staff compliance with interventions and efficacy of HC visits for facilitating the utilization of HBPM

Project Purpose

- This QI project aimed to:
  - Incorporate BP measurement technique education delivered MAs
  - Increase the distribution HBPM log
  - Pilot HC visit in patients ≥ 60-years-old to:
    - Assess home BP measurement techniques
    - Validate home BP devices
    - Provide lifestyle behavior education for improving BP

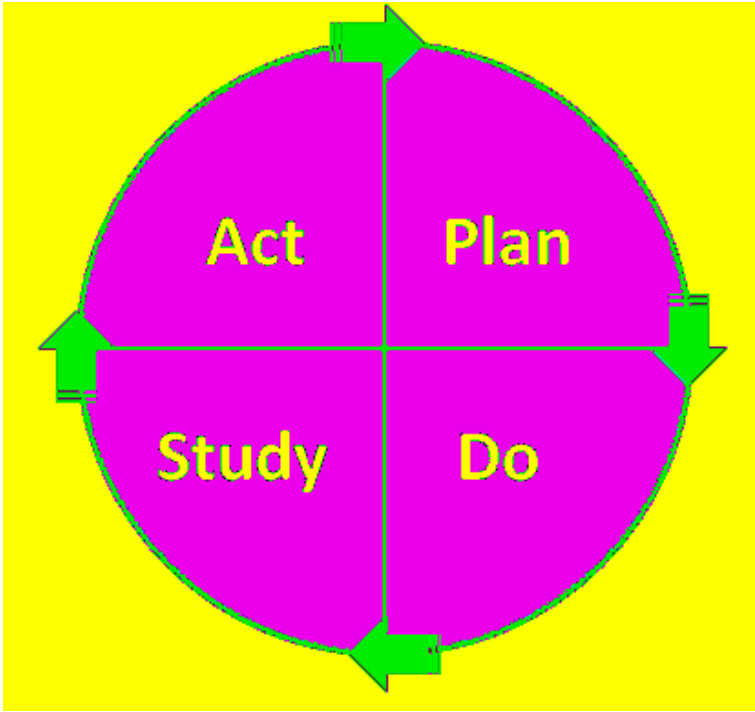
Project Objectives and Timeline

Date	Objective
January 7, 2021	-Conduct provider and staff education regarding HBPM project. -Identify patients who will be seen in clinic for HTN-related visits.
January 12, 2021	-Initiate MA education delivery and provider distribution of HBPM logs. -Begin weekly compliance chart reviews.
February 2, 2021	-Begin conducting health coaching visits by DNP student
March 1, 2021	-Front desk staff begin distributing anonymous questionnaires to patients at the conclusion of the patient follow up visits
March 31, 2021	Conclude data collection and begin analysis
April 20, 2021	Present outcome findings and sustainability recommendations to clinic staff
April 23, 2021	DNP project defense

Implementation Model: **PDSA**

Plan-Do-Study-Act (Institute for Health Improvement, 2018)

- **Plan**:
  - Staff education
  - Identify eligible patients (HTN*)
- **Do**:
  - MA delivered technique education
  - HBPM log distribution
  - Health coaching visits



HBPM Log

Name:____DOB:_____/_____/______

Date log provided: _______________________ Date log returned: ______________________

My Home Blood Pressure Log

My Blood Pressure Goal __________________________mm Hg

Adequate blood pressure control can reduce and prevent development of end-stage kidney disease and cardiovascular diseases such heart attack, stroke, coronary artery disease, and congestive heart failure.

Instructions

- Measure your blood pressure 3-4 times a **week**, preferably on separate days.
- Record your blood pressure on this sheet and show it to your doctor at every visit.
- If your blood pressure readings suddenly exceed 180/120 mmHg, wait 5 minutes and then test your blood pressure again. If it is still unusually high, contact the primary care provider's office immediately as you may be experiencing a hypertensive crisis.

Measurement Techniques

- Sit comfortably in chair with back resting against support and feet on the ground if possible
- Avoid leg crossing legs
- Use the restroom beforehand if needed
- Rest arm on table so that it is at the level of your heart
- Avoid talking while the device is measuring your BP
- Avoid exercising, using tobacco products, or caffeine 30 minutes prior to recording BP

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*Adapted from American Heart Association's *My Home Blood Pressure Log*

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*Adapted from American Heart Association's *My Home Blood Pressure Log*

BP Demonstration/Device Validation

Pre/Post Blood Pressure Measurement Technique Demonstration

Pre-education BP technique demonstration:

Patient has rested 2-5 minutes before recording BP	Yes____ No_____
Correct size and placement of cuff (not over clothing)	Yes____ No_____
Seated upright in chair with back supported	Yes____ No_____
Feet planted on ground, legs uncrossed	Yes____ No _____
Arm resting on support at level of heart	Yes____ No_____
Patient denies smoking or drinking caffeine in last 30 mins	Yes____ No_____
	Yes total_____/6

Post-Education BP technique demonstration:

Patient has rested 2-5 minutes before recording BP	Yes____ No_____
Correct size and placement of cuff (not over clothing)	Yes____ No_____
Seated upright in chair with back supported	Yes____ No_____
Feet planted on ground, legs uncrossed	Yes____ No _____
Arm resting on support at level of heart	Yes____ No_____
Patient denies smoking or drinking caffeine in last 30 mins	Yes____ No_____
	Yes total_____/6

Home BP Device Validation:

1st Home BP device result _____/_____

2nd Home BP device result _____/_____Home BP device average _____/_____

1st Office BP device result _____/_____

Is the average of the two Home BP device results within 5 mm Hg of the Office BP device result? If yes, the device can be used for HBPM.

Yes_____ No_____

If no, obtain ONE additional Office BP device measurement, and ONE additional Home BP device measurement. Then, average the two Office BP device measurements and compare the average to the most recent Home BP device measurement.

1st Office BP device result _____/_____ 2nd Office BP device result____/_____

Office BP result average_____/_____

3rd Home BP device result _____/_____

Is the average of the two Office BP results within 10 mm Hg of the 3rd Home BP device result? Is yes, the home device can be used for HBPM. If no, the device should not be used for HBPM

Yes_____ No_____

Note: Demonstration checklist based on recommendations by Kallioinen et al., 2017; Device validation based on recommendations by American Heart Association, 2018.

Health Coaching Education Resources

What Can I Do To Improve My High Blood Pressure?

TARGET: BP

	Modification	Recommendation	Approximate SBP Reduction Range
	Weight reduction	Maintain normal body weight (BMI=18.5-24.9 kg/m²)	5 mm Hg
	DASH eating plan	Diet rich in fruits, vegetables, low fat dairy and reduced in fat	11 mm Hg
	Restrict sodium intake	<1500 mg of sodium per day	5-6 mm Hg
	Physical activity	Be more physically active. Aim for at least 90 to 150 minutes of moderate-intensity activity per week.*	5-8 mm Hg
	Moderation of alcohol consumption	No more than 2 drinks/day for men and 1 drink/day for women	4 mm Hg

*Adults should also do muscle-strengthening activities 2 or more days per week.
BP = Blood pressure, BMI = Body mass index, SBP = Systolic blood pressure, DASH = Dietary Approaches to Stop Hypertension

Best Proven Nonpharmacologic Interventions for Prevention and Treatment of Hypertension
According to 2017 Hypertension Clinical Practice Guideline

Post Follow-Up Visit Questionnaire

Follow-up Blood Pressure Management Appointment Questionnaire

This is an anonymous survey aimed to determine whether the blood pressure health coaching visit with the nurse practitioner (NP) student helped you make changes to your lifestyle.

Instructions:
Please **DO NOT** include your name or other identifying information on this paper. This questionnaire is meant to be anonymous.

Question 1: Since meeting with the nurse practitioner student, what are the chances you do the following to improve your blood pressure?

Please write one of the estimated percentages (%) below for each of the following.

- No chance at all = 0%
- A small chance = 25%
- A 50/50 chance = 50%
- A good chance = 75%
- Complete chance= 100%

1. Try losing weight: _____% chance
2. Eat more fruits, vegetables, and low-fat foods: _____%
3. Cut down on salt: _____%
4. Exercise regularly: _____%
5. Completely avoid or drink alcohol in moderation: _____%

Question 2: The blood pressure measurement technique education provided by the medical assistant was helpful for when I was taking my blood pressure at home.

Please mark your answer by writing an X on the line next to your selection

Strongly disagree: _____

Disagree: _____

Neutral: _____

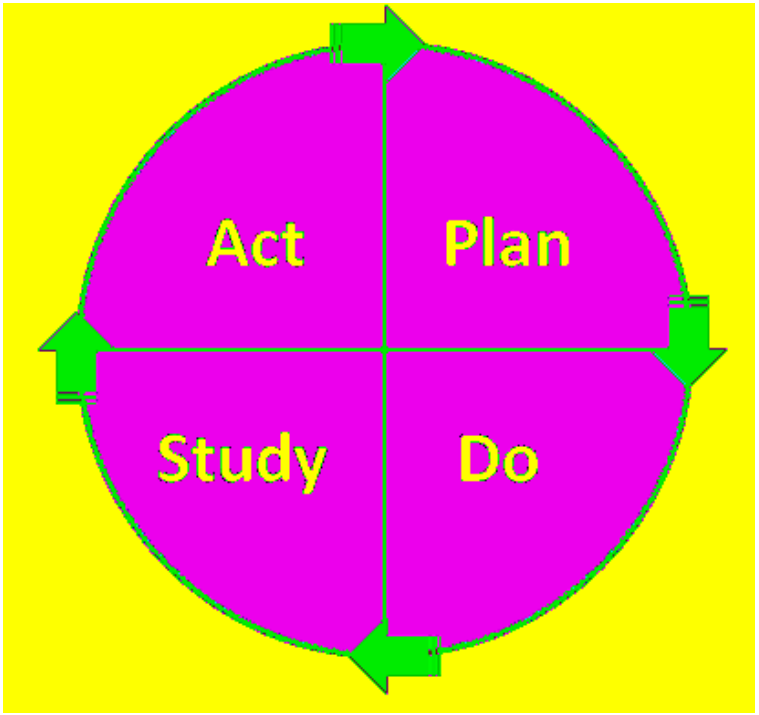
Agree: _____

Strongly agree: _____

Note: Questionnaire adapted from survey tool by Mularcik (2010).

Implementation Model: **PDSA**

- **Study**:
  - Data collection
  - Statistical analysis
- **Act**:
  - Adapt, adopt, or abandon



Implementation Strategies

Implementation Strategy	Description	Framework Alignment
Educational meetings (Powell et al., 2015).	-Education session with staff to provide overview of project	Plan Do
Develop and distribute education materials (Powell et al., 2015).	-Adapt HBPM log provided by AHA and provide to patients - Establish a written procedural outline - Create tools for HC visits	Plan Do
Prepare patients to be active participants (Powell et al., 2015).	-MAs and providers educate patients on proper BP monitoring techniques and use of HBMP log	Do
Intervene with patients to enhance uptake and adherence (Powell et al., 2015).	-Health coaching sessions with patients ≥ 60 years of age with HTN	Do
Obtain and use patient feedback (Powell et al., 2015)	-Determine impact of MAs providing education regarding evidence-based BP measurement strategies	Study
Purposely reexamine the implementation (Powell et al., 2015)	-Evaluate intervention effectiveness and make recommendations for continuous improvement	Study Act

Measures and Evaluation

Topic	Concept	How Measured	Measurement Analysis
Patient Outcomes	Improvement in BP	EHR review of initial and follow-up BP	-Descriptive statistics -Fisher's exact test
	Recorded readings on HBPM log	HBPM log collection and review	Descriptive statistics
	BP measurement technique knowledge	Pre/post health coaching visit BP technique demonstration	-Descriptive statistics -Wilcoxon signed-rank test
	Patient-reported likelihood of lifestyle modifications	Post follow-up questionnaire	Descriptive statistics
Staff/Clinic Outcomes	Provider utilization and distribution of logs	-EHR review -Comparison with previous project	-Descriptive statistics -Chi-square test
	BP measurement technique education by MAs	EHR review	Descriptive statistics

Ethical Considerations

- GVSU Institutional Review Board approval
- HIPAA compliance with protected patient information
- No identifiable patient information will be collected
  - Anonymous post follow-up questionnaires

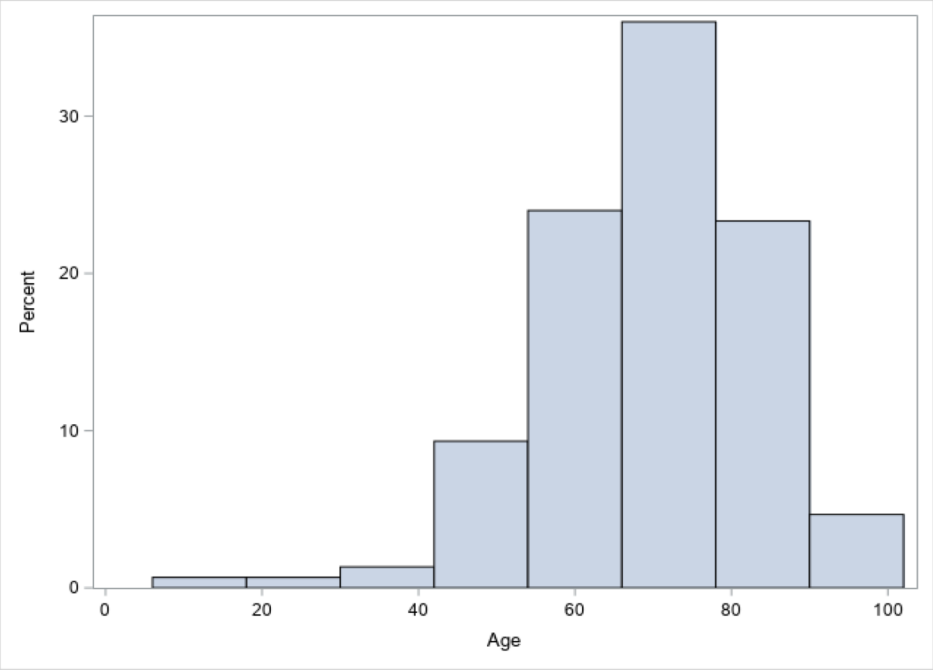
Results

Results: Demographics

Variable	N	Mean	Standard Deviation	Min	Max
Age	147	69.19	13.021	27	95

Variable	Count	Percent
Gender		
Male	89	60.5%
Female	58	39.5%

Initial Visit	Follow-up visit
147	15



Results: Initial Office BP and Follow-Up BP

Parameters	Initial visit average (*N*= 147)
Systolic pressure (mmHg)	131.33 ± 14.78 mm Hg
Diastolic pressure (mmHg)	74.36 ± 10.94 mm Hg

Parameters	Follow-up visit average (*N*=15)
Systolic pressure (mmHg)	139.47 ± 16.95 mm Hg
Diastolic pressure (mmHg)	69.47 ± 8.69 mm Hg

Improved BP with HC = 3
Improved BP without HC = 4

- Improved BP at follow-up for HC vs no HC:
  - Fisher's Exact test, two-sided *P* value 1.00 (0.05 level of significance)

Results: MA Education Delivery

- Of the 147 patients, 95 patients received the MA-delivered BP measurement technique education
  - 64.62% received education
  - 2 participants in the HC visits did not receive the MA-delivered education

Results: HBPM Log Distribution

Variable	Count	Mean systolic BP at initial visit	Mean diastolic BP at initial visit
Received HBPM log	100	134.47 ± 15.56	75.28 ± 11.12
Did not receive HBPM log	47	124.47 ±10.31	72.40 ± 1039

- 68% of eligible patients received the HBPM log (*N*=147)
- 60% received the HBPM log in the previous project (*N*= 217)

- Frequency of HBPM log distribution compared to previous project
  - Chi-Square test statistic: 2.4837, *P* value 0.1150 (0.05 level of significance)

Results: Number of Recordings on HBPM log

- Of the 15 patients who returned for follow-up, 8 patients returned a HBPM log.
- Mean number of readings between initial and follow-up visit
  - 19.88
- Median number of readings from initial visit to follow-up visit
  - 20.5
- Reductions in BP at follow-up were seen in half the patients returning the HBPM log

Results: Pre- and Post BP Technique Demonstration

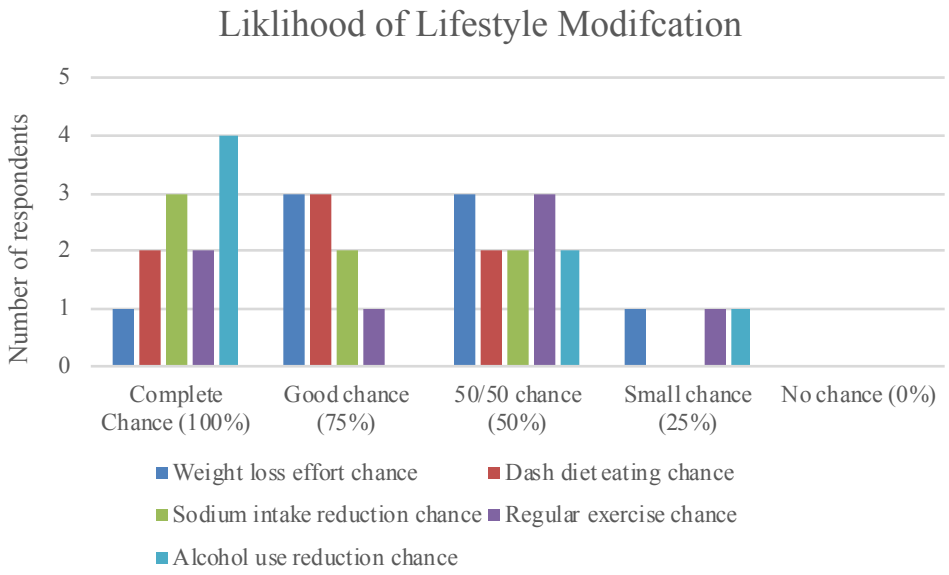
- A total of 6 BP technique behaviors were considered during the HC visits (*N*= 12)
  - Pre-Education median: 5.0
  - Post-Education median: 6.0

- Adequate time to rest
- Feet on floor, legs uncrossed
- Back supported in chair
- Arm at heart level
- BP cuff directly on arm
- No caffeine or nicotine in past 30 minutes

- Improvement following DNP-delivered BP technique correction
  - Wilcoxon signed-rank test: *Z*= 14, *P* value 0.0156 (0.05 level of significance)

Results: Lifestyle Modification Chance

- The anonymous patient survey was completed by 7 HC visit participants
- All patients reported at least some chance of modification for each behavior
- Alcohol in moderation was the most frequently reported behavior modification

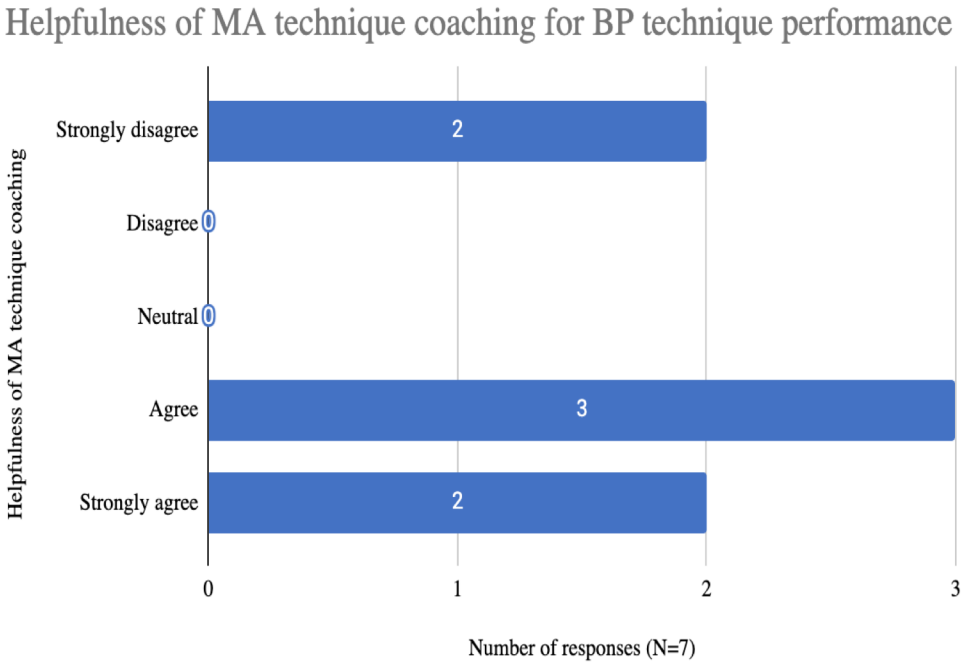


Results: Device Validation

- Home BP device readings compared against a manual sphygmomanometer
- 10 of the 12 devices met the validity procedure criteria from the AHA (2018)
- One of the two devices that did not pass was a wrist measured BP device

Results: Value of MA-Delivered Technique Education

- Of the 7 survey participants, 5 indicated agreeing or strongly agreeing with the value of the MA-delivered technique education
- The other two strongly disagreed



Project Budget

Revenue	
Project Manager Time (in-kind donation) *Note.* Based on the DNP student hourly rate over three semesters	$15,500.00
Incentive Payments from Insurance Companies: $3,555.00 incentive payments *Note*. $3,555.00 ~ the amount of money received for meeting a benchmark for one insurance company *Note*. Revenue from additional insurance companies not yet available	$3,555.00
Total	$19,055.00
Expenses	
Project Manager Time (in-kind donation)	$15,500.00
Productivity Loss due to Staff Education: 1. Medical assistants (MAs): $17.00/hour wage x 2 hours x 2 MAs 2. Primary care physician: ~$125/hour wage x 1 hour 3. DNP prepared NP: $45/hour wage x 1 hour 4. Care manager RN: $30/hour wage x 1 hour	 $68.00 $125.00 $45.00 $30.00
Copies of handouts $0.05 x 100 copies of handouts Note. $0.05 is the average cost of printing a black and white paper. Copies of handouts include all needed printed documents for this project.	$5.00
Total	$15,773.00
Net Operating Plan	$3,282.00

Discussion

- MA-delivered technique education
  - Beneficial when provided
- HBPM log distribution
  - Increase in frequency from baseline
  - Prioritized less in individuals with BP < 130/80
- Piloted HC visits
  - Appears beneficial
  - Impact on BP control yet to be determined

Limitations

- Diversity of population
- Small number of patients returned for follow-up
- COVID-19

Sustainability Plan

- Subsequent PDSA cycle
- Distribution of the Partner with Patients interventions among staff
- Involvement of care manager RN for continuation of HC visits
  - Billing for care manager services
- Reimbursement potential
  - Incentive payments

Summary

- The aim of this QI project was to implement multi-dimensional strategies to improve the management of HTN in adults at a rural PCC
- A multi-layered approach to HTN care can improve partnerships with patients (Liyanage-Don et al., 2019; McManus et al., 2018)
- These interventions have the potential for increasing provider confidence with utilizing the evidence-based HBPM strategies for improving the management of HTN

DNP Essential Reflection

DNP Essential:	Satisfied through:
I: Scientific Underpinnings for Practice	Literature review and incorporation of evidence-based practice methods for improving BP management
II: Organizational and Systems Leadership	Organizational assessment, SWOT analysis, stakeholder engagement/facilitation, cost-effective interventions.
III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice	Development and implementation of practice strategies, analysis of project results, dissemination of findings
IV: Information Systems/Technology	Using EHR for data collection related to BP control and staff compliance with the interventions
V: Advocacy for Health Care Policy	Advocating for improvement of HTN management to improve patient care, development of a practice HTN procedure outline
VI: Interprofessional Collaboration	Collaboration with physician, NP, care manager RN, and MAs, demonstrated leadership through executing objectives
VII: Clinical Prevention and Population Health	Development and evaluation of interventions targeting health promotion/disease prevention efforts related to HTN
VIII: Advanced Nursing Practice	Incorporation of patient-centered evidenced-based HTN care strategies, 1000 hours (clinical + project hours)

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