2024

An Educational Intervention on Provider Knowledge of Hypertension Guidelines and Home Blood Pressure Monitoring

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An Educational Intervention on Provider Knowledge of Hypertension Guidelines and Home Blood Pressure Monitoring

Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Nursing Practice at the University of Kentucky

By

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Shelbyville, KY

2024

Abstract

Background: While hypertension is the leading preventable risk factor for cardiovascular disease, disease control remains suboptimal. In the U.S., 47% of adults have hypertension, but only 25% are controlled. Despite having quality evidence-based guidelines, many recommendations are not implemented due to clinical inertia, or the tendency to not change therapy when targets aren't met. Research has shown that this can be overcome with educational programs. **Purpose:** To provide training on hypertension guidelines and home blood pressure monitoring (HBPM) to overcome clinical inertia and improve patient outcomes related to hypertension. **Methods**: The project was a quasi-experimental, pre- and post- survey design combined with a quality improvement process. A chart review was performed to determine hypertension control in 2022. A pre-survey of knowledge of latest guidelines and HBPM was given, followed by education and a post-survey. An HBPM handout was then implemented in practice. Finally, two Plan-Do-Study-Act (PDSA) cycles were conducted to seek provider feedback on the guideline and handout, and tools were provided to help improve utilization. **Results:** The number of adults with controlled HTN was previously suboptimal at 15.38%. There was an increase in knowledge scores from pre- to post-survey, although not statistically significant. A chart review performed 60 days post intervention showed 21.0% BP control, showing a 73.3% improvement post intervention. **Conclusions:** While the increase in knowledge scores was not statistically significant, BP control improved post intervention. Implementing the HBPM handout was both simple and cost-effective, highlighting its effectiveness in improving patient outcomes and potential value in sustaining practice change.

Acknowledgements

The project described was supported by the NIH National Center for Advancing Translational Sciences through grant number UL1TR001998. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH. A special thanks goes to my committee members, Dr. Julianne Ossege, Dr. Angela Grubbs, and Dr. Julianne Ewen for their support of this project and guidance throughout the program. I would also like to thank Dr. Amanda Thaxton Wiggins for her assistance with statistical analysis. Finally, I would like to thank the lead APRN at the Wilmore Clinic, Dr. Lori Fugate, for her clinical mentorship, as well as all APRNs working at the Wilmore Clinic, Kristy Piersawl, RN, and Tammy Mickschl, Patient Relations Specialist, for their role in supporting this project at the Wilmore Clinic.

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An Educational Intervention on Provider Knowledge of Hypertension Guidelines and Home Blood Pressure Monitoring

Background and Significance

Hypertension (HTN) is defined as persistent blood pressure (BP) ≥130/80 mmHg. It is a major contributor to premature morbidity and mortality worldwide and is a leading preventable risk factor for cardiovascular disease (Loder & Owens, 2020; WHO, 2019). In 2020, nearly 700,000 deaths in the U.S. included HTN as a primary or contributing cause (CDC, 2023). HTN costs the U.S. $131 billion each year, which includes the cost of healthcare services, medication, and missed days of work (CDC, 2023). By 2030, Benjamin, et al. (2017) projects that the total annual cost of HTN could reach over $200 billion. One of the leading health indicators for Healthy People 2030 is adults aged 18 and older whose blood pressure is well-controlled. This objective coincides with the number one objective of Healthy People 2030, which is to increase overall cardiovascular health in the U.S. population (Office of Disease Prevention and Health Promotion [ODPHP], 2020).

Problem Statement

While HTN remains one of the most pervasive preventable causes of death worldwide, diagnosis and control remain suboptimal. Lack of provider knowledge and adherence to best evidence from current practice guidelines is one of the major contributors to the rapidly increasing number of undiagnosed and poorly controlled patients with HTN (Carey, et al., 2018; Turner, 2013). Further exacerbating the problem is the most recent change in the definition of HTN, resulting in significantly more people living with the disease that are either undiagnosed or poorly controlled (HHS, 2022; CDC, 2023). New guidelines published in 2017 by the American College of Cardiology (ACC) and the American Heart Association (AHA) define Stage 1 HTN as a BP ≥130/80 mmHg (ACC, 2021). This is a change from the previous definition from the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of

High Blood Pressure (JNC8) of ≥140/90 mmHg (James, et al., 2014). One of the most effective screening tools for diagnosis and treatment of HTN recommended by the ACC/AHA is home blood pressure monitoring (HBPM), but it is unclear how often and how well this teaching is being provided in patient visits (Muntner et al., 2019; Turner, 2013).

Context, Scope, and Consequences of the Problem

Of the 1.39 billion people worldwide who have HTN, fewer than 1 in 5 have the condition well-controlled (CDC, 2020). In the state of Kentucky, 38% of adults have HTN. Of those, only 24% have their condition under control, compared with the national average of 47% prevalence and 25% control, respectively, representing a large opportunity for improvement in HTN control for providers in the state of Kentucky (CDC, 2023). Studies have shown that provider adherence to the most recent ACC/AHA HTN guidelines is suboptimal, ranging from 40% to 79% (Alyabsi, et al., 2020; Hosseinzadeh-Shanjani, et. al., 2019; Sessoms, et al., 2015). One of the described reasons in the literature for suboptimal treatment of this disease is related to clinical inertia, or the tendency to not change or advance therapy when treatment targets are not being met according to current guideline recommendations, with lack of education and training being one of the cited reasons for poor adherence (Khunti & Davies, 2017; Lewinski, et al., 2022; Milman, et al., 2018; Zheutlin, et al., 2022).

Current Evidence-Based Interventions

The quality of patient care is often measured in terms of how care is provided compared with recommendations from practice guidelines. Guideline adherence by providers has been shown in research to positively correlate with positive patient outcomes in HTN (George & MacDonald, 2015). Research has shown that provider beliefs and attitudes coupled with lack of knowledge of current guideline recommendations can be influenced and overcome with educational training and decisional aids coupled with peer influence and advice from reputable sources (George & MacDonald, 2015; Munter, et al.,

2019). The proper implementation of evidence-based practice (EBP) along with accurate, cost-effective screening tools such as HBPM is necessary to best manage HTN in the outpatient setting. Increasing provider adherence to guideline recommendations as well as necessary patient teaching on HBPM are important aspects of best practice for this disease (Muntner et al., 2019).

Purpose/Objectives

The purpose of this study was to determine which CPG providers use in practice (JNC8 vs. ACC/AHA), determine the percentage of patients with uncontrolled HTN in the clinic, and increase provider knowledge of current guidelines for HTN including HBPM. More specifically, this project aimed to do the following:

1. Analyze BP data from January 1, 2022, to December 31, 2022, to determine the percentage of adult patients diagnosed with HTN that were controlled vs. uncontrolled at the Wilmore clinical site (with the definition of BP control as <130/80 mmHg).
2. Survey providers to determine which CPG is being used in practice (JNC8 vs. ACC/AHA).
3. Present information about the percentage of controlled vs. uncontrolled HTN in the clinic setting and provide educational training on current ACC/AHA guidelines for management of HTN including HBPM.
4. Administer a pre- and post- knowledge survey to assess provider knowledge of latest HTN guidelines before and after the educational training.
5. Implement a HBPM handout to be given to all patients with uncontrolled HTN in the study setting and observe providers in clinic to evaluate the implementation of the guideline and handout.
6. Evaluate effectiveness of the educational intervention and HBPM handout on HTN control by comparing BP data 60 days post intervention to calendar year 2022.

Theoretical Framework

Narrowing the gap between discovery in research and implementation in practice requires effective strategies to implement and solidify new treatments at the bedside. The theoretical framework used for this project was Lewin's Three Step Model of Planned Change. This model describes management of team member perception and aims to prepare the affected stakeholders for a proposed organizational change. Stage 1 is known as the Unfreeze stage, where the researcher must conduct a needs analysis, gain stakeholder buy-in, and communicate why the change is necessary. During stage 1, the researcher assessed the need for provider education by determining which CPG was being used in practice and what percentage of patients had uncontrolled HTN in the Wilmore practice. This information helped to gain provider buy-in on the use of ACC/AHA guidelines, including a patient handout teaching proper BP monitoring at home. Stage 2 is known as the Change stage, in which the change is implemented in practice. During this stage, the study intervention was implemented, along with use of the HBPM handout. Stage 3 is known as the Refreeze stage, where the change is solidified and made part of standard practice in the healthcare setting (Barrow, et al, 2022). The observation periods assisted in the Refreeze period with reinforcement of guideline recommendations and use of the handout.

Review of Literature

PICOT Question

The clinical question developed to analyze research relevant to the intervention for this project was as follows: For primary care providers (P), is providing education on ACC/AHA guidelines for HTN including HBPM (I) versus not providing the education (C) effective in improving provider knowledge and adherence to guideline recommendations (O) 60 days post intervention (T).

Search Strategies

PubMed and CINAHL were searched using the following keywords: primary care provider OR clinician OR nurse practitioner OR physician assistant OR physician AND blood pressure education OR

knowledge; hypertension guideline OR guideline adherence AND provider inertia OR clinician inertia OR therapeutic inertia AND home blood pressure monitoring OR self-measured blood pressure; AND barriers to knowledge OR barriers to adherence. Inclusion criteria included peer-reviewed research articles in English, with full text available, published in the last 10 years. Exclusion criteria included articles more than 10 years old. The search yielded 103 articles and were narrowed down to 13 studies pertaining to improving provider knowledge and adherence to HTN guidelines and HBPM.

Synthesis of Evidence

Studies have shown that providing training on new guideline recommendations improves adherence to the latest evidence but choosing the best educational training to remove this barrier to care has yet to be fully described in the literature (Joosen, et al., 2019; Lewinski, et al.; Milman, et al.; Pederson, et al., 2018). Research on the most effective strategies for improvement in provider knowledge include the following training modalities: group in-service training, where on-the-job training is provided for a group of providers in-person by a facilitator; conference sessions, where providers travel to a conference for face-to-face instruction provided by experts in the field; remote/video education via a streaming application such as Zoom with live instruction by a facilitator (Kristjansdottir, et al., 2021); self-study in-service training, where providers study by themselves without direct supervision or attendance in a class (includes web-based training; Kristjansdottir, et al., 2021; Rowe, et al., 2021); educational outreach visits, with on-the-job training with face-to-face visits to individual providers at their workplace by persons regarded as an expert or opinion leader; and peer-to-peer training, led by a colleague (for example, a provider attends a training course and then returns to their clinic and shares the training information with other providers; Watson, et al., 2021; Wei, et al., 2019). While all these methods of learning have shown effective in improving provider knowledge, web-based trainings and remote/video education have shown consistently moderate to large effect size in the literature (Block, et al., 2018; Breytenbach, et al., 2017; Jackson, Brabson, & Herschel, 2018; Taylor, et al., 2021; Wei, et al., 2019).

Another important aspect of the ACC/AHA guideline is HBPM, a cost-effective screening method that has become an integral part of both diagnosis and management of HTN. Providing training on proper HBPM has been found to be instrumental in promoting correct technique (George & MacDonald, 2015), increasing utilization (Muntner et al., 2019), promoting disease self-efficacy (Shimbo et al., 2020), and improving BP control (Visseren et al., 2021). Researchers have estimated that only 30% of providers teach proper HBPM to their patients (Tang, et al., 2020; Turner, 2013). While evidence-based training programs on HTN management and BP measurement for primary care providers have resulted in improved provider knowledge and changes in practice (Hayer et al., 2022; Meinema, et al., 2017), there is a lack of research on whether providing HBPM training to providers makes them more likely to provide this education to patients. Additionally, further research is needed to assess whether providers who teach proper HBPM techniques to their patients are more likely to follow current treatment guidelines. The overall strength of evidence was mixed, including research from retrospective cohort studies, systematic reviews and meta-analyses, RCTs, cross-sectional studies, and cluster RCTs.

Gap Identification and Need for Proposed Practice Change

Assessing and enhancing provider knowledge of guidelines has been identified as an important factor in improving BP control. While a large body of research has shown that providing information and training on latest guideline management and correct technique in HBPM leads to improvement in BP control, these are not being routinely implemented in practice. This project proposed the need for provider education on ACC/AHA guidelines including implementation of HBPM to increase knowledge and adherence to the latest guideline recommendations.

Methods

Design

The design of the project was a quality improvement initiative, with a quasi-experimental one-group descriptive, pre- and post- survey design. A chart review was conducted to determine the percentage of patients with well-controlled HTN, and this information was disseminated to the providers. A survey of knowledge of ACC/AHA HTN guidelines and HBPM was given, then educational training

was provided, followed by the same survey after the training. The HBPM handout was implemented in the clinic setting, and observation was performed to seek provider feedback on the education and handout. Tools were then provided to help providers remember treatment algorithms and use the handout.

Setting

Agency Description

The setting for the project was the University of Kentucky (UK) Phyllis D. Corbitt Community Wellness Center in Wilmore, KY. This clinic provides comprehensive care for people of all ages including health promotion, disease prevention, and management of acute and chronic health problems. This clinic also administers immunizations and does school and sports physicals and pre-employment health screenings. The practice is staffed by 5 APRNs who are also faculty in the UK College of Nursing.

Project Congruence

UK Healthcare's vision is "One community committed to creating a healthier Kentucky." The mission of the organization is commitment to patient care, education, and research, using the 5 DIReCT values of Diversity, Innovation, Respect, Compassion, and Teamwork. The UK Healthcare 2025 Strategic Plan includes 5 objectives: Build Our Culture, Invest in Our People, Provide More Value, Advance Care Strategically, and Create a Healthier Kentucky (UK Healthcare, n.d.). This project aligns with the mission and vision of UK Healthcare as it seeks to improve the health of Kentuckians, promote continuing education, develop expertise among providers, and aid in translation of research into practice. There are several objectives making up UK Healthcare's strategic plan that are promoted in this endeavor. The first objective, "Build Our Culture," seeks to engage staff by developing, supporting, and encouraging an environment where a focus on collaboration enables providers to improve patient care. The next objective, "Provide More Value," seeks to provide high-value, performance driven care to improve quality, safety, and patient experience, as well as appropriately manage costs and build efficiencies throughout the system. These goals are supported through this project by meeting performance driven Merit-based Incentive Payment System (MIPS) criteria set forth by the Centers for Medicare and Medicaid Services (CMS) for Controlling High Blood Pressure (Partnership for Quality Measurement

[PQM] 0018) and provides high value by decreasing healthcare costs related to uncontrolled HTN (Partnership for Quality Measurement, 2020).

Stakeholders

The stakeholders involved in this project included 5 APRNs working at the Wilmore Clinic, a practice manager, and two support staff, including a nurse and the patient-relations representative, as well as patients with HTN receiving treatment at the Wilmore clinic. To improve HTN outcomes, the project sought to gain provider buy-in by educating staff on latest evidence for HTN management. The APRN role in this project included taking a knowledge pretest, receiving guideline-specific training, followed by a knowledge post-test. Providers were also observed in the clinical setting to provide feedback on ease of use of the guidelines and handout. The practice manager's role in this project was to facilitate a meeting with providers to implement the intervention and surveys. The role of the nurse and patient-relations staff member were to provide care to patients in alignment with provider practices put into place after receiving the education, including collecting HBPM logs from patients.

Facilitators and Barriers

Facilitators for this project included providers comprised of all APRNs employed in the UK College of Nursing. This unique staff demographic was poised to provide first-line HTN treatment as they are faculty who are already trained to evaluate and implement EBP. Barriers to implementation included the small size of the facility. With one office and two exam rooms, there was not enough space in the facility to engage all providers in an educational program on-site. Due to size restrictions, only one provider is on-site daily providing patient care. An online training course was then ideal for this practice due to space limitations.

Sample

The target population for this project was all regular providers at the Wilmore Clinic. Inclusion criteria included all APRNs treating adult patients who diagnose and manage HTN. Exclusion criteria included PRN staff that does not regularly practice at this site. Convenience sampling was used in this project as there were 5 providers practicing at this site, and this project sought to improve knowledge of

all providers in this setting. Six APRNs participated in the study, but only 5 were full-time staff. All five full-time APRNs completed both the pre- and post-surveys and all responses were included. Responses from the PRN APRN were not recorded for the study.

Procedure

IRB Submission Process

This project was submitted to the Institutional Review Board (IRB) for approval to assure the safety of all subjects involved in the project. Submission was made using the process set forth by the UK College of Nursing and was approved on 8/29/23.

Description of Evidence-Based Intervention

The evidence-based intervention used for this project was training provided to Wilmore Clinic APRNs on current ACC/AHA HTN practice guidelines, including the use of proper HBPM technique. Training included the current recommendations for diagnosing and managing HTN, including lifestyle modifications and pharmacologic therapies, and proper HBPM technique. The intervention was implemented at the November staff meeting via Zoom. The goal of this intervention was to improve provider knowledge of latest evidence-based guidelines which would then improve patient outcomes related to HTN. The second intervention for the project was the implementation of a HBPM handout, with the goal of providers giving the handout to all patients with uncontrolled HTN at their office visits.

Measures and Instruments

A chart review was conducted from January 1, 2022, to December 31, 2022, to determine the percentage of patients with HTN who were well controlled. University of Kentucky Center for Clinical and Translational Science (CCTS) performed the chart review. The outcome variables measured in this project were percentage of patients with well-controlled HTN and provider knowledge of current HTN guidelines. The provider knowledge outcome measure was assessed using a survey adapted from a validated and reliable questionnaire created by the World Hypertension League known as the Knowledge, Attitudes and Practices, or KAP, survey, with a Cronbach alpha of 0.70 (Campbell, et. Al., 2017). The survey questions related to HTN knowledge were used in the pre- and post-survey, as provider attitudes

and practice were not being studied for this project. The pre-survey included 3 open-response questions, including creating a unique identifier to maintain survey confidentiality, and two demographic questions related to number of years of experience along with which guideline they used in practice. These questions were followed by 14 structured-response multiple choice questions about HTN knowledge. One point was given for each correct answer for questions 3-16 on HTN knowledge, with 14 points possible. A score of 80% on the survey was deemed knowledgeable by the World Hypertension League. An HBPM handout was then placed in each exam room for providers to give to patients with uncontrolled HTN at their office visits. Finally, two Plan-Do-Study-Act (PDSA) cycles were completed, in which the researcher observed providers in clinic and asked 4 questions after patient visits. These questions included the following: Was the patient's BP controlled (<130/80); Was the HBPM handout used; Did they change the patient's medication; and what would make implementation of the ACC/AHA guidelines and HBPM handout easier for their practice? These observations took approximately 30 seconds, so as not to disrupt clinic flow, and were asked in the provider office to maintain the privacy of the patients being seen. Suggestions to improve ease of implementation were recorded and presented to the providers. Several providers requested a smart-phrase be created in the medical record with written HBMP handout instructions that could be sent to patients electronically. This smart-phrase was created and given to the providers and implemented in practice. Providers also requested that the treatment algorithm be printed and this was posted in their office for ease of reference. The second PDSA cycle was then performed in the same manner, by observing providers and asking the same 4 questions related to patient visits. After the second observation cycle, providers were taught how to access a history of present illness (HPI) smart-block for HTN that prompts the provider to ask the patient about diet, exercise, risk factors for HTN, and medication compliance. A sign was also placed on the outside of each exam room reminding providers to use the HBPM handout.

Data Collection

Deidentified BP data was collected from CCTS for calendar year 2022 to determine the percentage of patients with controlled HTN, with the definition of control being a recorded BP <130/80.

During the pre-survey, providers were polled to determine which HTN guideline they used in practice. Other data collected for the project was pre- and post- survey scores to determine provider knowledge of HTN guidelines and HBPM. Data was gathered through a web-based questionnaire through Qualtrics. Survey collection and training was completed during the November 2023 staff meeting. Observational data was collected over a period of 2 weeks from the 2 PDSA cycles and presented to the providers via email, followed by implementation of the suggested improvements requested by the providers.

Data Analysis

Deidentified BP data collected from chart review was analyzed to determine the percentage of patients with well-controlled HTN from both calendar year 2022 and 60-days post project implementation. Data collected from the surveys was subjected to analysis using descriptive statistics that included percentages. Quantitative data collected was analyzed using Statistical Package for Social Sciences (SPSS) software (version 29). Mean scores were calculated on the pre- and post- surveys. The Pearson Correlation coefficient was performed to determine if there was a correlation between the number of years of experience and pre-knowledge score. A paired t-test ($p < 0.05$) was performed to determine percent change from pre- to post-knowledge survey scores after receiving the educational training. Scores were then examined for each question to determine which questions improved in score from pre- to post-survey.

Descriptive data was collected to determine number of APRN years of experience, as well as which CPG providers were using in practice. The post-survey included open-ended program evaluation questions related to the value and feasibility of both the training and use of the HBPM handout. Qualitative data from the PDSA cycles was recorded and presented to the APRNs, including BP control at the office visit, changes made to medications, use of the handout, and suggestions for improvement in guideline and handout implementation.

Results

Demographic data on years of experience ranged from 3-32 years with a mean of 5.8 years of experience (SD = 12.14). When polled on which CPG was used in practice, two providers reported

exclusively using ACC/AHA, one provider used both ACC/AHA and JNC8, and one provider didn't specify a certain CPG. On the knowledge survey, there was an increase in knowledge scores from 68.6% (SD = 21.2) to 77.0% (SD = 21.8) from pre- to post-survey; this change was not statistically significant (p = .32; see Table 1). A knowledge score of 80% on the survey was deemed knowledgeable by the World Hypertension League, and none of the providers achieved this score. There was no statistically significant correlation between years of experience and pre-knowledge score (r = -.20, p = .74; see Table 2). When examining surveys to determine which questions improved in score from pre- to post-intervention, five questions improved in score, one question decreased in score, and the rest of the questions scored the same (see Table 3). BP data collected from 2022 showed that the percentage of adults with controlled HTN was 15.4% in the pre-chart review, and 21% in post-intervention, with a 73.3% improvement in BP control.

Observational data was collected during the first PDSA cycle for 15 patients with uncontrolled BP. The HBPM handout was used in 11 out of 15 patient encounters (73.3%), and medication was changed for 9 of those 15 patients (60%). When providers were polled for changes that would make implementation of the guidelines and handout easier, two change requests emerged after data saturation was met. The providers requested a smart-phrase with HBPM instructions to be sent electronically, and a printed copy of the ACC/AHA treatment algorithm to be placed in the office for ease of reference. The smart-phrase was created and shared with all the APRNs, and the algorithm was printed and placed on the bulletin board above the provider work desk. After these changes were made, a second PDSA cycle was performed with 13 patients seen with uncontrolled BP. Of those, the handout was given either in-person or electronically 11 times (84.6%). Medication was changed 10 times (76.9%). When asked again for requests to ease implementation, three more change requests emerged. The first change was a sign added to the outside of the exam room doors reminding the providers to use the handout. The smart-phrase was improved by one of the providers with the addition of the ACC/AHA HBPM diagram and BP log added to the written instructions. Finally, providers were taught how to access the HTN HPI smart-block to be used

in progress notes. Provider feedback was positive for all the changes made, and implementation of the handout was deemed useful and helpful by the providers.

Discussion

The results from this project were mixed. Each of the objectives related well to existing literature. For objective 1, only 15.4% of patients had well-controlled HTN at the Wilmore Clinic prior to the project, which aligns with CDC data on poor disease control (CDC, 2020). For objective 2, provider adherence to latest guidelines was suboptimal at Wilmore Clinic with only 2 providers exclusively using ACC/AHA for guideline management (Alyabsi, et. al., 2020; Hosseinzadeh-Shanjani, et. al., 2019; Sessoms, et. al., 2015). The educational training and handout implementation was successful in improving provider knowledge. Improvement in survey scores, although not statistically significant, does align with other studies that show that educational interventions increase provider knowledge (Campbell, et al., 2017; Williams, et al., 2023; Naciri, et al., 2021; Mousseau, et al., 2021).

While there is a lack of published research on whether providing training on HBPM to providers increases guideline adherence and utilization in office visits, utilization was high at the Wilmore clinic, suggesting applicability to other clinical sites. Changes in medication at visits when BP was poorly controlled happened frequently during the PDSA cycles, suggesting increased provider adherence to guideline recommendations after the training. The observation periods aided in the Refreeze Stage of the practice change, while solidifying knowledge gained from the training through practice at the bedside. High utilization of the handout and treatment changes in alignment with guideline recommendations supports the need for applying knowledge in practice to aid in solidification of concepts learned during training, an important tenant of Adult Learning Theory (Mukhalalati & Taylor, 2019). Finally, use of HBPM in practice has been shown to result in lower BP and higher medication adherence among patients (Tang, et al., 2020), and the improvement in BP control seen in this project aligns with and supports this (George & MacDonald, 2015; Muntner et al., 2019; Shimbo et al., 2020; Visseren et al., 2021).

This project impacted the Wilmore Clinic by improving provider knowledge and translation of evidence into practice. Use of the handout and alignment of management with guideline recommendations was readily apparent in the observation periods. To make the project sustainable over time, an electronic copy of the HBPM handout was sent to the patient relations staff member to replenish supply in exam rooms and access to the smart-phrase was granted to all of the APRNs. Next steps for the Wilmore Clinic could include a recurrent yearly educational training to reinforce knowledge of the guidelines and the importance of HBPM, as well as ongoing evaluation of the percentage of patients with uncontrolled HTN.

Implications for Practice, Education, Policy, and Research

Implementing ACC/AHA HTN guidelines has significant implications for public health, disease outcomes, and the financial burden of this pervasive disease (Tiwana & Young, 2019). This study reinforced the importance of providing continuing education to providers on these guidelines to aid in overcoming the clinical inertia that contributes to poor disease control. In this project, providing the training alone did not significantly increase provider knowledge. A greater demonstration of increased knowledge and guideline adherence was seen after performing PDSA cycles, and both were necessary to achieve the clinical impact seen in this project. Policy changes that would better align with the recommendations of ACC/AHA include changing the MIPS criteria set forth by CMS for Controlling High Blood Pressure (PQM 0018) to a goal BP <130/80 (the standard still aligns with the JNC8 recommendation of BP <140/90 for this measure). On a local level, UK Healthcare also uses the BP goal of <140/90 to rate provider metrics as they compare to the national standard from CMS. Policy changes within UK Healthcare to mirror the guideline recommendation of BP <130/80 would provide better metrics to providers for how their practice aligns with best evidence. Future implications for research could include more studies to determine whether provider education on HBPM increases guideline adherence and utilization of HBPM in practice.

Costs associated with this project were minimal and included paper copies of the handout in the exam rooms, laminated signs on the exam room doors, and a paper copy of the treatment algorithm. These tools were not only cost effective but can easily be reproduced in other settings. One of the tools requested

by providers that was not feasible for this study was a prompt in the EMR for hypertensive patients to aid in clinical decision-making. The cost and time needed to add this capability to the EMR made this impractical. There was no cost associated with creating a smart-phrase in the EMR as this feature is already built into Epic at UK Healthcare. However, clinical settings that do not use Epic may not have this capability, or it may come at an additional cost. Although HTN medications are relatively inexpensive, the impact of adoption of ACC/AHA over JNC8 has the potential to be costly for a population with only 25% of those with HTN well-controlled (Watkins, 2018). While full adoption of ACC/AHA and optimal adherence comes with higher costs for treatment, the relative benefit would be significantly higher with improvement in the estimated $51.1 billion in national annual healthcare costs associated with morbidity and mortality of this disease (CDC, 2023).

This project's importance was not only to improve outcomes in one clinical site, but to translate findings, from which benefits can be derived in a broader context. While objectives of the study were partially met, and there wasn't a statistically significant impact on provider knowledge in the survey scores, the clinical impacts were readily apparent after implementation of the guideline and handout. With a larger group of participants, the increase in survey scores may have been statistically significant, suggesting potential translation of findings from this study to larger study populations. Implementation of the HBPM handout was successful at the Wilmore clinic with provider buy-in and willingness to make practice changes amongst all APRNs. The improvement in BP control after the study interventions suggests future improvement in cardiovascular health and proposes the potential for similar success in other clinical settings.

Limitations

There are a few limitations noted in this study. The primary limitation of the study is the small sample size. Having a larger sample would allow a larger response group and may have resulted in a statistically significant change in knowledge scores. While there was good discussion and questions asked by the APRNs during the web-based training, providing the educational intervention in-person may have encouraged more active discussion among the participants. This was not an option with this population as

the space needed to hold an in-person meeting with all APRNs is not available at the UK Wilmore Clinic, and arranging to have an in-person meeting at another location would possibly limit attendance due to scheduling conflicts and other teaching responsibilities the providers have with the College of Nursing. Due to time limitations for collection of data for this project, a prospective chart review at a longer interval after implementation may not show the same successful increase in BP control as was seen 60 days post intervention, making prediction of long-term success of the practice change more difficult to estimate. Administering another knowledge survey after implementation of the guideline and handout in the PDSA cycles may have shown a greater improvement in survey scores, as formation of learning and knowledge are facilitated through experience (Mukhalalati & Taylor, 2019). Another potential limitation to this study is the translation of success from this project with a study population of all APRNs who teach in the College of Nursing to other populations whose providers may not also be educators. The willingness to adopt change and implement latest evidence may be higher among these participants because of their role in academia.

Conclusion

Providing education on ACC/AHA HTN guidelines and HBPM is instrumental in overcoming clinical inertia and promoting translation of best evidence into practice. With proper management of HTN suboptimal, adherence to guideline recommendations is important and necessary to improve outcomes in disease morbidity and mortality related to CVD. This project reinforces the value of continuing education to facilitate and enhance formation of learning and knowledge. In this project, providing the training alone did not significantly increase provider knowledge. A greater demonstration of increased knowledge and adherence to guideline recommendations was seen after performing PDSA cycles, and both were necessary to achieve the clinical impact seen in this project. Implementing the educational training and HBPM handout was both simple and cost-effective and can be easily utilized in practice. After completion of this study, BP control improved by 73.3%, highlighting its effectiveness and value in sustaining practice change and improving HTN outcomes.

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Results Tables

Table 1. Pre- and Post-Knowledge scores (*N* =5)

	Pre-Knowledge Score	Post-Knowledge Score	*p*
	mean (SD)	*mean* (SD)	
Knowledge	68.6 (21.2)	77.0 (21.8)	.32

Table 2. Correlation between years of experience and score on pre-survey (*N*=5)

	Years of Experience	Years of Experience	*p*
	mean (SD)	*r*	
Knowledge	5.8 (12.14)	-.20	.74

Table 3. Percent correct from pre- to post-survey for the 14 knowledge questions (N=5)

Knowledge Items	Pre-education % correct	Post-education %correct
What percent of adults in the U.S. have hypertension?	**60**	**100**
Of those with hypertension, what percent of people are controlled?	**20**	**60**
What is the recommended daily level of salt consumption for people who have hypertension?	**80**	**100**
If a patient who is overweight and hypertensive loses 1 kilogram (2.2 lbs) weight, what is the average reduction in systolic blood pressure?	**60**	**80**
Lower than what usual level of diastolic blood pressure represents normal blood pressure control in most adult patients?	**60**	**80**
It is recommended that people with hypertension obtain at least _____ minutes of moderate physical activity a week.	100	100
All of the following are appropriate techniques for home blood pressure monitoring except:	100	100
Home BP measurements are recommended to confirm the diagnosis of hypertension and for titration of BP-lowering medication with an average of 2 or more readings taken in the seated position on at least 2 separate occasions	100	100
What is the lowest level of usual diastolic blood pressure considered to be 'hypertensive' in adults?	60	60
Lower than what usual level of systolic blood pressure represents normal blood pressure in most adult patients?	40	40
Many people with hypertension in the community are not diagnosed. What is the best mechanism for detecting hypertension in the people in your community?	60	60
When recording blood pressures at home, patients should do all of the following except:	60	60
All of the following are true about a patient's home blood pressure monitor except:	*100*	*80*

Note: **Bold** items include the question scores that improved from pre- to post-survey, *italics* indicate decreased score

Appendix A – Home Blood Pressure Monitoring Handout (Front Side)

(ACC, 2021)

Appendix A – Home Blood Pressure Monitoring Handout (Back Side)

American Heart Association.

My Blood Pressure Log

Name: _____

My Blood Pressure Goal: _____ mm Hg

Instructions:

- Measure your blood pressure twice a day—morning and late afternoon—at about the same times every day.
- For best results, sit comfortably with both feet on the floor for at least two minutes before taking a measurement.
- When you measure your blood pressure, rest your arm on a table so the blood pressure cuff is at about the same height as your heart.
- Record your blood pressure on this sheet and show it to your doctor at every visit.

DATE	AM	PM

DATE	AM	PM

(ACC, 2021)

Appendix B – HBMP Smart-Phrase ".homebp"

Instructions for Proper Home Blood Pressure Monitoring

Prior to Measurement:

- Empty your bladder and avoid smoking, caffeine, or exercise within 30 min before BP measurements.
- Ensure at least 5 minutes of quiet rest before BP measurements.
- Self-measure your blood pressure 30 to 60 minutes before taking BP medications.

Sit correctly:

- Sit with back straight and supported (on a straight-backed dining chair, for example, rather than a sofa).
- Sit with feet flat on the floor and legs uncrossed.
- Keep arm supported on a flat surface (such as a table), with the upper arm at heart level.
- Bottom of the cuff should be placed directly above the antecubital fossa (bend of the elbow).

Take multiple readings:

- Take at least 2 readings 1 minute apart in morning before taking medications and in evening before supper.
- Ideally, you should measure and record BP daily
- At least weekly BP readings beginning 2 weeks after a change in the therapy and during the week before a clinic visit.

Record all readings accurately:

- Monitors with built-in memory should be brought to all clinic appointments.
- BP should be based on an average of readings on ≥2 occasions for clinical decision making.
- Arm cuffs are more accurate than wrist cuffs.

Appendix C – Pre-Survey adapted from the Knowledge Questions from the World Hypertension League Knowledge, Attitudes and Practices (KAP) survey (Campbell, et. Al., 2017).

1. Your number of years in practice: _____
2. What hypertension guidelines do you use?
    a. I do not use hypertension guidelines.
    b. _____ (state name)
3. What percent of adults in the U.S. have hypertension?
    a. 20%
    b. 32%
    c. 46%
    d. 57%
4. Of those with hypertension, what percent of people are controlled?
    a. 25%
    b. 31%
    c. 49%
    d. 62%
5. What is the lowest level of usual systolic blood pressure considered to be 'hypertensive' in adults?
    a. 140 mmHg
    b. 125 mmHg
    c. 130 mmHg
    d. 145 mmHg
6. What is the lowest level of usual diastolic blood pressure considered to be 'hypertensive' in adults?
    a. 90 mmHg

b. 75 mmHg

c. 85 mmHg

d. 80 mmHg

7. What is the recommended daily level of salt consumption for people who have hypertension?

    a. 1500 mg.

    b. 2300 mg.

    c. 3300 mg.

    d. Less than 5000 mg.

8. It is recommended that people with hypertension obtain at least _____ minutes of moderate physical activity a week.

    a. 75

    b. 100

    c. 150

    d. 200

9. If a patient who is overweight and hypertensive loses 1 kilogram (2.2 lbs) weight, what is the average reduction in systolic blood pressure?

    a. No change in blood pressure.

    b. 1-3 mmHg.

    c. More than 3 mmHg.

10. Lower than what usual level of systolic blood pressure represents normal blood pressure in most adult patients?

    a. 130 mmHg

    b. 140 mmHg

    c. 120 mmHg

    d. 110 mmHg

11. Lower than what usual level of diastolic blood pressure represents normal blood pressure control in most adult patients?
    a. 85 mmHg
    b. 90 mmHg
    c. 80 mmHg
    d. 70 mmHg
12. Many people with hypertension in the community are not diagnosed. What is the best mechanism for detecting hypertension in the people in your community?
    a. Recording of two high blood pressure measurements at different office visits.
    b. One recorded high blood pressure measurement at an office visit, one at the pharmacy, and one at home.
    c. Recording of three high blood pressure measurements, 15 minutes apart, in the same office visit.
    d. Recording one high blood pressure measurement at a community health fair.
13. All of the following are appropriate techniques for home blood pressure monitoring except:
    a. The patient is rested for 5 minutes in a quiet, comfortable place before measurement.
    b. An upper arm cuff is the correct size for the patient's arm.
    c. Don't smoke, exercise, or drink caffeine or alcohol within 30 minutes of measurement.
    d. Sit with legs crossed and arm resting in your lap for measurement.
14. Home BP measurements are recommended to confirm the diagnosis of hypertension and for titration of BP-lowering medication with an average of 2 or more readings taken in the seated position on at least 2 separate occasions.
    a. True
    b. False
15. All of the following are true about a patient's home blood pressure monitor except

a. Have patients bring their home monitor to their provider's office to measure its accuracy against a mercury sphygmomanometer or comparable automated device
b. Upper arm self-measured BP monitoring devices are preferred over wrist devices
c. Most adults with hypertension do not require a different cuff size from a standard adult-sized BP cuff
d. Only validated self-measured BP monitoring devices are recommended for clinical use, and several websites include validation information on self-measured BP monitoring devices

16. When recording blood pressures at home, patients should do all of the following except
    a. Take at least 2 readings 1 min apart in the morning before taking medications and in the evening before supper.
    b. Measure and record BP daily.
    c. Obtain weekly BP readings for 2 weeks after a change in the treatment regimen and during the week before a clinic visit.
    d. Take blood pressure at different times of the day, regardless of timing of meals, exercise, and medication administration.

Appendix D: Post-Survey adapted from the Knowledge Questions from the World Hypertension League Knowledge, Attitudes and Practices (KAP) survey (Campbell, et. Al., 2017).

1. What percent of adults in the U.S. have hypertension?
    a. 20%
    b. 32%
    c. 46%
    d. 57%
2. Of those with hypertension, what percent of people are controlled?
    a. 25%
    b. 31%
    c. 49%
    d. 62%
3. What is the lowest level of usual systolic blood pressure considered to be ‘hypertensive’ in adults?
    a. 140 mmHg
    b. 125 mmHg
    c. 130 mmHg
    d. 145 mmHg
4. What is the lowest level of usual diastolic blood pressure considered to be ‘hypertensive’ in adults?
    a. 90 mmHg
    b. 75 mmHg
    c. 85 mmHg
    d. 80 mmHg
5. What is the recommended daily level of salt consumption for people who have hypertension?
    a. 1500 mg.

b. 2300 mg.

c. 3300 mg.

d. Less than 5000 mg.

6. It is recommended that people with hypertension obtain at least _____ minutes of moderate physical activity a week.

    a. 75

    b. 100

    c. 150

    d. 200

7. If a patient who is overweight and hypertensive loses 1 kilogram (2.2 lbs) weight, what is the average reduction in systolic blood pressure?

    a. No change in blood pressure.

    b. 1-3 mmHg.

    c. More than 3 mmHg.

8. Lower than what usual level of systolic blood pressure represents normal blood pressure in most adult patients?

    a. 130 mmHg

    b. 140 mmHg

    c. 120 mmHg

    d. 110 mmHg

9. Lower than what usual level of diastolic blood pressure represents normal blood pressure control in most adult patients?

    a. 85 mmHg

    b. 90 mmHg

    c. 80 mmHg

    d. 70 mmHg

10. Many people with hypertension in the community are not diagnosed. What is the best mechanism for detecting hypertension in the people in your community?
    a. Recording of two high blood pressure measurements at different office visits.
    b. One recorded high blood pressure measurement at an office visit, one at the pharmacy, and one at home.
    c. Recording of three high blood pressure measurements, 15 minutes apart, in the same office visit.
    d. Recording one high blood pressure measurement at a community health fair.
11. All of the following are appropriate techniques for home blood pressure monitoring except:
    a. The patient is rested for 5 minutes in a quiet, comfortable place before measurement.
    b. An upper arm cuff is the correct size for the patient's arm.
    c. Don't smoke, exercise, or drink caffeine or alcohol within 30 minutes of measurement.
    d. Sit with legs crossed and arm resting in your lap for measurement.
12. Home BP measurements are recommended to confirm the diagnosis of hypertension and for titration of BP-lowering medication with an average of 2 or more readings taken in the seated position on at least 2 separate occasions.
    a. True
    b. False
13. All of the following are true about a patient's home blood pressure monitor except
    a. Have patients bring their home monitor to their provider's office to measure its accuracy against a mercury sphygmomanometer or comparable automated device
    b. Upper arm self-measured BP monitoring devices are preferred over wrist devices
    c. Most adults with hypertension do not require a different cuff size from a standard adult-sized BP cuff

d. Only validated self-measured BP monitoring devices are recommended for clinical use, and several websites include validation information on self-measured BP monitoring devices

14. When recording blood pressures at home, patients should do all of the following except
    a. Take at least 2 readings 1 min apart in the morning before taking medications and in the evening before supper.
    b. Measure and record BP daily.
    c. Obtain weekly BP readings for 2 weeks after a change in the treatment regimen and during the week before a clinic visit.
    d. Take blood pressure at different times of the day, regardless of timing of meals, exercise, and medication administration.
15. A patient handout on home blood pressure monitoring handout would be useful and valuable to my patients with hypertension.
    a. Strongly Disagree
    b. Disagree
    c. Nearly agree nor disagree
    d. Agree
    e. Strongly agree
16. I found this educational program informative and useful in my management of patients with hypertension.
    a. Strongly Disagree
    b. Disagree
    c. Nearly agree nor disagree
    d. Agree
    e. Strongly agree

Appendix E: Variable Table

Variable	Strategy for measurement	Level of measurement	Statistical tests	Timing of measurement
Outcome Variable 1 Determine percentage of patients with well-controlled HTN (defined as BP <130/80)	Chart audit	Ratio	Percentage	Chart audit from calendar year 2022; second chart audit 60 days post intervention
Outcome Variable 2 Provider pre-knowledge score of ACC/AHA guidelines and HBPM	Pre-survey	Ratio	Percentage	One-time measurement at time of Fall 2023 training session
Outcome Variable 3 Provider post-knowledge score of ACC/AHA guidelines and HBPM	Post-survey	Ratio	Percentage	One-time measurement at time of Fall 2023 training session
Outcome Variable 4 Change in score from pre- to post-knowledge survey	Post-survey	Ratio	Paired t-test	One-time measurement at time of Fall 2023 training session
Outcome Variable 5 Correlation between years of experience and pre-knowledge score	Pre-survey	Ordinal/Ratio	Pearson's r	One-time measurement on pre-survey at the time of Fall 2023 training session
	DEMOGRAPHIC VARIABLES			
Variable	**Data to be collected**	**Level of measurement**	**Statistical tests**	**Timing of measurement**
Number of years of APRN experience	Years of APRN experience expressed as a whole number	Interval	N/A	One-time during Fall 2023 training session
CPG used	Which CPG is used in practice expressed as words	Nominal	N/A	One-time during Fall 2023 training session