

SELF-MONITORING BLOOD PRESSURE AS A TOOL IN THE PRIMARY CARE
SETTING

by
Nancy Tiet

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As members of the DNP Project Committee, we certify that we have read the DNP project prepared by Nancy Tiet, titled Self-Monitoring Blood Pressure as a Tool in the Primary Care Setting and recommend that it be accepted as fulfilling the DNP project requirement for the Degree of Doctor of Nursing Practice.

Theresa Allison Date: Nov 14, 2022
Theresa Allison, DNP, FNP-C

Patricia Daly Date: Nov 14, 2022
Patricia Daly, PhD, FNP-BC, ENP-BC, FAANP

ee Date: Nov 14, 2022
Veronica Torres-Hernandez, MD

Final approval and acceptance of this DNP project are contingent upon the candidate's submission of the final copies of the DNP project to the Graduate College.

I hereby certify that I have read this DNP project prepared under my direction and recommend that it be accepted as fulfilling the DNP project requirement.

Theresa Allison Date: Nov 14, 2022
Theresa Allison, DNP, FNP-C
DNP Project Committee Chair
College of Nursing



TABLE OF CONTENTS

LIST OF FIGURES	6
ABSTRACT.....	7
INTRODUCTION.....	9
Background Knowledge and Significance	9
Treatments for Hypertension (HTN)	10
Self-Monitoring Blood Pressure (SMBP).....	10
Local Problem	11
Intended Improvement.....	12
Project Purpose	12
Project Question.....	12
Project Objectives	12
Theoretical Framework.....	13
Individual Characteristics and Experiences.....	13
Behavior-Specific Cognitions and Affect.....	14
Behavioral Outcomes.....	14
Literature Synthesis.....	15
Evidence Search	15
Comprehensive Appraisal of Evidence	16
Strengths of Evidence	18
Weaknesses, Gaps, and Limitations of Evidence.....	19
METHODS	20
Project Design.....	20
Model for Implementation	21
Part 1: Aims, Measures, and Changes	21
<i>What Are We Trying to Accomplish?</i>	<i>21</i>
<i>How Will We Know That a Change is an Improvement?</i>	<i>22</i>
<i>What Changes Can We Make That Will Result in Improvement?</i>	<i>22</i>
Part 2: Plan-Do-Study-Act (PDSA).....	23

TABLE OF CONTENTS - Continued

<i>Plan</i>	23
<i>Do</i>	23
<i>Study</i>	24
<i>Act</i>	24
Stakeholders	24
Setting	25
Participants and Recruitment	25
Consent and Ethical Considerations	25
Timeline	26
Planning the Intervention	26
Data Collection	27
Data Analysis	28
RESULTS	28
Outcomes	28
What the Patients Knew and Did Not Know	29
Patients' Current Practices	30
DISCUSSION	30
Summary	30
Interpretation	31
Implications (Practice, Education, Research and Policy)	31
Limitations	32
DNP Essentials Addressed	33
DNP Essential IV: Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care	33
DNP Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health	34
Conclusions	34
Plan for Sustainability	35

TABLE OF CONTENTS - Continued

Plan for Dissemination	35
APPENDIX A: SITE APPROVAL / THE UNIVERSITY OF ARIZONA INSTITUTIONAL REVIEW BOARD AUTHORIZATION LETTER	36
APPENDIX B: DISCLOSURE FORM.....	40
APPENDIX C: PRE- AND POST-EDUCATION QUESTIONNAIRE	42
APPENDIX D: PARTICIPANT MATERIAL.....	45
APPENDIX E: PROJECT TIMELINE.....	47
APPENDIX F: LITERATURE REVIEW GRID.....	50
REFERENCES	57

LIST OF FIGURES

Figure 1	<i>Pender's Health Promotion Model in SMBP</i>	15
Figure 2	<i>Model for Improvement</i>	22
Figure 3	<i>Pre- and Post-Education Questionnaire Results</i>	29
Figure 4	<i>Pre-Education Questionnaire Item #8: "I Take my Blood Pressure at Home ..."</i> ...	30

ABSTRACT

Purpose

The purpose of this quality improvement project was to incorporate educational support regarding self-monitoring blood pressure (SMBP) into the hypertensive patient's treatment regimen, with the ultimate intent of improving blood pressure (BP) control in the primary care setting.

Background

Hypertension (HTN) is a chronic disease that puts an individual at major risk for cardiovascular disease, diabetes mellitus, chronic kidney disease, and premature death. Despite these consequences, uncontrolled HTN remains a large problem and thus a priority in the primary care setting, where it is most often managed. Primary treatments for HTN include pharmacologic management and lifestyle modifications. Strong evidence shows promising results for the use of SMBP at home, along with additional support, such as education, to decrease BP.

Methods

Patients at Family Care in Maricopa County were recruited to participate if they had been diagnosed with HTN in the past or if their BP was elevated at their clinic visit. Following the patient's encounter with his/her provider, one-on-one verbal teaching occurred, and an accompanying educational handout was given. Patients received a handout about the condition of HTN, the consequences of uncontrolled BP, and how to correctly perform SMBP at home. Pre- and post-education questionnaires were used to quantify the impact of the education and to determine its effectiveness on SMBP. Patients were asked to return the latter within ten days of

the education session.

Results

14 patients were recruited for this project, and five of these subjects participated in the post-education questionnaires. All five subjects demonstrated an increase in knowledge following the intervention. 20% demonstrated an increase in SMBP at home.

Conclusions

Education increased the patient's understanding of HTN and SMBP. However, more research is needed to determine the effect of education on the patient's performance of SMBP at home and on their BP measurements.

INTRODUCTION

Despite its dire cardiovascular consequences, one important health problem that persists in the primary care setting is hypertension (HTN) (Ashman et al., 2017). Strong evidence exists supporting the use of self-monitoring blood pressure (SMBP) at home as a promising intervention for improving HTN control (Glynn et al., 2010; Stergiou et al., 2018; Uhlig et al., 2013). HTN, or more commonly known as high blood pressure (BP), is defined as having a systolic blood pressure (SBP) measurement ≥ 130 mmHg or a diastolic blood pressure (DBP) measurement ≥ 80 mmHg (World Health Organization [WHO], 2021). Over a billion people worldwide have HTN (WHO, 2021). HTN is predominantly treated in the outpatient, primary care setting. Almost 47% of all primary care visits by adults were made by those with HTN; however, HTN was under control at less than two-thirds of these visits (Ashman et al., 2017). This quality improvement (QI) project consisted of providing one-on-one HTN and SMBP education to hypertensive patients at a primary care office in Maricopa County, Arizona.

Background Knowledge and Significance

With HTN, the pressure of the blood pushing against one's arteries is consistently raised (WHO, 2021). This chronic state puts an individual at major risk for cardiovascular disease, diabetes mellitus, and chronic kidney disease, all of which lead to premature death (Aekplakorn et al., 2016; WHO, 2021). Increased cardiovascular morbidity and mortality, as well as increased use of health care resources, have been associated with uncontrolled HTN (Merai et al., 2016). The cost of treating HTN is approximately \$49 billion annually and increasing (Mozaffarian et al., 2016). Despite these individual and large-scale consequences, only about 24% of those with HTN have their BP under control (Centers for Disease Control and Prevention [CDC], 2020).

Thus, uncontrolled HTN remains a large problem, and HTN control is a clinical priority (Frieden et al., 2017). HTN is diagnosed from measurements gathered at 2-3 office visits showing SBP ≥ 130 mmHg and/or DBP ≥ 80 mmHg, occurring at 1-4 week intervals. This chronic condition is most often managed at the primary care setting.

Treatments for Hypertension (HTN)

Improved control of BP can help prevent HTN-associated morbidity and mortality rates (Mozaffarian et al., 2016). Primary treatments for HTN include anti-hypertensive medications and lifestyle modifications (Aekplakorn et al., 2016). Despite readily available pharmaceutical treatment options, Hosseininasab et al. (2014) reports poor pharmacologic compliance as one major cause of uncontrolled HTN. The literature suggests several interventions that could increase adherence to pharmaceutical regimen and thereby improve overall BP control (Hosseininasab et al., 2014). Interventions include patient education, support programs, reminder systems, and a more simplified anti-hypertensive medication regimen. Other examples of additional support are web-based educational resources, counseling, telephone calls, or behavioral management (Uhlrig et al., 2013). Glynn et al. (2010) showed SMBP as the most effective way to manage HTN, followed by nurse- or pharmacist-led care and appointment reminder systems as potential resources in improving BP. Strong evidence shows promising results for the use of SMBP at home, along with additional support, to decrease BP (Uhlrig et al., 2013).

Self-Monitoring Blood Pressure (SMBP)

SMBP is the act of routine measurements taken by the patients in their usual home environment using personal devices, and these measurements are shared with their primary care

provider (PCP) (Shantharam et al., 2022). The act of regularly checking one's BP could raise patients' awareness of their high BP, leading to pharmaceutical compliance and healthy behaviors (Yi et al., 2015). SMBP appears to better control HTN in the short term (Fung et al., 2013; Hosseininasab et al., 2014). The literature has shown that the most effective way to manage HTN in the primary care setting is through a combination of SMBP and education, antihypertensive medications, and follow-up visits (Aekplakorn et al., 2016). Furthermore, SMBP enables patients to be more involved in their care by closely following their BP values (Ciemins et al., 2018). Using home BP monitoring results in a greater BP decline following medication adjustment, as compared to using office measurements (Stergiou et al., 2014). Thus, SMBP positively impacts the patient in many ways.

SMBP is a cost effective, non-invasive intervention for HTN management in the primary care setting (Shantharam et al., 2022). It requires minimal commitment, and the patient's primary care provider (PCP) can monitor BP control over time and prevent subsequent negative outcomes. Prevention is key.

Local Problem

In 2019, the county of Maricopa, Arizona, where the population was almost 4.5 million people, had a 29.6% estimated prevalence of high BP among adults aged 18 years and older (CDC, 2022). This QI was implemented at a primary care clinic in Maricopa, Arizona. A PCP in the area reported the majority of her patient panel are diagnosed with HTN. The PCP encourages her patients to measure their BP at home and bring in any records to their follow-up visit. Reviewing logs allows individualized adjustment of the patient's medications accordingly. However, a needs assessment revealed a lack of a systematic approach to SMBP in this clinic.

Specifically, she noted there is a lack of formal education on measurement technique, frequency, and documentation (V. Torres, personal communication, October, 2021). This presented an opportunity to implement a SMBP protocol to the primary care setting.

Intended Improvement

Project Purpose

This project incorporated educational support regarding SMBP into the hypertensive patient's treatment regimen, with the purpose of improving BP control in the primary care setting.

Project Question

Will the implementation of SMBP education for patients with HTN at Family Care improve their HTN?

Project Objectives

The following objectives applied to adult patients who presented with elevated BP (SBP \geq 130mmHg or DBP \geq 80mmHg) or who have been diagnosed with HTN at Family Care:

- (1) Following patient education on the condition of HTN, on the importance of managing it, and on proper SMBP technique, patients will demonstrate increased knowledge on how to improve their BP control.
- (2) Following patient education on the condition of HTN, on the importance of managing it, and on proper SMBP technique, patients will more frequently measure their BP at home.

Theoretical Framework

Pender's Health Promotion Model (HPM) was used as a guide for this project, because promoting SMBP at home allows for the patient to be more involved in their care. HPM focuses on health promotion as a framework for disease prevention and improving population health (Pender et al., 2006). It emphasizes the active role that the patient has with his/her interpersonal and physical environments as he/she pursues health and function (Pender et al., 2006). The concept of health promotion is a practical principle for the primary care setting. When HPM is applied to practice, the provider raises awareness, promotes self-efficacy, and changes the environment to allow for behavior change within the patient, resulting in improved health outcomes.

Pender's model focuses on patients' interactions with their environments as they attempt to increase their level of well-being. According to Pender et al. (2011), there are three factors that influence the underlying motivation of patients to initiate, maintain, and engage in health-promoting behaviors: (1) individual characteristics and experiences, (2) behavior-specific cognitions and affect, and (3) behavioral outcomes. In this QI project, the provider increased awareness on the importance of controlling HTN, thus placing the patient in a better position to follow their BP closely at home, with the ultimate goal of gaining better control of their HTN.

Individual Characteristics and Experiences

Each patient has personal factors – characteristics, background, and experiences – that affect his/her actions. These factors could be biological, psychological, and/or sociocultural, and they are important in influencing the patient's behavior. Pender proposed that behavior affects one's engagement in health-promotion. One's behaviors or prior habits may allow him/her to be

more open to change as compared to another patient (Pender et al., 2006). The provider must consider these factors when appealing to the patient to incorporate SMBP into his/her daily life.

Behavior-Specific Cognitions and Affect

In Pender's HPM, there are four variables that are significant in one's motivation level (Butts & Rich, 2018). Pender suggests the provider target these variables – perceived benefits of action, perceived barriers to action, perceived self-efficacy, and activity-related affect – in order to instill a behavioral change within the patient. In the context of this QI project, the project manager took into account what the patient believes is the benefit of SMBP, the patient's barriers to conducting SMBP at home, the capacity the patient has to follow-through with SMBP, and how SMBP affects the patient.

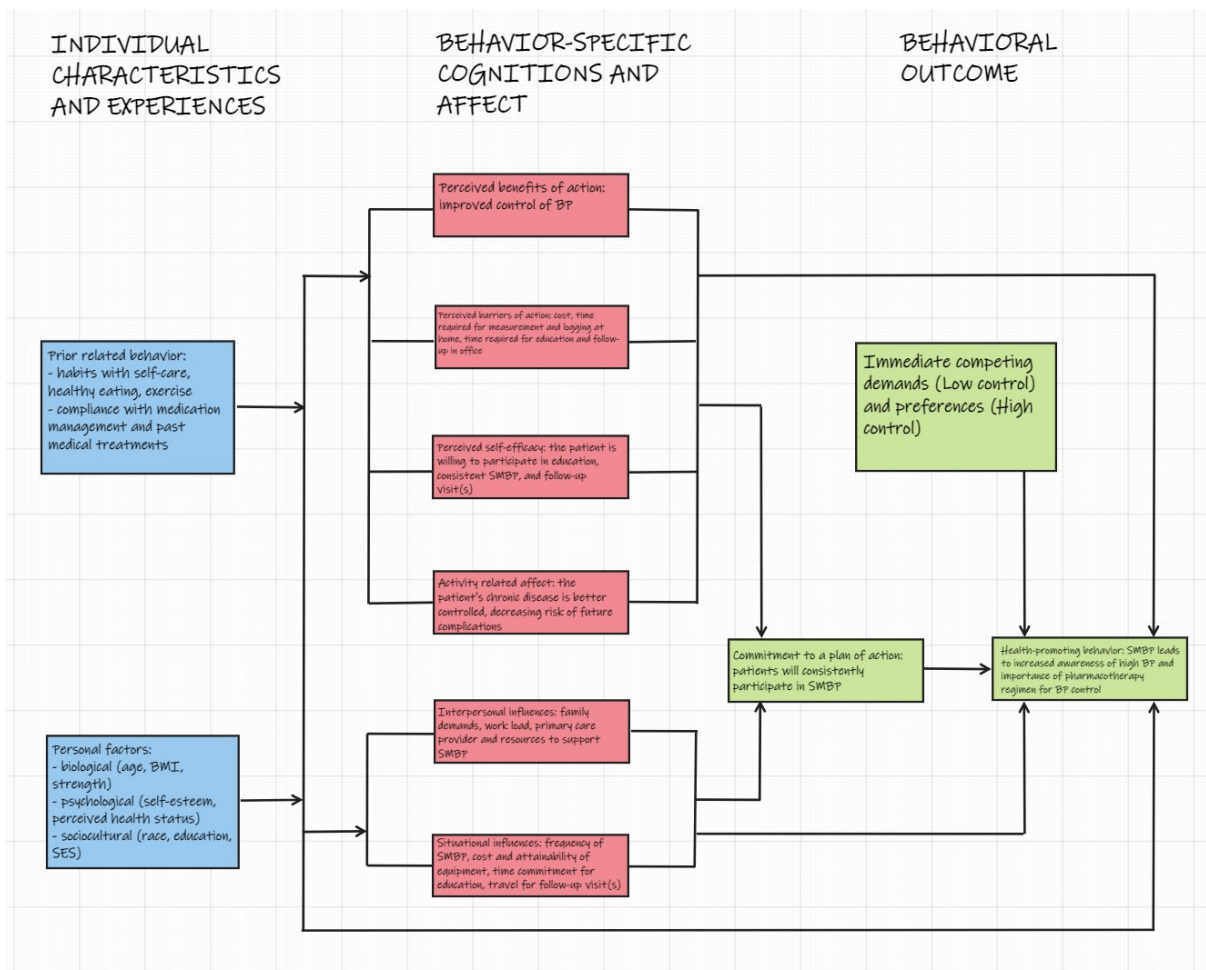
Behavioral Outcomes

The greater the commitment to a specific plan, the more likely health-promoting behaviors are to be maintained over time (Butts & Rich, 2018). Pender's HPM posits that health care providers are important sources of interpersonal influence that can increase or decrease commitment to and engagement in health-promoting behavior (Butts & Rich, 2018). Thus, the provider can modify the patient's environment to support behavior change, manage barriers to the change, and create a suitable plan of action, selling SMBP to the patient. Guided by Pender's HPM, this QI project provided education and support, encouraged patients to correctly and consistently self-monitor their BP, and led patients towards an active role in their health.

Implementation of the model into this QI project is demonstrated in Figure 1.

Figure 1

Pender's Health Promotion Model in SMBP



Literature Synthesis

Evidence Search

A search strategy was formulated for use with the PubMed database to identify background literature on the topic of SMBP in HTN management. The following search was performed, (“Blood Pressure Monitoring, Ambulatory”[MeSH]) AND (“Hypertension”[MeSH] OR “Essential Hypertension”[MeSH]), which yielded 7,337 results. In order to narrow down the

results, the following filters were applied: Free full text, meta-analysis, randomized controlled trial, systematic review, in the last 10 years, English, adult: 18+ years. Furthermore, animal studies, editorials, and review articles were excluded.

The project manager then reviewed the abstracts of 198 articles to find 32 research articles related to the clinical question. The full text files of these articles were reviewed, and their reference lists were checked for similar studies. 12 articles were selected to be relevant to the topic (Appendix F). The project manager then evaluated the designs and protocols (including randomization & treatment conditions), sample sizes and subjects (including recruitment & blinding), outcome measures (including strength, standardization, validity, & reliability), data analysis, and limitations. Lastly, the project manager interpreted the findings.

Comprehensive Appraisal of Evidence

Collectively, the literature reinforced the growing concern of poor HTN control and substantiates the use of SMBP as a tool for improving HTN control. Across the 12 studies, there was an overarching objective of investigating whether SMBP was effective in reducing elevated BP. All the studies evaluated were quantitative studies in the primary care setting. A majority of the studies analyzed were systematic reviews (SRs) or randomized controlled trials (RCTs). These two design types are amongst the strongest bodies of evidence: SRs are a Level 1 quality of evidence, and RCTs are the gold standard for clinical research (Terry, 2014). Of the 12 studies, two were SRs (as well as one SR of RCT's & one SR with meta-analysis). There were three RCTs (as well as three cluster RCTs, one secondary analysis of RCT, and one group study).

Two high-yield themes were noted in both the RCTs and the SRs: the time period for which SMBP affects HTN and the importance of education in combination with SMBP. The evidence shows that SMBP has the potential to decrease BP in the short term (Aekplakorn et al., 2016; Ciemins et al., 2018). The consensus between at least three articles was a statistically significant decrease in BP within the first six months of SMBP (Hosseininasab et al., 2014; Uhlig et al., 2013). The literature highlighted additional support that may contribute to BP control, including education on BP monitor usage prior to intervention, education on HTN, frequent follow-up visits, and BP medications. This finding was consistent in at least five studies (Fung et al., 2013; Glynn et al., 2010; Hosseininasab et al., 2014; Li et al., 2019; Uhlig et al., 2013).

SMBP may increase awareness of patients' high BP and possibly empower them to better control their BP at home (Halme et al., 2005). Older patients are more likely to consistently measure their BP at home, as they spend more time there compared to working middle-aged adults (Aekplakorn et al., 2016). Given the higher percent of participation in the RCTs asking for less frequent measurements, future studies may have stronger evidence with less frequent or less demanding logging requirements (Aekplakorn et al., 2016; Ciemins et al., 2018). In fact, participants in the intervention group reported ease in integrating home BP monitoring into their routine once weekly (Margolis et al., 2015), while patients expected to take twice daily BP measurements had "low percentage of complete records" (Aekplakorn et al., 2016).

Importantly, changes to patients' pharmacological regimen continued to occur during and across all studies. SMBP is promising for medication adherence. Ultimately, the literature was supportive of SMBP in managing hypertensive adults.

Strengths of Evidence

Although SMBP education for patients varied from RCT to RCT, the staff in the medical offices obtained measurements systematically within each study. Control groups across the literature consisted of usual care, or conventional treatment, as suggested by their physician. The interventions and controls across the RCTs are thus replicable, contributing to higher strength of evidence. Furthermore, the results were standardized within each RCT. Most RCTs experienced low dropout rates. One exception was Aekplakorn et al. (2016), a RCT that experienced low cooperation or adherence to frequent self-measurements, as well as low percentage of complete self-measuring records. The outcome measurements of BP were reproducible across the RCTs and thus have both high reliability and high validity.

The SRs had large sample sizes, each containing an adequate number of studies. The total number of subjects per SR was also large. Furthermore, the patient population across the literature were diverse. The large number of participants, as well as their varying demographics, backgrounds, and comorbidities makes for generalizable results.

Across the SRs, the outcome measurements were consistent. Intervention groups included adults being managed for HTN, who self-measured their BP at home, with or without additional support (Glynn et al., 2010; Uhlig et al., 2013). Control groups were usual care patients, with clinic-based measurements. Outcome measurements included mean change in BP medications and in BP (Agarwal et al., 2011), differences in mean systolic and mean diastolic BP (Glynn et al., 2010), or BP change at various time points (Uhlig et al., 2013).

Weaknesses, Gaps, and Limitations of Evidence

Across the studies, the subjects volunteered for their respective trials. This method of recruitment may result in biased data, as volunteers may be more apt to cooperate in the intervention than the average person. Despite volunteering for the studies, consistency in attending follow-up visits unfortunately varied from study to study. These are two weaknesses to the evidence.

Another limitation to the evidence was the level of concealment. Medical personnel (i.e. research assistants (Fung et al., 2013), medical assistants, and physicians (Halme et al., 2005)) were not always blinded across the RCTs. In the Li et al. (2019) study, both participants and researchers were unmasked. More effective concealment across the RCTs would make for stronger studies.

Of note, none of the RCTs could control for anti-hypertensive medications. The personalized pharmacological management the subjects received during the trials likely affected the results. Ideally, the project manager would design a RCT for pre-hypertensive or hypertensive patients who are not currently on BP medications. This would tell readers whether SMBP could prevent an increase in BP, without the additional intervention of pharmacokinetics. The project manager hypothesizes that one explanation for this gap across the RCTs is patient safety. This type of design would raise an ethical concern of not initiating treatment and having potential negative outcomes. As chronic HTN goes untreated, the study participants may develop consequences to their general health, leading other diseases like heart disease and more. It may be too much of a risk to allow study subjects to participate without their anti-hypertensive medications.

Furthermore, existing evidence had difficulty controlling for HTN severity. Some SRs studied participants with uncomplicated hypertension (Uhlig et al., 2013), while other SRs had a lack of control for comorbidities (Sheppard et al., 2016), demonstrating varying generalizability. Many uncontrolled factors weaken the evidence but make the data more generalizable to patients in different health conditions.

SMBP appears to better enhance BP control in the short term; though self-measuring decreases BP in the long term as well, the evidence is not significant (Aekplakorn et al., 2016; Fung et al., 2013; Uhlig et al., 2013). The project manager hypothesizes that long-term self-measuring may not be feasible for busier, working adults in particular. The issue may be frequency of SMBP and perhaps this is where adjustment needs to be made and measured. Thus, the absence of an effective, standardized protocol for SMBP with education, along with the strong evidence for it, substantiates the need for one in the primary care setting.

METHODS

Project Design

We identified (1) the need for a systematic SMBP protocol in the clinic setting, and (2) evidence showing that SMBP, when paired with support such as education, has the potential to improve BP control. This QI project manager created a protocol consisting of education that sets patients up for successful SMBP at home. This QI project emphasized the education component that occurs prior to implementation of a new procedure – SMBP – in the primary care setting. Upon viewing the educational material and receiving verbal education, patients learned what the condition of HTN entails, the dangers of persistent, uncontrolled HTN, and how to correctly perform SMBP at home. The data was collected in the form of a pre- and post-education

questionnaire (Appendix C). A quantitative approach was used to measure the impact of the education and to determine its effectiveness on SMBP.

Model for Implementation

The Model for Improvement is a strategy to systematically and effectively manage change (Institute for Healthcare Improvement [IHI], 2022). The model has two parts and is demonstrated in Figure 2. The first part asks three fundamental questions: what are we trying to accomplish, how will we know that a change is an improvement, and what changes can we make that will result in improvement? These three questions set the aim, establish measures, and select changes, respectively. The second part is the Plan-Do-Study-Act (PDSA) cycle. This cycle tests and implements a change in a small but real work setting (Health Resources and Services Administration, 2011). The PDSA cycle guides the test of change and determines whether the change is an improvement (IHI, 2022).

Part 1: Aims, Measures, and Changes

What Are We Trying to Accomplish?

This QI project targeted adults (aged ≥ 18 years) who presented to the clinic with elevated BP (SBP ≥ 130 mmHG or DBP ≥ 80 mmHG) or who have been diagnosed with HTN at past visits. The aim of this project was for the subjects to demonstrate increased knowledge on HTN, such as the importance of keeping it controlled and how to improve their BP measurements, particularly with SMBP.

Figure 2*Model for Improvement****How Will We Know That a Change is an Improvement?***

Quantitative measures were used to determine if the education provided actually led to an improvement in knowledge on HTN and SMBP. Our outcome was the difference between the subject's pre- and post- education questionnaire scores. This difference was calculated in the form of a percentage.

What Changes Can We Make That Will Result in Improvement?

The change implemented in this project was in the form of education (Appendix D). The patient received education on the condition of HTN, the importance of managing it, and proper SMBP technique. Following data collection, the next step in the QI project was to identify

changes that are most likely to result in improvement (Institute for Healthcare Improvement, 2022). Thus, the outcome measures will be reviewed, and changes will be made accordingly to the educational materials, SMBP technique, and/or questionnaires.

Part 2: Plan-Do-Study-Act (PDSA)

Plan

The plan was to deliver effective education to the hypertensive patient. The education would produce increased awareness on the patient's condition, increased knowledge on SMBP, increased support to patients during their health maintenance journey, and decreased BP measurements.

Do

Prior to the visit, the front office staff called the patient for the usual appointment reminder and confirmation. In this phone call, the staff member asked the patient to bring in their BP device for calibration if they own one. Upon arrival to the appointment, the medical assistant roomed the patient, and a set of vital signs were taken. Any elevated BP was noted. Upon rooming the patient, staff asked whether they owned BP monitoring equipment – a requirement for participation. Following the encounter with provider and while we had the patient's attention in the exam room, the patient was presented with a disclosure document for participation. The project manager emphasized the benefits of the project to the patient's HTN treatment plan. If the patient chose to opt into the project, they were asked to complete a pre-education questionnaire. It was collected, and then the educational intervention occurred in the form of a handout (Appendix D) and accompanying one-on-one verbal teaching. He/she learned about condition of HTN, various methods to reducing BP, and proper SMBP technique. The patient's

machine was calibrated with the office machine and used in return demonstration. Lastly, he/she was provided with the educational handout, the disclosure document (Appendix B), and a postage-paid envelope with the post-education questionnaire inside. The patient was asked to return it within ten days.

Study

Upon collection of post-education questionnaire, both the pre- and post-education questionnaire results were calculated, as well as the difference in scores between the two. Specifically, we noted whether we met our measurement goal of post-education improvement. These outcomes showed whether the patients retained knowledge from the educational session in office, felt supported by their primary care team, and tried SMBP at home.

Act

If results are promising, adjustments may be made as necessary, and the next step would be to implement this project for a longer time period with a larger amount of patients. If patients continue to demonstrate positive feedback from the education, patients may then be asked to perform SMBP home, and providers can review documented BP logs, adjusting pharmacologic therapies thereafter. Over time, other providers in the office can adopt the protocol, and if successful, the entire clinic and other clinic locations may implement this education with SMBP in the future as well.

Stakeholders

Stakeholders are individuals who have a vested interest in the project, such as the project outcome. These individuals can have an effect on or could be affected by the outcome of the project (Moran et al., 2020). Stakeholders in this QI project included the patient and his/her PCP.

The patient is a critical stakeholder, because HTN control will decrease the patient's risk factors for heart and renal disease, improving their overall health. The outcomes of the QI project will be used to influence the PCP's practices for treating hypertensive patients in the future.

Setting

Family Care is an integrated healthcare delivery network. The general population at this primary care clinic includes patients across the lifespan, from pediatric patients to seniors. The medical team offers services such as physicals and wellness exams, men's and women's health, immunizations, hormone replacement therapy, ultrasounds and more. Family Care offers coordinated and personalized management for chronic conditions such as HTN, diabetes, weight issues, thyroid disorders, hepatitis, and more.

Participants and Recruitment

This QI project recruited patients who were diagnosed with HTN or who presented to clinic with elevated measurements (SBP \geq 130mmHg and/or DBP \geq 80mmHg). Another form of recruitment occurred during the chart review process. The QI manager reviewed the patient's electronic health record (HER) prior to the encounter, and any patient with a diagnosis of HTN in the chart was flagged. Delivery of QI project information occurred, willingness to participate indicated consent, and a disclosure form was given to the subject. There was no compensation with this initial project, though the patient was incentivized to participate to gain better control of their health.

Consent and Ethical Considerations

Protection was ensured for all subjects who chose to participate in this QI project. The Institutional Review Board (IRB) of the University of Arizona approved the project (Appendix

A), and it was established with the IRB that patients' names and other identifying factors were not required for this project. Information retained for the purposes of the project included only BP values from the office visit. Other patient information remained confidential throughout the project. Privacy was maintained, and information was stored in a secure manner.

Timeline

This QI project progressed over the span of 20 days. The first five days focused on recruitment and implementation. That is, five full clinical days was spent recruiting patients and implementing education: subjects were recruited, pre-education questionnaires were collected, the educational sessions occurred, and they departed from their respective visits with their post-education questionnaire.

The patient then had the next ten days following the encounter to perform SMBP at home. He/she/they practiced SMBP at home and worked on completing his/her/their post-education questionnaire. He/she/they then mailed the questionnaire to the project manager.

Evaluation by the project manager occurred in the last five days. As post-education questionnaires were received, both pre- and post-education questionnaires, were reviewed. Patient progress was analyzed. Results determined how the project should proceed in the future.

Planning the Intervention

Comprehensive patient education was key; thus, the educational material was a handout that had to be easy to read (Rooney et al., 2021). Every effort was made to ensure readability at the recommended sixth grade level. Pictures were displayed for visual learners.

An easy-to-understand definition of HTN was on the handout. The handout included eye-catching statistics meant to draw the patient's attention to the alarming consequences of

uncontrolled HTN. The cost and health consequences associated with HTN were also be included. Treatments for decreasing BP were mentioned, with emphasis on SMBP.

Patients learned the preparation prior to measurements at home: (1) no eating, caffeine consumption, smoking, exercise, or other activities for at least 30 minutes, (2) empty the bladder, (3) sit comfortably for at least 2 minutes, with arms and back supported, legs uncrossed, and feet flat on floor, and (4) avoid talking or using electronics (American Heart Association [AHA], 2020; Shimbo et al., 2020). Approved devices, appropriate cuff size (40% of arm circumference and covering at least 80% of the upper arm), and proper cuff placement (on bare skin, not on clothes, lower border of cuff just above the antecubital space, arm resting at heart level) were discussed (AHA, 2020). The handout included directions to measure BP at the same time every day (in the AM, 1-2 hours after medications), taking 2-3 measurements, at least 1 minute apart, then averaging those measurements (AHA, 2020). Proper documentation of values was discussed (AHA, 2020). Finally, the patient was reminded to take their medications normally and to bring in the log for their PCP to review.

Collecting the post-education questionnaire is critical for the data collection in this QI project. Thus, patients received written instructions prior to their departure from the visit. A postage-paid envelope increased the ease of the patient's task.

Data Collection

To evaluate the outcomes of the project, the subjects' pre- and post-educational questionnaires results were collected, and their difference calculated. Questionnaires are an appropriate tool for this project because they can quantify the degree to which the subject retained the educational information. This data will be in the form of a percentage, reflecting

how many questions the subject answered correctly.

Data Analysis

The difference between the questionnaires were be calculated: (“post-education questionnaire score” minus “pre-education questionnaire score”), divided by 100 = overall score increase (%). A positive overall score increase indicated that the subject acquired increased knowledge on HTN and SMBP following the intervention.

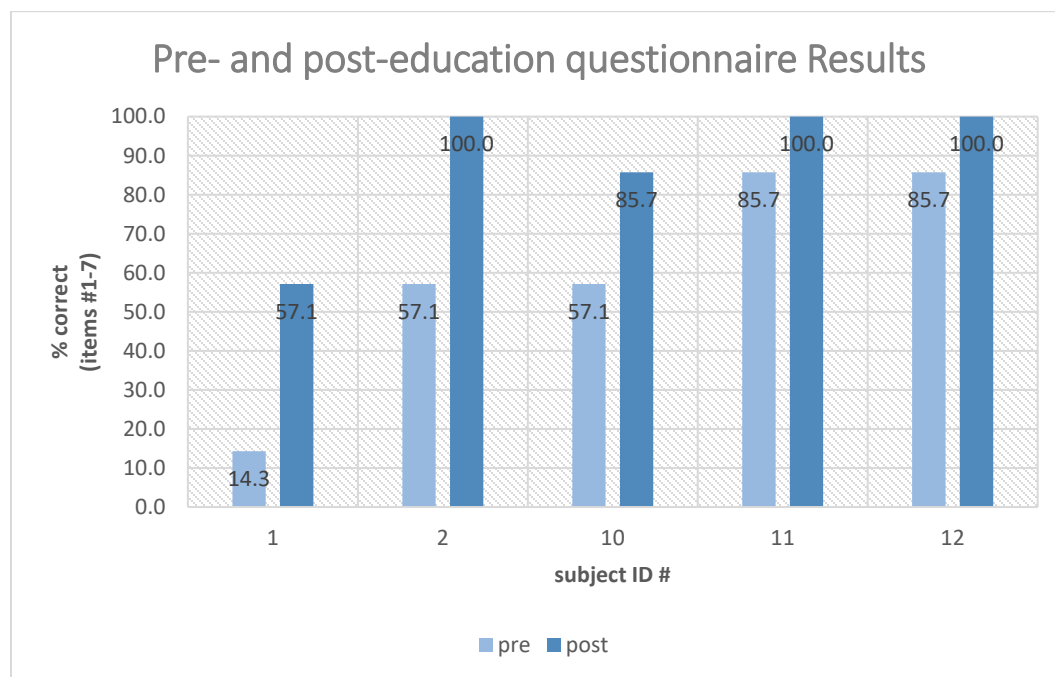
RESULTS

Outcomes

Over the span of five clinical days, the project manager recruited 14 patients for this QI project and implemented the educational session for each of these individuals. Eight of the 14 (57.1%) subjects had an uncontrolled BP reading at their visit. Of the 14 subjects recruited, five individuals mailed in their post-education questionnaires. This is a response rate of 35.7%.

There was a total of ten items on the pre- and post-questionnaires (Appendix C). Items #1 through #7 asked questions regarding HTN and SMBP technique and had one correct answer out of four multiple choice selections. Items #8 through #10 on the questionnaires surveyed the patient’s current practices and beliefs regarding HTN, without correct answers.

All five subjects who returned a post-education questionnaire showed an improvement from the pre-education questionnaire in terms of the first seven items. Thus, as seen in Figure 3, 100% of these individuals gained knowledge from the education session. There was an average of 31.4% improvement from the first questionnaire, meeting our first objective. As for our second objective, two of these five subjects increased the frequency of SMBP following education (questionnaire item #8).

Figure 3*Pre- and Post-Education Questionnaire Results***What the Patients Knew and Did Not Know**

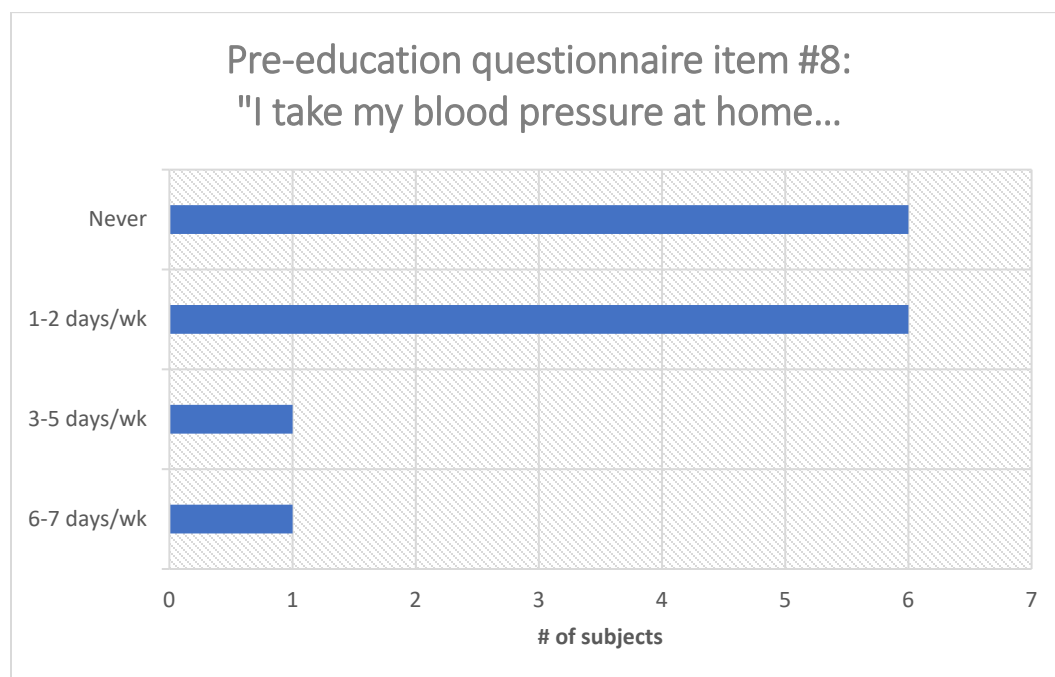
It is worth mentioning the data shown in the 14 pre-education questionnaires alone. Interestingly, only five of the 14 subjects correctly answered the definition of high BP (questionnaire item #1). That is, about 2/3 of subjects did not know that high BP results from the increased force of blood pumping against the artery walls. Furthermore, less than half (42.9%) of the subjects knew the best time to measure BP at home is 1-2 hours after medications (questionnaire item #7). Positive results showed 71.4%, 92.9%, and 64.3% of subjects correctly answered the consequences of uncontrolled BP (questionnaire item #3), the importance of a low sodium diet (questionnaire item #5), and other treatments for HTN (questionnaire item #6), respectively.

Patients' Current Practices

Figure 4 shows six of the 14 patients measured their BP 1-2 days a week, while another six patients performed even fewer measurements. 12 of the 14 patients endorsed taking their medications 100% of the time (questionnaire item #9). In addition, patients felt supported by their care team in managing their HTN (questionnaire item # 10).

Figure 4

Pre-Education Questionnaire Item #8: "I Take My Blood Pressure at Home..."



DISCUSSION

Summary

The literature demonstrated the concerning prevalence of poorly controlled HTN. Noting that over half of the subjects had uncontrolled BP (SBP \geq 130mmHg or DBP \geq 80mmHg) at the time of the intervention reinforced the need for this intervention. In addition, the literature recognized SMBP with support as an evidence-based and effective means of reducing BP. This

project encompassed educational support with SMBP, with the purpose of improving BP control at Family Care.

From the data that was collected, the implementation of SMBP education for patients with HTN at Family Care beneficially impacted patient outcomes by improving patient knowledge of HTN and how to improve their BP control. The project's first objective resulted in increased knowledge for 100% of subjects whom we received both pre- and post-education questionnaires. The second finding provides support for the patient to perform SMBP. 20% of subjects for whom we received both pre- and post-education questionnaires demonstrated an increase in the frequency of SMBP, this project's second objective.

Interpretation

From the pre-education data collected, most of the patients at Family Care reported taking their anti-hypertensive medications regularly; this was surprising, as noncompliance was one cause for uncontrolled HTN noted in the literature. The data collected showed patients were aware of the other recommended treatments for HTN (including low sodium diet), and they know the myriad of problems that uncontrolled BP can lead to. However, they did not (a) check their BP at home and (b) know what having high BP actually means. Following the education, it was anticipated that an increase of knowledge would enhance the subjects' SMBP performance at home. The outcomes of this project contribute to the body of evidence promoting education for SMBP.

Implications (Practice, Education, Research and Policy)

Family Care has a large adult population with HTN. Currently, patients at this clinic who have Medicare insurance are receiving personal devices that record and upload their BP values

into a secured cloud. This “Remote Program Monitoring” (RPM) allows clinicians at Family Care to review patients’ data (R. Le, personal communication, June, 2022). The impact of this QI project on RPM is the incorporation of education on SMBP to RPM participants. This implementation would ideally set participants up for success in RPM. If SMBP education is successfully adopted clinic-wide and RPM shows promising patient outcomes, then on an even wider scale, it may be distributed to patients who have other insurances or to other primary care offices around the county.

Limitations

In the planning stages of this QI project, the benefits of the 1:1 education session – the project manager could assess the patient’s learning, the patient had personalized learning, and it was convenient as the patient was in office for a scheduled appointment – seemed to outweigh the drawbacks – the patient was spent over an hour in the building waiting to be roomed, being seen by the provider, participating in the session, and drawing labs after. The project manager had contemplated an alternative means of education: an open invitation to hypertensive patients clinic-wide to a one-hour, classroom style, PowerPoint-guided, educational session occurring over the span of one evening. The turn-out rate for this alternative was questionable, and thus it was decided that more patients could be captured in the exam room. However, a limitation of this project was the number of participants who would return the post-education questionnaire. Thus, this project was limited by a small sample size, which restricts analyses and limits generalizability of findings. Reminder phone calls, which could have increased completion of post-education questionnaires, were not made in an effort prevent collection of patient identifiers. Furthermore, an item analysis of the questions would not have been unreasonable, to

gauge the effectiveness of several of the questionnaire items.

DNP Essentials Addressed

The advanced practice nurse (APRN) undergoes extensive training and education to address the growing number of health problems inside and outside of the clinic setting. The doctorate-prepared APRN completes a rigorous curriculum that includes standardized competencies called the Doctor of Nursing Practice (DNP) Essentials (American Association of Colleges of Nursing, 2006). The Essentials guide the APRN in clinical decision-making and problem solving, evidence-based practice, and patient care. This QI project demonstrated how Essentials IV and VII were applied to SMBP as part of the treatment modality for the large population of patients who have uncontrolled HTN.

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

Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care (Essential IV) “prepares the DNP graduate to use information technologies in ways that improve patient care outcomes” (Butts & Rich, 2018). Essential IV aides the APRN in utilizing unique, feasible, and alternative interventions, such as telecommunication or mobile apps. This QI project introduced the use of BP monitors into the patient’s home and daily life. These automatic machines are becoming smaller, more affordable, and they are easy to use, sometimes with as few as two buttons – on/off and start/stop. Furthermore, remote monitoring will transform the future of health care.

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

Clinical Prevention and Population Health for Improving the Nation's Health (Essential VII) prepares the DNP graduate to develop, implement, and evaluate interventions that promote health and prevent disease in the community (American Association of Colleges of Nursing, 2006). Increasing the control of high BP in adults is one of the national objectives to improve health and well-being over the next decade (Healthy People 2030, n.d.). This QI project contributes directly to this Healthy People 2030 objective; the national target for this objective is for 18.9% of adults aged 18 years and over to have their high BP under control. From the data collected, Family Care has 42.8% of subjects' BP meeting goal.

Conclusions

Current evidence on HTN management suggests that SMBP, along with educational support, has the potential to improve BP control. This QI project implemented an educational intervention about HTN and SMBP to adults at Family Care with HTN, with the ultimate purpose of improving BP control in the primary care setting. Pre- and post-education questionnaires were administered to quantitatively assess the outcome of increased knowledge. Of those who completed both questionnaires, all subjects demonstrated increased knowledge on HTN and SMBP. However, there is insufficient data to conclude an increase in the frequency of SMBP following the intervention. Future research in SMBP education and interventions may support implementation in other similar settings.

Plan for Sustainability

The educational intervention provided to patients lasted no greater than 5 minutes of their time and thus is reasonable to include in patients' teaching. An alternative would be to offer the teaching in the form of a video recording. BP logs of patients who received the educational intervention may be viewed by the PCP to determine longer term retainment of the education, adherence to SMBP, and decrease in BP measurements. These documented measurements may be valuable to the provider, not only in the management of that patient's condition, but also in whether such education should continue to be implemented in the future.

Plan for Dissemination

This QI project's findings will be verbally shared with providers at Family Care. In addition, findings will be presented to the University of Arizona at the project manager's DNP Final Defense.

APPENDIX A:

SITE APPROVAL / THE UNIVERSITY OF ARIZONA INSTITUTIONAL REVIEW BOARD
AUTHORIZATION LETTER

FOUNTAINS FAMILY CARE
2015 N Dobson Rd #11
Chandler, AZ 85224

6/27/2022

University of Arizona Institutional Review Board
c/o Office of Human Subjects
1618 E Helen St
Tucson, AZ 85721

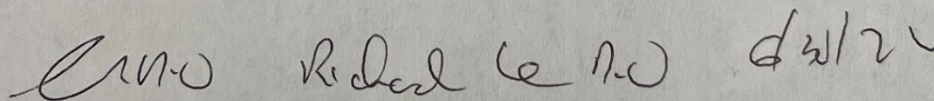
Please note that Ms. Nancy Tiet, UA Doctor of Nursing Practice student, has permission from Fountains Family Care to conduct a quality improvement project at our facility for her project, "Self-Monitoring Blood Pressure in the Primary Care."

Ms. Tiet will provide a short ~5 minute educational session to patients who present with elevated blood pressure or those who have been diagnosed with hypertension at Fountains Family Care. She will recruit patients following their encounter with the provider and the 1-on-1 educational session. The educational session will occur in the form of a handout to accompany verbal teaching. The patient will learn about the condition of hypertension and various methods to reduce blood pressure at home. The importance of self-monitoring blood pressure (SMBP) at home, the correct techniques on SMBP, and documentation of measurements will also be emphasized. With the patient's consent to the project, she will provide the patient with the educational handout, a description of the project, and a postage paid envelope with the post-education questionnaire inside, to be returned within 10 days. The responses to the post-education questionnaire will be compared to the pre-education questionnaire the patient will have completed upon arrival in the waiting room. Ms. Tiet's activities will be completed by 10/31/2022.

Ms. Tiet has agreed to provide to my office a copy of the University of Arizona Determination before she recruits participants. She will also present aggregate results to the providers at their monthly staff meeting.

If there are any questions, please contact my office.

Signed,



Richard Le, D.O.
Fountains Family Care, P.C



University of Arizona IRB
 845 N Park Ave., Suite 537A
 Tucson, AZ 85719
 Fax: 520-621-9810
VPR-IRB@arizona.edu

NOT HUMAN RESEARCH

September 9, 2022

Nancy Tiet

Dear Nancy Tiet:

On 9/9/2022, the IRB reviewed the following submission:

Type of Review:	Initial Study
Title:	Self-monitoring blood pressure as a tool in the primary care setting
Investigator:	Nancy Tiet
IRB Submission ID:	STUDY00001842
Sponsor:	None
Prime Sponsor:	None
IND, IDE, or HDE:	None
Documents Reviewed:	<ul style="list-style-type: none"> • Advisor Attestation.pdf, Category: Institutional Approval; • TIET Disclosure, Category: Consent Form; • TIET IRB Protocol for Determination of Human Research v2021-11.docx, Category: IRB Protocol; • TIET questionnaires, educational material, site authorization letter, Category: Participant Material;

The IRB determined that the proposed activity is not research involving human subjects as defined by DHHS and FDA regulations.

IRB review and approval by this organization is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities are research involving humans in which the organization is engaged, please submit a new request to the IRB for a determination. You can create a modification by clicking **Create Modification / CR** within the study.





University of Arizona IRB
845 N Park Ave., Suite 537A
Tucson, AZ 85719
Fax: 520-621-9810
VPR-IRB@arizona.edu

All Covered Individuals must disclose all sponsored and non-sponsored Research Projects to the Office for Responsible Outside Interests (OROI) prior to Conducting Research if the individual is an Investigator. Please visit the [OROI](#) website for more information.

We value your feedback and would appreciate you taking the time to complete our survey about your experience with the IRB staff:

https://uarizona.co1.qualtrics.com/jfe/form/SV_ehQ04WxNA06b42i

If questions arise at any time during your study, please email the general IRB inbox at VPR-IRB@arizona.edu.



APPENDIX B:
DISCLOSURE FORM

Self-monitoring blood pressure as a tool in the primary care setting
Nancy T., MS, RN, DNP-FNP student

The purpose of this project is to provide education about self-monitoring blood pressure into the hypertensive patient's treatment plan, with the purpose of improving blood pressure control in primary care.

If you choose to take part in this project, you will be asked to (1) complete a pre-education questionnaire, (2) receive education about high blood pressure and self-monitoring blood pressure at home, and (3) complete and return a post-education questionnaire within 10 days from today. It will take approximately 25 minutes to complete questionnaires and the education. There are no foreseeable risks associated with participating in this project. You will receive no immediate benefit from your participation. Your responses are anonymous. Your name will not be collected or linked to your answers.

If you choose to participate in the project, participation is voluntary, refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may withdraw at any time from the project. In addition, you may skip any question that you choose not to answer. By participating, you do not give up any personal legal rights you may have as a participant in this project.

For questions, concerns, or complaints about the project, you may email Principal Investigator, Nancy, at ntiet1220@arizona.edu.

You agree to have your responses used for this project.

APPENDIX C:
PRE- AND POST-EDUCATION QUESTIONNAIRE

Hypertension Questionnaire

1. What is high blood pressure?
 - The blood is not carrying enough oxygen to the heart
 - The heart is pumping too fast
 - The force of blood pumping against the artery walls is too high**
 - There is fat build-up along the artery walls
2. Hypertension is blood pressure over...
 - 120/80
 - 130/80**
 - 130/90
 - 140/80
3. If my blood pressure stays out of control, I can develop...
 - Kidney disease
 - Heart attack
 - Stroke
 - All of the above**
4. What is the most common symptom of high blood pressure?
 - Fast heartbeat
 - Tired
 - Fever
 - No symptoms**
5. Diet is important. Make sure to eat...
 - Less sodium (salt)**
 - More sodium (salt)
 - Less vegetables
 - More fat
6. What else can I do to control my blood pressure?
 - Exercise
 - Take my medications regularly
 - Monitor my blood pressure at home
 - All of the above**
7. Checking my blood pressure at home shows your provider how well your medication is working. At home, the best time to measure my BP is...
 - 30 min after medications
 - 1-2 hour after medications**
 - After exercise
 - After eating

8. I take my blood pressure measurement...
- 6-7 days a week
 - 3-5 days a week
 - 1-2 days a week
 - Never
9. I remember to take my blood pressure medications...
- 100% of the time
 - 75% of the time
 - 50% of the time
 - Less than 50% of the time
10. Do you feel supported by your care team in managing your hypertension?
- Yes
 - Most of the time
 - Sometimes
 - No

Office Staff only:

Blood pressure in office ____ / ____

Date: ____ / ____ / 2022

Subject # ____

APPENDIX D:
PARTICIPANT MATERIAL



What is HYPERTENSION?

(High Blood Pressure)

Hypertension, or high blood pressure, is a measurement over 130/80mmHg. In hypertension, the pressure of the blood is increased, pushing against the walls of your arteries. Over time, this constantly raised pressure can lead to heart disease, kidney damage, and more.

47%

of adult primary care patients have HTN

29.6%

of adults in Maricopa have HTN

24%

have their HTN under control

\$49B

spent in healthcare resources

Treatments

At least 150 minutes per week

Exercise

Low: sodium, saturated fat
More: potassium, calcium, magnesium

Diet

Examples: lisinopril, losartan, hydrochlorothiazide

Medications

Self-Monitor Blood Pressure

Measuring your BP in the comfort of your own home where you spend most of your time provides the most accurate values. Your doctor can review your numbers at your next visit. Then, they can change your medications if needed.

Prepare:

- **No activities**
No eating, caffeine, smoking, or exercise 30min before
- **Empty your bladder**
- **Sit comfortably**
Arm & back supported, legs uncrossed, feet flat on floor for at least 2min
- **Cuff placement**
Over bare skin on relaxed arm, at level of heart (see photo)



Your BP Log:

DATE	AM	PM
02/12/22	144/88	147/90

Measure:

Same time every day: AM (before meds), then 1-2 hours after meds

Take 2-3 measurements, at least 1min apart. Then take the average.

Don't forget to take your medications normally!

Write down your numbers (←see example)

Bring your machine and your log to your next doctor's visit

Prevent disease:

Cardiovascular disease

Diabetes

Chronic Kidney Disease

Live your life!



APPENDIX E:
PROJECT TIMELINE

Completion Date	Planning	Pre-implementation	Implementation	Evaluation
9/20/2022	<p><i>Following IRB approval:</i> The handout, disclosure form, and pre- and post-education questionnaires will be printed out. They will be assembled into packets with a pre-stamped and addressed empty envelope.</p>			
		<p><i>Prior to patient's appointment:</i> The front office staff will call the patient for the usual reminder and confirmation of upcoming appointment. In this phone call, the staff member will ask the patient to bring in their BP device for calibration if they own one.</p>		
10/04/2022			<p><i>Recruitment:</i> When the patient arrives for his/her appointment, the project manager will review vital signs for elevated BP and charts for diagnosis of HTN. Following the exam with the provider, these individuals will be presented with the disclosure document and asked if they are willing and interested in participating in the project.</p>	
10/04/2022			<p><i>Pre-education questionnaire:</i> The patient will take the questionnaire.</p>	
			<p><i>Education:</i> The project manager will review the educational handout with the patient. The patient's machine will be</p>	

			calibrated with the office machine. Return demonstration will occur by the patient.	
10/14/2022			<i>SMBP</i> : The patient performs SMBP.	
			<i>Post-education questionnaire</i> : The patient completes the questionnaire and returns it via outgoing mail.	
10/19/2022				<i>Data analysis</i> : The project manager will review questionnaires, determine patient progress, and how the SMBP can be incorporated into the clinic's practice.

APPENDIX F:
LITERATURE REVIEW GRID

Project Question: Will the implementation of SMBP with education for patients with HTN at the 4C Medical Group Scottsdale Clinic improve their HTN?

(Author's Last Name, Pub. Year)	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
(Aekplakorn et al., 2016)	Effectiveness of self-monitoring blood pressure in primary care: A randomized controlled trial	RCT	<p>SBP in both SMBP and usual care groups decreased at 6mo and 12mo by 2.5mmHg and 1.2mmHg, respectively, though with no significant difference.</p> <p>SMBP reduced BP for >60years with uncontrolled HTN at 12mo (P=.02).</p> <p>No significance difference between SMBP and usual care groups according to sex, BMI, or <60years.</p>	<p>Examines SMBP without other interventions</p> <p>SMBP may increase awareness of [uncontrolled HTN] patients' high BP and possibly lead them to better control their BP.</p> <p>Patients >60years usually spend more time at home and thus are more likely to measure.</p>
(Agarwal et al., 2011)	Role of home blood pressure monitoring in overcoming therapeutic inertia and improving hypertension control: A systematic review and meta-analysis	SR and meta-analysis	Home BP monitoring significantly improved SBP, DBP, and mean BP.	<p>Effect of home BP monitoring on changing medications</p> <p>Home BP monitoring led to greater reduction in medication</p>
(Ciemins et al., 2018)	Improving blood pressure control using smart technology	Prospective observational cohort study	<p>Patients in the HBPM program demonstrated significantly greater improvement in BP control compared to control.</p> <p>The program, with involvement of a nurse navigator and NP, facilitated patients taking a more active role in their care and lifestyle</p>	<p>Addressed both physician therapeutic inertia and patient medication adherence.</p> <p>Given patient's decreasing compliance throughout the study, HMBP might have use for short-term patient monitoring during</p>

(Author's Last Name, Pub. Year)	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
			and physicians responding to the results in a more frequent and timely manner.	medication changes or with BP fluctuation.
(Fung et al., 2013)	Home blood pressure monitoring: A trial on the effect of a structured education program	Cluster RCT	<p>Mean SBP and DBP of both groups decreased from visits 1 to 3.</p> <p>There was a significantly greater DBP reduction at the 3mo visit (P=0.004) in the intervention group.</p> <p>However, this difference was no longer significant by the 6mo visit.</p>	<p>Coupled HMBP with education to ensure correct usage of machine at home</p> <p>HBPM education program has the potential to produce greater reductions in BP of HTN patients.</p> <p>HBPM education appears to enhance short term improvement in BP control.</p>
(Glynn et al., 2010)	Self-monitoring and other non-pharmacological interventions to improve the management of hypertension in primary care: A systematic review	SR	<p>Significant reduction of - 2.5mmHg in SBP from self-monitoring (12 RCTs)</p> <p>Reduction in mean DBP from self-monitoring (14 RCTs)</p> <p>No significant improvement in BP control (6 RCTs)</p>	<p>Compares self-monitoring with other non-pharmacological interventions for HTN</p> <p>Self-monitoring is the most effective way to manage HTN amongst other non-pharmacological interventions for BP control.</p> <p>Nurse- or pharmacist- led care, as well as appointment-reminder systems are promising in improving BP.</p>
(Halme et al., 2005)	Self-monitoring of blood pressure promotes achievement of blood pressure target in primary health care	Randomized, multicenter, parallel-group study	<p>SBP and PP decreased significantly (at home) in the self-monitoring group.</p> <p>SBP decreased significantly more in the self-monitoring</p>	<p>Examines self-monitoring at home without other interventions</p> <p>Intermittent measurements may be easier to adhere to</p>

(Author's Last Name, Pub. Year)	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
			<p>group than in the control group, specifically by 3.3/0.8mmHg at home.</p> <p>All SBP, DBP and PP measurements at home and office decreased.</p>	<p>than daily measurements for patients</p> <p>Home BP measurement is a potential tool for patients who are sufficiently motivated to treat their high BP.</p> <p>BP decreased significantly in the control group, as well, which shows that participation in studies also intensifies the treatment of the control group.</p>
(Hosseinasab et al., 2014)	Self-monitoring of blood pressure for improving adherence to antihypertensive medicines and blood pressure control: A randomized controlled trial	RCT	<p>Both SBP and DBP at week 4 were significantly lower than at week 0 for both groups ($P < 0.001$).</p> <p>Difference in medication adherence between study groups was statistically significant at all 3 follow-up visits.</p> <p>Results could not support a clinically meaningful effect of self-monitoring.</p>	<p>Adherence to medications measured following BP self-monitoring</p> <p>Study shows significant decrease in blood pressure at 4-week follow-up (more so than at 12- or- 24-week visit).</p> <p>Short term BP control in both intervention and control group; authors suggested that informed consent procedure may have resulted in higher rate of adherence.</p> <p>Three follow-up visits may have resulted in improving patients' adherence. Unconfirmed whether self-</p>

(Author's Last Name, Pub. Year)	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
				monitoring contributed to this result.
(Li et al., 2019)	A WeChat-based self-management intervention for community middle-aged and elderly adults with hypertension in Guangzhou, China: A cluster-randomized controlled trial	Prospective, cluster-RCT	<p>SBP and DBP declined significantly between intervention group and control groups by -6.9mmHg (P=0.002) and -3.1mmHg (P=0.016).</p> <p>No significant difference in SBP between baseline and follow-up in control group.</p> <p>HTN control increased.</p> <p>BP monitoring rate changed significantly compared to control.</p> <p>No difference in HTN knowledge, self-efficacy, and social support scores.</p>	<p>Weekly BP measurements in conjunction with education, health promotion, and social support</p> <p>Health education improved knowledge of hypertension among participants, increasing understanding of the disease, confidence in self-management, and behavior changes.</p>
(Margolis et al., 2015)	A successful multifaceted trial to improve hypertension control in primary care: Why did it work?	<p>Planned mediation analysis</p> <p>Two-group cluster-RCT</p>	<p>Increases in medication treatment intensity (24%) and home BP monitor use (19%) showed significant mediation in SBP change.</p> <p>Each unit increase in BP med class reduced SBP by 5.64mmHg.</p>	Multifaceted trial showed a combination of self-monitoring and medication intensification more effectively improving HTN control.
(Powers et al., 2011)	Measuring blood pressure for decision making and quality reporting: Where and how many measures?	Secondary analysis of RCT	SBPs could be accurately categorized with 80% probability based on the mean of 5 home measurements.	Multiple (home) BP readings are needed to determine whether BP is adequately controlled.

(Author's Last Name, Pub. Year)	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
(Uhlrig et al., 2013)	Self-measured blood pressure monitoring in the management of hypertension: A systematic review and meta-analysis	SR and meta-analysis	<p>Moderate strength evidence shows SMBP alone significantly lowers BP (-3.9/-2.4mmHg) compared to usual care at 6 months. No significance at 2mo or 12mo.</p> <p>High strength evidence supports SMBP with additional support shows lower BP than usual care.</p> <p>Insufficient evidence for SMBP monitor alone compared to with support.</p> <p>Insufficient evidence for beyond 12mo and for clinical outcomes</p>	<p>SR comparing SMBP (with or without additional interventions) with usual care</p> <p>SMBP alone lowers BP at 6mo</p> <p>Support in addition to SMBP lowers BP</p> <p>More medication changes and greater medication adherence with SMBP monitoring</p> <p>SMBP monitors vary: manual, semiautomated, automated</p> <p>Additional support may include counseling, education Web-based resources, educational materials, letters on treatment recommendations, phone monitoring, tele counseling, behavioral management, medication management with decision support, nurse or pharmacist visits, calendar pill packs, and adherence contracts</p>
(Yi et al., 2015)	Self-blood pressure monitoring in an urban, ethnically diverse population: A randomized	RCT	No difference in achieving BP control	Self-blood pressure monitoring in a largely minority, urban population

(Author's Last Name, Pub. Year)	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
	clinical trial utilizing the electronic health record			(Hispanics, black, uninsured). Utilizing electronic systems and relationships maximized efficiency

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