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Implementing a Self-measured Blood Pressure Monitoring Process

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Implementing a Self-measured Blood Pressure Monitoring

Process

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This Manuscript Partially Fulfills the Requirements for the

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Implementing a Self-measured Blood Pressure Monitoring Protocol

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Abstract

Practice Problem: Because of the prevalence of hypertension worldwide, it is prudent for all patients to have the knowledge and ability to self-monitor their blood pressure. Patients monitoring their own blood pressure and communicating the readings with healthcare providers facilitates a more comprehensive plan of care.

PICOT: The PICOT question that guided this project was: In adults 18-90 years old with primary hypertension (P), will a self-measured blood pressure monitoring that includes a monthly telehealth visit with a provider (I), compared to blood pressure monitoring at routine office visits (C), decrease patients' systolic blood pressure readings by five mmHg (O) within 8 weeks (T)?

Evidence: Research shows that self-measured blood pressure monitoring reduces blood pressure, possibly because treatment adherence is improved due to daily monitoring and reporting the reading to a provider.

Intervention: Twenty participants took their blood pressure at home with a verified monitor and entered the readings into the patient portal for the provider to review for 8 weeks. Pre and post-project blood pressure readings were analyzed for home monitoring effectiveness.

Outcome: A two-tailed paired samples t-test was used to show that the mean of the pre-project systolic blood pressure was significantly higher (143.60 mmHg) than the mean of the post-project systolic blood pressure (130.50 mmHg). Clinical significance was observed by lower systolic blood pressure readings of the hypertensive participants by the end of the project.

Conclusion: By monitoring at home daily, the patient is aware of their blood pressure readings and understands when treatment changes are necessary. This increases patient engagement in the self-care of hypertension while reducing their blood pressure.

Implementing a Self-measured Blood Pressure Monitoring

Process

Elevated blood pressure or hypertension (HTN) is one of the most common chronic

conditions in adults that damages blood vessels and leads to cardiovascular disease (NCD Risk

Factor Collaboration, 2017). Known as the silent killer, hypertension is often the first chronic

disease in patients that creates a domino effect of other conditions with devastating consequences

(Department of Health and Human Services [HHS], n.d.). Approximately half of all adults in the

United States, or 116 million people, have systolic blood pressure greater than 130 mmHg or

diastolic blood pressure greater than 80 mmHg (Centers for Disease Control and Prevention

[CDC], n.d.-a). Unfortunately, people are often unaware of when their blood pressure (BP) is

elevated; therefore, frequent monitoring is recommended (Whelton et al., 2018). Adequate

management of hypertension by healthcare professionals and the individual is essential to avoid

health complications and improve quality of life (World Health Organization [WHO], 2022).

Self-monitoring of BP and follow-up visits with a clinician can promote quality management of

hypertension. These actions will help prevent the negative cascading effect of

hypertension (Whelton et al., 2018).

Significance of the Practice Problem

There are 1.3 billion hypertensive people globally, with approximately 720 million not

receiving proper treatment (WHO, 2022). Cardiovascular disease is the leading cause of death in

the United States (United Health Foundation, 2022). In 2018, approximately 96,000 deaths were

attributed to hypertension in the United States (CDC, n.d.-a). Research shows that an estimated

$131 billion is spent yearly on hypertensive patients compared to those without hypertension

(Kirkland et al., 2018). A study from the State of Kentucky reports that 40.9% of its population has hypertension, with 11,345 deaths in 2020 attributed to heart disease (CDC, n.d.-b; United Health Foundation, 2022).

Because there are often no signs of increased BP, patients may be unaware of the damage to their blood vessels. Even with patients aware of their chronic hypertension, routine tracking of BP is integral to a successful plan of care (WHO, 2022). This is especially true as BP progressively increases with age. In 2017, 77.3% of people 65 and older in the US had hypertension (CDC, 2019). Before 2017, the threshold for a hypertension diagnosis was blood pressure consistently 140/90 mmHg or higher (Department of Health and Human Services, n.d.). After extensive research on the damage of hypertension, the ACC and the AHA published a clinical guideline to change the hypertension threshold to 130/80 mmHg or greater (Whelton et al., 2018).

At most primary care visits at a large ambulatory clinic in central KY, the patients have their BP taken before meeting the clinician. If the reading exceeds 140/90 mmHg, another BP is taken in 5 minutes. This additional reading ensures that the elevated BP is not because of walking from the parking garage to the clinic. However, this practice does not account for white coat hypertension. Abnormal BP readings in the clinic compared to a normal BP measured outside the clinical setting are called white coat hypertension (Johansson et al., 2021). To make this comparison, the patient must take their BP at home. Because of the prevalence of hypertension, it is prudent for all patients to have the knowledge and ability to self-monitor their BP. A self-measured blood pressure (SMBP) protocol would be beneficial in identifying patients that have not been diagnosed yet with hypertension and patients diagnosed with hypertension but need additional treatment.

PICOT Question

The PICOT question that guides this evidence-based project is: In adults 18-90 years old with primary hypertension (P), will a self-measured blood pressure monitoring that includes a monthly telehealth visit with a provider (I), compared to blood pressure monitoring at routine office visits (C), decrease patients' systolic blood pressure readings by five mmHg (O) within 8 weeks (T)?

The conceptional definition for each component is a population (P) of 18-90 years old in a primary care clinic at a large teaching hospital; the intervention (I) is self-measured blood pressure readings reported daily via the organization's patient portal and monthly telehealth visits with a provider; the comparison (C) is the usual care of attending an appointment in the clinic with a blood pressure reading done by the staff; the desired outcome (O) of the intervention will be a decrease by five mmHg in the systolic measurement; the timeframe (T) for the data collection is 8 weeks. The current practice of the providers in the clinic is to encourage the patients diagnosed with hypertension to monitor their BP at home and report the readings at the next office visit. However, there needs to be a process to assist in doing this. This change project will initiate an SMBP protocol among 20 patients in the clinic to ascertain the effectiveness of daily reporting of BP readings to the provider and monthly follow-up visits.

Evidence-Based Practice Framework & Change Theory

DNP projects require a framework that guides the process of translating the EBP into practice. This project utilized the Johns Hopkins Nursing Evidence-based Practice (JHNEBP) model (Dang et al., 2022). The JHNEBP model focuses on a three-step process called PET: practice question, evidence, and translation (Dang et al., 2022). The purpose of this model is to

provide the latest research findings that support best practices (Dang et al., 2022). For this project, the process plan was as follows:

Step 1 Practice Question

An interprofessional committee was organized, and meetings were held to determine the need for change from current BP management practices. Stakeholders were identified at this time. From this information, the PICOT question was developed.

Step 2 Evidence

A rigorous search was done for evidence for data pertaining to the SMBP monitoring. The themes that were identified were a reduction in BP readings, telehealth visits, and daily readings increased treatment adherence. Each article was appraised for quality and information relevant to the project. Relevant articles were chosen, and the findings were synthesized for the best practice recommendations.

Step 3 Translation

Clinic-specific recommendations, such as SMBP with telehealth follow-up visits, were identified by the project committee that correlated with the organization's mission. Support from the organization's leadership was obtained. Once the project was completed, the outcomes were disseminated to the organization and other entities.

The Diffusion of Innovation (DOI) change theory was used for this project. In 1962, E.M. Rogers developed this theory to explain how an idea spreads over time in a specific population (Rogers, 1983). Effective communication is required to create momentum for an idea to be adopted by others (Binji, 2020). This change theory works well with the project as the patient monitors their blood pressure and reports to the provider via the patient portal. Lower BP

readings confirm that the SMBP protocol assists in creating a positive outcome for patients by managing their hypertension.

Evidence Search Strategy

The evidence search strategy for this project involved using three databases: CINAHL Complete, PubMed, and Joanna Briggs Institute EBP Database. In the CINAHL Complete database, the terms searched with the Advanced Search filter were "home blood pressure monitoring" OR "self-measured blood pressure or smbp" OR "self-monitoring blood pressure" OR "Out of the Office Blood Pressure Monitoring" AND "hypertension or high blood pressure" AND "patient portal or telemedicine." The inclusion filters of publishing date from 2017-2022, English language, abstracts, and peer reviewed. The filters "All Adult" and "USA" were chosen after the initial search results to narrow the search even more. In the PubMed database, "home blood pressure monitoring" OR "self-monitoring blood pressure" OR "self-measured blood pressure" AND "patient portal OR telemedicine." The inclusion filters used were 5 years, English, abstract, randomized clinical trial (RCT), and adult:19+. Lastly, the Joanna Briggs Institute of EBP database was used. The search words were "home blood pressure monitoring AND hypertension." An Advanced Search filter narrowed the dates to 2017-2022 and searched for articles with abstracts.

Evidence Search Results

The evidence search provided 278 articles to be reviewed. The abstracts of these articles were investigated to ascertain the relevance of the evidence to this translational project. Articles were discarded due to duplication, the need for more quality of the study, and irrelevance to the PICOT question. The full texts of the articles whose abstracts passed the first review were obtained for a more thorough inspection. The JHNEBP criteria were used to grade the quality of

the final group of articles analyzed (Dang et al., 2022). The JHNEBP table provides a hierarchy

of evidence based on the study type used to retrieve the data and its reliability. The evidence

levels range from level I, which includes RCTs, to level V, which includes literature reviews and

case reports (Dang et al., 2022). The evidence grades range from A to C, based on the quality of

the results (Dang et al., 2022).

After reviewing and grading 61 full-text articles, 15 were chosen for this project due to

their pertinence and strong evidence grades (see Figure 1). There are nine primary research

articles, two systematic reviews with a meta-analysis, two systematic reviews without a meta-

analysis, and one position statement by the American Heart Association and the American

Medical Association (see Appendices A, B & C). Six of the primary research articles were

JHNEBP quality rated I/A because the RCTs produced thorough scientific evidence and

definitive conclusions regarding SMBP (Margolis et al., 2018; McManus et al., 2018, 2021;

Tzourio et al., 2017; Yatabe et al., 2021; Zhang et al., 2021). One cohort study (III/A) was

chosen because the participants utilized SMBP and input their readings into a patient portal (Lee

et al., 2022). This study re-analyzed data from an earlier RCT to ascertain how the clinician

responded to their alerts in the patient portal. One mixed method designed Study (II/A) and one

qualitative study (III/A) were selected because of the extensive evidence presented (Allen et al.,

2019; Beran et al., 2018). Lastly, the position paper was chosen because it is the gold standard

for self-management of high blood pressure (Shimbo et al., 2020). The HHS created a website

based on these recommendations to assist patients and clinicians in implementing SMBP

programs throughout the United States (HHS, n.d.)

Themes with Practice Recommendations

Reduction of Blood Pressure

The primary theme of the research (see Appendices A and B) is that SMBP reduces blood

pressure over and above the usual care of an office visit BP reading (Guirguis-Blake et al., 2021;

Lee et al., 2022; Margolis et al., 2018; McManus et al., 2018, 2021; Shimbo et al., 2020; Tucker

et al., 2017; Tzourio et al., 2017; Viera et al., 2021; Whelton et al., 2018; Yatabe et al., 2021;

Zhang et al., 2021). Some studies reported a reduction in systolic blood pressure up to 12 mmHg

(Beran et al., 2018; McManus et al., 2021; Tzourio et al., 2017). However, it is crucial that the

patient is educated on how to take their blood pressure correctly, as well as, verifying the home

BP machine used produces accurate readings (Lee et al., 2022; Margolis et al., 2018; McManus

et al., 2018; Shimbo et al., 2020; Tucker et al., 2017; Tzourio et al., 2017; Whelton et al., 2018;

Zhang et al., 2021). One study indicated that 66.7% of the participants reduced their BP below

140/90, possibly because treatment adherence was improved due to daily monitoring and

reporting to a provider (Zhang et al., 2021). SMBP is recommended for diagnosing hypertension

accurately (Guirguis-Blake et al., 2021; Lee et al., 2022; Viera et al., 2021; Whelton et al.,

2018).

Diagnosis of Hypertension

Many studies included data on the use of ambulatory BP measurement to diagnose

hypertension (Guirguis-Blake et al., 2021; Shimbo et al., 2020; Viera et al., 2021). Ambulatory

BP measurement is done by placing a cuff on the patient for 24 hours, which collects readings at

set intervals (Shimbo et al., 2020; Whelton et al., 2018). While this may be considered the Gold

Standard for diagnosing HTN, some patients cannot tolerate having their BP taken consistently

over 24 hours (Shimbo et al., 2020; Viera et al., 2021; Whelton et al., 2018). SMBP is less

restrictive to the patient and provides data over weeks (Beran et al., 2018; Guirguis-Blake et al., 2021; Shimbo et al., 2020; Viera et al., 2021; Whelton et al., 2018). Often patients have high BP readings only while at an office visit. SMBP can be used to determine if this is true HTN or white coat HTN (Shimbo et al., 2020; Viera et al., 2021; Whelton et al., 2018).

SMBP with Additional Interventions

Several studies identified that collaboration between the patient and the provider, along with SMBP, often resulted in a better outcome than SMBP alone (Beran et al., 2018; Lee et al., 2022; McManus et al., 2018, 2021; Tucker et al., 2017; Whelton et al., 2018). Specifically, combining a scheduled telehealth visit to discuss blood pressure trends results in identifying barriers to self-managing HTN. During this telehealth visit, lifestyle modifications and medication adjustments can be timely addressed (Beran et al., 2018; McManus et al., 2018, 2021; Tucker et al., 2017; Whelton et al., 2018; Yatabe et al., 2021). Another intervention that increases patient engagement and decreases the chance of sustained HTN is electronic reporting of daily BP readings to the provider. With this information, the provider is alerted that the BP pressure is out of parameters, and adjustments can be made quickly (Beran et al., 2018; Lee et al., 2022; McManus et al., 2018, 2021; Shimbo et al., 2020; Tucker et al., 2017).

Practice Recommendations

The strength of the research reviewed included evidence levels I, II, III, and IV, with an A quality level. The high-caliber quality and strength of evidence answer the PICOT question by identifying that SMBP reduces high BP (Beran et al., 2018; Guirguis-Blake et al., 2021; Lee et al., 2022; Margolis et al., 2018; McManus et al., 2021; McManus et al., 2018; Shimbo et al., 2020; Tucker et al., 2017; Tzourio et al., 2017; Yatabe et al., 2021; Whelton et al., 2018; Zhang et al., 2021). Initiating an SMBP protocol in a primary care clinic that includes home BP

monitoring machine validation and education on proper techniques for taking the BP is beneficial to patients with high blood pressure (Guirguis-Blake et al., 2021; Margolis et al., 2018; McManus et al., 2018, 2021; Shimbo et al., 2020; Whelton et al., 2018). Daily BP readings recorded by the patient directly into their chart through the patient portal provide BP trends that assist the clinician in determining the proper treatment. An alert will notify the clinician if BP readings are out of range (Lee et al., 2022).

Monthly telehealth visits with the provider offer the opportunity to educate and make necessary changes to medication (Beran et al., 2018; Margolis et al., 2018; McManus et al., 2018, 2021; Yatabe et al., 2021). The patient being directly involved in their care increases patient engagement and medication adherence (Beran et al., 2018; Margolis et al., 2018; Yatabe et al., 2021). The illustration in Figure 2 shows the symbiotic relationship necessary for successful SMBP monitoring (CDC, 2020). This collaboration between the patient and the provider creates effective patient-centered care (Margolis et al., 2018; Tucker et al., 2017).

Setting, Stakeholders, and Systems Change

The setting of this DNP scholarly project was a small primary care clinic affiliated with a large teaching hospital. The patients' ages range from 21 to 100 years old. The services provided in the clinic include managing acute and chronic medical conditions, annual health exams, health promotion, disease prevention, and patient education. The staff consists of two physicians, one nurse practitioner, one registered nurse, one medical assistant, and one registration clerk. The clinic sees approximately 50 patients each week.

The needs of the organization were discussed with stakeholders to determine if the DNP Evidence-based Project was appropriate. Over 50% of the clinic panel has been diagnosed with HTN. A discussion with the providers revealed that this patient population is asked to annotate

BP readings on paper logs, but many of these patients do not provide this information back to the staff. A way to report the BP readings directly into the chart would benefit the patient and the provider.

The stakeholders in this project are primarily the clinic patients and the providers. With an established protocol of SMBP that includes reporting BP readings via the patient portal, the providers have sufficient data to treat this chronic condition appropriately. Other stakeholders are the chief nurse executive for ambulatory care and providers in the cardiac clinic that may also be treating the patient. Intercollaboration of care is crucial in improving the quality of care by coordinating with all clinicians that may be treating the patient (Melnyk & Fineout-Overholt, 2019). The organization's mission is to commit to patient care, education, and research. The enterprise supported this project by extracting data from the EHR by the Center for Clinical and Translational Science department. Sustainability is feasible with staff training to include SMBP as part of their HTN plan of care.

A SWOT analysis (see Figure 3) was performed to identify internal and external opportunities and concerns. It was essential to understand the project's strengths compared to weaknesses. The main strengths of the SMBP project were patient engagement in their care and positive outcomes with their chronic disease. This project also provided the opportunity to develop an SMBP protocol that could be used organization-wide and add revenue for increased telehealth visits. The weaknesses that were exposed involved internet and patient portal access. Threats to the project included inconsistent patient adherence to the SMBP protocol and taking their medications as prescribed. This micro-system change project enabled the patient to become more active in their care and strengthened their communication with the provider. In turn, the provider gained essential data to guide the treatment needed for a positive outcome.

Implementation Plan with Timeline and Budget

The JHEBP model provided tools to translate the evidence into an action plan (See

Appendix D). With these tools, the following plan was developed:

JHEBP Action Plan

Care Team Actions

1. Initiate standardized training of clinicians to take BP measurements accurately one week

    before the project (See Appendix E).

Care Team/Participant Actions

1. Staff validated the SMBP device with the office BP machine on day 1 of the project.

2. Staff educated the participant on the proper SMBP technique on day 1 of the project

    (See Appendix F).

3. Staff instructed the participant to use the patient portal to record daily BP readings on

    day 1 of the project.

4. Initial BP readings were recorded at the office on day 1 of the project.

5. Telehealth appointments with a clinician to review BP readings and adjust medications

    were scheduled for week 4 of the project.

6. BP readings were recorded at the office on week 8 of the project.

The BP data collected in the office at the beginning and end of the project were analyzed to

ascertain the significance of SMBP in managing HTN. Four main objectives guided the

implementation plan for the project:

1. Selection of 20 adults diagnosed with HTN from the internal medicine clinic by EHR

    random selection by the end of week 4 of NUR 7802.

2. Attained access to the patient portal for 100% of project participants, and each had a
   validated home BP monitor to begin data collection by the end of week 5 of NUR 7802.

3. Retrieved data of 90 % of project participants' BP readings by the end of week two of
   NUR 7803.

4. Analyzed all data with Intellectus statistical software and completed the project with
   practice recommendations by the end of week 6 on NUR 7803.

Diffusion of Innovation

The project action plan utilized the five stages of the change adoption process of the

Diffusion of Innovation theory (Binji, 2020).

Knowledge

Patients were asked to take their blood pressure at home and report the readings to their

providers. This information was instrumental for the provider to develop a care plan

accurately (CDC, 2013; Guirguis-Blake et al., 2021; Murakami et al., 2015; Shimbo et al., 2020;

Whelton et al., 2018).

Persuasion

Stakeholders were identified, and a meeting was held to discuss the clinic's advantages

and disadvantages of SMBP monitoring. A PICOT question was created from the brainstorming

done at the meeting.

Decision

An extensive literature search was done to find evidence to support the implementation of

SMBP monitoring with interventions. A detailed, clinic-specific action plan was developed

and discussed in a team meeting to ascertain feasibility.

Implementation

The project began when approval was received, and the participants were selected. Data will be collected for 8 weeks. Once retrieved, the data were analyzed for statistical significance.

Confirmation

The purpose of this project was to encourage patients to take accountability for their care while reducing their BP. Even without statistical significance, this process educated patients in managing a chronic disease, and it was a success.

Timeline

The SMBP project was developed, completed, and disseminated in approximately ten months. The first 15 weeks of the project entailed constructing a proposal by identifying the problem and translating the literature into beneficial practice recommendations. During the second 15 weeks, the proposal was sent for approval by the Institutional Review Board (IRB). Once consent was given and the project participants were selected, the data was collected over 8 weeks. The last 15 weeks were used for analyzing the outcomes, survey results, and their relationship to the clinical significance. For a detailed project schedule, see Appendix G.

Budget

The project utilized the clinic staff to educate the intervention participants on using proper SMBP techniques and navigating the patient portal. The CPT code 99473 was used for this educational visit. CPT code 99474 was used for subsequent SMBP data review and interpretation, and CPT code 99423 was used for the monthly telehealth visit with the provider. Minimal costs were incurred during the project. For a detailed explanation of the budget, see Table 1.

Results

The SMBP proposal was submitted to the EBP Project Review Council at USAHS for approval. The proposal was presented to the facility's IRB committee for approval. Once the approvals were obtained, the project participants were randomly selected from a list of hypertensive patients provided by the organization's Center for Clinical and Translational Science (CCTS). After thoroughly explaining the project's purpose, the project manager obtained signed consent for each participant. This consent reviewed why the participant was chosen, what was expected, and how they could quit at any time without repercussions. The consent also explained that there would be minimal risk or discomfort as they would only be taking their BP at home. The project participants' identities were protected by assigning the numeric digits as identifiers. Data stewardship and protection were always maintained by utilizing secured files on password-protected, locked computers and filing cabinets. All project data were kept for future projects on a password-protected computer.

The project manager collected BP data for analysis at the end of the 8-week project, see Table 2. The project manager analyzed the following three measures:

1. Difference in BP readings pre- and post-project

2. Percentage of participants who reported BP readings into the patient portal

3. Percentage of participants who attend the telehealth visit

These measures captured the process and outcome of the project by analyzing the effectiveness of SMBP. The outcome of the BP readings pre-and post-project measured sustainability. The pilot group's telehealth visits at 1 month measured financial gains and the context of the participant's ability to utilize electronic technology, see Table 3. Fortunately, all participants completed the data collection with no missing data to address. The data were entered into

Intellectus for analysis for statistical significance, but for most EBP projects, the clinical

significance is the best way to measure effectiveness. Understanding the effectiveness of a

treatment is essential to EBP.

A two-tailed paired samples *t*-test was conducted to examine whether the mean difference

between Pre-project SBP and Post-project SBP significantly differed from zero (Intellectus,

2022). A Shapiro-Wilk test was conducted to determine whether the differences in Pre-project

SBP and Post-project SBP could have been produced by a normal distribution (Razali & Wah,

2011). The results of the Shapiro-Wilk test were not significant based on an alpha value of .05,

$W = 0.94$, $p = .296$. This result suggests the possibility that a normal distribution produced the

differences in Pre-project SBP and Post-project SBP cannot be ruled out, indicating the

normality assumption is met (Intellectus, 2022).

The result of the two-tailed paired samples *t*-test was significant based on an alpha value

of .05, $t(19) = 3.46$, $p = .003$, indicating the null hypothesis can be rejected. This finding

suggests the difference in the mean of Pre-project SBP and the mean of Post-project SBP was

significantly different from zero (Intellectus, 2022). The mean of Pre-project SBP was

significantly higher (143.60 mmHg) than the mean of Post-project SBP (130.50 mmHg), see

Table 4. The benchmark of a decrease of 5 mmHg of SBP or greater by the end of 8 weeks was

met.

The patient portal was utilized for reporting BP readings by 14 of the 20 participants

(70%). The benchmark of 85% of patient portal reporting was not met. The six participants that

did not use the patient portal stated they used their app to record the BP readings. Interestingly,

only four participants (20%) attended a telehealth visit with the provider. The benchmark of 75%

participation in a telehealth visit was not met. The main reason given by the participants who did

not participate in the visit was that they did not feel it was necessary, as their BP was within

normal limits.

After the data analysis, the outcomes were reported to the stakeholders. They were

pleased that SMBP monitoring resulted in a significant reduction in the systolic blood pressure of

most of the participants. Regardless of the statistical significance, the clinical significance was

determined by the benefit of SMBP to all the patients' well-being. Even with a slight reduction in

BP, patients have a lower risk of having a cardiac event (CDC, 2013; Murakami et al., 2015;

Shimbo et al., 2020; Whelton et al., 2018).

Impact

The SMBP project was statistically significant, but more importantly, it was clinically

significant because of the lowering of systolic blood pressure in participants at the end of data

collection. The current practice of the patient monitoring their BP at home and keeping a written

log of the readings has yet to be efficient for the patient or the provider. This may be due to

several factors, such as the need for more training on taking their BP properly, the need for

verifying the home BP machine for accuracy, and the inability to record the BP readings

digitally. The SMBP project has successfully addressed the ongoing practice problem of patients

monitoring their blood pressure and reporting the findings to their providers. The clinic's

participants and providers were pleased with the reduction in SBP readings.

SMBP monitoring can rule out white-coat hypertension, which is often misdiagnosed

(Johansson et al., 2021). Implementing the SMBP process on a larger scale may require

purchasing loaner BP machines for patients to use short term. A curriculum for training staff and

patients should be developed to ensure proper home BP monitoring techniques. While written

literature would be sufficient, a hands-on demonstration for the patients would be ideal. During

the face-to-face interaction, training on how to navigate the patient portal could be included.

Fortunately, there are CPT codes that can be billed for this instruction. A concerted effort should

be made to enroll all patients into the patient portal and educate them on navigating it. BP data

entered there will ensure an evaluation of the effectiveness of SMBP. The process will be

sustained by implementing the SMBP protocol with all patients diagnosed with hypertension

within the clinic. Further discussion has been initiated to implement the SMBP protocol in other

ambulatory care clinics.

There were some limitations to this project. The initial goal was to recruit 30 participants

for a robust sampling. The recruitment phase began a few weeks before Thanksgiving, and many

potential participants decided against enrolling because of the upcoming holidays. Because of

time constraints, the project started when 20 participants were obtained. Another area for

improvement was the lack of interest in a telehealth visit with a provider in week 4 of the project.

This would have been a prime opportunity to educate on healthier lifestyle choices. It also could

have been a chance to discuss the participant's complications with the patient portal. While some

participants used their app to record their BP readings, using the patient portal is optimal. Data

entered into the portal is seen by the provider and is annotated in the chart. This would ensure

that the provider would know when the patient is in a hypertensive crisis. The project met the

goal of lower blood pressure, as well as the added benefit of increasing patient engagement.

Dissemination Plan

Dissemination of the results of a change project is essential in making others aware of the

impact and overall outcome (Harris et al., 2020). A peer review of the manuscript was done by

DNP professors at USAHS and colleagues at the organization before publishing. A PowerPoint

presentation was given at the conclusion of the project to the stakeholders. The Scholarship and

Open Repository (SOAR) at USAHS published the manuscript to make the information readily available for researchers. Oral poster presentations were done at the organization's annual poster presentation and for the doctoral committee at USAHS.

Because the AHA has extensive research on SMBP, this professional society has been contacted to begin the submission process for publishing this manuscript. The organization has some professional cardiology journals that would be appropriate for publication. Specifically, this project will be submitted to the Blood Pressure Monitoring Journal. This journal maintains its ethics of scientific publishing as a member of the Committee on Publication Ethics. The peer-review committee comprises experts in the field who review the manuscript to ensure its originality and significance. Wolters Kluwer has an online submission and review system that assists authors in meeting the stringent guidelines for peer review and publication (Wolters Kluwer, 2022). Dissemination of the manuscript on a global level is the goal, as the success of this project may benefit other clinics that are managing hypertension.

Conclusion

This project aims to incorporate optimum healthcare strategies for those with hypertension. This chronic disease is insidious and can be deadly if not managed appropriately and consistently (Shimbo et al., 2020; Whelton et al., 2018). The literature shows that SMBP, with additional interventions, reduces BP in adults (Beran et al., 2018; CDC, 2020; Shimbo et al., 2020; Whelton et al., 2018). This change project implements an SMBP process that includes utilizing the patient portal to record the daily BP measurements and scheduled telehealth visits to discuss lifestyle modifications and medication adjustments. With increased knowledge of the importance of a proper diet, reduction of salt, exercise, and medication adherence in managing HTN, the patient can become more engaged in their health. By using SMBP monitoring daily,

the patient is aware of their BP readings and can see when changes are necessary. Another

benefit is the collaboration of care with the healthcare team using the technology available

through the organization's EHR. The patient portal provides a platform to store data for the

clinician to review in the patient's chart. These trends allow the provider to make decisions

quickly on the plan of care changes. Together, the patient and the healthcare team create an

increased quality of life.

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Table 1

Implementation of EBP Project Budget

Expenses		Revenue	
Indirect- Included in regular operating costs	$ unknown	Billing CPT 99473 BP monitor validation $15.16 X 20	$606.40
		CPT 99474 SMBP data collection & interpretation $15.16 X 20	$1000.00
		CPT 99423 NP telehealth visit $50 x 20 patients (at 4 wks)	
Salary and benefits x 1 hour for training, variable staff.	~$15 – clerk ~ $35 – nurse ~$50 – NP	Supplies/ patient	$0
Supplies x 1 patient/ day, variable patient count	$ 0 X 20 patients/ day	Grants	0
Overhead	$0		
Supplies – office	$<100		
Estimate Total Expenses	$200	Estimate Total Revenue	$1606.40
Net Balance (revenue minus expenses)			~$1406.40

Note: All budget entries are estimates. Expenses are based on means. Revenue estimates do not include potential cost avoidance due to realized outcomes. All costs associated with salary and benefits, patient care supplies, and overhead are fixed indirect expenses unrelated to this project. Project costs are nominal for printing and laminating, under $100.

Table 2

SMBP Collection Data

SMBP Data Collection log	Pre-project SBP	Pre-project DBP	Post -project SBP	Post-project DBP	Attended telehealth visit	Reported Daily BP readings		
Patient 1	123	75	124	69	2	1	1= yes	
Patient 2	146	75	142	83	2	1	2=no	
Patient 3	136	90	130	82	2	1		
Patient 4	136	88	132	80	2	1		
Patient 5	138	91	146	67	2	1		
Patient 6	166	96	139	66	2	2		
Patient 7	159	91	144	85	2	2		
Patient 8	101	68	96	68	2	1	12 yes reporting	
Patient 9	167	98	171	95	1	1	8 no	
Patient 10	114	76	122	61	2	1		67%
Patient 11	120	51	128	60	1	2		
Patient 12	157	81	134	61	1	1		
Patient 13	153	90	119	81	2	2		
Patient 14	144	83	128	65	1	1		
Patient 15	158	91	141	82	2	1	16 no TH	
Patient 16	161	89	137	82	2	1	4 yes TH	
Patient 17	124	81	119	72	2	2		25%
Patient 18	172	98	139	92	2	2		
Patient 19	158	79	110	63	2	2		
Patient 20	119	75	109	70	2	1		

Table 3

Variable Table

MEASURES	CATEGORIES					
	OUTCOME	PROCESS	BALANCING	FINANCIAL	SUSTAIN	CONTEXT
1. Percentage of participants who report BP readings into the patient portal for a given time: (sum the number of BP readings in the patient portal/total of all intervention participants).	X	X	X			X
2. Difference in blood pressure readings in pre and post-project: (sum of systolic BP reading at the end of project minus sum of systolic BP readings at the beginning of the project).	X	X			X	
3. Percentage of the participants that attended the telehealth visit with the provider (sum of participants that participated in TH visit/sum of participants in the interventional group).	X	X		X		X

MEASURES	DATA COLLECTION			STATISTICAL TESTS		CLINICALLY MEANINGFUL CRITERIA
	Baseline	30 day	60 day	Paired t-test	Other	
1. Percentage of participants who report BP readings into the patient portal for a given time: (sum the number of BP readings in the patient portal/total of all intervention participants).	X		X		X	Pt will be engaged in self-management of care. Benchmark: 85% participation in reporting in patient portal
2. Difference in blood pressure readings pre and post-project: (sum of systolic BP reading at end of project minus sum of systolic BP readings at beginning of the project).	X		X	X		SMBP will make patient aware of BP which will help in reducing BP by medication adherence and lifestyle changes. Benchmark: 5 mmHg or greater decrease in SBP
3. Percentage of participants that attended the telehealth visit with the provider (sum of participants that participated in TH visit/sum of participants in the interventional group).		X	X		X	TH visits allow education on lifestyle changes and medication changes. Benchmark: 75% participation in telehealth visit

Table 4

Two-Tailed Paired Samples t-Test for the Difference Between Pre-project SBP and Post-project SBP

Pre-project SBP		Post-project SBP				
M	*SD*	*M*	*SD*	*t*	*p*	*d*
142.60	20.36	130.50	16.18	3.46	.003	0.77

Note. N = 20. Degrees of Freedom for the *t*-statistic = 19. *d* represents Cohen's *d*.

Figure 1

PRISMA Flowchart

Identification

Records identified through database searching (n=278)

Additional records identified through other sources (n=0)

Screening

Records after duplicates removed (n=230)

Records screened (n=230) ⟶ Records excluded (n=157)

Eligibility

Full-text articles assessed for eligibility (n=73) ⟶ Full-text articles excluded, with reasons (n=61)

Excluded for:
*not a research study
*poor quality study
*wrong population

Included

Studies included in synthesis (n=14)

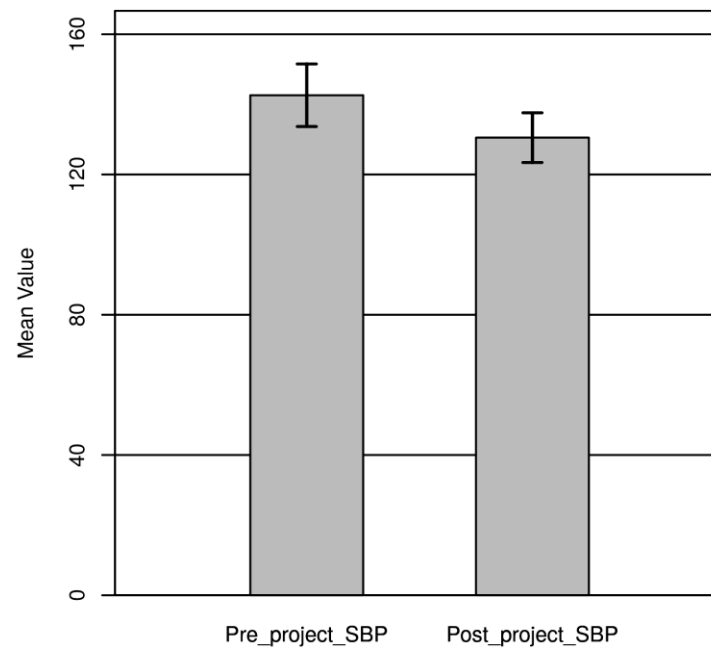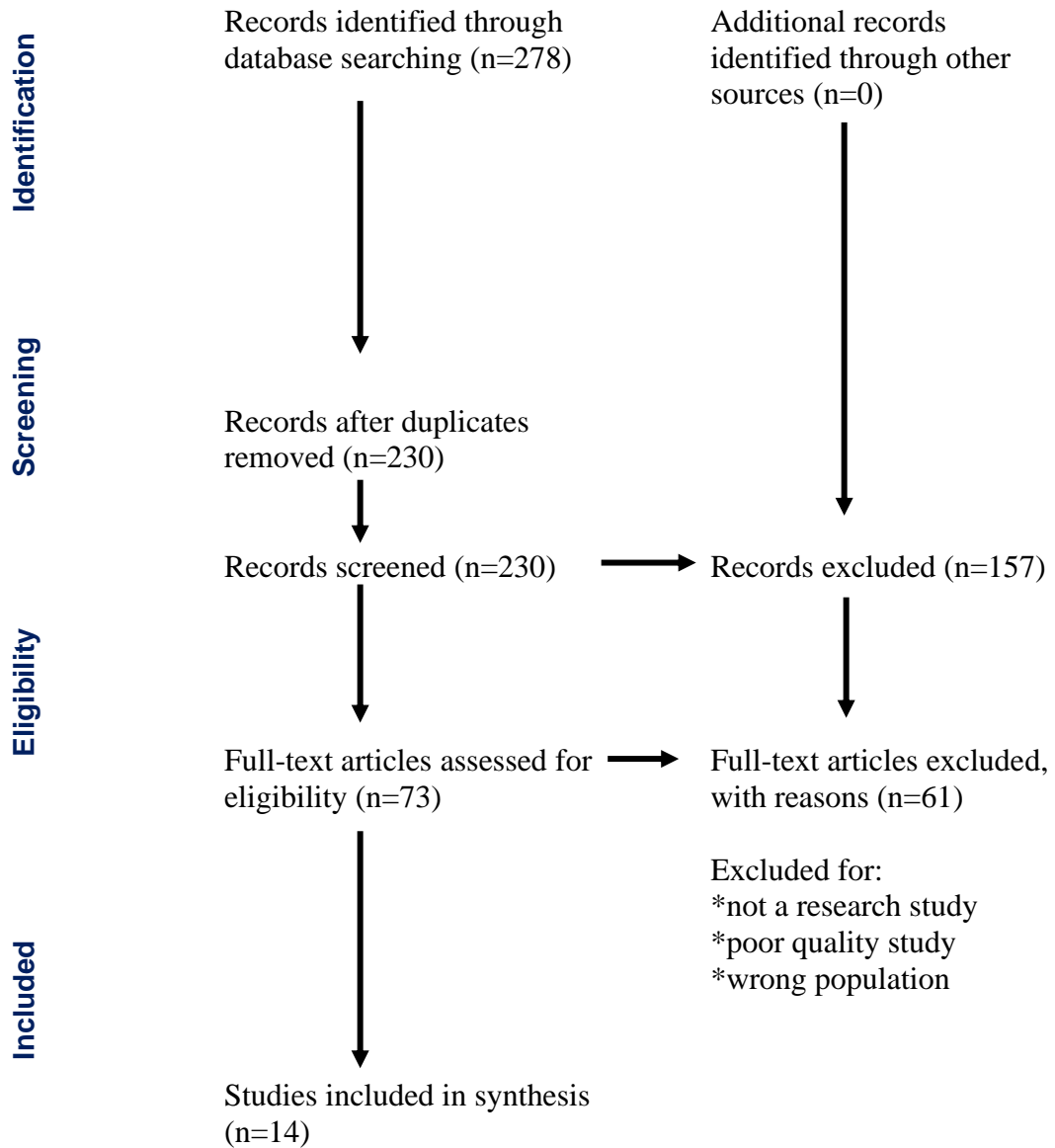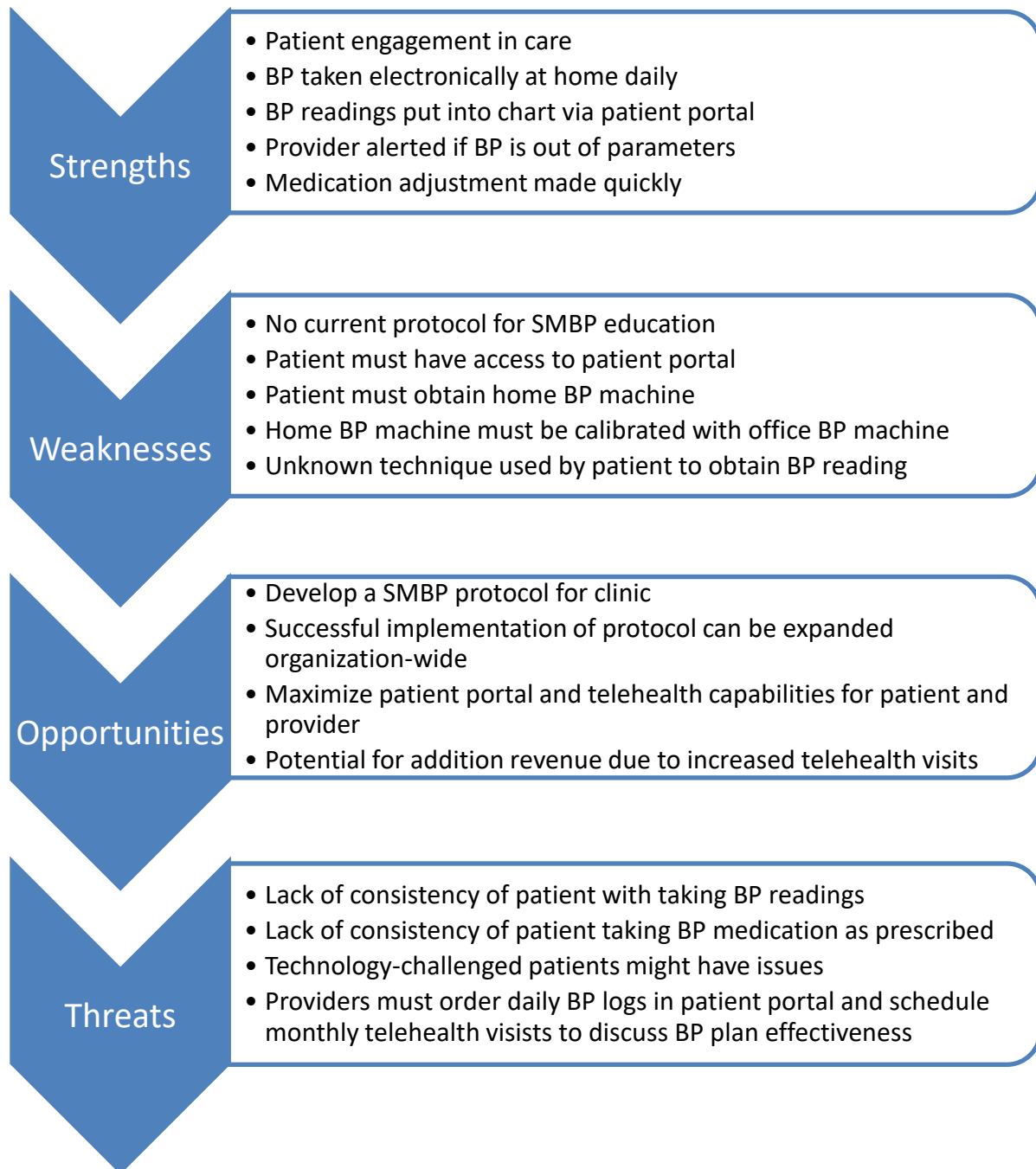*Note.* Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Annals of Internal Medicine, 151*(4), 267. https://doi.org/10.7326/0003-4819-151-4-200908180-00135

Figure 2

Feedback loop between provider and patient

Note. Centers for Disease Control and Prevention. (2020). Hypertension control change package. Million Hearts. https://millionhearts.hhs.gov/files/HTN_Change_Package.pdf

Figure 3

SWOT Analysis

Strengths
- Patient engagement in care
- BP taken electronically at home daily
- BP readings put into chart via patient portal
- Provider alerted if BP is out of parameters
- Medication adjustment made quickly

Weaknesses
- No current protocol for SMBP education
- Patient must have access to patient portal
- Patient must obtain home BP machine
- Home BP machine must be calibrated with office BP machine
- Unknown technique used by patient to obtain BP reading

Opportunities
- Develop a SMBP protocol for clinic
- Successful implementation of protocol can be expanded organization-wide
- Maximize patient portal and telehealth capabilities for patient and provider
- Potential for addition revenue due to increased telehealth visits

Threats
- Lack of consistency of patient with taking BP readings
- Lack of consistency of patient taking BP medication as prescribed
- Technology-challenged patients might have issues
- Providers must order daily BP logs in patient portal and schedule monthly telehealth visists to discuss BP plan effectiveness

Appendix A

Summary of Primary Research Evidence

Citation	Design Quality and Grade	Sample	Intervention Comparison	Theoretical Foundation	Outcome Measure	Usefulness Results
Allen, M., Irizarry, T., Einhorn, J., Kamarck, T., Suffoletto, B., Burke, L., Rollman, B., & Muldoon, M. (2019). SMS-facilitated home blood pressure monitoring: A qualitative analysis of resultant health behavior change. *Patient Education and Counseling, 102*(12), 2246–2253. https://doi.org/10.1016/j.pec.2019.06.015	Qualitative study with semi-structured post-intervention interview III / A	40	Intervention: Patients were asked to watch six short videos on hypertension. They were then enrolled with an app on the telephone that alerts them when it is time to take their SMBP and allows the SMBP to be recorded into the app.	Health Belief Model and Social Cognitive Theory	The interviews were audiotaped. The information was organized and coded with the Atlas.ti7.5 software. The themes noted were increased hypertension literacy, day-to-day awareness of BP, and BP awareness as behavioral feedback.	Patients were more engaged with HTN education and a reminder to take their BP daily. The feedback from the self-reporting app was beneficial for the patient to see progress with their self-managed health care.
Beran, M., Asche, S., Bergdall, A., Crabtree, B., Green, B., Groen, S., Klotzle, K., Michels, R., Nyboer, R., O'Connor, P., Pawloski, P., Rehrauer, D., Sperl-Hillen, J., Trower, N., &	Mixed method RCT	450 patients that met the criteria	Intervention: Patients were given a home	N/A	The intervention of SMBP with telehealth	Because of the prompt data from telemonitorin

| Margolis, K. (2018). Key components of success in a randomized trial of blood pressure telemonitoring with medication therapy management pharmacists. *Journal of the American Pharmacists Association, 58*(6), 614–621. https://doi.org/10.1016/j.japh.2018.07.001 | II / A | of BP ≥140/90 at the research clinic

23 patients were selected for the focus group after the trial had ended. | BP monitor with education on how to use it. They met with the clinician at baseline visit and then via a phone call every 2-4 weeks for the first six months.

Comparison:

Usual care in which a patient is seen in the office at the discretion of the physician | | visits compared to the usual care visits showed a decrease of BP by 27% at six months and 18% at 12 months. Most adjustment to medications were made during the first three months (10% at baseline, 33% at the first telehealth visit, 36% at the second telehealth

SAS version 9.4 was used for statistical data.

The focus group data were analyzed by five researchers using the grounded theory. Themes were | g and telehealth visits, frequent medication adjustments resulted in a rapid decrease in BP. |

					coded in NVivo10.
Lee, N., Anastos-Wallen, R., Chaiyachati, K., Reitz, C., Asch, D., & Mehta, S. (2022). Clinician decisions after notification of elevated blood pressure measurements from patients in a remote monitoring program. *JAMA Network Open, 5*(1), e2143590. https://doi.org/10.1001/jamanetworkopen.2021.43590	Retrospective cohort study; second analysis of data from an RCT III / A	162 patients and 28 clinicians in an initial 16-week clinical trial of remote BP monitoring	Comparison: Usual patient care in the office with pre and post-study BP measurement. Intervention: 1. Digital self-reporting BP to a clinician with an alert when BP is out of parameters. 2. Digital self-reporting BP alerts, and a social support person is alerted when BP is out of parameters.	N/A	The data from this study was taken from an RCT studying the effectiveness of SMBP in lower BP. This retrospective study addresses the use of the EHR to log BP measurements and the clinicians' actions when an alert is received. Over 62% of the alerts prompted a clinical action. Of these actions, 46.9% resulted in a medication change. Half of the patients who had their medication changed were asked to come	The clinician was alerted in EHR when at least three of the last 10 BP readings were out of parameter or BP was >180/110. There were no protocols in the study on how the clinician should respond. The researchers acknowledged that this study was done before Covid 19 and the explosion of telehealth. They believe these numbers would be much higher today since clinicians are trained on telehealth

						in for an office visit.	visits, and insurance companies have created comparable reimbursement codes.
Margolis, K., Asche, S., Dehmer, S., Bergdall, A., Green, B., Sperl-Hillen, J., Nyboer, R., Pawloski, P., Maciosek, M., Trower, N., & O'Connor, P. (2018). Long-term outcomes of the effects of home blood pressure telemonitoring and pharmacist management on blood pressure among adults with uncontrolled hypertension. *JAMA Network Open, 1*(5), 1–13. https://doi.org/10.1001/jamanetworkopen.2018.1 617	RCT I / A	450 patients with uncontrolled HTN	A home BP telemonitoring intervention with pharmacist management or usual care.	N/A		In the intervention group, mean SBP at 6-, 12-, 18-, and 54-month follow-up was 126.7, 125.7, 126.9, and 130.6 mm Hg, respectively. In the usual care group, mean SBP at 6-, 12-, 18-, and 54-month follow-up was 136.9, 134.8, 133.0, and 132.6 mm Hg, respectively.	SMBP telemonitoring with medication management lowered BP substantially for the first 18 months of the study. However, this was only sustained throughout part of the research. A long-term maintenance plan may need.
McManus, R., Little, P., Stuart, B., Morton, K., Zhang, J., Kelly, J., Rafferty, J., Bradbury, K., Zhu, S., Murray, E., May, C., Mair, F., Michie, S.-A., Smith, P., Band, R., Ogburn, E., Allen, J., Rice, C., Nuttal, J., & Williams, B. (2021). Home and online management and blood pressure evaluation (HOME BP) using a digital intervention in poorly controlled hypertension:	RCT I / A	622 participants, 18 years or older with BP>140/90, on medication	Intervention: Online digital intervention, home monitoring of BP, and user-selected	N/A		Analysis using general linear modeling to compare systemic BP in both groups; the imputation model	The digital intervention, with self-monitoring BP, teleconferences with health professionals,

Randomised controlled trial. *BMJ, 372*, m4858. https://doi.org/10.1136.bmj.m4858		and access to the internet	lifestyle modifications Comparison: Usual care of office visits and subsequent drug changes		included all outcome and stratification variables. 74% of the digital intervention group reduced their BP by at least 5 mmHg compared to 60.3% of the usual care group. The intervention group was more likely to have their medications adjusted quicker with success. 92% of the digital intervention group engaged through the 12-month study.	and personalized lifestyle modifications, showed a reduction in BP. Since the Covid 19 crisis, this digital intervention for hypertension has been timely. The study states that more providers must be willing to utilize it to succeed. The author also acknowledges that an electronic medical records system needs to fully incorporate digital interventions.
McManus, R., Mant, J., Franssen, M., Nickless, A., Schwartz, C., Hodkinson, J., Bradburn, P.,	RCT	1182 participant	Intervention:	N/A	Analysis was done with a	Both intervention

| Farmer, A., Grant, S., Greenfield, S., Heneghan, C., Jowett, S., Martin, U., Milner, S., Monahan, M., Mort, S., Ogburn, E., Perera-Salazar, R., Shah, S.,...Hobbs, R. (2018). Efficacy of self-monitored blood pressure, with or without telemonitoring, for titration of hypertensive medication (TASMINH4): An unmasked randomized controlled trial. *Lancet, 391*, 949–959. https://doi.org/10.1016/s0140-6736(18)30309-x | I / A | s in 142 general practice offices in the UK, older than 35 years old, BP >140/90 | The intervention groups were SMBP alone and SMBP with the teleconference.

Comparison:

BP was taken as usual in the office only. | | linear mixed-effects model to show outcome data collected at six months and 12 months.

The SMBP and SMBP with teleconferencing groups were first compared to the usual care group. Then the SMBP and SMBP with teleconferencing were compared to each other.

After 12 months, the mean systolic BPs were lower in both intervention groups: 3.5 mmHg in the SMBP group and 4.7 mmHg in the telemonitoring group. | groups made medication adjustments to lower the systolic BP without increasing the clinicians' workload. After one year, the patients whose medications were changed had a significantly lower systolic BP than those patients only in the clinic.

Telemonitoring with the patients allowed for more education on lifestyle changes that could contribute to a positive outcome. However, SMBP alone is an effective |

						way for the patient and provider to know when BP is up and when changes should be made.
Tzourio, C., Hanon, O., Godin, O., Soumare, A., & Dufouil, C. (2017). Impact of home blood pressure monitoring on blood pressure control in older individuals: A French randomized study. *Journal of Hypertension, 35*(3), 612–620. https://doi.org/10.1097/HJH.0000000000001191	RCT I / A	1733 patients diagnosed with HTN were randomly chosen for a 24-month study	Intervention: Patients were educated on how to use the home blood pressure machine and instructed to take BP three times in the morning and three times in the evening. Comparison: BP was taken in the office for a baseline at 12 months and 24 months.	N/A	Paired *t*-tests were used to compare BP readings at baseline and 24 months. The chi-square test was used for discrete outcomes. After 24 months, the SMBP group had a lower systolic BP by 3.4 mmHg (95% CI). The diastolic BP was lower by 1.1 mmHg. SAS version 9.2 was used.	This study recognizes that many studies on home blood pressure monitoring suggest that the best results are from SMBP coupled with another co-intervention such as telehealth visits. The researcher for this study wanted to know how SMBP alone would affect BP in older patients. This study shows that SMBP alone is

						beneficial for patients diagnosed with HTN.
Yatabe, J., Yatabe, M., Okada, R., & Ichihara, A. (2021). Efficacy of telemedicine in hypertension care through home blood pressure monitoring and videoconferencing: Randomized control trial. *JMIR Cardio, 5*(2), e27347. https://doi.org/10.2196/27347	RCT I / A	An Excel-based random sampling number system randomly chose 99 patients.	Intervention: Usual care was educating on SMBP and logging the results on a paper log. Subsequent follow-up office visits were up to the provider. Comparison: Patients were educated on SMBP and electronically transmitted the results to the providers. Videoconferences were also scheduled every six weeks. Videoconferences were also scheduled every six weeks.	N/A	Statistical analysis using 2-sided *P* values with *P*≥0.5 was considered statistically significant. SPSS version 21 was used for analysis. During the last week of the trial, the systolic BP of the telemedicine group was 6 mmHg lower than the UC group. The telemedicine group only met the therapeutic target of >135/85. The number of times a BP measurement	This study shows telemedicine is a safe and effective way to manage HTN. Both groups had a reduced systolic BP (9.2 mmHg vs. 5.4 mmHg) when utilizing SMBP practices. Monitoring BP at home was adequate, but additional interventions were more effective. The scheduled follow-up telemedicine visits were necessary because the provider could review the BP

					was taken each week was significantly higher in the telemedicine group (17.8 vs. 12.1).	readings and make medication changes when needed.
Zhang, D., Huang, Q., Li, Y., & Wang, J. (2021). A randomized controlled trial on home blood pressure monitoring and quality care in stage 2 and 3 hypertension. *Hypertension Research*, *44*, 533–540. https://doi.org/10.1038/s41440-020-00602-0	RCT I / A	501 patients with a 1:4 ratio of SMBP to office visits without SMBP	Comparison: Once selected, the comparison group returned to the office for BP measurement at 2, 4, 8, and 10 weeks. Intervention: Participants were brought into the office to educate on the home blood pressure machine and how to use it correctly. They were also brought into the office at 2, 4, 8, and 10 weeks.	N/A		

Summary of Systematic Reviews

Citation	Quality Grade	Question	Inclusion Exclusion	Data Extraction and Analysis	Key Findings	Usefulness/ Recommendation
Guirguis-Blake, J. M., Evans, C. V., Webber, E. M., Coppola, E. L., Perdue, L. A., & Weyrich, M. S. (2021). Screening for hypertension in adults: updated evidence report and systematic review for the US Preventive Services Task Force. *Journal of the American Medical Association*, *325*(16), 1657–1669. https://doi.org/10.1001/jama.2020.21669	II / A	1. Does screening for hypertension in adults improve health outcomes? 2. What is the accuracy of office-based BP measurement during a single encounter as an initial screening for HTN compared with the standard ambulatory BP measurement?	Databases: MEDLINE, PubMed, Cochrane Central Register of Controlled Trials, and CINAHL Inclusions: *Studies that enrolled untreated adults *Studies conducted on countries rated "very high" on the 2015 Human Development Index *Q 2: included patients with	All significance tests were 2-sided. Statistical significance was .05 or less. The strength of evidence was assessed using the Methods Guide for Effectiveness and Comparative Effectiveness Review. Stata version 15.1 statistical software was used.	Masked hypertension and white coat hypertension are often missed with office-based BP readings. Multiple strategies were identified to identify these types of HTN, which include ambulatory BP, SMBP and SMBP with additional interventions as education and telemonitoring.	Ambulatory BP measurement is the most consistent as it provides BP readings over a 24-hr. However, it was reported to be restrictive by many patients. SMBP provided more accurate readings than office-based blood pressures and patients were more incline to follow the SMBP protocol.

			at least one elevated BP in the office.			
Tucker, K., Sheppard, J., Stevens, R., Bosworth, H., Bove, A., Bray, E., Earle, K., George, J., Godwin, M., Green, B., Hebert, P., Hobbs, R., Kantola, I., Kerry, S., Levia, A., Magid, D., Mant, J., Margolis, K., McKinstry, B.,...McManus, R. (2017). Self-monitoring of blood pressure in hypertension: A systemic review and individual patient data meta-analysis. *PLoS Medicine, 14*(9), 1–29. https://doi.org/10.1371/journal.pmed.1002389	I / A	What is the effectiveness of BP self-monitoring on BP reduction and hypertension control?	Databases: Medline, Embase, and Cochrane Library Inclusion/Exclusion *RCTs with patients diagnosed with HTN and being treated in an outpatient clinic *Self-monitoring by patient or caregiver; without medical input *Home BP monitor was validated	2-stage IPD meta-analysis using linear regression for continuous outcomes and logistic regression for proportions. Studies aggregated by random-effects inverse variance methods Used STATA version13.1 statistical software	Strong evidence that BP is lowered when self-monitoring is combined with additional support Little or no effect from self-monitoring alone	Combining self-monitoring with the collaboration of a clinician can result in decreased BP and improved stability of BP. Understanding the cost-effectiveness of SMBP with interventions compared to usual care with hospitalizations is essential to policy changes.

			* At least 100 participants * Followed at least 24 months			
Viera, A., Yano, Y., Lin, F., Simel, D., Yun, J., Dave, G., Vol Holle, A., Viera, L., Shimbo, D., Hardy, S., Donahue, K., Hinderliter, A., Voison, C., & Jonas, D. (2021). Does this adult patient have hypertension? *JAMA, 326*(4), 339–347. https://doi.org/10.1001/jama.2021.4533	II/A	How can clinicians best identify adult patients likely to have hypertension?	Databases: PubMed/MEDLINE, Embase, Cochrane Library, and ClinicalTrials.gov Inclusion: *compared conventional office manual BP with 24-hr ABPM, SMBP with 24-hr ABPM, or office digital BP with 24-hr ABPM. *taking no HTN	Each study's sensitivity, specificity, and likelihood ratios were calculated for the random effects bivariable summary measures. Used SAS version 9.2 statistical software	Office BP from a single visit or home BP monitoring over a few days has limited data for diagnosing HTN. A high BP in the office and high BP readings at home are more reliable in diagnosing HTN.	Patients with high BP in the office should be given a daily BP log and educated on using a home BP monitor. Follow-up appointments with a clinician to discuss findings are recommended.

			medication while in study *studies had to include patients with elevated and non-elevated BP measurements Exclusion: *non-English speaking patients *not primary research				
Whelton, P., Carey, R., Aronow, W., Casey, D., Collins, K., Dennison-Himmelfarb, C., DePalma, S., Gidding, S., Jamerson, K., Jones, D., MacLaughlin, E., Munter, P., Ovbiagele, B., Smith, S., Spencer, C., Stafford, R., Taler, S., Thomas, R., Williams, K., Wright, J. (2018). Guideline for the prevention, detection, evaluation, and	II / A	Is there evidence that self-directed monitoring of BP and/or ambulatory BP monitoring are superior to office-based measurement of BP by a healthcare worker for 1) preventing				An increasing number of individual studies and meta-analyses of observational data have reported a gradient of progressively higher CVD risk from normal BP to elevated BP and stage 1 hypertension. Most HTN studies before 2017 were	An average of 2 to 3 BP measurements obtained on 2 to 3 separate occasions will minimize random error and provide a more accurate basis for estimating BP. Recommendation: Out-of-office BP measurements are recommended to confirm the diagnosis of hypertension and titration of BP-lowering

management of high blood pressure in adults. *Journal of the American College of Cardiology, 71*(19), e127–248. https://doi.org/10.1016/j.jacc.2017.11.006		adverse outcomes for which high BP is a risk factor and 2) achieving better BP control?			based on the use of the 140/90–mm Hg for recognition of hypertension and would have been substantially higher had the 130/80–mm Hg been used.	medication in conjunction with telehealth counseling or clinical interventions.

Appendix C

Summary of Non-Research Articles

Shimbo, D., Artinian, N. T., Basile, J. N., Krakoff, L. R., Margolis, K. L., Rakotz, M. K., & Wozniak, G. (2020). Self-measured blood pressure monitoring at home: A joint policy statement from the American Heart Association and American Medical Association. *Circulation*, *142*(4). https://doi.org/10.1161/cir.0000 000000000803	IV / A	The diagnosis of HTN has been primarily based on BP measured in the office. BP may differ significantly when taken outside of the office. Many RCTs and Systemic Reviews have validated self-measured BP monitoring. Self-measured BP is essential in diagnosing white coat HTN and masked HTN. A standardized BP measuring and monitoring protocol, including a validated home BP monitor, proper position of patient and cuff, and a consistent monitoring schedule, is recommended. Compared with usual care in the office, using SMBP leads to moderate reductions of systemic and diastolic BP at six months.

Legend for Appendices A, B, and C

Evidence Level	Evidence Guide
	Types of Evidence
I	- Randomized controlled trials (RCT) - Explanatory mixed methods with level 1 quantitative study - Systemic review (SR) of RCTs with or without meta-analysis (MA)
II	- Quasi-experimental (QE) study - Explanatory mixed methods with level II quantitative study - SR with a combination of RCT and QE with or without MA
III	- Non-experimental (NE) study - SR with RCT, QE, and NE studies with or without MA
IV	- Opinion of respected/nationally recognized committees - Clinical practice guidelines - Consensus panels/position statements
V	- Experiential and non-research evidence - Scoping review/literature& integrative reviews - Quality improvement/financial evaluations - Case reports

Grade	Evidence Guide
	Types of Evidence
A	**HIGH**: Consistent, generalizable results; sufficient sample size; adequate control; definitive conclusions; consistent recommendation based on thorough scientific evidence
B	**GOOD:** Reasonably consistent; sufficient sample size; some control; fairly definitive conclusions; reasonably consistent recommendations that include some scientific evidence
C	**LOW/Major Flaws:** Little evidence with inconsistent results; insufficient sample size; no conclusions

Appendix D

Procedure for Implementation

Initial Care Team Actions:

2. Standardized training of clinicians to take BP measurements accurately

3. Conduct clinician competency check-off for new employees

   a. Cuff selection

   b. Proper patient positioning

   c. Measurement is done without talking

4. Establish a secure feedback channel that adheres to HIPAA regulations.

   a. Secure patient portal that provides:

      i. Report of SMBP readings

      ii. Request for medication refill

      iii. Secure messaging between patient and provider

      iv. Provide visit summaries for patients to review

   b. Secure telehealth (audio and visual) portal

Care Team/Patient Actions:

7. Review types of SMBP devices available

8. Validate SMBP device with office BP machine

9. Educate on proper SMBP technique:

   a. How to operate the SMBP device

      Turn on device

      Select proper cuff size

   b. Proper position

Sit in a chair with a back.

Place feet flat on the floor and uncrossed.

Rest an arm on a table at heart level.

Place the cuff on the bare arm just above the elbow at heart level.

c. Proper technique

Do not smoke, exercise, or drink caffeinated drinks or alcohol within 30

minutes of measurement.

Do not talk, text, or use technical devices.

Write down the reading if the machine does not store them automatically.

Wait one minute and repeat the process.

Take two BP readings in the morning and two in the evening.

d. Use of a patient portal to record BP readings

Ensure the patient has access to portal

Annotate BP readings in the patient portal.

The clinician will be alerted in the patient portal if BP is out of range.

10. Telehealth appointments with a clinician

Made at four and eight weeks of SMBP monitoring.

Discuss lifestyle modifications

1. Diet
2. Exercise
3. Sodium intake

Medication adjustments as needed

Appendix E

Care Team Training Literature

Note. Murakami, L., Rakotz, M., Daniel, D., & Prall, M. (2015). *Self-measured blood pressure: Engaging patients in self-measurement*. American Medical Association. https://www.ama-assn.org/sites/ama-assn.org/files/corp/media-browser/public/about-ama/iho-bp-engaging-patients-in-self-measurment_0.pdf. Copyright 2015 by the AMA and Johns Hopkins Medicine. In the public domain.

Self-measured blood pressure monitoring program:
Engaging patients in self-measurement

This program is designed for use by physician offices and health centers to engage patients in self-measurement of blood pressure. This program describes various ways that the patient can obtain blood pressure (BP) measurements outside of the clinical office either through the purchase of a device or a physician-led blood pressure monitor loaner program. Your practice or health center will establish a process for

- Training staff on engaging patients in a self-measurement program
- Educating patients on hypertension
- Measuring blood pressure using proper positioning
- Suggestions for communicating blood pressure measurements back to the care team
- Guidance for instituting a blood pressure monitor loaner program

Disclaimer: Always make sure patients know what to do should they have a blood pressure measurement that is outside the pre-determined acceptable range or if they experience any symptoms with a high or low blood pressure measurement, including seeking emergency treatment if appropriate. This guidance to the patient should be individualized by the clinician and reinforced by clinical staff at the initiation of any SMBP monitoring program.

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Table of contents

Self-measured blood pressure monitoring program:
Engaging patients in self-measurement

Page	Name of document	Practice staff	Patient	Blood pressure monitor loaner program	Patient-owned blood pressure monitor
		Audience			
4	Measuring accurately: Self-measured blood pressure monitoring	X		X	X
6	Clinical competency: Patient self-measured blood pressure at home	X		X	X
8	Measure accurately: A guide for blood pressure measurement	X		X	X
9	How to check a home blood pressure monitor for accuracy	X		X	X
10	Patient selection criteria for a blood pressure monitor loaner program	X		X	
11	Patient enrollment process for a blood pressure device loaner program	X		X	
12	Patient participation and blood pressure device loaner agreement	X		X	
13	Diagnosis, communication, documentation and management	X		X	X
15	Recommended infection prevention process for blood pressure monitors loaned to patients	X		X	
16	BP monitor loaner log	X		X	
17	High blood pressure (hypertension) overview		X	X	X
19	Self-measured blood pressure at home		X	X	X
21	Self-measured blood pressure technique: How to take your own blood pressure		X	X	X
22	Self-measured blood pressure monitoring at home – flow sheet		X	X	X
23	Self-measured blood pressure patient log (wallet card)		X	X	X

Fast facts

Measuring accurately:
Self-measured blood pressure monitoring

What is self-measured blood pressure monitoring?

Self-measured blood pressure (SMBP) monitoring, sometimes called home blood pressure monitoring, is a patient-performed measurement of their own blood pressure outside of a clinical setting. Research shows that SMBP:

- Can improve adherence and health outcomes for hypertensive patients[1]
- Is different from, and more convenient than, ambulatory blood pressure monitoring, which requires a more specialized monitor to measure multiple blood pressures at set intervals over a 24-hour period[2]
- Should always be accompanied by additional support, such as a one-time training session by a health care professional, during which patients should be observed to determine that they measure blood pressure readings correctly
- Is proven to improve blood pressure control when a patient/clinician feedback loop is used to provide personalized support and advice based on the patient's data[1]

Which SMBP device should patients use?

Most of the methods shown to improve patient outcomes have used an automated (oscillometric) device. With automatic devices, patients wrap a cuff around their arm and press a button to obtain a digital blood pressure reading.

When recommending an automated blood pressure measurement device for self-monitoring, take the following features into careful consideration.

Is the device valid? Automatic devices should be certified by one of three respected organizations:

- Association for the Advancement of Medical Instrumentation
- British Hypertension Society
- European Society of Hypertension

Does the device measure blood pressure from the upper arm? Only upper arm (not wrist) monitors produce reliable measures and these are the only type of monitors that reputable organizations recommend for home use.[2,3]

Will patients find the device easy to use? Devices come in a range of models with varying features. For example, patients with visual, motor or hearing impairments may prefer devices with large digital display and large buttons and/or that use voice commands to operate.

Does the device make it easy for patients to share results with their provider? Consider whether the device has the ability to:

- Store readings and report them back at a later time
- Calculate an average measure over multiple readings
- Transmit information to other devices, including to apps or to your electronic health record (EHR) system

Does your EHR permit the direct transmittal of blood pressure measurements via a patient portal?
If so, you should establish a protocol to ensure that dangerously abnormal readings reported into the EHR receive timely responses.

How much does the device cost? Many public and private health insurance plans do not cover the cost of self-monitoring devices. Prices for a typical, high-quality device (available for purchase at most drug stores) can range between $50 and $150.

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How should you and your patients use a home blood pressure monitor?

A universally accepted protocol for self-monitoring blood pressure does not exist. However, many patients and providers have found the following instructions useful. They are adapted from the Finn Protocol[4] by Michael Rakotz, MD, at Northwestern Medical Group.

- Ask your patients to find a space where they can position themselves appropriately: seated comfortably in a chair with their legs uncrossed, feet flat on the floor, and arm and back supported. The cuff should be wrapped snuggly but not tightly around their upper arm.

- Ask your patient to take two blood pressure readings at one- to two-minute intervals, both in the morning and in the evening for seven consecutive days. This will provide four blood pressure measurements a day, totaling 28 measurements for the week, which is ideal. However, it is worth noting that even three days of measurements (i.e., 12 readings) also has prognostic value.

- Ask your patient to record each blood pressure measurement.

- When you receive these measurements calculate the average (mean) value of all the systolic and diastolic blood pressures. Use this single average value to determine if your patient has hypertension or if your patient's blood pressure is controlled.

- It is important to note that self-monitored blood pressure values trend approximately 5mm Hg lower than those obtained by nurses in research settings. Thus a self-monitored systolic blood pressure of 135mm Hg is equivalent to a high-quality systolic blood pressure of 140mm Hg. The American Society of Hypertension recommends that when diagnosing or treating hypertension, providers and patients should consider a mean blood pressure >135/85 as the threshold for diagnosing hypertension or for treating high blood pressure.

Resources

List of validated home blood pressure monitors
Dabl Educational Trust website: http://bit.ly/1pLvucM
British Hypertension Society website: bhsoc.org//index. php?cID=247

Additional information on home blood pressure monitors
Association for the Advancement of Medical Instrumentation website: aami.org
European Society of Hypertension website: eshonline.org
Article on wireless blood pressure cuffs and Smartphone applications: http://bit.ly/1pLvFF4

References

1. Centers for Disease Control and Prevention Self-Measured Blood Pressure Monitoring: Action Stepsfor Public health Practitioners, GA: Centers for Disease Control and Prevention, US Dept. of Health and Human Services; 2013.
2. Pickering TG, Miller NH, Ogedegbe G, Krakoff LR, Artinian NT, Goff D. Call to action on use and reimbursement for home blood pressure monitoring: A Joint Scientific Statement from the American Heart Association, American Society of Hypertension, and Preventive Cardiovascular Nurses Association. Hypertension. 2008; 52:10-29.
3. Uhlig K, Balk EM, Patel K, Ip S, Kitsios GD, Obadan NO, et.al. Self- Measured Blood Pressure Monitoring: Comparative Effectiveness. Comparative Effectiveness Review No. 45. (Prepared by the Tufts Evidence-based Practice Center under Contract No. HHSA 290- 2007-10055-I.) AHRQ Publication No. 12-EHC002-EF. Rockville, MD: Agency for healthcare Research and Quality, US Dept. of Health and Human Services; 2012. http://www.effectivehealthcare. ahrq.gov/ehc/products/193/893/CER45_SMBP_20120131.pdf. Accessed July 9, 2014.
4. Niiranen TJ, Johansson JK, Reunanen A, Jula AM. Optimal Schedule for Home Blood Pressure Measurement Based on Prognostic Data: The Finn-Home Study. Hypertension. 2011; 57: 1081-1086. doi: 10.1161/HYPERTENSIONAHA.110.162123
5. Improving Health Outcomes: Blood Pressure. Murakami L, Astalas A, Boonyasai R, Wynia M, Rush C, Rakotz M. Fast Facts: Home Blood Pressure Monitoring. 1st ed. Daniel D and Prall M, eds. American Medical Association and the Johns Hopkins University School of Medicine; May 2014.

Make sure patients know what to do should they have a blood pressure measurement that is outside the pre-determined acceptable range, or if they experience any symptoms with a high or low blood pressure measurement, including seeking emergency treatment if appropriate. This guidance to the patient should be individualized by the clinician and reinforced by clinical staff at the initiation of any SMBP monitoring program.

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Self-measured blood pressure: Health care professional

Clinical competency:
Patient self-measured blood pressure at home

Clinical staff should be trained and tested on measuring blood pressure accurately. Using an essential competency like this will help demonstrate that staff can effectively teach patients to perform accurate blood pressure measurement independently at home.

How to use the competency form:

- Perform competencies at least twice a year.
- Fill in the name of the employee and the trainer.
- Follow the procedures step-by-step and determine if the employee is following them correctly.
- Based on the trainer's observation, place a check mark in either the column labeled "Meets competency" or "Needs more training."
- Use the following options to document the "Method of validation":
  - If the trainer showed the employee how to do the procedure and the employee then demonstrated the procedure, write "RD" for **return demonstration in a simulated patient setting**.
  - If the trainer is observing the employee perform the procedure while providing direct patient care, write "PC" for **direct patient care observation**.
- Both the employee and trainer should sign and date the competency form.
- Make the competency form part of the employee's training file.

This clinical competency is not intended to be comprehensive. Additions and modifications to fit local practice or health center are encouraged.

Self-measured blood pressure: Health care professional

Clinical competency:
Patient self-measured blood pressure (SMBP) at home

Employee's name (print): _____

Trainer's name (print): _____

Procedure	Meets competency (Check if "Yes")	Needs more training (Check if "Yes")	Method of validation RD: Return demonstration PC: Direct patient care observation
Explain the purpose of SMBP to the patient			
Tell the patient to use the bathroom if they need to prior to measuring their blood pressure (BP)			
Tell the patient to rest sitting in a chair for several minutes prior to measuring their blood pressure			
Ensure the patient's device has the correct cuff size (You may need to guide the patient to purchase a different size cuff from the manufacturer.)			
Show the patient how to position the cuff correctly on the arm against bare skin (NOTE: Refer to the manufacturer's user manual for instruction on placement of the tubing.)			
Teach the patient proper positioning: • Seated in a chair with back supported • Legs should be uncrossed • Feet flat on the ground or supported by a foot stool • Arm supported with the BP cuff in place and positioned so that the BP cuff is at the level of the patient's heart			
Direct the patient not to talk, use the phone, text, email or watch television during the procedure. (Also explain that no one else should be talking during blood pressure measurement.)			
Instruct the patient to take two readings one minute apart, once in the morning and once in the evening			
Show the patient how to turn on the device and press the start button			
If an error reading occurs, direct the patient to start over			
When the cuff completes the deflating process and a reading is displayed, explain to the patient which numbers represent the systolic and diastolic blood pressure			
Show the patient how to document their blood pressure on the flow sheet or wallet card			
If the device has memory capability, show the patient how to retrieve the readings			
Provide the patient with instructions on what to do if readings show an abnormal blood pressure measurement			

Comments: _____

Employee's signature: _____ Date: _____

Trainer's signature: _____ Date: _____

Self-measured blood pressure: Health care professional

Measure accurately:
A guide for blood pressure measurement

The importance of accurate blood pressure (BP) measurement cannot be minimized when diagnosing or treating hypertension. Measuring blood pressure accurately every time requires:

- Well-supported standard processes that are easy for staff to follow
- Staff who consistently use proper technique
- Easy availability of equipment and space

Excellent measurement technique requires training and skill building, but a few common problems related to patient preparation and positioning often account for unreliable readings.[1,2]

Here are several common problems that account for inaccurate blood pressure measurement:

When patient has ...	BP can change by this much ...[3,4]
Cuff over clothing	10–40 mm Hg
Full bladder	10–15 mm Hg
Conversation or is talking	10–15 mm Hg
Unsupported arm	10 mm Hg
Unsupported back	5–10 mm Hg
Unsupported feet	5–10 mm Hg
Crossed legs	2–8 mm Hg

A standardized process should be implemented to ensure blood pressure is measured accurately for each patient. Steps to include are:

- Use a validated, automated device to measure BP.[5]
- Ask the patient "Do you need to use the bathroom?" and allow him/her to do so if needed prior to measurement.[3]
- Use the correct cuff size for the patient's arm.[3]
- Ensure the patient is properly positioned[3]:
  - Seated in a chair with the back supported
  - Legs uncrossed
  - Feet flat on the ground or supported by a foot stool
  - Arm supported with the blood pressure cuff in place and positioned so that the cuff is at the level of the patient's heart
- Do not allow the patient to talk, use the phone, text or email during the procedure.
- Employees should also not talk during the procedure.

See the "Self-measured blood pressure technique" patient handout for a graphical representation of measuring accurately.

References
1. Williams JS, Brown SM, Conlin PR. Blood-Pressure Measurement. *N Engl J Med.* 2009;360(5):e6.
2. Ogedegbe G, Pickering T. Principles and techniques of blood pressure measurement. *Cardiol Clin.* 2010 Nov;28(4):571-86.
3. Pickering TG, Hall JE, Appel LJ, et al. Recommendations for blood pressure measurement in humans and experimental animals: part 1: blood pressure measurement in humans: a statement for professionals from the Subcommittee of Professional and Public Education of the American Heart Association Council on High Blood Pressure Research. *Circulation.* Feb 8 2005;111(5):697-716
4. O'Brien E, Asmar R, Beilin L, et al. European Society of Hypertension recommendations for conventional, ambulatory and home blood pressure measurement. *J Hypertens* 2003; 21: 821-848.
5. Campbell NR, Berbari AE, Cloutier L, et atl. Policy statement of the world hypertension league on noninvasive blood pressure measurement devices and blood pressure measurement in the clinical or community setting. *J Clin Hypertens.* 2014; 16(5): 320-322.

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Self-measured blood pressure: Health care professional

How to check a home blood pressure monitor for accuracy*

The first step in choosing an accurate monitor is to select one that has been approved under a formal validation protocol; all self-measured blood pressure devices sold in the United States are required to meet Food and Drug Administration standards. However, even a device that has passed an accepted validation test will not provide accurate readings in all patients; the error may be consistently + 5 mm Hg in many individuals, especially elderly patients or patients with diabetes. For this reason clinicians should encourage patients to bring any home blood pressure monitor they use to their physician's office to measure its accuracy against a mercury sphygmomanometer or comparable device before the readings are accepted. A simple version of the European Society of Hypertension International Protocol has been developed for this purpose and can be done quickly by the physician or other health care clinician and the patient.

The following steps to ensure accuracy take approximately 10 minutes.
1. Have the patient sit down with his or her arm at heart level. The arm should be completely relaxed.
2. Allow the patient to rest for five minutes.
3. Avoid any conversation during the measurements to prevent an increase in blood pressure.
4. Take a total of five sequential same-arm blood pressure readings, no more than 30 seconds apart.
5. Have the patient take the first two readings with his or her own device.
6. Take the third reading, preferably with a mercury sphygmomanometer or comparable device.
7. Have the patient take the fourth reading.
8. The fifth and final reading is taken by the health care clinician.
9. Compare the difference between the readings from the two cuffs.

    a. BP readings will usually decline over the five measurements. The final systolic blood pressure reading may be as much as 10 mm Hg lower than the first.

    b. If the difference is 5 mm Hg or less, the comparison is acceptable.

    c. Do the calibration again if the difference is greater than 5 mm Hg but less than 10 mm Hg.

    d. The device may not be accurate if the difference is greater than 10 mm Hg.
10. Repeat this procedure annually.

Though there is no established target for how close the readings from the patient's cuff should be to those from the clinician's cuff, the above exercise can provide a general sense of the device's accuracy, which can be taken into consideration for future measurements recorded at home. To further ensure accuracy, consider calibrating the clinic and home devices following the National Health and Nutrition Examination Survey (NHANES) Health Tech/Blood Pressure Procedures Manual. The manual can be found at: cdc.gov/nchs/data/nhanes/nhanes_09_10/bp.pdf

* Adapted from Centers for Disease Control and Prevention. *Self-Measured Blood Pressure Monitoring: Action Steps for Clinicians*. Atlanta, GA: Centers for Disease Control and Prevention, US Dept of Health and Human Services; 2014: 24.

Self-measured blood pressure: Health care professional

Diagnosis, communication, documentation and management

Diagnosis

When patients have elevated blood pressures in the office and the diagnosis of hypertension is suspected, self-measured blood pressure (SMBP) can be very useful in distinguishing between white coat hypertension (or isolated office hypertension) and true hypertension. White coat hypertension occurs when a patient's blood pressure is persistently elevated in the office setting, but out-of-office blood pressures are in the normal range. SMBP is also useful in identifying patients with masked hypertension. Masked hypertension occurs when office blood pressures are normal, but out-of-office blood pressures are elevated. This is one of the most dangerous types of hypertension, as both the patient and physician can remain unaware for long periods of time.

To confirm the diagnosis of hypertension[1] in a patient with elevated office blood pressures or to increase the chance of diagnosing a patient suspected of having masked hypertension, it is best to use multiple readings over time. This is due to the significant variability in everyone's blood pressure over time. There is one protocol for SMBP at home that is the most widely accepted, and used in most guidelines.[2]

- Have your patients take at least two blood pressure measurements with a validated automated upper arm device (one minute apart) each morning and each evening for at least four days.
- Calculate the average of all of the measured systolic and diastolic blood pressures into a single averaged systolic and single averaged diastolic blood pressure (see "Documentation" below).
- If the average blood pressure is either a systolic blood pressure (SBP) >135 mm Hg or diastolic blood pressure (DBP) > 85 mm Hg then the patient meets the criteria for having hypertension.
- If the diagnosis of hypertension, white coat hypertension or masked hypertension remains uncertain after using SMBP, then use 24-hour ambulatory blood pressure monitoring (ABPM).

Communication

To be most effective, self-measured blood pressures from home should be communicated back to the physician's office for interpretation.
Home blood pressure measurements can be communicated back to the physician or care team in several ways:

- The patient can phone the measurements to the office to an assigned staff member.
- The patient can fax the measurements to the office via a pre-provided secure fax number.
- The patient can send the measurements online through the facility's secure patient portal.
- The patient can send the measurements online through a secure telemedicine site, such as the American Heart Association's Heart360 tool (heart360.org).
- If the blood pressure device has memory storage capability, the patient can bring the device to the office for staff to review or download.
- The patient can return for a scheduled follow-up visit after the home measurement period is completed. (NOTE: If the patient received a loaner blood pressure device, this can assist in securing its return.)

Each physician office is encouraged to analyze the process it uses to have patients communicate home blood pressure readings. Inform to patients how and when you will respond to their communications and what the patient should do in the event of a concerning blood pressure reading, particularly if the office is not able or does not intend to respond immediately.

Documentation

The average SMBP measurement from home should be documented in the patient's health record.

All of the individual blood pressure measurements performed by the patient should be averaged into a single blood pressure that will be used to determine the diagnosis and/or guide treatment.

- Calculate the average of all the readings and document that result.
- If a patient provides you with an average of the readings, verify the method used.
  - Manual patient calculations should be verified by the physician or a member of the office staff.
- Some electronic medical record applications have the capability to do this automatically. If that is not available, perform a manual calculation.
- Place documentation of this average value in the patient's record in a field designated for self-measured or home blood pressure readings.
  - Some electronic medical record systems only provide the capability to record these extra blood pressure measurements within a text field of the clinical note.
  - Consult with your electronic medical record vendor for the best solution based on your electronic medical records' functionality.

Management

SMBP at home is useful in the management of hypertension for several reasons.

SMBP:

- Yields many blood pressure measurements over time, (with fewer office visits) which helps determine if a change in therapy is warranted and helps prevent over-treatment.
  - Variation in blood pressure occurs in everyone, making treatment decisions difficult. No single medication is equally effective for all patients, so multiple measurements over time are needed to determine if control has been achieved.
- Improves blood pressure control, especially if the patient uses a form of clinical support.
  - Examples include telemonitoring with counseling, pharmacist counseling, self-adjustment of medications, remote counseling from a nurse or lifestyle counseling.[3]
- Provides measurements correlated more closely with target organ damage as compared to office blood pressure measurements.
- Improves adherence to antihypertensive therapy.[4]
- When combined with telemonitoring, can increase aggressiveness of pharmacotherapy[5] and help reduce therapeutic inertia.

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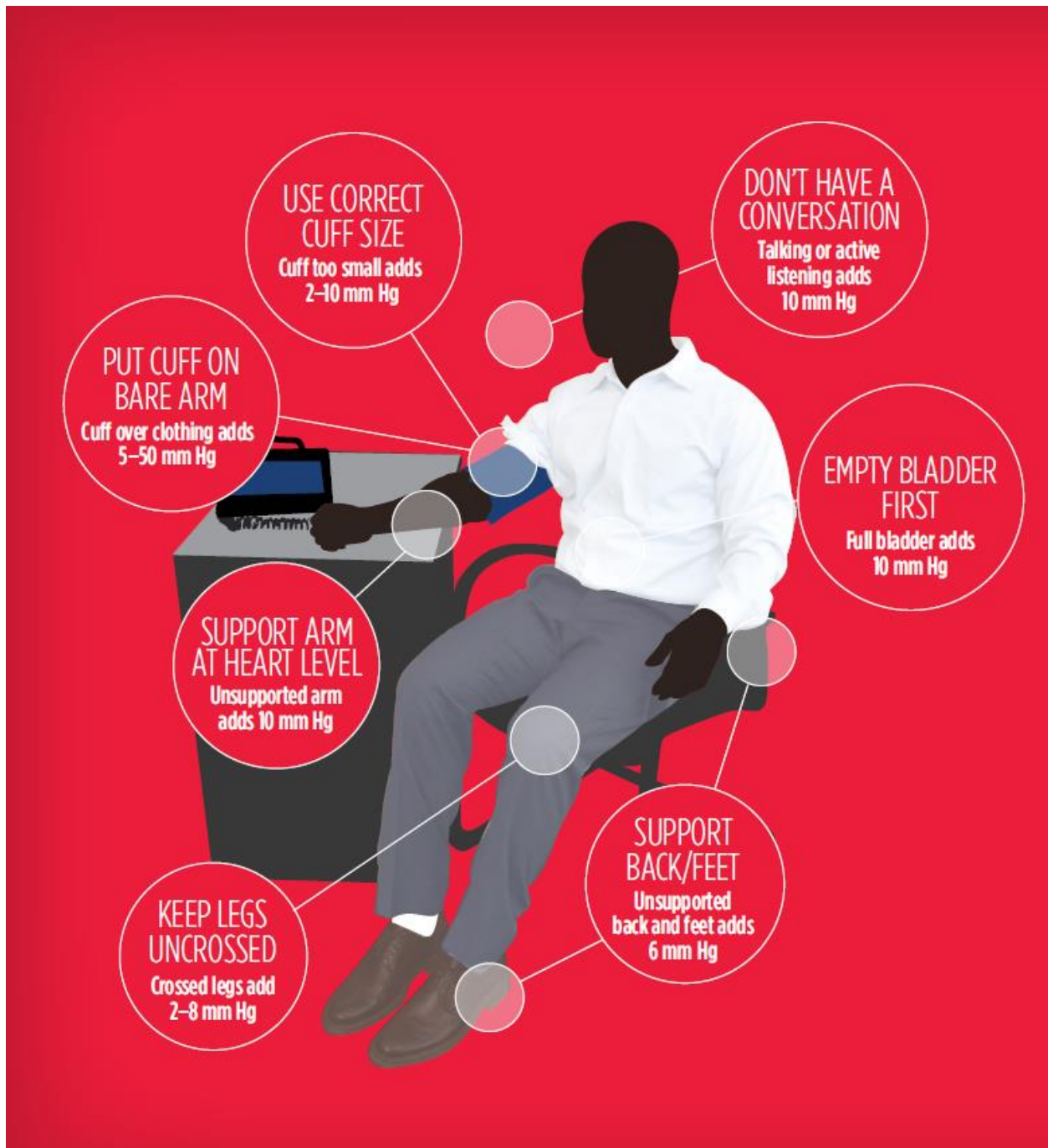
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Appendix F

Patient Training Literature

Self-measured blood pressure: Patient

Self-measured blood pressure at home

Importance of self-measuring blood pressure

Measuring your blood pressure at home and sharing measurements with your doctor has been shown to improve blood pressure control. By providing your doctor with more blood pressure measurements than would normally be taken in the office, your doctor will have a better idea of how well your diet, exercise and medicines are working to control your high blood pressure when you are not in the office.

This handout will show you how to:
- Choose a home blood pressure monitor
- Measure your blood pressure accurately

Choosing a home blood pressure monitoring device

If you are buying your own blood pressure monitor for home use, there are a few points to consider:
- Most upper arm home blood pressure monitors cost $50 to $100.
- Using wrist and finger cuffs on blood pressure monitors are less accurate and not recommended.
- Monitors are available with larger displays that are easier to read.
- If you enjoy technology, some monitors can connect with your smart phone and track your blood pressure readings.
- Always purchase a monitor that has the correct size cuff for your arm.

Recommended cuff sizes for accurate measurement of blood pressure

Arm circumference	Cuff size
22 to 26 cm	12 x 22 cm (small adult)
27 to 34 cm	16 x 30 cm (adult)
35 to 44 cm	16 x 36 cm (large adult)

There are many blood pressure monitors to choose from. Always select a blood pressure monitor that has been certified (confirmed to be accurate) by one of these three respected organizations:
- Association for the Advancement of Medical Instrumentation
- British Hypertension Society
- European Society of Hypertension

Additional certified monitors can be found on the internet at http://tinyurl.com/mxuvn7v.
If you buy your own device, consider taking it to your doctor's office and ask them to check the accuracy of your machine.

Measuring your blood pressure accurately

You will need to follow certain steps to help make sure that you are measuring your blood pressure accurately. Your doctor or care team may also give you instructions on how often to take your blood pressure. Always follow the advice of your doctor. Most of the time you will take two blood pressure measurements in the morning and two more in the evening for one to two weeks. You should plan to review these results with your doctor or a member of your doctor's staff. This can be done through a phone call, an office visit or using a patient portal on a computer if that is available to you.

From: Murakami, L., Rakotz, M., Daniel, D., & Prall, M. (2015). *Self-measured blood pressure: Engaging patients in self-measurement*. American Medical Association. https://www.ama-assn.org/sites/ama-assn.org/files/corp/media-browser/public/about-ama/iho-bp-engaging-patients-in-self-measurment_0.pdf. Copyright 2015 by the AMA and Johns Hopkins Medicine. In the public domain.

Self-measured blood pressure: Patient

To measure blood pressure correctly, there are things you should, and should not, do. Follow these guidelines to help make sure that you measure your blood pressure accurately every time. If you are sharing your machine with another family member or friend, remember to follow the manufacturer's instructions for changing the user.

Before you take your blood pressure:

- Do not exercise, eat a large meal, use caffeine, drink alcohol or take decongestants for 30 minutes before you take your blood pressure.
- Use the bathroom if you need to before taking your blood pressure.
- Sit quietly in a comfortable position for five minutes without crossing your legs or your ankles.
- Sit with your back supported keeping your feet flat on the floor.

When you are ready to take your blood pressure:

- Continue to sit with your back supported, your legs uncrossed and your feet flat on the floor. Use a step stool if needed to make sure your feet are flat on a surface.
- Following the instructions for your device, put the cuff on by wrapping it around your bare arm above your elbow. Face the palm of your hand up to relax your arm muscles.
- Rest your arm on a table or another flat surface at the level of your heart. Keep it stretched out and relaxed and sit still.
- Do not talk, read, text or watch television while taking your blood pressure.
- Following the directions of the monitor you are using, press the button to start the machine. The cuff will inflate and slowly deflate by itself.

When the machine has stopped taking your blood pressure:

- The machine will display two numbers. The top number is the systolic blood pressure and the bottom number is the diastolic blood pressure. Write down the date, time and result of your blood pressure if your machine does not store that information automatically. If there is a pulse recorded on the display, write that down as well.
- Remove the cuff from your arm and place the device in a safe and dry place.
- Remember to follow the instructions that your doctor or care team gave you for reporting your blood pressures. Take your written blood pressure log or the blood pressure machine with you to your next doctor's office visit if you have been instructed to do so.

For additional information on taking your blood pressure at home, see the "Patient self-measured blood pressure technique" handout.

Appendix G

Project Schedule

Activity	NUR7801								NUR7802								NUR7803							
	Week 1	Week 3	Week 5	Week 7	Week 9	Week	Week 13	Week 15	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11	Week 13	Week 15	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11	Week 13	Week 15
Meet with preceptor	X	X	X		X		X	X	X		X		X		X	X	X		X		X		X	X
Prepare project proposal (Problem, PICOT, literature search/synthesized, EBP recommendations, budget)	X	X	X	X	X	X	X	X																
Identify Stakeholders					X																			
Recruit interprofessional team		X	X	X																				
Team meetings					X		X			X			X		X			X		X		X		
Identify clinic-specific action plan							X	X																
Submit proposal to committees									X	X														
Retrieve list of potential participants (from CCTS)										X	X													
Select random participants; obtain consents										X	X													

Activity	NUR7801								NUR7802								NUR7803							
	Week 1	Week 3	Week 5	Week 7	Week 9	Week	Week 13	Week 15	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11	Week 13	Week 15	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11	Week 13	Week 15
Train clinic staff on SMBP process									X															
Meeting with intervention group to validate BP machines, teach proper SMBP technique, enroll in patient portal										X	X													
Implement action plan												X	X	X	X	X								
Evaluate data in Intellectus software																	X							
Identify next steps (if action plan will be continued)																		X						
Report outcomes to stakeholders																		X						
Disseminate findings																				X	X	X	X	X