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Implementation of Home Blood Pressure Monitoring

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Abstract

Approximately 48.1% of adults in the United States have high blood pressure. Providers may encourage patients to monitor and log their blood pressure at home. Still, patients often fail to bring this information to appointments, leading to reliance on less comprehensive in-office measurements. This quality improvement project aimed to increase adherence to home blood pressure logs using a Blood Pressure Toolkit. A descriptive, observational design was utilized to record patient adherence of taking home blood pressure measurements and increase the number of patients who brought their blood pressure logs to their healthcare provider visits over two months. A convenience sample of 81 adults was used. There was an 18.4% increase in patient adherence to bringing home blood pressure logs compared to none at baseline. The Patient Questionnaire revealed a discrepancy in blood pressure awareness and home blood pressure log adherence between Baseline and Intervention Groups. There was significance between the adherent group in-office systolic mean and home systolic mean and no significant difference in diastolic mean. A chi-square test did not observe significant associations between sex, race, and age and the likelihood of patients bringing their home blood pressure logs. Home blood pressure monitoring offers providers more information regarding patients' blood pressure ranges and aid in their hypertension management. Future research should focus on patient barriers to monitoring and bringing home blood pressure logs into the clinic, aiming to sustain adherence through effective strategies promoting patient understanding.

Keywords: adults, hypertension, home blood pressure monitoring, blood pressure, primary care, internal medicine, quality improvement

Implementation of Home Blood Pressure Monitoring

According to the American College of Cardiology and American Heart Association, hypertension is a blood pressure exceeding 130 mmHg systolic or 80 mmHg diastolic (Whelton et al., 2018). Stage two hypertension is defined as a blood pressure greater than or equal to 140/90 mmHg (Whelton et al., 2018). Approximately 48.1% or 119.9 million adults in the United States have high blood pressure (Centers for Disease Control and Prevention [CDC], 2023). One in five adults in the United States has undiagnosed hypertension (CDC, 2023). Of those diagnosed, only one in four have their blood pressure adequately controlled (CDC, 2023).

Hypertension increases the risk of heart disease and stroke, two primary contributors to mortality in the United States (CDC, 2023). The causes of hypertension are multifactorial including, nonmodifiable factors such as genetic predisposition and modifiable factors such as physical activity, alcohol intake, and diet (Whelton et al., 2018). Furthermore, hypertension is the most expensive of the cardiovascular diseases, estimated to cost $131 billion annually from 2003 through 2014 (Kirkland et al., 2018).

Currently, the diagnosis and management of hypertension rely on multiple blood pressure readings taken at different times in clinical environments. However, a single blood pressure reading in traditional clinical settings does not provide enough information alone to diagnose someone with hypertension nor does it allow providers to determine if a patient’s condition is effectively controlled with their current lifestyle modifications or pharmaceutical management. One challenge in the management of hypertension is the validity of blood pressure measurements in the clinical setting.

Sometimes readings performed in a clinician's office are artificially higher than if they were performed at the patient's home or their normal environment.

Many factors may lead to elevated blood pressure readings in traditional clinical settings including, but not limited to, stress and white coat hypertension. White coat hypertension refers to the relative difference of systolic blood pressures and diastolic blood pressures of at least >20/10 mm Hg, when measurements are taken in a healthcare setting (Whelton et al., 2018). White coat hypertension can lead to an overestimation of ambulatory blood pressure when measured in a clinic. It tends to be more common in older individuals, women, and non-smokers, when blood pressure is taken in a typical office setting by clinicians compared to when it is measured without the presence of medical staff (Whelton et al., 2018).

One way to negate the whitecoat effect of blood pressure measurement would be to conduct measurements at home. Conducting daily blood pressure monitoring at home helps patients gain insight into their condition, enables monitoring in their familiar environment, allows for the possible identification of white-coat or masked hypertension, and offers numerous readings, allowing for the assessment of blood pressure trends (Shimbo et al., 2020). Analyzing data from daily monitoring allows healthcare providers to interpret trends and offer appropriate guidance based on home measurements.

The U.S. Preventive Services Task Force (USPSTF) (2021) advises screening adults aged 18 and above for hypertension using office blood pressure measurement, however, confirmation of the diagnosis is completed by obtaining blood pressure readings outside the clinical setting before initiating treatment. Additionally, the USPSTF recommends yearly screening of adults 40 years and older and those with increased risk

factors (2021). Measurements of blood pressure taken outside of the clinical setting can help validate the diagnosis of hypertension and be used to adjust blood pressure-lowering medication (Whelton et al., 2018). While ambulatory blood pressure monitoring is the diagnostic standard for blood pressure measurements, home blood pressure monitoring is a more practical, holistic, and accessible option for patients (Shimbo et al., 2020; Whelton et al., 2018). This allows the clinician to obtain data from home blood pressure monitoring and in the clinic environment.

Given the prevalence and morbidity of hypertension, it is important that patients have accurate blood pressure readings. To do this, they may need to obtain at-home blood pressure measurements. To ensure these measurements occur, patients will need to be both encouraged and educated on how to obtain accurate blood pressure readings. Such education would include information about hypertension, provision of a clinically validated equipment list, ensuring patients are utilizing the correct cuff size, and instructing them on how to record these measurements (Whelton et al., 2018). Additional education would include helping them understand that resting for five minutes or more prior to initiating blood pressure reading, refraining from smoking, exercising, keeping the arm in use supported, and that the blood pressure cuff is at heart level are all important to ensuring accurate measurements (Whelton et al., 2018). For individuals currently on hypertension medications, it is essential to standardize the timing of blood pressure measurements by obtaining a reading two to three times daily, as a single measure will be an inadequate reflection of one's blood pressure ranges (Whelton et al., 2018).

Problem

While providers may encourage patients to monitor and keep a log of their blood pressure from home, patients may not bring this information to their appointments (Lin, 2021). Additionally, they may forget. As a result, providers may be unable to further analyze and manage the patient and have to depend on the use of a singular in-office blood pressure which may or may not accurately reflect the patient's blood pressure ranges.

Purpose & Aim

In an outpatient primary care office for patients 18-99 years of age, there is an opportunity for improvement in blood pressure management through increasing home blood pressure monitoring adherence. The evidence-based framework for this quality improvement project is the Institute for Healthcare Improvement (IHI) Model for Change. The purpose of this quality improvement project is to increase home blood pressure monitoring by 5% by implementing a toolkit that includes a formalized blood pressure log and instructions to obtain accurate blood pressure measurement within a two-month period. The primary outcome measure for this project will be the rate of patients who bring their blood pressure logs to the clinic. The secondary outcome measure is comparing the patients' home blood pressure measurements to their in-office blood pressure. The PICOT question for this project is: In adult patients 18-99 years of age seen in an outpatient primary care clinic, after implementation of the Home BP Monitoring Toolkit:

1. What is the rate of patients who adhere to bringing their AHA home blood pressure logs into the clinic over a nine-week period?

2. What is the difference between patients' home blood pressures to their singular, in-office blood pressure?

Review of Literature

The literature review process began by conducting a comprehensive search using three search engines: PubMed, CINAHL Plus with Full Text, and Medline (EBSCO). The search terms and phrases used included "hypertension," "home blood pressure monitoring," "white coat phenomenon," "masked hypertension," and "self-measured blood pressure monitoring." Boolean operators such as "AND" and "OR" were employed to refine the search and generate relevant results. The initial search via PubMed yielded a significant number of publications 5,570 total: 4,267 PubMed, CINAHL Plus with Full Text 849, and Medline (EBSCOhost) 454.

To narrow down the results, inclusion and exclusion criteria were applied. The inclusion criteria involved examining publications published within the last five years, availability in full-text, and the English language. Exclusion criteria included publications published more than five years ago, without full-text access, and not offered in the English language. After applying these criteria, the refined search produced a smaller set of publications resulting in 1,384 total: 1,048 (PubMed), 230 (CINAHL Plus with Full Text), and 106 Medline (EBSCOhost). No other search methods were utilized to generate additional publications. The final number of publications selected for this review was 11. The search process aimed to gather current and high-quality research on hypertension, home blood pressure monitoring (HBPM,) and its impact on improved blood pressure for patients in the primary care setting, the effect of HBPM on health care cost, and the effectiveness of HBPM.

The American College of Cardiology and American Heart Association (ACC/AHA) Clinical Practice Guidelines lay the foundation for this clinical scholarship project (Whelton et al., 2018). Guidelines for practice offer recommendations for healthcare practices in the United States and are crafted in partnership with other organizations to exert influence globally with the primary purpose of enhancing the quality of care for patients.

High blood pressure emerged as the underlying cause of cardiovascular disease, the number one cause of death and disability in 2010 (Whelton et al., 2018). In the United States, hypertension is a major cardiovascular disease (CVD) risk factor and contributes to more CVD-related deaths than any other modifiable risk factor (Whelton et al., 2018). The prevalence of hypertension alongside various co-existing CVD risk factors emphasizes the critical importance of accurately evaluating and addressing blood pressure.

Precise assessment and documentation of blood pressure is crucial. While measuring blood pressure in the office setting may seem to be the most accurate, errors are frequent and can lead to a misrepresentative assessment of an individual's actual blood pressure levels. To minimize systematic errors in blood pressure measurement, according to the ACC and AHA, healthcare professionals who are overseeing blood pressure measurement in the office should only utilize a clinically validated blood pressure measurement device, allow the patient to rest for five minutes prior to administration of blood pressure reading, support the limb used for measurement, position the blood pressure cuff at heart level, use the appropriate cuff size, and for auscultatory readings, gradually deflating the cuff (Whelton et al., 2018).

Multiple guidelines regarding the diagnosis of hypertension emphasize the need for multiple blood pressure measurements. ACC/AHA Guidelines along with the International Society of Hypertension (ISH) Practice Guidelines both agree that the diagnosis of hypertension should not be made on a single in-office blood pressure (ISH, 2020; Unger et al., 2020; Whelton et al., 2018). The United States Preventive Services Task Force (USPSTF) recommend screening adults aged 18 and older for hypertension using office blood pressure measurement with additional verification of blood pressure measurements in a non-clinical setting for diagnostic confirmation before initiating treatment (2021). Therefore, multiple health organizations agree with having multiple blood pressure measurements to ensure the accurate diagnosis and treatment of hypertension.

Ambulatory blood pressure monitoring (ABPM) is considered the standard for monitoring home blood pressure (Shimbo et al., 2020; Whelton et al., 2018). ABPM is a method used to collect blood pressure data over a 24-hour interval, where measurements are taken every fifteen to thirty minutes during the patient's usual daily activities and every fifteen minutes to every hour when the patient is asleep (Whelton et al., 2018). Patients are instructed to only remove the ambulatory cuff when bathing or participating in strenuous exercise (Kronish et al., 2020). Patients will return to the clinic after 24-hours to have their blood pressure data uploaded by their prescribing healthcare provider where the software will average blood pressure measurements and pulse (Kronish et al., 2020). Therein important factors such as nocturnal dipping, nocturnal hypertension, masked hypertension, white coat hypertension, orthostatic hypotension, and others will be considered by the patient's healthcare provider (Kronish et al., 2020).

ABPM has many advantages, among the collection of 24-hour comprehensive blood pressure data, it allows cardiovascular risk projection, and obtaining variability of measurements in the patient's natural environment (Kario et al., 2019). Although, ABPM is the most accurate method for monitoring blood pressure outside of the clinical setting this technique for measuring blood pressure has numerous challenges for the average patient. The expense and limited accessibility of ABPM devices, coupled with patient discomfort and inconvenience in wearing the blood pressure cuff for an extended period, deter its use (Kario et al., 2019). Furthermore, provider knowledge of interpreting the data and the requirement of training healthcare providers pose additional barriers (Kario et al., 2019). These factors collectively limit the utilization of ABPM despite it being deemed the gold standard for monitoring home blood pressure.

Approximately 10-30% of individuals seeking a healthcare provider for high blood pressure in a clinic setting exhibit white coat hypertension, whereas 10-15% have masked hypertension (Unger et al., 2020). Utilization of blood pressure monitoring has led to the classification of hypertension into distinct categories based on the location of blood pressure measurement such as masked hypertension and white coat hypertension. White coat hypertension is defined as increased office blood pressure levels but normal readings when measured outside the office using either ABPM or HBPM (Unger et al., 2020; Whelton et al., 2018). In contrast, masked hypertension is characterized by office readings indicating normal blood pressure, while ABPM or HBPM consistently reveal elevated blood pressure (Unger et al., 2020; Whelton et al., 2018). Therefore, HBPM or ABPM are important to the confirm diagnosis of primary hypertension, white coat hypertension, and masked hypertension. It is widely agreed that blood pressure readings

in an office setting often yield higher measurements compared to those obtained through ABPM or HBPM (Unger et al., 2020; Whelton et al., 2018).

Furthermore, home blood pressure monitoring (HBPM) or self-measured blood pressure (SMBP) monitoring has been deemed acceptable due to practicality (Shimbo et al., 2020; Whelton et al., 2018). For the use of this paper, HBPM will be used throughout the rest of this paper. Unlike ABPM monitoring, HBPM involves the patient measuring their blood pressure much less frequently. The process requires taking at least two readings, at a one-minute interval, both in the morning before administering antihypertensive medications and in the evening before dinner (Whelton et al., 2018).

When patients are advised to monitor their blood pressure at home using self-monitoring devices instead of relying, solely on ambulatory blood pressure, it is crucial to guarantee the use of clinically validated devices (Whelton et al., 2018). Additionally, patients should receive education on the optimal methods for obtaining the most accurate home blood pressure readings and the recommended frequency for conducting these measurements (Whelton et al., 2018).

A comprehensive comparison of various blood pressure monitoring methods reveals insightful findings. In a systematic review, Constanti et al. (2021) highlighted that HBPM demonstrated higher sensitivity (90% vs. 81%) and specificity (84% vs. 76%) compared to in-office measurements. Moreover, research by Whelton et al. (2018) suggested that in-office blood pressure measurements often exhibit higher values than those obtained through ABPM or HBPM.

Additionally, studies led by Egan et al (2018), McManus et al. (2018), McManus et al. (2021), and Shepard et al. (2019) demonstrated that HBPM resulted in lower blood

pressure readings. Specifically, Shepard et al. (2019) emphasized that HBPM effectively reduced blood pressure, regardless of hypertension-related co-existing conditions. Additionally, both randomized controlled trials conducted by McManus et al. (2018; 2021), implementing HBPM with self-titration of antihypertensive medications, observed decreased systolic blood pressure over a 12-month period.

In a quasi-experimental study, Egan et al. (2018) introduced the "MAP" protocol, which demonstrated improved blood pressure control over a six-month duration. However, these studies varied in their approaches, settings, and duration, with differences in patient demographics and follow-up rates impacting their outcomes and generalizability.

Despite such variations, Wierzejska et al. (2020) conducted a systematic review across fifteen countries, revealing substantial differences in hypertension-related healthcare costs. The United States exhibited the highest annual cost of $316 billion. Additionally, findings from the Medical Expenditure Panel Survey indicated that hypertensive individuals in the United States incurred an annual medical expenditure of $9,089, demonstrating a significantly higher financial burden compared to non-hypertensive individuals.

Essentially, while different blood pressure monitoring methods show varying effectiveness, the financial implications of hypertension management highlight substantial costs in healthcare expenditures, specifically in the United States. However, Wierzeiska et al. (2020) only covered 15 countries, potentially limiting a comprehensive global perspective, and impacting data accuracy, as costs might fluctuate over time. These compelling findings highlight the substantial benefits of hypertension management

not only in terms of cost savings for the healthcare system but also in enhancing patients' quality of life.

Despite numerous publications regarding ABPM and HBPM, there is insufficient evidence to definitively favor ABPM over HBPM in hypertension management. HBPM has been considered a strong alternative to ABPM in the diagnosis and management of hypertension, yet the decision to utilize either ABPM or HBPM ultimately relies on various factors, including the patient's health status and medications. For this quality improvement project, HBPM was chosen as the preferred blood pressure monitoring method due to its practicality and the lack of research to validate the superiority of either method.

The IHI Model for Change is a widely recognized framework for quality improvement and problem-solving in various fields. It uses a systemic and iterative approach that allows for testing and implementing changes with the goal of continuous improvement (Melnyk & Fineout-Overholt, 2023). This approach will provide a structured framework for addressing challenges, making informed decisions, and driving positive change in promoting patient engagement and improving healthcare outcomes.

The PDSA Cycle encompasses the following stages: Plan- introducing the change and observing its effects. Do- implementing the change on a small scale. Study- analyzing the data to glean the insights and lessons. Act- refining the change based on the knowledge gained and repeating the testing. Ultimately, while the action is founded on the likelihood of the change improving the outcome, absolute certainty, without external evidence supporting the improvement, cannot be guaranteed for any PDSA iteration (Melnyk & Fineout-Overholt, 2023).

Overall, these studies provide insights into the current hypertension literature, revealing challenges in office-based blood pressure management, advantages of home monitoring, and distinctions in masked and white coat hypertension. They highlight the cost of hypertension to the US healthcare system and the positive impact of HBPM in diagnosis and management.

This capstone project aims to improve adherence to self-blood pressure measurement logs among primary care patients using the PDSA Cycle as a guiding framework. By utilizing this cycle, the project strives to enhance patient education, encourage proactive engagement in blood pressure measurement, and improve healthcare decision-making for better patient outcomes.

Methods

Design

This quality improvement project used a descriptive, observational design. It involved an intervention to assess the impact of patient adherence of taking home blood pressure measurement and increase the number of patients who brought their blood pressure logs to their healthcare provider visits. This pre-post intervention study design focused on adult patients 18-99 years of age seeking care in an outpatient clinic between February 1, 2024 and March 29, 2024.

Setting

The setting was a suburban, Midwestern internal medicine clinic that is among one of the few physician-owned in the area. The project was set at one of the 22 clinics providing internal medicine services. This specific practice has four healthcare providers serving approximately 8,000 internal medicine patients. The primary physician

overseeing the patients selected for this Quality Improvement initiative manages the care of over 2,000 patients.

Sample

A convenience sample of patients receiving care in the internal medicine clinic between February 1 and March 29, 2024, was collected. Inclusion criteria included patients aged 18-99 years of age, English-speaking, with an active diagnosis of primary hypertension, with or without a prescription for antihypertensive medications, and under the management of one of the healthcare providers at the clinic for treatment of their hypertension within the last twelve months. Exclusion criteria were patients under 18 years of age, above the age of 99, and patients with blood pressure greater than 180/120 mm Hg (as this is a hypertensive emergency).

Approval Processes

Institutional Review Board (IRB) approval was obtained from the project site, as well as the educational institution. There were no risks or ethical considerations related to this project. The benefit of this project was improved blood pressure control among patients in this clinical setting.

Procedures

IRB approvals were obtained prior to initiating the quality improvement project. Permission was granted from an internal medicine clinic after obtaining consent and site approval.

The project aimed to improve blood pressure log adherence among patients with hypertension through a quality improvement project. This project was implemented in

three phases: Phase I: Pre-Implementation, Phase II: Intervention, and Phase III: Assessment of Impact.

The pre-implementation phase included baseline data collection through patient questionnaires. A brief overview of the quality improvement project with the purpose, aims, and phases of the project was provided to the medical assistant. The primary investigator identified patients who fit the inclusion criteria, were diagnosed with hypertension, and were scheduled for an office visit within the next week. A list of these patients who fit the inclusion criteria was provided to the physician's primary medical assistant.

The "Patient Questionnaire" was handed to patients containing three questions related to blood pressure log adherence. The questions focused on the purpose of the visit, whether the patient brought in their blood pressure measurements to the office, and if they received a form to record their blood pressure. The patients filled out the questionnaires and handed them to the provider's medical assistant, who collected and stored them in a provided, secured container. This data collection phase lasted for one week prior to the implementation of the intervention.

The Phase II intervention included the investigator identifying patients who fit the inclusion and exclusion criteria. The investigator reviewed patients' charts to identify individuals who fit inclusion criteria, were diagnosed with hypertension, and scheduled for an office visit within two to three weeks, then gathered data from the previous week's patient questionnaires.

The investigator sent a letter via mail (Appendix C), including an attachment containing an American Heart Association (AHA) blood pressure log (Appendix A) and

AHA Blood Pressure Measurement Instructions (Appendix D). The investigator provided clear instructions for the patients to record home blood pressure readings twice daily, using accurate methods, and to bring the log to their upcoming appointment.

The patients who received a letter via mail were instructed to bring their blood pressure logs into the clinic and provide a copy to the rooming technician. The medical assistant rooming the patient placed a copy of the patient's blood pressure log into the secured provided container. Then the rooming technician handed the patients a new AHA blood pressure log.

Phase III included an intervention assessment to determine whether the intervention increased patient adherence in bringing their blood pressure logs to appointments and compared the differences between home blood pressure and in-office blood pressure. The investigator repeated the data collection process used in Phase I during implementation of Phases II and III to gauge changes in adherence.

The main phases involved data collection, patient identification, communication, assessment of the impact of the intervention, and concluded with documentation and presentation of findings. The success was measured by comparing baseline data (Phase I) with the data collected during the implementation phase (Phases II and III) to determine if there was a notable increase in patients adhering to bringing their blood pressure logs to appointments.

Data Collection

This project aimed to improve blood pressure log adherence among patients with primary hypertension and utilized several data collection instruments. Data did not include the patient's medical record number but did include patient identifiers, such as

the patient's name and date of birth. These were only used by the primary investigator to find the patient in the electronic medical record and used to compare home blood pressures to in-office blood pressure readings.

The data collection instruments included a "Patient Questionnaire" and the American Heart Association (AHA) Blood Pressure Log. The purpose of the "Patient Questionnaire" was to gather baseline data regarding patients' adherence to blood pressure log maintenance, please see Appendix B. The purpose of the AHA Blood Pressure Log is to provide a standardized method for patients to record their blood pressure readings at home and for the primary investigator to gather home blood pressure monitor reading trends, please see Appendix A.

The methods used to obtain data included instructing the primary physician's medical assistant to hand the "Patient Questionnaire" to the patients who were at the clinic for hypertension during their check-in. The primary investigator screened patients who presented to office visits with the diagnosis of hypertension and had a list of patients prepared for the medical assistant to hand the questionnaire to. The patient was instructed to fill out the questionnaire and hand the completed questionnaire to the medical assistant rooming the patient. The medical assistant collected the slips and stored them for data entry and analysis, in a secured container with a lock, that was provided to the clinic for this project.

After baseline data was collected, the AHA Blood Pressure Log was sent to the eligible participants with a primary hypertension diagnosis via mail two weeks prior to the patients' scheduled appointment, see Appendix C, for an automated letter that was sent to the patient. Patients were instructed to record their home blood pressure readings

two times daily, in the morning and evening before dinner, and to bring their upcoming appointment.

Data was entered manually from the collected patient questionnaire slips and the outcomes from patient appointments were entered into an Excel spreadsheet. These entries were categorized based on intervention phases (Phase II or Phase III) and recorded patient responses, adherence to bringing blood pressure logs to their next appointment, and blood pressure trends between in-office blood pressures and home blood pressures.

Data Analysis

Descriptive statistics were used to summarize and describe data such as mean, standard deviation, and to describe adherence rates of the patients bringing logs to their appointment after the intervention. A t-test was used to compare at-home blood pressure to in-office blood pressure for those patients who brought their blood pressure logs to their next appointment. A Chi-Square test was also utilized to analyze whether variables such as sex, age, or race had a statistically significant relationship to blood pressure log adherence.

Results

Following project implementation, the total number of patients meeting criteria for inclusion was 65 (n= 65). Of these patients, 81.5% identified as female (n= 53) and 18.5% identified as male (n= 12). The racial demographic makeup was 29.2% White (n = 19), 69.2% African American/Black (n= 45), and 1.5% a different race (n= 1). The median age for the intervention group was 74, mean age was 73.5, and standard deviation of 9.7 respectively. These demographics are reflected in Table 1.

The total number of patients who fit inclusion criteria, were scheduled within the project implementation period, and were mailed the Home Blood Pressure Monitoring Toolkit was 65 (n = 65) patients. The adherence rate of these 65 patients who brought their home blood pressure logs into the clinic was 18.4% (n = 12).

A paired samples t-test was performed to compare the mean systolic and diastolic blood pressure measurements between in-office and at-home for the group who brought their blood pressure logs. There was a statistically significant ($p < 0.05$) difference between in-office and home systolic measurement, indicating a significant difference between home and office measurements (see Table 5). Conversely, there was not enough evidence to conclude that there is a significant difference in mean diastolic blood pressure as the p-value was 0.975, see Table 6.

A chi-square was conducted and found no significance between certain demographic factors and the likelihood of patients bringing in their home blood pressure logs. Further analysis suggested that patient's race, sex, and age did not influence their likelihood of bringing in their blood pressure logs.

Baseline data collection (see Table 2) was implemented via the Patient Questionnaire and included 16 (n = 16) patients who fit inclusion criteria, although 14 of the 16 (88%) agreed to fill out the Patient Questionnaire. The intervention group consisted of 65 (n= 65) patients who fit inclusion criteria, however, only 30 (n= 30), or 45.5% filled out the questionnaire, (see Table 3).

Of baseline patients, Question 1 "Are you here today for your blood pressure?" 50% (n= 8) answered no and 37.5% (n= 6) answered yes. The intervention group had 18.2% (n= 12) yes and 34.8% (n= 23) no.

Question 2 asked if participants brought their blood pressure measurements into the clinic. All of the baseline participants, (*n*= 14) answered no and of the intervention group 36.4% (*n*= 24) answered no. Nine participants (*n*= 9) or 13.6% of the intervention group answered yes, while 13 patients brought in their AHA Home Blood Pressure Logs.

Question 3 queried whether the patient had received a blood pressure form in the mail. One (*n*= 1) baseline participant answered yes with 75% (*n* = 12) selected no, and one participant stated that she "*did not read mail*." Of the intervention group, 37.9% (*n* = 25) reported they had received a blood pressure log in the mail with 12.1% (*n* = 8) stating they had not.

Discussion

The rate of patients who adhered to bringing their AHA home blood pressure logs into the clinic over a nine-week period was 18.4%. There was one outlier, one patient who brought a blood pressure log without being mailed the Blood Pressure Toolkit. This patient was not included in the overall data.

There were little differences between the baseline group, patients who did not bring their blood pressure logs in, and patients who did bring in their blood pressure logs in-office blood pressures, see Table 4 and Figure 1. However, there was a difference between in-home and in-office systolic and diastolic blood pressure measurements within the patient group who brought their blood pressure log into the clinic. Their in-office systolic mean was 132 mmHg and diastolic mean was 70 mmHg compared to the home systolic mean being 120 mmHg and the home diastolic mean was 70 mmHg. The difference in the systolic and diastolic measurements may stem from the physiological variation in cardiovascular function. Systolic pressure may have been more affected due

to measurement technique variation, device consistency, and patient variability such as white coat hypertension, stress, anxiety, fear, and pain.

The project observed an improvement in patient adherence, with 18.4% of participants now bringing in their AHA blood pressure logs compared to none at baseline. However, given that most participants still did not adhere, it is crucial to acknowledge the need for further investigation into the reasons behind this lack of adherence. This underscores the importance of enhancing patient education, communication, and implementing interventions to reinforce adherence.

Furthermore, most participants did not believe their appointment was related to blood pressure, as many of the appointments were annual physical exams and management of overall body systems and medications, including blood pressure medications, and therefore not specifically set up for blood pressure management alone.

Limitations

This quality improvement project encountered several limitations. The time allotted to successfully complete this project was constrained which impacted the depth of data collection. Whereas a longer period to collect data would have led to a more insightful conclusion. Secondly, this project was set in one clinic with one primary provider with a limited sample size, thus lacking generalizability.

Moreover, the method of patient recruitment introduced biases. Patients fitting the inclusion criteria were contacted via mail two to three weeks prior to their appointments. However, during data collection, it was discovered that the appointment list had fluctuated in size, potentially excluding eligible patients who were not contacted due to

the timing of the list compilation. Consequently, the small sample size may not accurately represent the population at large.

Strengths

Although the sample size was insufficient to establish statistically significant findings, the study serves as a stepping stone toward promoting HBPM adherence. Despite its small sample size, the quality improvement project assesses the feasibility, time constraints, and potential complications, laying a foundation for future implementation.

Recommendations

Further studies should focus on understanding the underlying factors contributing to low adherence rates and exploring effective interventions to address them. More research is needed to explore patient perspectives, examine barriers to bringing home blood pressure logs to clinic visits, home blood pressure monitoring, and identify actions to overcome these hurdles. The focus should be on enacting change through the implementation of blood pressure check reminders, patient education materials, and improvement in healthcare provider training to assist with effective communication regarding the importance of home blood pressure monitoring to the overall treatment and management of hypertension.

Conclusion

Before implementing the Home Blood Pressure Monitoring Toolkit, this internal medicine clinic had encouraged patients to use the AHA Home Blood Pressure log. However, in the first week of obtaining the clinic's baseline of patients who fit inclusion criteria, none of these patients brought in a blood pressure log, nor did the majority

believe their appointment was related to blood pressure according to their responses on the Patient Questionnaire. By implementing this quality improvement project and by encouraging patients to bring their AHA home blood pressure log into the clinic, there was an increase of patient adherence by 18.4%. Recommendations support the continued use of the AHA Home Blood Pressure Log along with home blood pressure measurement and scheduled follow-up. Future research should focus on patient barriers to monitoring their home blood pressure and bringing their logs into the clinic. Furthermore, there should be an aim to sustain and maintain patient adherence to bringing their home blood pressure logs into the clinic by identifying useful strategies to ensure patient understanding and adherence.

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Table 1

Demographics

		Baseline / Non-Intervention		Intervention Groups	
		n	%	n	%
Sex					
	Male	1	6.3%	12	18.5%
	Female	15	93.8%	53	81.5%
Race					
	White	8	50.0%	19	29.2%
	Black/African American	8	50.0%	45	69.2%
	Other	0	0.0%	1	1.5%
Age					
	Average	70.9		73.4	
	Standard Deviation	9.1		9.7	

Table 2

Baseline Group Questionnaire

	Q1: Are you here today for your blood pressure?	Q2: Did you bring your blood pressure measurements?	Q3: Did you receive a form to record your blood pressure?
Yes	6 (37.5%)	0 (0%)	1 (6.3%)
No	8 (50.0%)	14 (87.5%)	12 (75.0%)

Table 3

Intervention Group Questionnaire

	Q1: Are you here today for your blood pressure?	Q2: Did you bring your blood pressure measurements?	Q3: Did you receive a form to record your blood pressure?
Yes	12 (18.2%)	9 (13.6%)	25 (37.9%)
No	23 (34.8%)	24 (36.4%)	8 (12.1%)

Table 4

Baseline, Non-Adherent Intervention, Adherent Intervention Groups Blood Pressure Mean

	Baseline	Non-Adherent	Adherent
In-Office Systolic Mean	128	132	132
In-Office Diastolic Mean	72	73	70

Figure 1

Baseline, Non-Adherent (Week 4-9), and Adherent Group Average In-Office Systolic and Diastolic Blood Pressure

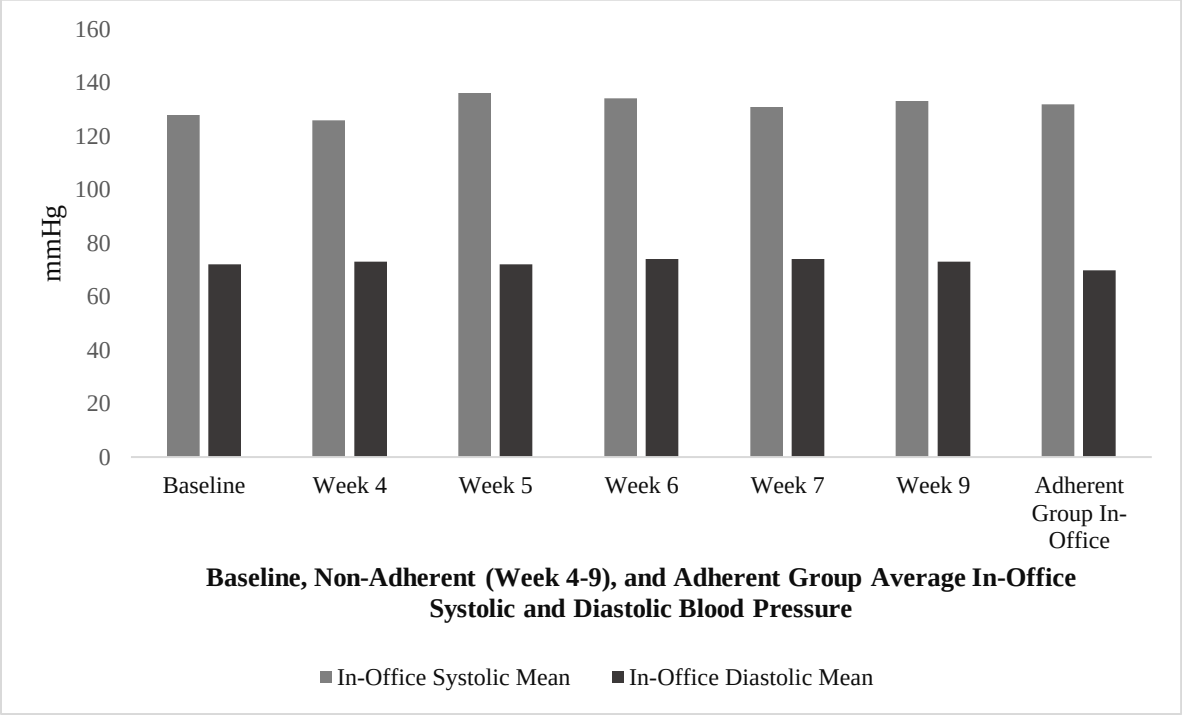


Table 5

T-test: Paired Two Sample for Mean Systolic Adherent Group

	In-Office Systolic Mean	*Home Systolic Mean*
Mean	131.846	120.308
Variance	125.808	146.731
Observations	13.000	13.000
Pearson Correlation	0.556	
Hypothesized Mean Difference	0.000	
df	12.000	
t Stat	3.775	
P(T<=t) one-tail	0.001	
t Critical one-tail	1.782	
P(T<=t) two-tail	0.003	
t Critical two-tail	2.179	

Table 6

T-test: Paired Two Sample for Mean Diastolic Adherent Group

	In-Office Diastolic Mean	*Home Diastolic Mean*
Mean	69.923	69.846
Variance	40.077	58.974
Observations	13.000	13.000
Pearson Correlation	0.231	
Hypothesized Mean Difference	0.000	
df	12.000	
t Stat	0.032	
P(T<=t) one-tail	0.488	
t Critical one-tail	1.782	
P(T<=t) two-tail	0.975	
t Critical two-tail	2.179	

Appendix A

My Blood Pressure Log

Name: _____

My Blood Pressure Goal: _____ mm Hg

Instructions:

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

DATE	AM	PM

DATE	AM	PM

Appendix B

Patient Questionnaire

Are you here today for your blood pressure? Yes

No

Did you bring your blood pressure measurements? Yes

No

Did you receive a form to record your blood pressure? Yes

No

Appendix C

Dear Patient of Esse Health,

You are receiving this letter because you have an upcoming appointment with Dr. Tracy. Our records show that you have high blood pressure. Please find a copy of the American Heart Association blood pressure log to keep track of your blood pressure measurements. Research has shown these can be helpful to your doctor when making decisions about your blood pressure. Please follow the instructions on the blood pressure log carefully. Dr. Tracy would like you to fill this out and bring to the next appointment.

Thank you,

Sarah Gutzke BSN, RN University of Missouri- St. Louis DNP Candidate 2024 (Doctoral of Nursing Practice)

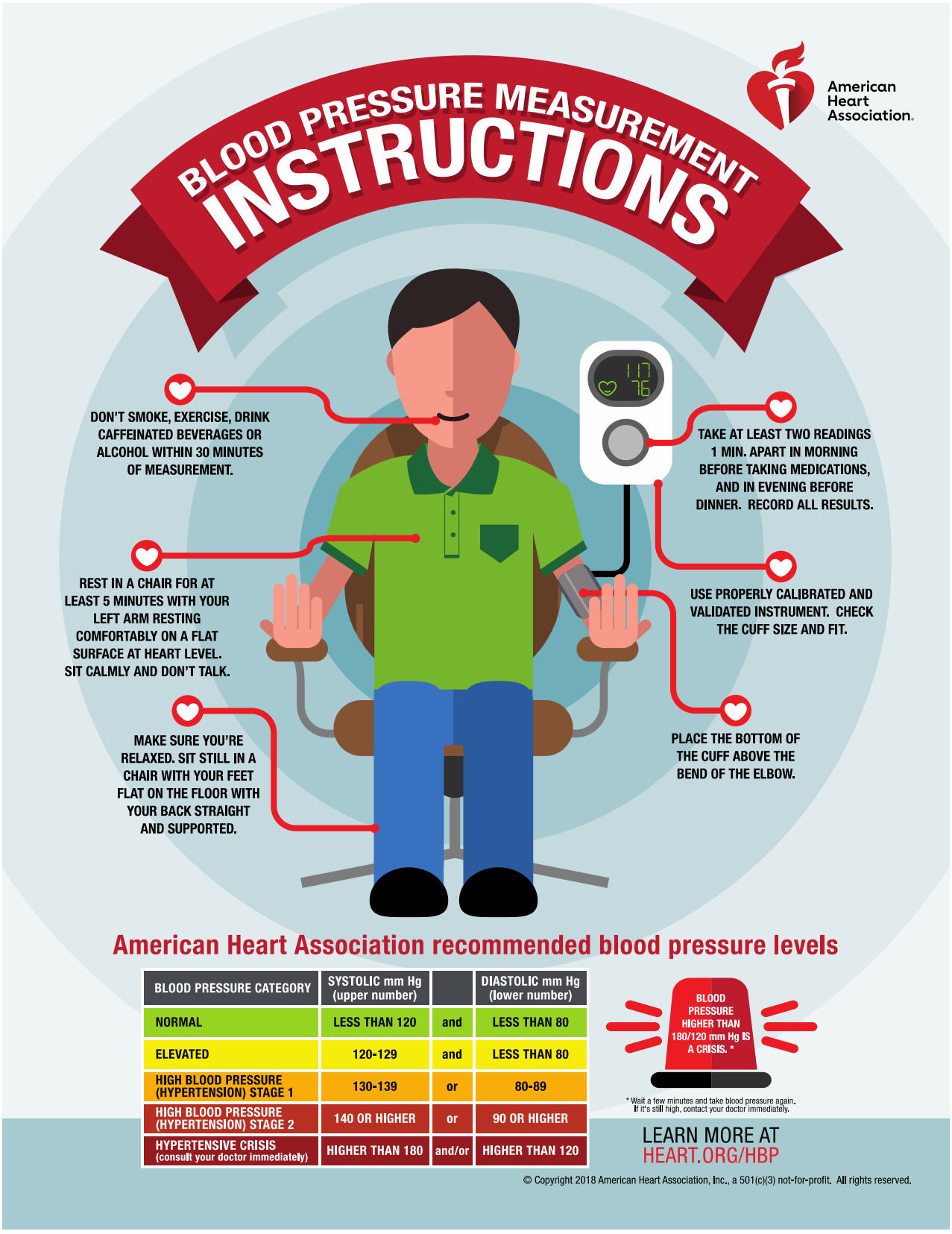
On behalf of Dr. Elizabeth Tracy.

Please contact the individuals below if you have further questions:

Sarah Gutzke, Principal Investigator Contact Information Sgy7c@umsystem.edu

Dr. Amanda Finley, Ph.D UMSL Project Chair Contact Information: finleyal@umsl.edu
USML IRB 314-516-5899

Appendix D


American Heart Association.
BLOOD PRESSURE MEASUREMENT INSTRUCTIONS
DON'T SMOKE, EXERCISE, DRINK CAFFEINATED BEVERAGES OR ALCOHOL WITHIN 30 MINUTES OF MEASUREMENT.
REST IN A CHAIR FOR AT LEAST 5 MINUTES WITH YOUR LEFT ARM RESTING COMFORTABLY ON A FLAT SURFACE AT HEART LEVEL. SIT CALMLY AND DON'T TALK.
MAKE SURE YOU'RE RELAXED. SIT STILL IN A CHAIR WITH YOUR FEET FLAT ON THE FLOOR WITH YOUR BACK STRAIGHT AND SUPPORTED.
TAKE AT LEAST TWO READINGS 1 MIN. APART IN MORNING BEFORE TAKING MEDICATIONS, AND IN EVENING BEFORE DINNER. RECORD ALL RESULTS.
USE PROPERLY CALIBRATED AND VALIDATED INSTRUMENT. CHECK THE CUFF SIZE AND FIT.
PLACE THE BOTTOM OF THE CUFF ABOVE THE BEND OF THE ELBOW.
117
76
American Heart Association recommended blood pressure levels
BLOOD PRESSURE CATEGORY | SYSTOLIC mm Hg (upper number) | | DIASTOLIC mm Hg (lower number)
NORMAL | LESS THAN 120 | and | LESS THAN 80
ELEVATED | 120-129 | and | LESS THAN 80
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 1 | 130-139 | or | 80-89
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 2 | 140 OR HIGHER | or | 90 OR HIGHER
HYPERTENSIVE CRISIS (consult your doctor immediately) | HIGHER THAN 180 | and/or | HIGHER THAN 120
BLOOD PRESSURE HIGHER THAN 180/120 mm Hg IS A CRISIS. *
* Wait a few minutes and take blood pressure again. If it's still high, contact your doctor immediately.
LEARN MORE AT HEART.ORG/HBP
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Appendix E

Dear Clinic Staff Member,

Thank you for assisting me with my final project for nurse practitioner school. The purpose of this project increase patient's adherence to bringing their blood pressure logs into their appointments. I will be implementing the project from January to March 2024.

Patients will first be assessed of their adherence of bringing their blood pressure logs to their appointments by handing out a patient questionnaire. Patients will be handed this when they check in and will fill this out while they wait to be roomed. When they are roomed, they will hand the completed questions (3 questions) to the medical assistant. The medical assistant will place the completed questionnaire in a secured container.

The next phase of the project will be when patients bring their blood pressure logs in, these will need to ensure they have the patient's name and date of birth. These will be placed in a secured container and the patient will be handed a fresh AHA blood pressure log.

Thank you for helping me with this project. Please reach out if you have any questions or concerns.

Best Regards,

Sarah Gutzke