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Remote blood pressure monitoring program: program evaluation.

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Remote Blood Pressure Monitoring: Program Evaluation

by

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Abstract

The prevalence of hypertension is high at the local, state, and national levels. In 2021, 39% of Kentucky adults were diagnosed with high blood pressure (CDC, 2021). Primary care providers are utilizing remote blood pressure monitoring (RBPM) to assist with the management of hypertension. Literature reveals that remote BP monitoring alone, without the use of other interventions such as counseling and education, may not effectively control blood pressure (Uhlig K, et al, 2013). This project evaluated the RBPM program utilized at a federally qualified health center in Louisville, KY. Patient engagement within the RBPM program includes BP measurement, communication with a health coach, as well as attending scheduled visits with the provider to discuss hypertension management. To determine the strengths, weaknesses, threats, and opportunities of the RBPM program at the center, a program evaluation was conducted. The SWOT recommendations were provided to the office to encourage enrollment or maintain engagement.

Remote Blood Pressure Monitoring: Program Evaluation

Problem Statement

Approximately 1 billion people worldwide have been diagnosed with hypertension (Konstantinidis et al., 2022). According to the Centers for Disease Control and Prevention (CDC, 2022), 47%, or 116 million adults in the United States have hypertension. Hypertension can be easily diagnosed, and in most patients, easily controlled. However, it is estimated that only about 1 in 4 adults (24%) have controlled blood pressure, and target blood pressure (<140/90) is achieved in less than 50% of patients with hypertension. (CDC, 2021; Park et al., 2021)

In-office blood pressure (BP) measurement has been the primary method for diagnosing and managing hypertension. It is well known that self-measured BP monitoring has health and economic benefits such as improved BP control in individuals with hypertension. However, for adults who participate in home-based blood pressure monitoring (HBPM) alone, without other interventions such as counseling, remote telemonitoring, or education, blood pressure management may not be sustained (Uhlig K, et al, 2013).

Background/Significance of the Problem

The root causes of hypertension are multifaceted including modifiable and nonmodifiable health factors. The CDC (2022) states modifiable risk factors for hypertension include poor diet choices including foods high in sodium and low in potassium, physical inactivity, diabetes, obesity, high alcohol use, and tobacco use. Nonmodifiable risk factors include genetics/family history and age (CDC, 2022). The CDC presented data from a study completed by Vasan et al., (2002) that revealed the residual lifetime risk for hypertension is 90% for individuals aged 55 and 65. Race is also a factor in hypertension. The prevalence of hypertension in African

Americans in the United States is one of the highest in the world. From 2011 to 2016, the prevalence of hypertension was 57.6% in African American males and 53.2% in African American females (Benjamin et al., 2019).

Individuals diagnosed with hypertension are at a higher risk for developing cardiovascular disease (Al Ghorani et al., 2021, Kim et al., 2020, Kirkland et al., 2018, Tsao et al., 2022). Vascular damage caused by hypertension contributes to heart disease, ischemic and hemorrhagic strokes, and renal failure (Al Ghorani et al., 2021, Kim et al., 2020, Kirkland et al., 2018). Hypertension-related mortality is a significant burden in the United States (Kirkland et al., 2018, Tsao et al., 2022).

Non-adherence to antihypertensive treatment contributes to patients not achieving controlled blood pressure (Redon et al., 2016). Reasons for non-adherence are specific to each patient, however, some factors include fear of possible or experienced adverse effects, lack of information regarding the medication, actual or perceived lack of benefit from treatment, forgetting to take medications, the potential complexity of dosing, and polypharmacy (Poulter et al., 2020). Failure of the provider to initiate or modify the treatment regimen and inconsistent or ineffective patient-provider communication can also contribute to patient non-compliance with the treatment regimen (Redon et al., 2016). Poor management of hypertension causes an increase in healthcare expenditure due to hypertension-related events. This increase in costs can be seen in inpatient, outpatient, and prescription expenditure costs (Tsao et al., 2022).

In 2021, 39% of adults in Kentucky were diagnosed with hypertension (CDC, 2021). According to the CDC (2021), 40% of adults in Jefferson County, Kentucky were told they have hypertension in 2021. The environment the problem was occurring in is a primary care office that provides medical care to patients from newborn to geriatric. This facility is a Federally

Qualified Health Center (FQHC) located in an urban and Health Professional Shortage Area (HPSA) in Louisville, Kentucky (Health Resources and Services Administration [HRSA], 2021). The most recent HRSA report in 2021 showed a total patient population of 3,901. The adult and geriatric populations were 2,918 with 761 adult/geriatric patients diagnosed with hypertension in 2021. However, according to the office's data for 2022, 734 adult/geriatric patients had been diagnosed with hypertension, and 322 adult/geriatric patients (43.6%) had uncontrolled hypertension (S. Whitfield, personal communication 12/15/2022).

The use of a remote blood pressure monitoring (RPBM) program is currently being implemented for adult/geriatric patients diagnosed with hypertension (BP > 140/90 on two or more visits). At the time of data collection, there were no guidelines for when the program is presented to patients. Information regarding the RBPM program is given at the providers' discretion to hypertensive patients. When a patient enrolls in this program, they are provided with a blood pressure cuff and receive instructions on how to use the cuff to monitor their blood pressure outside of the office. Additionally, patients are provided with a device that stores blood pressure measurements to be viewed by the provider. There were no requirements for the frequency patients are expected to check their blood pressure. Providers encourage patients to check their blood pressure every day, however, if they face difficulty with this, three to four times within the week is suggested. A healthcare coach is assigned to the patient with enrollment in the program. This healthcare coach contacts the patient weekly initially to ensure an understanding of how to measure the blood pressure, as well as to discuss blood pressure findings and the treatment regimen, then the health coach will touch base with the patient monthly. The healthcare coach also motivates the patient to consume healthy meals, engage in regular exercise, and remain compliant with the current treatment regimen.

Follow-up with the provider is patient specific. Patients with uncontrolled hypertension are expected to follow up every three months. If a patient is not responding to medication initiation or adjustments, the patient would follow up with the provider within two weeks to one month. (C. Sperry, personal communication, 1/23/2023, 2/20/2023; L. Nelson, personal communication, 2/14/2023).

Literature Review

The literature gathered consisted of 14 randomized controlled trials which are identified as level two evidence by Melnyk's evidence hierarchy model (Andersson et al., 2023, Cinar & Schou, 2014, Gooding et al., 2014, Hoppe et al., 2023, Kario, 2020, Kishi, 2021, Kim et al., 2020, Konstantinidis et al., 2022, Margolius et al., 2012, Persell et al., 2018, Schukraft et al., 2021, Sharapova et al., 2020, Tan et al., 2021, Wu et al., 2018). There were also two meta-analyses of randomized controlled trials (Meng et al., 2021, Mills et al., 2018), identified as level 1 evidence by Melnyk's evidence hierarchy model.

Problem

Failure to effectively manage hypertension can be attributed to four factors, including lack of patient understanding of physician instructions, poor patient participation in decision-making, low medication adherence, and clinical inertia (providers not addressing elevated blood pressure because of more pressing concerns). The combination of home blood pressure monitoring and health coaching addresses the first three barriers mentioned above by encouraging patients to be informed and active participants in their care. Some health coaches also address clinical inertia by using physician-approved protocols to assist patients in titrating antihypertensive medications at home if target blood pressure is not achieved with initial dosing (Margolius et al., 2012).

Literature reveals that inadequate motivation to foster lifestyle changes can contribute to ineffective management of hypertension (Cinar & Schou, 2014, Tan et al., 2021). Individual factors such as age, gender, and baseline health status were shown to impact the information patients receive (Meng et al., 2021). Gooding et al., (2014) stated young adults diagnosed with hypertension were less likely to receive counseling regarding healthy diet and exercise, had a decreased awareness of hypertension, and substantially worse management of blood pressure when compared to older adults.

Intervention

Mills et al., (2018) reported that health coaching and home blood pressure monitoring (HBPM) /RBPM significantly reduced systolic BP by 4.3 mmHg. The incorporation of HBPM/RBPM and health coaching took several forms within the literature, however, they all consisted of regular communication between the patient, health coach, and provider as well as BP measurement completed by the patient outside of the office. In some of the literature, patients were provided with a Bluetooth-equipped sphygmomanometer and blood pressure cuff to measure their BP throughout the day. These patients were also told to download an Android/iPhone application to transfer the BP measurements to an online database that can be viewed by the patient, health coach, and provider (Hoppe et al., 2023, Kim et al., 2020, Persell et al., 2018, Sharapova et al., 2020).

Other studies included a wearable monitor that measured the patients' blood pressure throughout the entire day. Providers were able to remotely monitor the patients' BP measurements (Kario, 2020, Kishi, 2021, Konstantinidis et al., 2022, Schukraft et al., 2021). Some studies included communication via text messaging between the health coach and patient to discuss certain factors such as BP measurements, medication intake, any adverse effects

experienced, stress level, well-being, and physical activity (Kim et al., 2020, Persell et al., 2018,). Motivational messages to encourage lifestyle changes and adherence to treatment regimens were also sent (Andersson et al., 2022, Persell et al., 2018). Additional methods included phone calls between the health coach and the patient. During these calls, lifestyle changes and hypertension management were discussed including stress management, sodium intake, alcohol and tobacco use, diet, physical activity, patient/provider interactions, medication adherence, home BP measurements, and weight loss (Hoppe et al., 2023, Margolius et al., 2012, Wu et al., 2018).

Summary

Evidence has shown that inadequate motivation to foster lifestyle changes can contribute to ineffective management of hypertension (Cinar & Schou, 2014, Tan et al., 2021). All the options on how to manage hypertension such as diet and exercise are not provided to everyone. Young adults particularly are affected and have substantially worse management of blood pressure. A combination of HBPM/RBPM and health coaching either through text messages or phone calls provides patients the ability to be active participants within their healthcare and determine where changes are indicated within the patients' lifestyle and/or medication to promote proper hypertension management (Margolius et al., 2012).

Rationale

Needs Assessment

A FQHC in a HPSA, in Louisville, Kentucky provides primary care to patients across the lifespan from newborn to geriatric. The total patient population in 2022 was 3,405. There were 734 adult/geriatric patients diagnosed with hypertension (BP >140/90 at two office visits). Of these patients, 412 were identified as having controlled blood pressure (BP <140/90 at two office

visits), and 322 patients (43%) were found to have uncontrolled BP (BP > 140/90 at two office visits). Within the facility, there is a clinical outcome goal for 60% of hypertensive patients to have controlled blood pressure. This goal is set by the facility. The rate of controlled blood pressure at the FQHC in 2022 was 56.4% with 43.6% of patients having uncontrolled blood pressure (C. Sperry, personal communication, 1/23/2023). Achieving the goal of 60% of hypertensive patients having controlled blood pressure would decrease the rate of uncontrolled hypertensive patients from 43% to 40% (C. Sperry, personal communication 1/23/2023).

The facility implemented a remote BP monitoring (RBPM) program to assist with patient hypertension management. There are currently 475 patients enrolled in the RBPM program. The goal for patient enrollment into this program was 380, which has been achieved. At the time of data collection, there were 34 patients actively engaged in the program. It was observed that patients were having difficulty using all the elements of the program. The biggest issue with the RBPM program reported by the Chief Medical Officer (CMO) of the facility, was the inconsistency of communication between the patient, health coach, and/or provider (C. Sperry, personal communication, 01/23/2023).

Conceptual Framework

Pender's Health Promotion Model focuses on individual characteristics and experiences (personal factors and prior behavior), behavior-specific cognitions (perceived benefit of action, barriers to action, and self-efficacy), as well as affect (activity-related emotions, interpersonal and situational influences), and behavioral outcomes (commitment to a plan of action and health-promoting behavior (Gonzalo, 2023).

Individual characteristics for hypertensive patients enrolled in the RBPM program included an understanding of how to use the BP measuring device and proper measuring of the

BP. According to the American Heart Association (AHA, 2018), proper BP measurement includes sitting in a chair relaxed with feet straight on the floor and the back straightened. Additional barriers included inconsistent communication with the health coach and/or provider. These barriers were specific to the patient but can include issues with communication, transportation, or financial ability.

Behavior-specific cognitions and affect included whether the patient believed they were capable of actively participating in the program including self-measurement of BP and regular communication with the health coach and provider. The patient's perceived efficacy of HBPM/RBPM and health coaching for proper BP management also played a role. Additional factors included the level of time the patient could dedicate to BP measurements, health coach communication, and provider follow-up. A supportive environment encouraging the patient to actively engage in the RBPM program including consistent BP measurements, communication with the health coach, and attending follow-ups with the provider as expected also contributed. Behavior-specific cognitions and affect of the health coach and provider also played a factor. These included the availability of blood pressure cuffs and health coaches to assign to patients whose schedules align for regular communication, patient encouragement from the health coach, provider, and other clinical staff to engage in the program, and the perceived strain of the RBPM program on all the individuals previously mentioned.

Patient behavioral outcomes consisted of the patient committing to regularly measuring their blood pressure out of the office, actively engaging with the health coach, attending follow-up visits with the provider, and consistently adhering to lifestyle or treatment changes recommended to promote controlled hypertension. Behavioral outcomes of the health coach included consistent communication with the patient for BP management. Provider behavioral

outcomes included committing to discussing BP management and engagement with the RBPM program with the patient, ensuring proper functioning of the BP measuring device and application, as well as the ability to communicate with the health coach.

Purpose and Specific Aims

The purpose was to evaluate the RBPM program used by the facility to assist with BP management in hypertensive patients. A specific aim of evaluation included patient engagement with the RBPM program by observing the frequency of remote BP measurements, the frequency of communication with the health coach, and whether the patient is attending scheduled follow-up visits with the provider regarding hypertension over the past year. The evaluation was aimed to gauge if engagement with the RBPM program had an impact on BP management. Based on the evaluation, recommendations on enrollment and engagement with the RBPM program were provided to the facility. A long-term goal is for the facility to achieve the clinical goal of 60% of hypertensive patients achieving controlled BP (<140/90).

Program Evaluation Model

The strength, weaknesses, opportunities, and threats (SWOT) analysis model was used to evaluate the RBPM program. This model identified the internal and external factors that were either helpful or harmful to patient enrollment and engagement with the RBPM program. Internal factors included strengths and weaknesses, and external included opportunities and threats (Minnesota Department of Health, 2022). Based on data obtained via interviewing with the clinical staff of the facility involved with the RBPM program, strengths included the willingness of the patient, health coach, and provider to actively engage in the program and the availability of a BP cuff and health coach to assign to a patient. Internal weaknesses included an inability of the patient to utilize the BP cuff or BP measuring device, inconsistency with patient BP

measurement, or a lack of communication with the health coach and/or provider. External opportunities included access to the BP measuring device at any time throughout the day and the ability to communicate with the health coach in between provider visits to discuss BP management. An external threat included poor alignment between the schedules of the patient and the health coach. Data from the chart review and patient feedback surveys regarding the RBPM program was used to complete a full SWOT analysis. An illustration of this analysis model can be seen in Appendix E.

Methods

Design

The focus of the program evaluation was the RBPM program utilized by the FQHC. Feasible recommendations to maintain patient engagement within the program were provided to the facility. The program evaluation informed the barriers and facilitators of the RBPM program and further assisted patients and providers with blood pressure management. Patient engagement was evaluated by observing the frequency of remote BP measurements, the frequency of communication with the health coach, and the patient attending scheduled hypertension-related follow-up visits with the provider. A comparison of the most recent blood pressure level was evaluated among hypertensive patients, including those not enrolled in the RBPM program/those enrolled but not engaged, patients enrolled with partial engagement, and patients fully engaged in the program.

Setting

The primary care facility is a FQHC in Louisville, KY. The area this facility resides in is identified as a HPSA. The office chose to withhold their name from this project to protect patient privacy. At the time of data collection, there were six providers including a family

medicine doctor who serves as the CMO and five family nurse practitioners (FNP). One FNP worked full-time at the primary care clinic, two worked full-time between the primary care clinic and the school-based center, and one worked part-time as a school-based pediatric NP. There were eight exam rooms. The total patient population in 2021 was 3,901 (HRSA, 2021). According to office data, there were 6,635 primary care patient visits in 2022. The facility also integrated behavioral health and dental services, as well as an onsite pharmacy, and a food pantry (C. Sperry, personal communication, 02/20/2023).

The RBPM program was implemented at the primary care facility to assist patients with achieving controlled BP (<140/90) by providing patients with a BP cuff and device to measure their BP out of the office. These measurements allowed providers to accurately determine patients' BP trends and identify where medication adjustments are needed, as opposed to relying solely on in-office BP measurements.

For patients enrolled in the RBPM program, inconsistency in communication between the patient, health coach, and/or provider hindered the efficacy of the program. Reasons for poor communication included the health coach and/or provider not having a current number for the patient, patients not being responsive to calls made by the health coach or provider, and/or the patient's phone service being disconnected. Patients not showing up for follow-up appointments with the provider due to transportation issues, inability to pay co-pays, and other life factors specific to the patient also served as an issue (C. Sperry, personal communication 1/23/2023).

Sample

Existing patients diagnosed with hypertension were included in the evaluation. Patients with a BP > 140/90 on two visits were identified as having hypertension. There were two samples within the program evaluation: a chart review sample and a patient feedback survey

sample. The chart review sample consisted of primary care patients of the facility who received a diagnosis of hypertension (BP >140/90 in two office visits). The most recent data reported 734 of the 2,918 adult/geriatric primary care patients were diagnosed with hypertension in 2022 (S. Whitfield, personal communication 12/15/2022). Of these 734 patients diagnosed with hypertension, 322 (43.6%) were found to have uncontrolled hypertension. The chart review was performed on 100 hypertensive patients. These patients were chosen at random by selecting every fifth patient on a roster listing all hypertensive patients until 100 participants were reached. Exclusion criteria based on the clinical guidelines of the facility included patients under the age of 18 or over the age of 84. Out of the 100 hypertensive patients, enrollment in the RBPM program was determined through the RBPM program enrollment roster. The random selection of 100 patients from a list of hypertensive patients from the facility ensures a good representation of the patient population is present in the evaluation.

In addition to the chart review sample, any hypertensive patient that presented to the primary care office during the four weeks of data collection completed a patient feedback survey, which made up the survey sample. The patient feedback survey for the remote blood pressure monitoring program determined patients' satisfaction with the communication and support provided, as well as provided general feedback about using the RBPM program.

Context

The 100 hypertensive patients selected for the chart review were grouped by their enrollment with the RBPM program and their level of engagement. The groups consisted of patients not enrolled in the RBPM program, patients enrolled in the RBPM program with zero engagement, patients partially engaged in the RBPM program who are missing at least one aspect of engagement (BP measurement, communication with the health coach, and/or follow-up

visits with the provider), and those fully engaged in the RBPM program. Fully active engagement with the RBPM program included the patient measuring their blood pressure throughout the day or several times within the week, having consistent phone communication with the health coach, and attending scheduled follow-up visits with the provider. The patients not enrolled and those enrolled but not engaged will be grouped during the comparison of BP levels amongst groups.

Blood pressure measurement data was automatically uploaded into the cloud-based application where blood pressure measurements could be viewed by the provider. Evaluation of BP measurements included how often the patient measured their blood pressure daily over three months. Patient communication with the health coach was evaluated by the number of phone calls the patient had with the health coach to discuss BP management over three months. The number of provider visits was evaluated by how many hypertension-related follow-up visits the patient attended over the past year.

Procedures

Once the chart review sample was identified using the patient's medical record, a chart review determined the patient's enrollment status in the RBPM program. Engagement and blood pressure management were also assessed. The number of blood pressure measurements and conversations with the health coach was documented based on a report from the remote blood pressure monitoring program. To determine if patients are attending scheduled visits with the provider, information from the chart will show whether the patient has more than two no shows for provider visits. Data were recorded in the chart audit tool.

Clinical staff, including medical assistants and nurses, provided the patient feedback survey to any hypertensive patent that presents to the primary care facility. These patients made

up the patient feedback survey sample. These patients were asked if they were enrolled in the RBPM program. If they were not enrolled, they were asked the reasons for non-enrollment, and this completed their survey. Enrolled patients were asked to complete the remainder of the patient feedback survey.

The evaluation team included the DNP student and clinical staff personnel. The DNP student determined the randomly selected hypertensive patients, reviewed charts for evaluation measures, and analyzed the data. Clinical staff handed out and collected the patient feedback survey. The health coaches, health care providers of the primary care office, and other clinical staff involved in patient care provided support to promote effective completion of the evaluation.

The healthcare center's administration and clinical staff were informed of the results of the observations of program engagement, comparisons of BP levels amongst groups, and recommendations indicated to improve patient engagement in the RBPM program. The timeframe for the evaluation of the RBPM program can be found in Appendix B.

There was no cost for data collection, evaluation of the RBPM program, or providing recommendations to the facility for the RBPM program. A nurse completing the same data collection during an eight-hour workday (40-hour work week) for six weeks while being paid $30/hour would amount to the nurse being paid a gross amount of $7,200.

Measures

Information gathered from the chart review can be seen in Appendix A. This chart audit tool was conducted in an Excel spreadsheet listing patients in numerical order (1,2,3,4,5, etc.) as they are selected from the roster. Patient engagement was measured by calculating the frequency of remote BP measurements, the frequency of communication with the health coach, and the patient attendance at hypertension-related follow-up visits with the provider. Additional data

included in the chart audit tool was demographic data including race, age, and the presence of obesity (determined by BMI), (CDC, 2022). The data gathered was double-checked to ensure the completeness and accuracy of data collection.

Instruments

The patient feedback survey was created to report patient satisfaction with communication and support in the RBPM program (Appendix C). The survey included two questions to determine enrollment. Satisfaction with communication and support in the RBPM program was determined by six statements rated by using a five-point Likert scale and three open-ended questions. The Likert scale statements were scored on a scale of 1 being completely dissatisfied and 5 being completely satisfied. A higher score indicated a higher level of satisfaction with the RBPM program. The measures of satisfaction within the patient feedback survey included ease of use with the BP measuring device, ease of communication with the health coach, instructions on how to manage blood pressure, the patient serving an active decision-making role in blood pressure management, and treatment plan, and support from the health coach and provider. The open-ended questions assessed patients' perceptions of the program and suggestions for improvement. There was also a space for the patient to provide additional comments on the RBPM program.

Data Analysis

SPSS Statistics 29.0.0 was used to analyze the data. Demographic data, including race, age, and obesity scoring was analyzed using descriptive statistics. Patient engagement was analyzed by calculating the frequency of remote BP measurements, communication with the health coach, and patient attendance at hypertension-related follow-up visits with the provider. Blood pressure levels among those not enrolled in the RBPM program/those enrolled with zero

engagement, those partially engaged, and those fully engaged were compared using the ANOVA test. An alpha of 0.05 indicated significance.

Individual items and the total score of the RBPM program patient feedback survey score will be assessed using descriptive statistics. The open-ended questions of the RBPM program patient feedback survey were reviewed for overarching themes. The analyses of the evaluation and feedback survey were applied to the continuous quality improvement SWOT model to inform the facility of the next steps. Random selection of participants helped to avoid evaluation bias. Potential barriers to data collection included outlier blood pressure measurements (extremely low or extremely high) skewing data analysis, as well a major difference in the frequency of BP measurement, such as a patient checking their BP once a week compared to a patient checking their blood pressure every day.

Key Stakeholders/Facilitators/Barriers

Key stakeholders included owners and shareholders of the primary care facility. Healthcare providers receiving payment and reimbursements for healthcare visits related to hypertension would also be identified as stakeholders. Additional stakeholders included patients, family members, and/or caregivers who paid for office visits, prescriptions, and other associated costs to manage hypertension.

There were facilitators and barriers to this evaluation. Facilitators included provider and administrative support to access the information included in the evaluation. Barriers included the data needed for the evaluation not being available or the patient not being willing to complete the feedback surveys in their entirety. It is also important to consider any unintended harm that came from evaluation and recommendations. Psychological harm to the provider involved an increase in stress and/or workload by providing support to this evaluation.

Ethical Considerations and Permissions

A 'Nondisclosure of Confidential Information' was completed to ensure information relative to patients of the primary care facility, and the facility as a whole, would not be released. Data were only collected and researched within the primary care office utilizing the medical record, and no identifiable protected health information (PHI) left the facility. Privacy and confidentiality were maintained by securing the computer where the data was held, requiring log-in information to access the computer. HIPAA standards were maintained throughout the data collection process. Data was compiled in an Excel spreadsheet on a password-protected computer. Printed materials did not have any identifying patient information and were stored in a key protected file. Data spreadsheets were completely de-identified. This program evaluation proposal was approved by the University of Louisville Institutional Review Board (IRB) for approval.

Results

Chart Review Sample

The chart review sample consisted of 99 participants. Demographic data showed 67 (67.7%) patients were Black, 17 (17.2%) White, 2 (2%) Hispanic/Latino, 3 (3%) Asian, and 10 (10.1%) consisted of other races (Table 1). The average age among participants was 53, with the median being 55, and the mode being 58. Results found that 68 (68.7%) of participants were obese.

There were 45 (45.5%) patients enrolled in the RBPM program. There were 6 (6.1%) patients enrolled in the RBPM program, but not actively engaged with the program. There were 30 (30.3%) patients who were partially engaged in the RBPM program. There were 4 (4%) patients fully engaged in the RBPM program. The remaining 5 patients de-enrolled from the

RBPM program due to losing interest or changing providers (Table 2). Of the 99 patients, 84 (84.8%) had less than two no shows for appointments with the provider in the office over the past year, and 15 (15.2%) patients had two or more no shows.

The range of the number of remote blood pressure measurements among patients in the RBPM program was from 0-40. Of the 99 patients, 89 (89.9%) patients had not taken any blood pressure measurements over the past three months, with the majority of these patients not being enrolled in the RBPM program. There were 2 (2.1%) patients that had taken their blood pressure once, and 3(3%) had taken their blood pressure twice. Some patients took their blood pressure 3, 5, 6, 36, and 40 times; they each made up 1 (1%) of the population (Table 3). For those not enrolled in the RBPM program or enrolled but not at all engaged the average blood pressure consisted of a systolic pressure of 133 and a diastolic pressure of 85. For those partially engaged in the RBPM program, the average systolic pressure was 128, and the diastolic pressure was 83. For those fully engaged in the RBPM program, the average systolic pressure was 137, and the diastolic pressure was 89 (Table 4).

There were 33 patients who communicated with a health coach over the past three months. Of these patients, 7 (7.1%) had one conversation, 8 (8.1%) had two conversations, 12 (12.1%) had three conversations, and 6 (6%) had four conversations (Table 5). The remaining 66 (66.7%) patients did not have any conversations with a health coach. The telehealth platform report revealed health coaches had difficulty contacting patients due to phone disconnections, number changes, etc.

Patient Feedback Survey Sample

The patient feedback survey sample consisted of 21 hypertensive patients. Eight patients who completed the survey were enrolled in the RBPM program. The patients not enrolled stated

that they was not being aware of the program. The ease of use of the blood pressure device, the ease of communication with the health coach, the level of support of managing blood pressure, instructions on how to manage their blood pressure, and the ability to be involved in their blood pressure management was rated on a 5- point Likert scale by the eight patients.

When the ease of use of the blood pressure device was evaluated by the patients who were enrolled in the program,one patient ranked the ease of use of the blood pressure device a 2, one person rated the ease of use a 3, and six patients rated the ease of use a 5 on a 5-point Likert scale with 5 being very satisfied. When the ease of communication with the health coach was evaluated, there was one patient who rated the ease of communication with the health coach a 1, one person rated t the ease of communication a 4, and six patients rated the ease of communication a 5. Two patients rated the discussion with the health coach about blood pressure management a 1, one person rated the discussion a 3, and five patients rated the discussion a 5 on a 5-point Likert scale. There was one patient who rated the level of support received managing blood pressure with the use of the RBPM program a 2, one person who rated the level of support a 3, and five who rated the level of support a 5 on the 5 point Likert scale There was one patient who rated the instructions on how to manage their blood pressure a 1, two patients rated the instructions a 3, one patient rated the instructions a 4, and four who rated the instructions a 5. When assessing the ability to be involved in their blood pressure management and treatment plan, there was two patients rated their ability to be involved a 3, and there were six who rated their ability to be involved a 5 on a 5-point Likert scale.

Responses to what patients liked about the RBPM program included “being able to keep up with BP”, “informative”, “it holds me accountable while going through this process”, and “they work with you.” Responses to what improvements would you like to see in the RBPM

program include “maybe an in-person visit with the health coach”, “none that I can say”, “it’s not really a have on communication thing (they call once a month)”, and “can’t think of any.” Responses to whether patients had any additional comments about blood pressure management or using remote monitoring consisted of “It’s easy to use and I was excited to receive, having high blood pressure was something new for me so having the remote monitoring helped ease my mind because I could check my pressure as needed.”

Discussion

Evaluation of the RBPM program provided the primary care facility the ability to assess where improvements were needed to ensure patient enrollment and active engagement within the program (Appendix E). Considering the prevalence of hypertension at the local, state, and national levels, through quantitative and qualitative measures, this evaluation focused on the impact of remote blood pressure monitoring on blood pressure management. Of the patients who qualified for the RBPM program, less than half enrolled. Of those enrolled, two-thirds were partially engaged; meaning they were missing one aspect of engagement (blood pressure measurement, communication with a health coach, or visit with a provider). The number of remote blood pressure measurements varied among patients. Some patients didn’t measure their blood pressure at all, while some patients measured their BP two or three times over the past three months. There was also a patient who measured their blood pressure 40 times during the past three months.

The majority of patients (84%) had less than two no shows for visits with the provider. Regarding the comparison of blood pressure levels among those not enrolled or enrolled but not engaged in the RBPM program, those partially engaged, and those fully engaged, the patients who were partially engaged had the lowest blood pressure of 128/83. Those fully engaged had

the highest blood pressure of 137/89. The average blood pressure of those not enrolled or enrolled but not engaged was 133/85. One patient that was fully engaged with the RBPM program had severely high blood pressure levels which could alter the true average blood pressure.

More than half of the patients that completed the survey (61.9%) were not enrolled in the RBPM program and were not aware of the program. The majority of the patients who completed the feedback survey and were enrolled in the RBPM rated the ease of use of the blood pressure device, ease of communication with the health coach, discussion with the health coach about blood pressure management, level of support received managing blood pressure, instructions on how to manage their blood pressure and their ability to be involved in their blood pressure management and treatment plan as satisfactorily.

The list of 100 hypertensive patients was created from a list of diabetic patients as opposed to the presence of hypertension alone. This may have affected the ability to adequately represent the patient population who only have hypertension. The initial goal for the number of charts to review was 100. However, one patient from the list was no longer a patient registered patient at the office at the time of the chart review. None of that patient's information was used in the analysis.

The number of feedback surveys completed was less than expected. The survey was handed out by the medical assistants in the clinic who were triaging the patients. The clinical manager mentioned staff may have forgotten to pass out surveys to patients. This could have been due to there being no workflow created for the completion of the survey. She believed patients may also have declined to fill them out.

The health coach is an integral part of the RBPM at the office. The health coach discusses the patients' health as a whole, not solely focusing on blood pressure measurements. However, there may be barriers to contacting the patient. In this program, the health coaches attempted to contact patients enrolled monthly. When a patient did not answer, the health coach would make four total attempts to call the patient. When the patient did not answer, the health coach would call the patient the following month. The patient's ability to call the health coach based on their schedule is limited.

Conclusion

Remote blood pressure monitoring is being utilized to assist with blood pressure management in hypertensive patients. The patients engaged in the program were satisfied with using the RBPM program and felt it positively impacted the management of their blood pressure. It was difficult to adequately evaluate the impact of the RBPM program on blood pressure management in this office. Based on patient feedback from the survey, there is a need for the providers to consistently inform patients of the availability of the RBPM program. For patients enrolled in the program, it's important to ensure the health coach has a current number to remain in contact with the patient.

Appendix A

Codebook for Chart Review

VARIABLE NAME	VARIABLE EXPLANATION (LABEL)	CODING/ SCORING INSTRUCTIONS (VALUE)	LEVEL OF MEASUREMENT
PTAGE	Patient Age	Age in years	Scale
PTRACE	Patient race	1=African American 2= White 3=Hispanic/Latino 4=Asian 5=Other	Nominal
RBPM	Patient ever enrolled in RBPM program	1=Yes 2=No	Nominal
NOENG	Patient enrolled but not engaged in RBPM program	0=N/A 1=Yes 2=No	Nominal
PARTENG	Patient partially enrolled in RBPM program	0=N/A 1=Yes 2=No	Nominal
FULLENG	Patient fully engaged in RBPM program	0=N/A 1=Yes 2=No	Nominal
OBESITY	Patient identified as obese (BMI>30)	1=Yes 2=No	Nominal
BPMEAS	Number of remote BP measurements	0=N/A # of BP measurements over the past three months	Scale
HEALTHCOACH	Number of conversations with health coach over past three months to discuss BP management	0=N/A # of conversations with health coach over past three months	Scale
PROVIDERVISIT	Patient has < two no shows for patient appointments over the past year	1=Yes 2=No	Nominal
SYSBP	Most recent systolic blood pressure	Most recent systolic blood pressure	Scale
DIABP	Most recent systolic blood pressure	Most recent systolic blood pressure	Scale
PFSENR	Are you enrolled in the RBPM program?	1=Yes 2=No	Nominal
PFSNOTENR	No (Provide a reason why you're not enrolled in the program)	Patient Response	Qualitative
PFSEASUSE	Ease of use of blood pressure measuring device	1: Very Dissatisfied 2: Dissatisfied, 3: Neither dissatisfied or satisfied 4: Satisfied 5: Very Satisfied	Ordinal
PFSCOMMHC	Ease of communication with a health coach	1: Very Dissatisfied 2: Dissatisfied, 3: Neither dissatisfied or satisfied 4: Satisfied	Ordinal

		5: Very Satisfied	
PFSHCBPM	Discussion with the health coach about blood pressure management	1: Very Dissatisfied 2: Dissatisfied, 3: Neither dissatisfied or satisfied 4: Satisfied 5: Very Satisfied	Ordinal
PFSSUPPRBPM	Level of support managing my blood pressure with the use of the RBPM program	1: Very Dissatisfied 2: Dissatisfied, 3: Neither dissatisfied or satisfied 4: Satisfied 5: Very Satisfied	Ordinal
PFSBPINS	Instructions on how to manage your blood pressure	1: Very Dissatisfied 2: Dissatisfied, 3: Neither dissatisfied or satisfied 4: Satisfied 5: Very Satisfied	Ordinal
PFSPTINV	Your ability to be actively involved in your blood pressure management and treatment plan	1: Very Dissatisfied 2: Dissatisfied, 3: Neither dissatisfied or satisfied 4: Satisfied 5: Very Satisfied	Ordinal
PFSPTDIS	For any statement that you scored less than 3 (three), please provide additional comments describing why you are dissatisfied	Patient Response	Qualitative
PFSOE1	What do you like about the RBPM program?	Patient Response	Qualitative
PFSOE2	What improvements would you like to see in the RBPM program?	Patient Response	Qualitative
PFSOE3	Do you have any additional comments about blood pressure management or using remote monitoring?	Patient Response	Qualitative

Appendix B

RBPM Program Evaluation Timeline

Completion Date	Planning	Pre-Implementation	Implementation	Evaluation
11/21/2022	Met with key stakeholders to discuss the needs and goals of the primary care office			
12/15/2022	First planning meeting: discussion of RBPM program, including current practices and intended goals with implementation			
1/23/2023	Meet with Chief Medical Officer (CMO) to discuss RBPM program needs and goals.			
1/26/2023	Provider shadowing to determine workflow with implementation of RBPM program			
2/20/2023	Meeting with CMO to further clarify RBPM program needs and goals.			
3/20/2023 - 03/27/2023		Identify 100 hypertensive patients to include in the evaluation. Determine if the patient enrolled in RBPM program		
3/28/2023 - 5/12/2023		Determine engagement data, BP measurements, and number of visits with provider. Input data into chart audit tool		
5/15/2023- 5/22/2023		Evaluation of data including patient engagement, BP measurements, and provider visits		
5/23/2023- 5/30/2023		Communicate recommendations to enroll and maintain engagement with RBPM program with healthcare providers and clinical staff involved in patent care		
5/29//2023- 6/29/2023				Patient feedback of RBPM program.
5/29/2023- 6/29/2023				Comparison of BP measurements of those enrolled in the RBPM program to those who are not.

Appendix C

Remote Blood Pressure Monitoring Program (RBPM) Patient Feedback Survey

A. Are you enrolled in the RBPM program?

1. **Yes**

   (Please complete Parts A, B, and C of this feedback survey.)

2. **No**

   (Please provide reasoning on why you're not enrolled in the program below.)

B. For the following statements below please rate your level of satisfaction with the RBPM program using the following scale:

1: Very Dissatisfied 2: Dissatisfied 3: Either dissatisfied or satisfied 4: Satisfied 5: Very Satisfied

1. Ease of use of blood pressure measuring device. 1 2 3 4 5
2. Ease of communication with a health coach. 1 2 3 4 5
3. Discussion with the health coach about blood pressure management. 1 2 3 4 5
4. Level of support managing my blood pressure with the use of the RBPM program 1 2 3 4 5
5. Instructions on how to manage your blood pressure 1 2 3 4 5
6. Your ability to be actively involved in your blood pressure management and treatment plan 1 2 3 4 5
7. For any statement that you scored less than 3 (three), please provide additional comments describing why you are dissatisfied.

C. Answer the questions about the remote monitoring program used at this office.

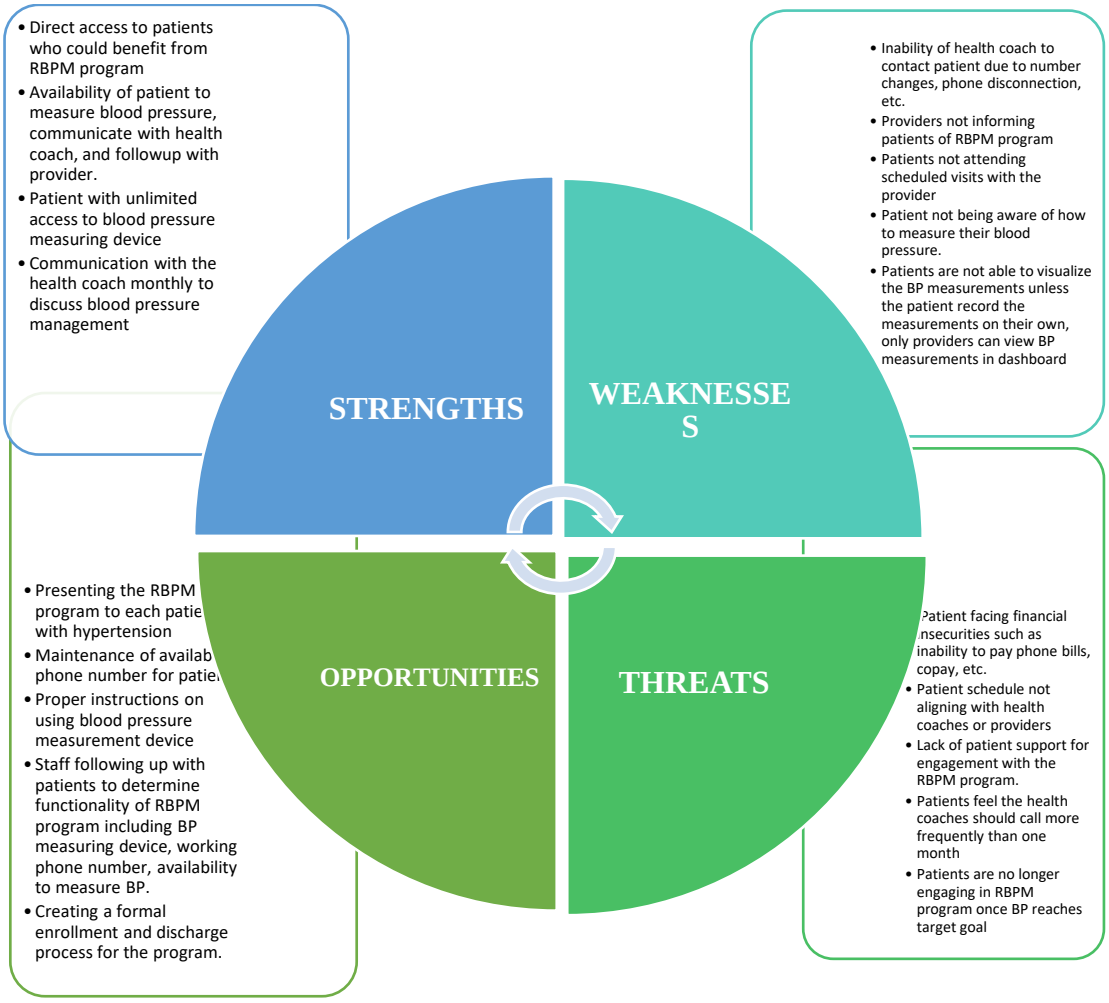
1. What do you like about the RBPM program?

2. What improvements would you like to see in the RBPM program?

3. Do you have any additional comments about blood pressure management or using remote monitoring?

Appendix D

SWOT Analysis



Appendix E

Table 1 : Race of participants

Race	Number (Percentage)
Black	67 (67.7%)
White	17(17.2%)
Hispanic/Latino	2 (2%)
Asian	3 (3%)
Other	10 (10.1%)

Table 2: Patient enrollment in RBPM Program

Enrollment in RBPM program	Number (Percentage)
Enrolled, but not engaged	6 (6.1%)
Partially engaged	30 (30.3%)
Fully engaged	4 (4%)
De-enrolled due to lose of interest/changed providers	5 (5.1%)
Total ever enrolled	45 (45.5%)
Not enrolled	54 (54.5%)

Table 3: Number of BP measurements of three months

Number of blood pressure measurements (3 months)	Number of patients (Percentage)
0	89 (89.9%)
1	2 (2.1%)
2	3 (3%)
3	1 (1%)
5	1 (1%)
6	1 (1%)
36	1 (1%)
40	1 (1%)

Table 4: Level of engagement in RBPM program

Level of engagement	Average most recent blood pressure
Not enrolled in RBPM program/Enrolled, but not engaged	133/85
Partially engaged	128/83
Fully engaged	137/89

Table 5: Number of conversations with health coach over three months

Number of conversations with health coach (3 months)	Number of patients (Percentage)
0	66 (66.7%)
1	7 (7.1%)
2	8 (8.1%)
3	12 (12.1%)
4	6 (6%)

Table 6: Patient feedback survey responses

Patient	Are you enrolled in the RBPM program?	If not enrolled, please provide reasoning on why you're not enrolled	Ease of use of blood pressure measuring device	Ease of communication with a health coach
1	1	0	2	4
2	2	Didn't know about it	0	0
3	2	Don't have one	0	0
4	2	Never had knowledge of programs existence	0	0
5	2	0	0	0
6	1	0	5	5
7	2	0	0	0
8	1	0	5	5
9	2	0	0	0
10	2	Never heard of it	0	0
11	2	Didn't hear about it until today	0	0
12	1	0	5	5
13	1	0	5	5
14	2	I didn't know they had one	0	0
15	1	0	3	3
16	2	0	0	0
17	1	0	5	5
18	2	I wasn't aware of the program	0	0
19	1	0	5	5
20	2	Never heard of it	0	0
21	2	0	0	0

Table 6: Patient feedback survey responses continued

Patient	Discussion with the health coach about BP management	Level of support managing my blood pressure with the use of the RBPM program	Instructions on how to manage your blood pressure	Your ability to be actively involved in your BP management and treatment plan	For any statement you scored less than 3, please provide additional comments for dissatisfaction
1	1	0	1	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0
5	0	0	0	0	0
6	5	5	5	5	0
7	0	0	0	0	0
8	5	5	4	5	0
9	0	0	0	0	0
10	0	0	0	0	0
11	0	0	0	0	0
12	5	5	5	5	0
13	1	2	3	5	0
14	0	0	0	0	0
15	3	3	3	3	0
16	0	0	0	0	0
17	5	5	5	5	0
18	0	0	0	0	0
19	5	5	5	5	0
20	0	0	0	0	0
21	0	0	0	0	0

Table 6: Patient feedback survey responses continued

Patient	What do you like about the RBPM program?	What improvements would you like to see in the RBPM program?	Do you have any additional comments about blood pressure management or using remote monitoring?
1	They work with you	To start back calling	
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0
6	It holds me accountable while going through this process	None that I can say	It's easy to use and I was excited to receive, having high blood pressure was something new for me so having the remote monitoring helped ease my mind because I could check my pressure as needed
7	0	0	0
8	Being able to keep up with BP	Can't think of any	0
9	0	0	0
10	0	0	0
11	0	0	0
12	Informative	0	No
13	0	It's not really a have on communication thing (they call you once a month)	0
14	0	0	0
15	0	0	0
16	0	0	0
17	I like the blood pressure	Maybe in-person visit with health coach	0
18	0	0	0
19	Great	Satisfied	None
20	0	0	0
21	0	0	0

Patient	PFSENR	PFSNOTENR	PFSEASUSE	PFSCOMMHC
1	1	0	2	4
2	2	Didn't know about it	0	0
3	2	Don't have one	0	0
4	2	Never had knowledge of programs existance	0	0
5	2	0	0	0
6	1	0	5	5
7	2	0	0	0
8	1	0	5	5
9	2	0	0	0
10	2	Never heard of it	0	0
11	2	Didn't hear about it until today	0	0
12	1	4	5	5
13	1	0	5	5
14	2	I didn't know they had one	0	0
15	1	0	3	3
16	2	0	0	0
17	1	0	5	5
18	2	I wasn't aware of the program	0	0
19	1	0	5	5
20	2	Never heard of it	0	0
21	2	0	0	0

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