Protocol

Title: Identifying Successful Strategies for Implementing Team-Based Home Blood Pressure Monitoring in Primary Care

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1. Purpose of the Study:

The overall goal of this study *is to identify and rigorously evaluate strategies for implementing and sustaining team-based home blood pressure monitoring (TB-HBPM) within primary care*.

We have successfully accomplished aim 1 (a-c) for Phase 1 (R61) of the study.

The aims of phase 2 (R33) are as follows:

Aim 2: Deploy theorized implementation strategies using a type-2 hybrid stepped-wedge randomized cluster trial

Aim 3: Assess the impact of implementation strategies using specific metrics based on RE-AIM

Aim 4: Test theoretical assumptions underlying the implementation strategies

2. Background:

Uncontrolled hypertension (HTN) is a major modifiable risk factor for CVD.[1-3] HTN is the single most important medically treatable CVD risk factor in the United States and the world.[4] Uncontrolled HTN is the leading determinant of Black-White disparities in CVD morbidity and mortality,[5,6] accounting for one third of CVD deaths among Blacks.[7] HTN control is a key target for preventing CVD, for improving life expectancy in the U.S., and for healthy heart equity.[8,9] Yet, U.S. progress in addressing this key risk factor has stalled. African Americans continue to have worse HTN control than Whites.[10,11] New models for HTN management are urgently needed.

Evidence from systematic reviews show that home blood pressure monitoring (TB-HBPM), when supported by teams, improves HTN control.[12-14] When appropriately implemented, TB-HBPM engages patients in self-management, fosters improved medication and lifestyle adherence, generates reliable and actionable data that can reduce clinical inertia (failing to intensify medication when indicated), and most importantly extends care beyond clinician-driven

office visits, yielding more frequent medication adjustments.[12-14] A critical challenge is that TB-HBPM is a complex intervention where not all patients benefit all of the time. Successful TB-HBPM requires a prepared team who can support the patient in correct BP measurement and reliable transmission of readings in addition to promoting HTN lifestyle self-management. Busy primary care clinicians cannot do this alone.[15] TB-HBPM is needed. TB-HBPM is cost-effective and critical to success.[13,16,17]

TB-HBPM is grounded in the evidence-based, Chronic Care Model (CCM)[18,19] and systematic reviews.[13,20] Key elements of TB-HBPM include: 1) Practice level identification of patients with uncontrolled BP;[21] 2) Patient training in TBHBPM;[22,23] 3) Confirmation of HTN diagnoses using TB-HBPM (or ambulatory blood pressure monitoring [ABPM] for patients opting out of TB-HBPM); 4) Optimized hypertension management and clinical decision support;[24-26] 5) Patient self-management support, including education regarding medication adherence and lifestyle changes;[20,27] 6) Optimized use of relevant clinical data by teams;[28-30] and 7) Team-based management that includes clinical pharmacists and hypertension specialists, through in-person visits and/or eConsults (currently in use at these practices).[31-35] TB-HBPM requires high functioning teams characterized by: effective leaders;[36] shared goals, including common mental models;[37,38] time to plan, delegate and coordinate activities;[39] cohesive team identity and psychological safety;[40,41] and structures (time and place) and processes that support team learning, problem solving and adaptation to achieve goals through data on progress.[42-44]

3. Study Population:

Number Enrolled

1. A retrospective review of baseline data on approximately of 6,000 eligible patients that are diagnosed hypertension in addition to staff and primary care providers (PCPs) who may be impacted by this clinical initiative and/or by the collection of their de-identified data in relation to patients.
2. Approximately 400 HFM clinicians and staff will be sent an email to a link with an information sheet and access to an anonymous/confidential Redcap survey. This surveys will be administered to clinicians and staff based on the assignment of their suite to the roll-out of TB-HBPM.
3. A subset group of patient participants (40), staff (20), and PCPs (20) will be formally consented for semi-structured key informant (KI) interviews.

Participants eligible for de-identified cohort (retrospective review of medical records [RRMR])

Because this is a quality initiative involving the implementation of best practices for hypertension control using a practice wide team-based home blood pressure monitoring intervention and because we will rigorously evaluate the real-world impact of this initiative, we are requesting waivers of informed consent for patients, clinicians and staff to access their de-identified data on participants using encrypted IDs to assess changes in blood pressure and other measures over time and association with suites including their clinicians and staff.

Patient participant inclusion criteria for de-identified cohort
Patients will be eligible for participation in the study based on: 1) age 18 and older; 2) Diagnosis of hypertension based on ICD-10 codes of I10-I15 and 2) at least one HFM visit and BP beginning no later than 7/1/2021.

Patient participant exclusion criteria
Documentation in the medical record that the patient died, transferred out of the practice or placed in long-term care or correctional facility prior to enrollment. Consistent with principles for pragmatic interventions, we will not exclude patients with most co-morbidities. Patient exclusion from the analytic cohort will include patients with pregnancy (O00-O9A), dementia (F01.x-F03, G30.x and G31.x), end-stage renal disease (Z99.2, N18.6), and hospice (Z51.5).

Staff and clinician participant inclusion criteria for de-identified cohort
All members of each of the eight suites are eligible participants for collection of study-relevant de-identified IDs that link them to patients. These participants include receptionist/medical secretaries, medical assistants (MAs), registered nurses (RNs), nurse practitioners, nurse practitioner residents, family physicians, family physician residents, clinical pharmacists and clinical pharmacist residents.

Exclusion criteria
None

Consented participants for key informant (KI) interviews and surveys

We will obtain informed consent from participants, whether they are patients, clinicians or staff, when we invite them to participate in selected surveys or qualitative interviews.

Patient inclusion criteria for KI interviews
Active family medicine patient age 18 and older during the project with diagnosis of hypertension. We will purposively select patients who did and did

not participate in the home blood pressure monitoring, in addition to purposively selecting based on age, sex, race, ethnicity, and insurance in order to ensure diversity in the sample

Patient Exclusion Criteria
Inability to speak or read the English language or to provide consent

Clinician and staff inclusion criteria for KI interviews and surveys

Any HFM employee (practice leaders, administrators, clinicians, or staff) that works with hypertensive patients during the study period, i.e. scheduling appointments, coordinating care, measuring blood pressure, responding to questions, and/or treating their blood pressure.

Approximately 200-400 HFM clinicians and staff will be sent an email to a link with an information sheet and access to the anonymous/confidential Redcap surveys. These surveys will be administered to clinicians and staff based on the assignment of their suite to the roll-out of TB-HBPM.

Clinician and staff exclusion criteria
None

All races and genders will be eligible to participate
Supervisors are not involved in requesting participation in the study

4. Recruitment for de-identified cohort

The de-identified analytic sample will be generated using data extracted from eRecord by applying the eligibility criteria and creating a unique encrypted IDs for participants and for providers and other relevant staff that interact with the patient.

5. Recruitment for consented participants

Patient KI recruitment: The research staff will work with the HFM data manager to conduct outreach to potential patient KIs based on when their suite starts the project. Recruitment flyers will be posted throughout HFM for patients and clinicians that may be interested in completing a qualitative interview with the study coordinators to provide feedback on their experiences with at home BP monitoring. Our goal is to purposively recruit patients with a range of

characteristics, e.g. age, sex, race, ethnicity, insurance, and participation or not in the home blood pressure monitoring. We will track and monitor enrollment by obtaining patient characteristics such as reviewing their history/diagnosis of hypertension, demographics that include age, race, ethnicity, gender, DOB, education, insurance, and more that result from each of these strategies in order to inform the success of our "Reach."

Employee KI recruitment: For staff, we will purposively sample from clinicians, nursing staff, reception, and administrators. Similar to patient KIs, these will be conducted based on when their assigned suite started the project. All information obtained is stored on a secure URMC server where only the research team in the department and health practice involved will have access to it for analysis purposes.

Survey recruitment: An anonymous/confidential Redcap survey will be administered broadly via email to Highland Family Medicine clinicians, faculty, and staff, approximately 250 people. If clinicians, faculty, and staff decide to participate in the anonymous/confidential Redcap survey, then their consent will be provided by having them personally read the information sheet and click the bottom of the screen to direct them into the RedCap survey. We have listed below the potential recruitment strategies that may be used:

- Tele-remote

  We will request that the HFM data manager with the assistance of the CTSI academic informatics unit, generate a list of HTN patients who meet study inclusion criteria using variables provided by the research team facilitating purposive sampling. The study research coordinator will call the patient and ask them if they are willing to participate in interview either now and/or at different time/day (see recruitment script). For patients who are interested, the research coordinator will meet with interested patients by phone or Zoom at time convenient to the patient, confirm eligibility criteria and consent patients who meet the inclusion criteria. Afterwards patients will receive relevant study documents and the Advarra Participant Payment System information sheet via postal mail.

- *On-site recruiting*

  The on-site recruitment strategy will be in accordance with the University of Rochester's research reboot guidance. We will remain vigilant about any additional changes that need to be made to study procedures if there are changes to the research reboot guidance in the future

(https://www.urmc.rochester.edu/coronavirus/coronavirusresearch/guidance-for-researchers/human-subjects-research.aspx).

Prior to meeting a study subject in person, the study coordinator will:

- Pre-screen all study subjects to see if they are symptomatic for COVID-19 (cough or shortness of breath, sore throat, fever, muscle aches, headache, new loss of taste or smell, repeated or shaking chills). We will suggest all individuals who have COVID-19 symptoms get tested and see their healthcare provider
- Defer study procedures or observations with any individual(s) testing positive
- Social Distance – Maintain social distancing from all study subjects during the study activities.
- Protect study staff and subjects. Study staff and subjects will be required to wear a mask during the visit.
- The study coordinator will invite eligible subjects who meet the University of Rochester's research reboot guidelines and that are willing to learn more about the study, to meet with the study coordinator in a location at HFM that allows for proper social distancing and privacy.

HFM Employee KI recruitment: The research coordinator will work with practice leadership to identify employees from the different job categories who may be interested in providing feedback on the implementation of the TB-HBPM intervention at HFM. The research team will propose several methods of recruitment including Zoom, telephone (see recruitment script), and face-to-face, where the purpose, rationale, design of the study and roles and responsibilities will be discussed, information regarding compensation will be shared, and interest in participating ascertained.

• *Sign-up sheet* – The study coordinator will work with the HFM leadership to identify employees who may be interested in providing feedback on implementing a TB-HBPM intervention at the practice. Those whom are interested will be asked to provide their names and preferred contact information (name and phone number or email address) in order to schedule an interview with the study team. This information will only be used to contact those whom are interested, and will not be used in the study analyses.

• *Staff meeting outreach* – study coordinators will work with practice leadership to deliver a lunch and learn session for all HFM employees. During the session, study coordinator will review study details and invite potential subjects to consent. One follow-up email may be sent to employees approximately 2-weeks after the lunch and learn to gauge interest and schedule a time to consent and conduct the interview via telephone or Zoom.

• *Email outreach* – RA's already have access to the employee listserv through their HFM affiliation. The study coordinator will send an email via the listserv explaining the study and include contact information that employees can use to reach the research team. If the employee is interested, the study coordinator will schedule an appointment to confirm eligibility, obtain informed consent and conduct the interview via telephone or Zoom. The study coordinator will send one follow-up email two weeks after the initial email is sent.

Use of E-mail in Research

Participants have the option to receive communications about this study via email by indicating so during this verbal consent process. Email communications between participants and the study team may be filed in their personal research records.

Emails will be used to send you Information Sheets about this study. It may also be used in order to receive payment for participating.

Email communications may be sent or received in an unencrypted (unprotected) manner. Therefore, there is a risk that the content of the communication, including personal information, could be shared beyond you and the study team. The University of Rochester is not responsible for any interception of messages sent through email. The University of Rochester will make every effort to keep the information collected from participants private. In order to do so all information collected be stored in a secure server where only the research team involved in this project has access. Sometimes, however, researchers need to share information that may identify you with people that work for the University, regulators or the study sponsor. If this does happen we will take precautions to protect the information you have provided. Results of the research may be presented at meetings or in publications, but names will not be used. Permission to use health information for this study will not expire unless told to cancel it.

The study team will keep the information we collect for seven years after the completion of the study at which point it will be destroyed.

Consent: *(Interview Portion)*

Consent is an on-going process that starts when you first inform potential subjects about the study and ends when the subject's study participation is completed. Informed consent will be obtained from employees (clinicians) and patients prior to conducting interviews. To ensure appropriate safety precautions when conducting in-person study procedures at the University of Rochester, the process for conducting in-person visits outlined in the Guidance for Human Subject Research will be followed[45]. In person consenting will take be in a quiet place, away from distractions and will provide the opportunity for participants to ask questions and they will take home copies of all study materials that includes the consent form and study information sheet. The method of authentication used when eConsenting will be a password verification based on already known information about the subject such as their DOB, middle name, street name, etc. When conducting remote consent via telephone, research staff will provide a Redcap eConsent and go through the form with the study participant. Upon remote consenting, participants will be mailed copies of all study materials including consent form and the study information sheet. Coercion will be minimized throughout the on-going consenting process by having participation be voluntary with the possibility to withdraw from the study at any time, without any penalty or loss of benefits to which employees and patients are entitled to at the health facility.

Waiver of Documentation of Consent (survey portion)

We will provide an information sheet in REDCap for staff and clinician survey participants but will not require documentation of consent for completion these anonymous surveys that do not address sensitive topics.

Waiver of Informed Consent and waiver of HIPAA *(RRMR portion)*

As we have successfully done in other pragmatic trials approved by the University of Rochester (1R18HL117801), where the practice is the unit of intervention, we will request waivers of informed consent and HIPAA consent authorization for the RRMR portion of the study. The Common Rule allows Institutional Review Boards to "approve a consent procedure which does not include, or which alters, some or all of the elements of informed consent outlined in this section, or waive the requirements to obtain informed consent provided the [research ethics committee] finds and documents that: (a) The research involves no more than minimal risk to the subjects; (b) The waiver or alteration will not adversely affect the rights and welfare of the subjects; (c)

The research could not practicably be carried out without the waiver or alteration; and, (d) Whenever appropriate, the subjects will be provided with additional pertinent information after participation."

Similarly, the Privacy Rule contains criteria for the waiver or alteration of the authorization requirement for Protected Health Information (PHI) (45 CFR §164.512(i) 1) by an IRB.135. These criteria, based on "minimal risk" principles, are similar to those in the Common Rule criteria for waiver of patient informed consent. They are: "(a) The use or disclosure of protected health information involves no more than minimal risk to the privacy of individuals, based on, at least, the presence of the following elements: (1) An adequate plan to protect the identifiers from improper use and disclosure; (2) An adequate plan to destroy then identifiers at the earliest opportunity consistent with the conduct of the research, unless there is a health or research justification for retaining the identifiers or such retention is otherwise required by law; and (3) Adequate written assurances that the protected health information will not be reused or disclosed to any other person or entity, except as required by law, for authorized oversight of the research study, or for other research for which the use or disclosure of protected health information would be permitted by this subpart. (b) The research could not practicably be conducted without the waiver or alteration, and c) The research could not practicably be conducted without access to and use of the protected health information."

As we detail above, this research poses minimal risk to subjects. The practice is undertaking the clinical intervention (TB HPBM). *The study does not infringe on the rights or welfare of participants*. From the patient vantage point, they will see clinicians who are better trained to collaboratively meet their needs including encouragement to follow-up more frequently for improved BP control and monitoring. Patients have the right to agree or not to this advice from their clinician and will provide clinical consent to home blood pressure monitoring. *The proposed research could not be carried out without the waiver of informed consent due to an inability to fully shield patients from a practice-wide QI initiative*. Specifically, non-consenting patients (and clinicians or staff) will be nonetheless exposed to "trained clinicians." Without a waiver of informed consent, *there would be a loss of scientific relevance* (selected enrollment undermines a central feature of a pragmatic trial - generalizability). Similarly, a waiver of the authorization requirement is needed to access existing PHI. *An authorization from the patient would likely fundamentally alter the study in the same way a requirement for informed consent would – selected recruitment into the study with loss of external validity*. Denial of either of these waivers would result in significant changes in

the study and loss of external validity. We intend to share our findings with practices and encourage practices to post them in waiting rooms for all patients to view. We detailed steps below to protect patient identification through the use of a de-identified data set for analysis and by our commitment to destroy confidential linkages between study ID numbers and subjects and also linkages between patients, clinicians, and practices. Our data sharing plan makes a limited data set available once additional protections are taken, i.e. use of broad age categories, removal of any time variables, restriction to summary comorbidity scores, absence of any hierarchical linkages, and obtaining a data use agreement (see data sharing plan below for further details).

5. Study Activities

Aim 2: Deploy theorized implementation strategies using a type-2 hybrid stepped-wedge randomized cluster trial

The department of family medicine will *roll out the clinical intervention (TB-HBPM).* To improve rigor in evaluation, the study biostatistician will use computer-generated numbers to randomly assign each of the eight suites to when they will begin the intervention during one of three wedges (Figure 1). We will randomize two suites in the first wedge and three each to the second and third wedge.

Figure 1. Stepped Wedge Cluster Randomized Design in Involving Eight Suites.

M1-M12	M15-M20	M21-M26	M27-M32	M33-M38	M39-M44	M44-M49
Control	**Rollout**	TB-HPBM	TB-HPBM	TB-HPBM	TB-HPBM	Assess
Control	Control	**Rollout**	TB-HPBM	TB-HPBM	TB-HPBM	Assess
Control	Control	Control	**Rollout**	TB-HPBM	TB-HPBM	Assess

Description of TB-HBPM Clinical Quality Improvement Intervention

Table 2 describes key components of the TB HBPM, the Rationale and adaptations that are permitted.

Table 2. TB-HBPM Components, Description, Rationale and Permitted Adaptations

TB-HBPM Components	Description	Justification	Permitted Adaptations
The Team	The TB-HBPM team composition includes the clinician, MA or LPN, RN (shared), receptionist, Care Manager, Clinical Pharmacist (shared between teams), and specialist consultation through in-person or eConsult and lifestyle programs. PCPs establish alerts, review reading from OH Dashboard and contacts patients for	Teams are organized by each practice. Each member has a role: The PCP diagnoses, treats, counsels, and refers. Reception does phone outreach. RNs provide education and visits. MAs	The roles of team members are adaptable. On some teams, PCPs and clinical pharmacists and/or RNs may

	medication adjustment. OH nursing personal contact PCPs when BP readings are out of range. Clinicians request DFM care managers to work with patients whose BP remains uncontrolled after 60 days. PCPs are encouraged to refer patients with persistent SBP>160 to the clinical pharmacist for intensive management. Teams meet monthly to assess progress, problem-solve solutions, and assign tasks.	and LPNs conduct HBPM training, specialists provide expert input and clinical pharmacists work with patients needing intensive management.	co-lead group medical visits. MAs and LPNs may help with outreach. Care managers may help with training. RNs may conduct HTN visits. Specialists can provide eConsults
Population Management and Outreach	Pro-active outreach to engage patients with past two BP readings ≥ 140/90 or last BP ≥ 160/100 with no visit within 60 days.	Data from the practices show that 15% of patients with uncontrolled HTN have not been seen within the year. Nearly, one in four have BP ≥ 160/100.Population management is critical to reaching these patients.	Delegation of outreach to various staff to contact and engage the patient.
Optimal Office Blood Pressure Measurement	Use of automated office devices. Correct sitting position, cuff size, no talking and repeat taking of any elevated readings after >3 minutes.	Accurate, reliable BP readings are critical to HTN management.[38]	Clinicians will be strongly discouraged from taking their patients BP themselves using manual devices.
Patient Self-monitoring	*The* **primary care clinician (PCP)** explains the initiative to the eligible patients and elicits patients' agreement to be contacted by the RPM vendor, OH and the clinician documents this in the medical record using a smartphrase. The clinician sends a secure message to OH with patient contact information (name and phone number). **Trained OH nursing personnel** call the patient and formally consent interested patients. For consenting patients, OH personnel will obtain date of birth, address and additional relevant contact information, arrange for shipping of the device and provide phone education to the patient regarding appropriate procedures for measuring their blood pressure using the device. OH personnel will check on progress and provide additional education and support as needed for patients to engage in RPM of their blood pressure. **Patients** take daily BP readings using the device that automatically transmits these readings to the OH Dashboard (server).	Patient skill proficiency is foundational to effective HBPM.[39]	PCP and HFM staff may over time assume responsibilities for formal consent, education.
Patient Self-Management including RPM	Patient training in RPM will be provided by OH and/or DFM personnel depending on circumstance. Smart phrases for patient education include patients' BP goal, reminders to use RPM and suggested lifestyle changes, and tips on improving medication adherence. Smartphrases for referrals to the HFM clinical pharmacist	ACC/AHA and other guidelines emphasize the importance of lifestyle changes. Staff will be trained in how to assist patients in setting, tracking and following-up on achievable lifestyle goals and will be referred to internal and external	The specific workflows will be decided by teams. Teams will be encouraged to permit the MA or LPN to invite patients to identify lifestyle

	the Center for Community Healthy Living Program, the YMCA Hypertension program, and depression program. Patients will be trained in home BP self-management, including target BP goals, adherence and goal setting for lifestyle changes, i.e. physical activity, e.g. minutes of walking, DASH diet steps, e.g. reducing sugar and salt laden products and smoking cessation, including links to community resources for these.	resources for more intensive counseling.	goals. Clinicians will assist patients or delegate care. Clinicians will make referrals and use smartphrase to summarize after visit information.
BP Device Integration	Validated digital BP devices that transmit data to the OH server will be used. These data will be integrated into the EPIC. The initial integration will involve transmission of PDF via direct messaging to each providers in basket. Subsequent integration will involve full scale EPIC integration of structured data.	Device integration reduces errors in entering numbers and minimizes clinician and staff burden in viewing and responding to HBPM readings.[40-43]	FDA approved, validated, devices will be allowed for eRecord integration.
Clinical Decision Support (CDS)	Smartphrase that summarizes prior BPs and prompts PCP to invite patients with BP≥ 140/90 to participate in RPM and document whether the patient agrees to participate and allow OH to contact them. Smartphrase that prompts the PCP to check the **target BP goal** (<130/80) or indicate alternative targets and compare with mean recorded BPs over the last three readings. The smartphrase will pull in the RPM readings averaged over the prior five readings Smartphrases will supports documentation of lifestyle counselling. Smartphrase will pull in 10-year ASCVD risk and prompts the PCP to consider statins. Smartphrase will supports smoking cessation counselling and billing.	Team-based CDS permits delegation and sharing of actions to address gaps in care. Plan to address these gaps before the visit minimizes computer alert fatigue and distraction during visits.[44,45]	Teams will share design of these smart phrases and processes for addressing gaps
Audit and Feedback reports	These monthly reports will summarize comparative performance by team and clinician and progress and include actionable data and practical suggestions for improvement. 1) % patients with BP<140/90 and <130/80 by race/ethnicity and insurance 2) Mean target BP and medication intensification 3) % of patients engaged in RPM 4) ASCVD 10 risk scores and prescription of statins 5) BP >140/90 and no visit in 90 days 6) % Current smokers and # quit in past month/year	Audit and feedback reports improve implementation of clinical practice guidelines (CGPs) including HTN.[46,47] They are more effective with actionable recommendations.[48,49]	Suites will have input into the formatting and content of these feedback reports.
Team Processes	These include monthly meetings for planning and delegation of tasks, team-based coordination and debriefing and meeting to review audit and feedback, to problem solve and adapt strategies.	These current team processes, coupled with critical interpersonal processes, i.e. psychological safety, conflict management and motivation are critical to team function.[50] Notably, time for reflection, problem solving and co-learning are important.[51,52]	Mode and style for debriefing and approach to problem solving.
Training of clinicians and staff	1) Staff will be trained in correct blood pressure measurement using automated office	Training will address identified gaps in	Content will be modified based

	blood pressure devices, checklists and best practices. 2) Clinicians will be trained based on assigned wedge. There will be **three one-hour trainings** for each suite. The first will address HTN management including ACC/AHA guidelines. The second will address BP targets, smartphrase and monthly audit and feedback reports. The third session will address shared decision-making and lifestyle changes. In addition, suite teams will be trained in best team practices related to leadership, psychological safety, planning, executing and debriefing	knowledge, skills and new resources.	on emerging data. T
Billing for RPM and chronic are management	Clinicians and staff will bill for set-up, monitoring, and management of HBPM using existing remote patient monitoring and chronic care management billing codes facilitated the vendor Twistle.	Insurance reimbursement for RPM is critical financial sustainability.	Templates and time stamped data will be adapted to support compliant billing

Key Informant Interviews

All KIs will be called upon to assist with informing the implementation process of TB-HBPM at HFM. The interview process will involve asking questions in person, via telephone, or via zoom that are tailored to the participant KI for addressing their use of home blood pressure monitoring devices, appropriate training of patients, use of the patient portal, and outreach to patients with uncontrolled blood pressure who have not been seen within three months. For example, we will ask clinicians about their experience with barriers and facilitators to patients conducting home blood pressure monitoring using bidirectional texting technology provided by the URMC approved vendor, Twistle. We will ask patients about barriers and facilitators they encountered when taking their blood pressure at home and sending readings to their clinician. We will similarly ask patient about their experience in taking their home blood pressure using the cuffs provided, transmission of readings, and communication with their health care team.

Steering Committee Minutes

A departmental steering committee will guide the process though Phase 2 with monthly meetings (weekly when required). The meeting minutes are conducted within a practice level and will include discussion on any study updates, and the planning of study processes throughout each year. No patient PHI is collected or discussed during these meetings. We de-identify the written minutes of the steering committee minutes and use these minutes as a data source.

Coding Analyses:

Our qualitative evaluation will be based on coding of open-ended questions from the interviews. We will be particularly attentive to themes relating to feasibility including time burden, disruption of routines, adaptions, comfort, trust, perceived value, which patients benefit and which did not. The location of the interviews will take place in a private setting at HFM or remotely at the preference of the KIs. Each interview will be conducted by a member of the research team.

All interviews will be audio-recorded and then transcribed through a service called Rev.com which is a University of Rochester Qualified Supplier. If the interview is conducted using video, only the audio portion will be recorded using an audio-recording device. No personally identifiable information will be transcribed. The de-identified data will be stored in a password-protected file on a secure URMC shared drive housed in the Department of Family Medicine. Only the research team will have access to the de-identified data. 7 years after the completion of the study, the audio recordings will destroyed.

1. Several members of the research team will adopt a focused, rapid, qualitative, needs assessment using a priori codes based on the PRISM framework to identify barriers and facilitators for each of the five RE-AIM domains. Thus, we will assess internal and external context, practice infrastructure relevant to implementing and sustaining TB-HBPM and the views of recipients (HFM leaders, administrators, clinicians, staff and patients).
2. The codes will then be used to create a template for coding by the whole research team and applied to all of the transcripts. These will include identification of internal and external contextual issues that affect decision-making and its consequences.
    a. The coding template will be pilot tested by members of the study team to ensure reliability and understanding.
3. The coding process will be iterative; each transcript will be read by two coder(s) to generate a general understanding of the overarching themes and issues that evolved during a particular interview. The same coder(s) will read the transcript again, and code the transcript using the coding template noted in step 1 above. Additional codes will be applied as needed, by approval of the research team.
4. Each transcript will be coded by at least 2 research team members to ensure concordance/agreement of themes. In the case of coder disagreement, the issue will be resolved via discussion with the research team. Each coder will enter their independent codes into a MAXQDA database where the codes can be summarized and collated for further analyses.

MAXQDA is a URMC approved software that is designed for a qualitative and mixed methods data, text and multimedia analysis. The password -protected MAXQDA database is stored on the secure URMC shared network drive housed in the Department of Family Medicine. The MAXQDA database does not have personal access to the data stored within the system and will be protected according to institutional and HIPAA regulations.

The transcripts from each KI and SC meeting will be given a randomly assigned ID number related to the person facilitating the group and not the subject. No personal identifiers will be included in the transcripts to link any of the subjects to the any of the KIs or SCs. The team members will not code any of the transcripts for the interviews they facilitated. We will triangulate the transcribed data from the KIs, SC meetings and field notes from the study coordinator to interpret the findings.

Payment

KI subjects will receive $50 either in-person or through the postal mail for completing the interview. For this study, we use a subject payment system called Advarra Participant Payments. The system allows three ways to provide payment. You can choose: a reloadable debit card; direct deposit; or mailed paper checks. The study team will help you create a "subject profile" in the system. In order to provide payment, we will need to enter your name and date of birth into your subject profile. Depending on which payment method you choose, you may also need to enter your email address and banking information. If you already have an Advarra account (because you are in another study that uses this system), your existing profile will be used to provide payment. See the **'Information Sheet for Advarra Participant Payments"** for additional information. There will be no cost to you to participate in this study.

6. Risks and Benefits of Participation:

Risks: This is a Minimal Risk study. The study activities are unlikely to pose harm or discomfort any greater than that ordinarily encountered in daily life. We will inform subjects that participation is voluntary. We do not anticipate that any questions will make patients uncomfortable. All participants will be advised they may decline to answer any questions.

The primary risk to subjects is breach of confidentially. In addition, there is a risk that employee KIs may feel coerced to take part in the study as KIs to maintain their employee status or benefits at the health center.

We will minimize the risk of breach of confidentiality through appropriate training of all study personnel regarding confidentiality. All study personnel have completed training and have obtained certification in clinical research. Subject data and audio-recordings will be securely stored on the Department of Family Medicine shared-drive. To protect HFM employees from feeling coerced into participating, no direct supervisors will approach potential participants. We will provide employees who would like more time to consider an information letter to take home, and ask them follow up with a research staff if they are interested in participating in the study. To minimize breaches in confidentiality, we will avoid names, transform actual dates, and convert Zip Codes to area-based measures, i.e. median income.

Benefits: We do not anticipate any direct benefits to those who participate in this study beyond potential benefits from the clinical intervention, i.e. improved blood pressure. However, employees and patients may derive benefit if the intervention is successful. Potentially, these employees may have more effective clinical interactions and improve the level of care they provide their patients.

7. Inclusion Criteria

(See section 3. Population for eligibility criteria for both the de-identified study cohort and consented participants

8. Data Measures and Analysis:

<u>Aim 3</u>: Assess the impact of implementation strategies using specific metrics based on RE-AIM

Table 3 below describes the specific hypotheses being tested in addition to data source for this testing. The main hypotheses are being tested using de-identified data extracted from the eRecord. Secondary and mediating hypotheses are based surveys that are administered. These include the Primary Care Team Dynamics Survey (PCTDS), Two 3 item surveys (Acceptability Implementation Measure (AIM) and the Feasibility Implementation Measure (FIM)), the Quality Improvement Capacity Assessment survey (QICA) and the Teams Tool (TT)

Table 3. Primary, Secondary, and Exploratory Outcomes and Hypotheses

RE-AIM (Reach, Effectiveness, Implementation, Maintenance) Hypothesis reflecting the effect of TB-HBPM	Data source
<u>R</u>each	

R1: More than 50% of patients who are invited to engage in RPM for HBPM will consent.	EHR
R2: There will be a 50% reduction in patients with uncontrolled HTN with no follow-up reading within 90 days	EHR
Effectiveness	
E1: HTN control rates (< 140/90 mm Hg) will improve by 6%,i.e. from 50% to 56% (**Primary Outcome)**	EHR
E2: Overall mean systolic blood pressures will improve **(Secondary outcome)**	EHR
E3: Improvements in HTN control will be similar by race, ethnicity, and insurance **(Secondary outcome)**	EHR
Adoption	
A1: 70% of patients eligible for HBPM will be invited to consent by their clinician	EHR
A2: TB-HBPM will be viewed as acceptable and feasible by patients, staff, and clinicians	AIM, FIM**
Implementation	
I1: More 50% of patients who consent to HBPM will transmit BP readings on >15 days/month	EHR
I2: TB-HBPM elements will improve as measured by the QICA** scale	QIQA** scale
Maintenance	
M1: HTN control will be sustained throughout the project	EHR
M2: Revenue from billing will exceed the costs of implementation and sustaining HBPM using RPM	Costs and billing
Mediators (in the causal path between the intervention of TB-HPM and improved BP control)	
Med 1: Lower clinician BP targets	Survey, EHR
Med 2: More frequent patient HBPM readings transmitted	EHR
Med 3: More frequent clinician BP medication treatment intensification	EHR
Med 3: Team function (PCTDS*) I	PCTDS* scale, EHR
Exploratory	
Exp 1: LDL-C values and current smoking will decrease	EHR
Exp 2: Joy in practice, personal growth, and leadership and learning will improved based on the TT***	TTξ scale
Exp 3: Hypertension related ED visits will decrease	EHR

PO= Primary Outcome. IPT=initial program theory, OR=Outreach using BP registry, GR=Gap Reports, A&F=Team and Clinician Audit & Feedback reports, CPGT=Clinical Practice Guideline Training, TT=Team Training and Coaching, *PCTDS=Primary Care Team Dynamics Survey, **AIM=Acceptability Implementation Measure, **FIM=Feasibility Implementation Measure ***QICA=Quality Improvement Capacity Assessment survey ξTT=Teams Tool.

Notes on Surveys: *PCTDS is a 29-item survey that assesses core team dimensions: conditions, shared understanding, accountability, communication, conflict resolution, acting and feeling like a team and effectiveness, with α's ranging from .75-.91.[53] The **AIM and **FIM scales each contain 4 items with α's of 0.85 and .89, with reasonable discriminant validity and test-retest reliability.[54] The ***QICA assesses the extent to which the CCM for CVD prevention is implemented. It has been validated in primary care CVD prevention research.[55] It was selected because its domains map to the TB-HBPM. The ξTT is the 14 item scale that has been developed using existing items and validated in primary care practices in CVD prevention.[56] It includes three subscales: *Joy in Practice* (α=0.88), *Personal Growth* (α=0.81), and *Leadership and Learning* (α=.91).

Statistical Plan

We propose to use generalized linear mixed models to estimate the treatment and covariate effects in the SWCRT. These methods are the conventional tools advocated in the statistics literature for this type of study design. Let Y_{ijk} be a Bernoulli (yes/no) outcome indicating controlled BP for the *j*th patient nested in the *i*th suite at the *k*th time point. We model the conditional probability of controlled BP given the *j*th patient and *i*th suite as:

$$logit[P(Y_{ijk} = 1|\alpha_i,\alpha_{j(i)})] = \mu + \alpha_i + \alpha_{j(i)} + \beta_k + x_{ik}\theta$$

Where μ is the background level of BP control (on the logit-scale), $\beta_k$are fixed effects for time t_k, α_i is a mean-zero Gaussian practice effect with variance τ_1^2, $\alpha_{j(i)}$ is a mean-zero Gaussian patient-level effect for the *j*th patient nested within the *i*th suite independent from α_i and has variance τ_2^2. The x_{ik} are time-dependent treatment indicators (1=if the *i*th suite has begun the intervention rollout by time t_k, 0=otherwise) and θ is the treatment effect. Our above model is an extension of the basic SWCRT model by Hussey and Hughes (2007) because our approach models patient-level heterogeneity within suite via the random effect $\alpha_{j(i)}$. This random effect plays an important role in our hierarchical model. We propose to use Satterthwaite's method to adjust for the denominator degrees of freedom for small numbers of clusters. All the calculations will be conducted in SAS (i.e. GLIMMIX, NLMIXED in SAS, SAS Institute, Cary, NC).For secondary analyses, the mixed model regression framework above can be generalized to allow for additional covariate adjustments without difficulty.

Sample size calculation

The study was designed to detect a 6% increase (e.g. 51 to 57%) in the population level of BP control (defined to be <140/90 for an office based reading or mean HBPM 135/85 based on most recent reading at the end of the study period). We have selected this difference based on the following criteria. First, Kaiser Permanente improved control rates from 44 to 90% over 13 years or an average 3.5 mm Hg/year improvement. Similar HTN control improvements, (i.e. 6%) have been obtained in safety net practice through adaptations of the Kaiser team-based approach by others, and by our team. Thus, we believe a 6% overall improvement in practice wide HTN control is achievable and clinically meaningful. There are eight practices and approximately 720 patients nested within practice for a total of 5805 patients. We used the above model to compute statistical power via Monte Carlo simulation study. To match the actual study setting as closely as possible, we let each practice have 10 providers apiece for a total of 80 providers (in fact, there are 83 providers). We assumed that each provider sees 72 patients for a grand total of roughly 5760 patients enrolled in the study The variance components τ_1^2 and τ_2^2 for the suite and patient-within-suite random effects, respectively, are unknown for this population and so we used reasonable values from some of our own studies conducted at the University of Rochester Medical Center. We estimated parameters in the generalized linear mixed model using the 'lme4' package in the R statistical software. If we set the standard deviations $\tau_1 = \tau_2 = 4$, then we estimated the statistical power to be 95% for a two-sided test of the treatment effect at the nominal 5% level. If we increased the patient-within-suite standard deviation to $\tau_2 = 8$ but retained the suite-level standard deviation at $\tau_1 = 4$, then the statistical power reduces

to 87% for two-sided tests at the 5% level. This power will allow us to explore interactions between HTN control and patient demographic factors, i.e. age (<65 vs ≥65), sex (M vs F), race (Black vs White), ethnicity (Hispanic vs non-Hispanic) and insurance (Self pay vs any and Medicaid vs Commercial). We will use a similar approach to examining the second primary outcome, i.e. improvement in patients transmitting HBPM readings.

Outcomes and Analyses

Primary outcome

We will adopt the prototypical SWCRT mixed-effects model and analysis described above for the primary binary, BP control outcome (E1). We will use the most recent BP from either office or HBPM to define control (BP < 140/0 mm Hg) at month 44. Because HBPM readings are systematically 5 mm Hg lower than office readings,[62] we will add 5 mg to the SBP and DBP for HBPM readings to ensure comparability with office readings.

Secondary RE-AIM outcomes

Similarly, we will adopt the prototypical SWCRT mixed effects model and analysis above for the secondary RE-AIM outcomes (R1, R2, E2, E3, A1, A2, I1, I2, M1, M2).

Cost Analyses (*M2: Revenue from billing will exceed the costs of implementation and sustaining TB-HBPM).*

The cost analysis will be performed with respect to both the health system and patients. We will consider the net impact based on the marginal revenue minus the marginal costs.

Marginal revenue will be based on billing using RPM and CCM CPT codes for a diagnosis of hypertension, e.g. ICD-10 110.x, in addition to CPT codes for visits for the cohort. We will capture all types of visits including traditional office visits, telehealth visits, and patient group visits. Office visits will be identified based on CPT codes, e.g. 99213, 99214 etc. Telehealth visits involve use of modifiers, e.g. 95 for video and 93 for phone visits. Group patient visits will be identified based on standardized smart phrases. Thus, CPT codes and billing data will allow us to calculate corresponding marginal changes in revenues for the cohort

The first cost item will be based on OH charges for enrollment, training, and coordination of care. These are monthly per-patient charges that will be estimated based on the total months. HBPM will be included in current team meetings. We will flag these HTN-related meetings (and trainings), capture attendance, duration, and frequency of meeting/training based on clinician and staff type. This will allow us to estimate costs of the personnel attending

based on salary/benefits ($/hour) multiplied by time. RPM time for HTN (which can be converted into costs based on the clinician type) will be estimated using the time audits on the OH dashboard that tracks time use. Depending on clinician workflows, we may need to impute time (for clinicians who choose not to use the dashboard and/or communicate with patients outside the OH platform where time is not tracked). This could be estimated based on time use among clinicians and staff who use the platform and based on prior studies on clinician time in reviewing BP data and communicating with patients. Time required for communicating with patients is tracked using the OH platform (when used), and we will record clinician time spent in patient group visits and study-specific training. Patient costs will include time required to measure BP according to frequency (times/day x number of days per month x months). We will adopt a similar approach for assessing patient time to that taken for assessing clinician time. Specifically, we will record patient time spent in patient group visits. We will also measure the marginal change in clinic visits, whether in-person, telehealth, individual or group. Clinic visits for patients may increase as patients are monitored more closely, or they may decrease as care switches to group visits and OH. Thus, we will record all clinic visits and associated diagnosis and CPT codes and compare clinic visits to historical averages (or time off study) to determine the marginal cost, which could be positive or negative. Additional medication costs can be estimated based on mean changes in the number of antihypertensive medications with estimates of both the medication costs, both average wholesale price (payer perspective) and out-of-pocket costs (patient perspective). We will conduct sensitivity analyses that consider costs based on hypertension-related emergency department visits using data from the exploratory analyses described below.

Mediating analyses

Mediation analyses for SWCRT have not been well-developed.[63] The strategy that we aim to employ is the method by Baron and Kenny.[64] In general, our strategy to assess mediation will be to fit 3 regression models: (a) regress the BP control outcome on the HBPM intervention in a SWCRT, (b) regress the mediator on the HBPM intervention, and (c) regress the BP control outcome on the HBPM intervention in a SWCRT while also adjusting for the mediator. For the sake of the mediation analysis plan, we assume that HBPM intervention significantly affects both the outcome (via (a)) and potential mediator (via (b)). The Baron-Kenny method is to infer complete mediation if the statistical significance of the HBPM intervention disappears in the adjusted model (c) after having adjusted for the potential mediator; one infers partial mediation if the statistical significance if the statistical significance is weakened but does not completely disappear. If there is a statistically significant effect of the intervention on the mediators, we will next assess whether changes of these

mediators (e.g. BP targets, intensification), are associated with changes in improved BP. If necessary, we will explore structural equations models.[63]

Exploratory analyses
We will adopt the SWCRT model and mixed model analysis above for the exploratory outcomes in Exp 1, Exp 2, and Exp 3

The key variables will be extracted from the eRecord (Table 4 below) at baseline and at the end of the study to assess changes.

Table 4. Limited Data Set

Variable	Source for data
Patient eMRN (converted to a unique ID)	Demographic File
Primary Care Practitioner (PCP) Name (converted to a unique ID)	Care team
Continuity Care Practitioner (CCP) Name (converted to a unique ID)	Care team
HFM Suite Number	Care team
Age DOB will be adjusted to de-identify	Demographic File
Sex (birth)	Demographic File
Male	
Female	
Other	
Missing	
Sex (legal)	Demographic File
Male	
Female	
Other	
Missing	
Race %(N)	Demographic File
Asian/Pacific Islander	
Black	
Indigenous/American Indian	
White	
Other	
Missing	
Hispanic ethnicity	Demographic File

Yes	
No	
Missing	
Marital Status/partner%(N)	Demographic File
Divorced	
Legally Separated	
Life partner	
Married	
Significant other	
Single	
Widowed	
Unknown/missing	
Employed	Demographic file
Yes	
No	
Missing	
Level of Education/Degree Completed	Demographic file
Years	
Missing	
Social Determinants of Health	Social Determinants file
Financial Resource Strain	
Transportation Needs	
Stress	
Intimate Partner Violence	
Housing Instability	
Food Insecurity	
Physical activity	
Social Connections	
Illiteracy	
Missing	
Language preferred	Demographic file
Language e.g English, Spanish, ASL	
Missing	
Interpreter Needed	Demographic file
Yes/No	
Missing	
Insurance	Demographic file
Commercial/other	

Medicare	
Medicaid	
Other	
No insurance/self-pay	
Missing	
Residence Zip Code	Demographic file
Smoker	Substance and Sexual Activity
Current	
Never	
Former	
If former, how many years ago	
Missing	
% Current smokers counseled to quit <12 months CPT codes 99406,99407	CPT codes from any office visit beginning 4/1/2021
Alcohol use	
Never	
Former	
Current	
Drinks/week	
Missing	
BMI including Ht and Wght, dates	Vital (most recent).
Comorbidities %(N)	Problem list most recent and billing ICD-10 codes including Z codes
PHQ-9	
Values	Values/dates from 4/1/2021
Missing	
10-year ASCVD risk Score	Smart phrases that include ASCVD
Missing	
Hypertensive Medications	Medication list beginning 4/1/2021
Name frequency and dose	New antihypertensive stated since 4/12021
None	
New/Change in antihypertensive from 4/1/2021	
Taking statin	Current medication list
Name dose	
None	
Taking other lipid lower medication	Current medication list
Name dose	
None	

Labs	Most recent lab values and dates
Lipid panel	
Total cholesterol	
HDL cholesterol	
LDL cholesterol	
Triglyceride	
Missing	
A1c (%) %(N)	Most recent lab including POCT values and date
Missing	Most recent value and date
eGFR Black and Caucasian	Most recent value and date
Potassium, serum	Most recent values including missing and date
Urine Microalbumin	Most recent value and date
Office Blood pressures	Vitals All readings with dates/location beginning 4/1/2021
Blood pressures from eRecord/MyChart	Values/dates/ begin 4/1/2021 exclude dialysis
EKG	CV procedures date (no restriction on lookback)
24-hour ambulatory blood pressure monitor	CV procedures date (no restriction on lookback)
Enrolled in MyChart	URMC MyChart Administration
Yes	
No	
Missing	
Used MyChart (ever or # of times in 12 months?)	URMC MyChart Administration
Yes	
No	
Missing	
Mean# Office visits 12 months by Last BP	All office visits date/BP beginning 4/1/2021
Recent HFM office or telehealth visits	Visit dates, blood pressure reading from 4/1/2021
Referral to Healthy Lifestyle (CCH)	Date of referral
Referral to YMCA Hypertension program	Date of referral
Cardiology encounters	Visit dates, blood pressure reading from 4/1/2021
# No shows HFM encounters	# No show
# No show any encounter	# No show
ED visits in prior 12 mths HTN ICID-10 codes	Dates, I10.x begin 4/1/2021

Hospitalized in prior 12 mths/ HTN ICD-10 codes	Dates I10.x begin 4/1/2021

9. Data Storage and Confidentiality:

The study protocol will be monitored by the PI for safety via weekly contact with the research staff, with resolution of any safety issues that arise. The protocol will be monitored by means of REDCap tracking the status of activities of all key phases of the study such as recruitment, enrollment, and interviews. The files will be kept for a total of 7 years (from the completion of the study), at which point they will be destroyed according to institutional and HIPAA regulations. SC and KI contact information (name and phone number or email address) will be destroyed once the interviews are complete and the subject no longer needs to be contacted by the study team. Only the key investigators, project coordinator and research assistants will have access to individually identifiable Key Informant data. The data will be entered into a password protected spreadsheet stored on the study team's fire-wall protected REDCap database.

All research material will be maintained in locked files at the University of Rochester. As noted above, the files will be kept for a total of 7 years (from the completion of the study), at which point they will be destroyed according to institutional and HIPAA regulations.

All audio recordings will be stored in a secure protected electronic database. The audio recorded interviews will be kept until they have been transcribed. Once transcription is complete the recordings will be destroyed according to institutional and HIPAA regulations.

10. Data and Safety Monitoring Board (DSMB) and Charter and Safety Monitoring Plan

Background

TB-HPBM (Team-Based Home Blood Pressure monitoring) is a Stepped Wedge Cluster Randomized Trial Design (SWCRT) to assess implementation of the Chronic Care Model for Hypertension with HPBM. TB-HPBM will support patients with diagnosed with hypertension (HTN) with HBPM and other self-management support. Core implementation strategies involve contracting with remote monitoring vendor (RPM), billing codes, creation of HTN registry, monthly feedback reports, EPIC smartphrases, patient outreach and training in HTN management, measurement and team care for HTN. The leadership of the Department of Family Medicine at the University of Rochester is adopting

this model with support from the research team. The research team will rigorously evaluate implementation using the RE-AIM framework using an SWCRT design.

This Charter describes the roles and responsibilities of the Data Safety Monitoring Board (DSMB), including the timing of meetings, methods of communicating information to the DSMB, frequency and format of meetings, and statistical issues and reporting relationships.

Roles and Responsibilities

The intervention, including home blood pressure monitoring, the Chronic Care Model for TB-HPBM and the implementation strategies are widely used in different ways in clinical care. Thus, we anticipate that the risk posed to participants (patients, staff and clinicians) are minimal, i.e. no greater than the risk associated with the management of HTN in routine practice. The aims of the DSMB are to assure that appropriate procedures are in place to monitor the safety of the study, ensure the protection and privacy of participants and monitor the overall conduct of the trial. The DSMB will act in an advisory capacity to the TB-HBPM Steering Committee, and if needed will provide reports to the funded institution the University of Rochester. Dr. Kevin Fiscella, MD, MPH, the TB-HPBM PI chairs the trial's Steering Committee. The full voting membership of the Steering Committee is listed below.

TB-HBPM STEERING COMMITTEE

Co-Chairs

Kevin Fiscella, M.D, MPH PI (Kevin_Fiscella@urmc.rochester.edu)
Matt Devine, M.D., Chief Medical Office and Site PI Co-Chair (Matt_Devine@urmc.rochester.edu)

Members

University of Rochester

Brent A. Johnson, Ph.D. (Co-I)
Tziporah Rosenberg, Ph.D (Co-I)
Mechelle Sanders, PhD (Co-I)
Soumya Sridhar, M.D., M.P.H. (Co-I)
Emma Strujo, M.P.H (Project Director)
Marie Thomas

Highland Hospital

Marsay Houston
Katie Lashway, R.N.

Stacey Makubire, BSN, NE-BC
Amy Thein, Pharm.D., BCGP

University of Michigan
John D. Bisognano, M.D., Ph.D (co-I)

University of Iowa
Linnea A. Polgreen. M.A., Ph.D.

Oxford University
Geoff Wong, MA MBBS MD(Res) MRCGP FHEA

The initial function of the DSMB will be to review and approve the protocol prior to starting this implementation trial. This will include reviewing procedures for patient enrollment, data management, and safety and adaptations.
After this approval, the DSMB will meet at periodic intervals during the course of the trial to:

- Review any changes in the research protocol;
- Evaluate the progress of the trial, including assessments of data quality and completeness; participant accrual; participant risk versus benefit; performance of the trial; and other factors that can affect study outcomes;
- Consider factors external to the study when relevant information becomes available, such as scientific or therapeutic developments and contextual factors that may have an impact on the safety of the participants or the ethics of the trial;
- Review and assess any treatment harm (e.g. severe adverse events) reported for trial participants and potential impact on the participants and the trial; monitor compliance with previous DSMB recommendations; and
- make recommendations to the Steering Committee and URMC (and indirectly to NIH NHLBI) concerning continuation without modification, continuation with modification, or termination of the trial based on data quality, study progress, or the observed adverse effects of the treatment under study. (Modifications may include but are not limited to changes in inclusion/exclusion criteria and alterations in study procedures)

The DSMB will consist of three members. Two members will constitute a quorum. DSMB members must be completely independent of the trial and have no financial, scientific, or other conflict of interest with the trial.

11. DSMB COMMITTEE

Members

Gbenga Ogedegbe, M.D. M.P.H., New York University (Chair)
Valy Fontil, M.D., MAS University of California, San Francisco
Daniel Tancredi, Ph.D., University of California, Davis

Collectively the DSMB members provide expertise in: clinical trials methodology, biostatistics/epidemiology, primary care, hypertension, and blood pressure and vitals monitoring. The NIH NHLBI Program Officer, Dr. Keith A. Mintzer, will be invited to participate in DSMB as a non-voting member.

Dr. Gbenga Ogedegbe will serve as DSMB Chair. In this capacity, he will develop meeting agendas in consultation with the PI/Study Chair, oversee the conduct of DSMB meetings, and review and approve the draft minutes from each meeting.

Staff from URMC will provide administrative and logistical support for the DSMB, including taking minutes of all DSMB meetings and reimbursing DSMB members for expenses and honoraria. They will strive to ensure that suitable meeting dates are selected to enable all DSMB members to attend. Members will participate by teleconference. If the DSMB is considering recommending major action after a meeting without a quorum, the DSMB Chair should talk with absent members as soon possible after the meeting to check if they agree, and if they do not, a conference call will be arranged for the full DSMB. DSMB members will receive an honorarium of $500 for each meeting attended. In addition to the initial meeting during project year 1, the DSMB is expected to meet 4-5 additional times during the course of the study.

Organization of DSMB Meetings

Meetings are attended by the study PI, Dr. Kevin Fiscella, study program manager (Emma Strujo), and other steering committee/TB-HPBM investigators and staff members as appropriate.

The format for DSMB meetings consists of:
a) an open Session,
b) a closed Executive Session,
c) a debriefing Session.
The closed Executive Sessions are attended only by the voting members of the DSMB and, if requested by the DSMB, the PI/Study Chair. The purpose of these sessions is to discuss the report presented to the DSMB, highlight any issues requiring attention or resolution, and formulate recommendation(s)

related to the trial progress and continuation. The first optional Executive Session is typically used for early input about key issues of concern. Every effort should be made for the DSMB to reach a unanimous decision. If the DSMB cannot decide unanimously, a vote may be taken, although details of the vote should not be included in the report to avoid conveying information about the state of the trial. Implications (ethical, practical, financial, statistical, etc.) should be considered before recommendations are made. Should the DSMB decide to issue a termination recommendation, a full vote of the DSMB will be required and a majority vote will rule. A minority report may be prepared at the discretion of the DSMB members not supporting a termination recommendation.
The Open Session may be attended by the PI/Study Chair and other study staff. Issues discussed at Open Sessions will include the conduct and progress of the study, including patient accrual, compliance with the protocol, problems encountered, intervention process data, and safety monitoring data.
As with the initial Open Session, the Debriefing Session may be attended by the PI/Study Chair and other study staff as appropriate.

DSMB Communications
Meeting materials: Trial monitoring reports are generally distributed to the DSMB 1 week prior to a scheduled meeting. The contents of the report are determined by PI/Study Chair in consultation with the DSMB Chair. Additions and other modifications to these reports may be requested by the DSMB at any time.

Minutes: The PI/Study Chair will provide draft minutes from DSMB Open Sessions and Debriefing Sessions to the DSMB Chair within 1 week of the DSMB meetings. The DSMB Chair will review these minutes with the other DSMB members and send finalized minutes to the Study Chair within 4 weeks of receipt of the draft minutes. The Study Chair will then circulate these minutes to the full Steering Committee and to the Project Officer at NHLBI. Study staff will file an IRB DSMB report within 10 days of meeting.
Confidentiality: All materials, discussions, and proceedings of the DSMB are completely confidential and should not be discussed outside of the DSMB meetings. DSMB members also should properly dispose of all trial monitoring reports after each meeting.

12. Safety Monitoring and Stopping Rules
The TB-HPBM is considered a minimal risk study. It is designed to compare commonly used and recommended methods (or those practiced by care as usual) of BP measurement and hypertension treatment, augmenting implementation in several key ways. The primary risk is breach of

confidentiality. Less serious issues involve potential anxiety about high BP from frequent monitoring. Thus, the study protocol does not include any provision for formal interim monitoring (and stopping rule) for efficacy. However, the DSMB may recommend early termination for safety or lack of ability to meet study goals (due to inadequate recruitment or participant inability to complete study protocols). To that end, the Steering Committee has adopted a formal Data and Safety Monitoring Plan (DSMP) which will be submitted to the URMC IRB and NIH NHLBI. The study investigators will also track and report on participant and provider complaints related to the study, breaches of confidentiality, and any protocol violations that occur during the course of the study.

Post-Trial Reporting

Following completion of the trial, the DSMB will have the opportunity to review trial findings and to read and comment on the main outcomes paper before submission.

Changes to the Charter

Following initial approval of this Charter, changes to it may be approved by a simple majority vote of DSMB members. A historical record of changes to the Charter will be maintained by staff.

DATA AND SAFETY MONITORING PLAN

A. Confidentiality

1. Protection of Subject Privacy: During this study, blood pressure data will be recorded. Data will be kept in strict confidence. No information will be given to anyone without permission from the subject, and confidentiality will be protected by use of randomly generated identification code unique to the subject. Health Information Portability and Accountability Act (HIPAA) guidelines will be followed.
2. Database Protection: Data will be secured with password protection.
3. Confidentiality during AE Reporting: Adverse event (AE) reports and annual summaries will not include subject-identifiable material. Each will include the identification code only.

B. Adverse Event Information

1. Definition: An adverse event (AE) is any untoward medical occurrence in a subject temporally associated with participation in the clinical study. An adverse finding can include a sign, symptom, abnormal assessment (laboratory test value, vital signs, etc.) or any combination of these. For this study, we will be routinely monitoring all home blood pressure readings collected during the trial, with clear safety follow-up for patients recording very low or very high BP values. Clinicians will be

trained to establish alerts based on BP thresholds as part of sound clinical practice. Clinical team members will contact patients about these readings, assess patient symptoms and the situation and take appropriate action. We also may uncover other patient-reported adverse events through regular communication with participants (e.g., symptoms reported to pharmacist, clinician, or staff during the study, or self-reported AE on the follow-up study survey) and will track and review them using a standardized documentation tool via RedCAP.

2. Classification of AE Severity: AEs will be labeled by the study team according to severity which is based on their impact on the patient, per this Event Grading Scale:

Grade 1 Mild
Transient of mild discomfort; no limitation in activity; no medical intervention/therapy required

Grade 2 Moderate
Mild to moderate limitation in activity – some assistance may be needed; no medical intervention/therapy required.

Grade 3 Severe
Marked limitation in activity, some assistance usually required; medical intervention/therapy required, hospitalizations possible.

Grade 4
Life Threatening
Extreme limitation in activity, significant assistance required significant medical intervention/therapy required, hospitalization or hospice care probable.

3. AE Attribution Scale: AEs will be categorized according to the likelihood that they are related to the study intervention. Specifically, they will be labeled either definitely, probably, possibly or unrelated to the study intervention.
4. Expected Risks: Expected risks to the subject are mild given that the trial will be conducted as integrated into routine primary care practice. Risks are considered to be minimal and are addressed in the protocol and consent form. Participants will have a contact number to report any potential adverse events that occur in between scheduled study visits. They will also have an opportunity to privately discuss any physical complaints due to remote blood pressure monitoring when they visit their provider.
5. SAE Reporting: SAEs that are unanticipated, serious (grades 3 and 4), and/or possibly related to the study intervention will be reported to the IRB and NIH in accordance with requirements. Anticipated SAEs or those unrelated to the study intervention will be reported in accordance with

requirements. We plan to proactively identify SAEs specific to hospitalizations by setting an alert within our Epic EHR to capture in real-time hospital encounters for study participants, which will be categorized and followed up directly.

C. Data Quality and Safety Review Plan and Monitoring

1. Data Quality and Management
    a. Description of Plan for Data Quality and Management – The PI will review all data collection forms on an ongoing basis for data completeness and accuracy as well as protocol compliance. A statement reflecting the results of the review will be sent to the NIH in the annual report. The EHR is the primary data source. EHR data quality will be assessed using extreme outlier data, missing data for outcome variables (i.e. office or transmitted blood pressure readings, dates of visits, participant ID), and loss to follow-up (no data for the participant appears in EHR, e.g. due to relocation, left practice etc). Note: clinical staff will conduct outreach to all participants as part of sound clinical practice. Regular data checks and data cleaning will be deployed to optimize data quality. Multiple imputation methods will be used as necessary to address missing data as described in the statistical analysis.

Measure	**Goal**	**Acceptable Value**
Outlier for EHR key data	3%	5% of participants
Missing data for outcome variables	5%	10% of participants
Participant loss-to-follow-up	10%	20% of participants

    b. Frequency and Review

For each measure listed above, we will summarize annually from study tracking database (in REDCap).

2. Subject Accrual and Compliance
    a. Measurement and reporting of subject accrual, adherence to inclusion/exclusion criteria – Review of the rate of subject accrual and adherence to inclusion/exclusion criteria will occur annually during the entire recruitment phase. Note: practice and patient participant accrual is passive through EHR and it is expected that 75% of the total accrual will occur during the first three months of the trial.
    b. Measurement and reporting of participant compliance to treatment protocol

Data on compliance to the treatment protocol will be collected via the home BP monitoring devices. Compliance on the part of participants will be evaluated for participants' home BP readings on a weekly basis. Participants who are not recording home BP readings will be automatically reminded via text messaging, with follow-up phone call if they continue to have gaps in their home BP readings. On a quarterly basis, the Steering Committee will review these data and determine if there are any concerns about whether compliance has reached a level that might inhibit the ability of the study to test its primary hypotheses. If there are concerns, these will then also be raised to the DSMB.

3. Stopping Rules – This study will be stopped prior to its completion if: (1) study recruitment or retention is too low for the study to provide meaningful results; (2) any new information becomes available during the trial that necessitates stopping the trial; and (3) other situations occur that might warrant stopping the trial. Given that the trial intervention is relatively safe, we will not monitor efficacy and will not stop the trial prior to planned completion for unexpected efficacy. Furthermore, even if the intervention is efficacious at 6 months, it will still be important to continue data collection to determine the extent to which its benefits are maintained at 1 year as planned and whether benefits accrue to disparity groups, e.g. African American patients, those without insurance, and older patients. The trial will be stopped early if the DSMB finds that the harm to study participants outweighs the benefit of the scientific evidence to be accrued by continuing the trial. Finally, the trial will be stopped early if the DSMB finds that new information from sources outside the trial provides definitive information that the intervention is effective or harmful.

D. Safety Review Plan

Study progress and safety will be reviewed monthly by the PI. Progress reports, including patient recruitment, retention/attrition, and adverse events will be provided to the DSMB annually for independent review. An annual report will be compiled and will include a list and summarization of adverse events. In addition, the annual report will address (1) reason for dropouts from the study; (2) whether continuation of the study is justified on the basis that additional data are needed to accomplish the stated aims of the study. The annual report will be forwarded to the appropriate IRB and NIH contacts on an annual basis.

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