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Research Paper

Multifaceted strategies to improve blood pressure control in a primary care clinic: A quality improvement project

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ABSTRACT

Background: Approximately 80% of patients with hypertension in the Internal Medicine Clinic were uncontrolled (BP > 130/80 mmHg), according to the 2017 American College of Cardiology (ACC)/American Heart Association (AHA) hypertension guidelines, leading to increased morbidity and mortality. The aim of this quality improvement (QI) was to improve BP control <130/80 from the baseline rates of 20%–30% and <140/90 from the baseline rates of 40%–60% between ages of 18–75 years, within 12 months.

Methods: We used the Plan-Do-Study-Act method. A multidisciplinary QI team identified barriers by fish bone diagram. Barriers included: 1) Physicians' knowledge gap and clinical inertia in optimization of medications, and 2) Patients' nonadherence to medication and appointments. The outcome measures were the percentage of patients with BP < 140/90 and < 130/80. Process measures included: 1) attendance rates of physician and nurses at educational sessions, 2) medication reconciliation completion rates and 3) care guide order rates. Key interventions were: 1) physicians and nurses' education regarding ACC/AHA guidelines, 2) patient education and engagement and 3) enhancement of health information technology. Data analysis was performed using monthly statistical process control charts.

Results: We achieved 62.6% (n = 885/1426) for BP < 140/90 and 24.47% (n = 349/1426) for BP < 130/80 within 12 months project period. We sustained and exceeded at 72.64% (n = 945/1301) for BP < 140/90 and 44.58% (n = 580/1301) for BP < 130/80 during the 10 months post-project period.

Conclusions: Overcoming physician clinical inertia, enhancing patient adherence to appointments and medications, and a high functioning multidisciplinary team were the key drivers for the success.

1. Introduction

1.1. Problem description

In the Erie County Medical Center (ECMC), an academic, hospital-based safety-net Internal Medicine Clinic (IMC), 80% of hypertensive patients had uncontrolled blood pressure (BP) (>130/80 mmHg), according to the 2017 the American College of Cardiology (ACC)/American Heart Association (AHA) guidelines [1]. ECMC participated in the comprehensive primary care plus (CPC+) payment model, developed by the center for Medicare and Medicaid. Optimal BP control in the IMC population was the highest priority for the CPC+ Model for health care [2]. The aim of this quality improvement (QI) was to improve BP control < 130/80 mmHg from the baseline rates of 20%–30% and <140/90 mmHg from the baseline rates of 40%–60% between ages of 18–75 years, within 12 months.

1.2. Background

Hypertension (HTN) is a leading risk factor for morbidity and mortality worldwide; however, detection and treatment still remain low [3–5]. In 2017, the ACC/AHA published new guidelines for HTN, recommending intense BP control, citing reduced risk of stroke, coronary events, major cardiovascular events and cardiovascular mortality [1,6]. The health consequences of poor BP control cause deteriorating medical conditions such as myocardial infarction (MI), stroke, and chronic kidney disease (CKD), which also leads to increased emergency department visits, hospitalization and rising health care costs [7]. Previous guidelines (2014) recommended a less intensive approach to BP control [8]. Meta-analyses and systematic reviews provide strong support that more

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intense BP lowering significantly reduces the risk of stroke, coronary events, major cardiovascular events and mortality, however, the data are less clear about optimal BP targets [6,9–12]. Recent trials include, SPRINT (2015) and ACCORD (Action to Control Cardiovascular Risk in Diabetes, 2010) with targets of more intensive systolic BP (less than 120 mm Hg) versus standard (systolic BP less than 140 mm Hg) [12,13]. These trials yielded mixed results; SPRINT was stopped early as more intensive BP control resulted in a significant reduction in primary outcome (CVD) and all-cause mortality [12]. However, in the ACCORD study there was no significant reduction in CVD, although incidence of stroke was significantly reduced.

Based on the 2017 ACC guidelines, normal adult BP should be less than 120/80 mm Hg. Stage 1 HTN is classified as systolic BP 130–139 or diastolic BP 80–89 mm Hg. If clinical Atherosclerotic Cardiovascular Disease (ASCVD) or estimated 10-year CVD risk is greater than or equal to 10%, both lifestyle modification and BP lowering medication should be initiated (Class I) to achieve BP goal. Stage 2 HTN is classified as BP greater than or equal to systolic BP 140 mmHg or diastolic BP 90 mmHg, and similarly, both lifestyle modifications and BP-lowering medication should be initiated in these patients (Class I) with close follow up to monitor BP [1,14].

2. Methods

2.1. Setting

This QI project was performed at the IMC, located within a tertiary care, safety net hospital in Western New York. Safety-net clinics provide necessary health care for disadvantaged communities, minorities, and Medicaid beneficiaries [15]. The patient population is largely underprivileged, urban and 75% African American. About 70% of IMC patients are diagnosed with HTN and have multiple comorbidities including type 2 Diabetes Mellitus, hyperlipidemia and morbid obesity (mean body mass index (BMI) of 32 (obesity = BMI of 30 or greater). Furthermore, the majority of the clinic population has Medicare, Medicaid or are uninsured (about 75%). Patients utilize the IMC as a longitudinal primary care clinic with approximately 800 average monthly visits. Twenty-nine resident physicians from the Internal Medicine Residency program of the University at Buffalo, State University of New York, and four attending physicians serve this clinic.

2.2. Measurement

In collaboration with information technology staff, physician leaders created a patient registry from electronic health records (EHR) and verified their accuracy. A retrospective review of the registry revealed about 80% patients seen in the clinic within the past 18 months had BP control >130/80 and 60% had BP > 140/90. Inclusion criteria were male and female patients aged 18–75 years old with a diagnosis of HTN and at least two clinic visits from May 1, 2018 to April 30, 2019. The outcome measures were the percentage of patients with BP < 140/90 and < 130/80. Process measures included: 1) the percentage of nurses and physicians that attended education on HTN, 2) medication reconciliation completion rates, and 3) care guide order rates for patient education. Balance measures comprised of potential increase in patient wait time and dissatisfaction of nursing staff and physicians.

The team selected two BP goals for the outcome measures. BP control <130/80 was based on updated ACC/AHA guidelines [1], and BP control <140/90 was aligned with the organizational objective for CCP+ initiatives [2]. Physicians determined medication nonadherence and discussed barriers with patients at the time of completion of medication reconciliation, therefore the team selected medication reconciliation as a process measure. Once medication adherence was confirmed, physicians offered optimization of BP medications to patients for uncontrolled BP. Optimization was defined as increase in the dose and/or addition of another medication for BP control.

2.3. Design

The QI team defined the aim statement using Specific, Measurable, Achievable, Relevant and Timely ("SMART") objectives [16]. We utilized the Plan-Do-Study-Act (PDSA) model of health care improvement and six Domains of the Institute of Medicine; Safe, Timely, Effective, Efficient, Equitable and Patient-centered (STEEEP) [17,18]. For this QI project, we used SQUIRE 2.0 guidelines [19]. The multidisciplinary QI team consisted of attending physicians, resident physicians, nursing and front-line clinic staff, administrative leadership, patients, a social worker, a case manager and information technology staff. The QI team performed a root cause analysis in a small group discussion to identify barriers to optimal BP control (Fig. 1). The major barriers included: 1) Physicians' knowledge gap and clinical inertia in optimization of medications, and 2) Patients' medication non-adherence and lack of follow up, 3) transportation to appointment and pharmacy, and 4) cost of medications. Team members created the process flow map to optimize workflow (Fig. 2). Key team members participated in stakeholder mapping to develop a stakeholders' engagement strategy. Stakeholders were classified based on the level of influence and level of interest (Fig. 3) [20]. Small group feedback sessions were conducted with various stakeholders and data was shared every 5 weeks.

2.4. Strategy

We implemented six PDSA cycles.

2.4.1. PDSA Cycle 1 (May- July 2018) Physician and Nursing Education

The physician leaders conducted PowerPoint presentations in a small group format on the 2017 ACC/AHA guidelines, accurate completion of medication reconciliation and home blood pressure monitoring. Pre and post-tests were conducted to assess improvement in residents' knowledge. The nursing manager provided education and training to the nursing staff regarding HTN guidelines and accurate BP measurement techniques. Dietary Approaches to Stop Hypertension (DASH) diet [21], exercise, smoking cessation and medication adherence were emphasized for patient education. Nurses and physicians were instructed to re-check BP with manual device after 5–10 min of rest when initial reading on automatic BP machine was >140/90 in the clinic.

2.4.2. PDSA Cycle 2 (August 2018) Customization of EHR and Patient Engagement

In collaboration with the IT department, physician leaders created a customized template and implemented an innovative nursing workflow to assess barriers to nonadherence to medication. There were two questionnaires in the history of presenting illness section; a) In the last 2 weeks, did you take all your BP medications as prescribed? Options were: 1) more than 5 days a week, 2) 3–5 days per week, and 3) less than 3 days a week; and b) Reasons for nonadherence. Nurses completed these questionnaires during the patient check in process in the examination room. Physician leaders designed a HTN medication adherence tool for physicians based on The European Society for Patient Adherence, COMpliance, and Persistence (ESPACOMP) Medication Adherence Reporting Guidelines (EMERGE) [22]. The HTN care guide was implemented for patient education. The care guide consisted of life style modification and check list to assess barriers for medication and appointment nonadherence. Physicians were trained to order care guide in EHR.

The Patient navigator was assigned for patient outreach and scheduled clinic visits when patients with uncontrolled hypertension were not evaluated in the last 3 months. Patients were notified by a letter to reschedule a missed appointment. The team created a stamper with "HTN project" to be used on the paper billing sheet during patient registration to alert nurses, physicians and patients. The team implemented a standing order policy to schedule a follow up visit every 5 weeks for patients with BP > 140/90. The continuity of care resident physician

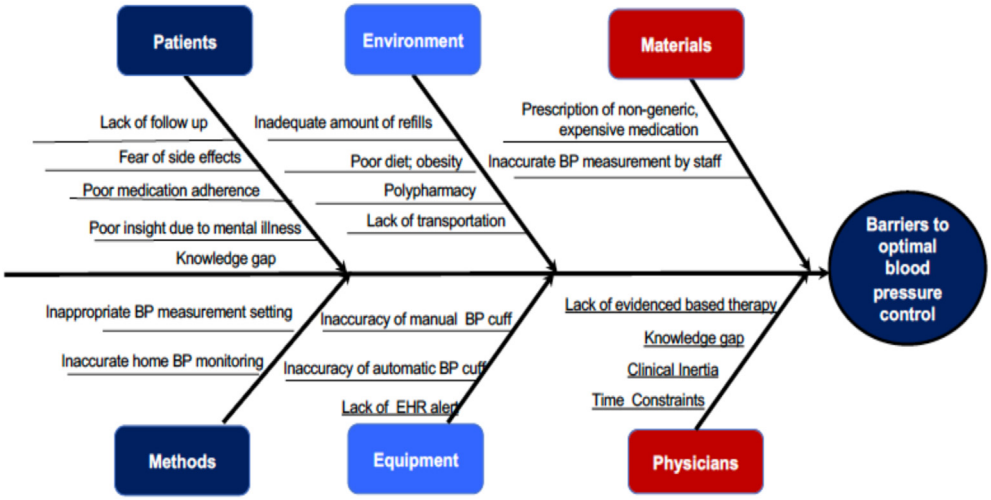

Fig. 1. Fishbone diagram; Root cause analysis identifying barriers for optimal blood pressure (BP) control.

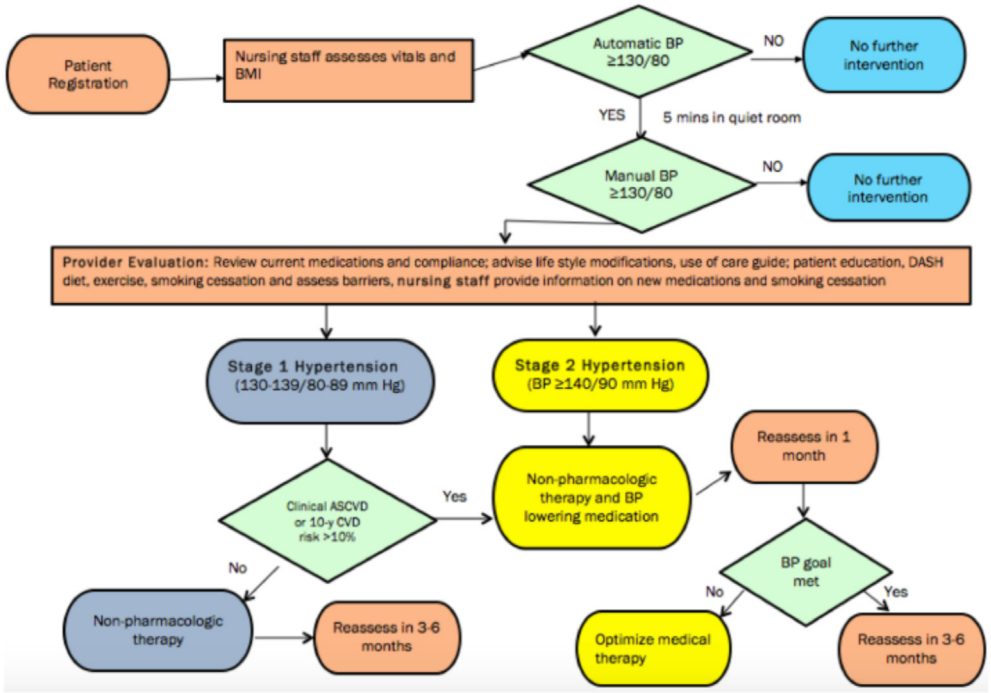

Fig. 2. Process workflow chart for patients with hypertension. BP, blood pressure. ASCVD, atherosclerotic cardiovascular disease. CVD, cardiovascular disease. BMI, Body Mass Index.

rotated in the clinic every 5 weeks, therefore visits were scheduled every 5 weeks. Physicians discussed the need for home blood pressure monitoring with the patient and prescribed a BP monitor device.

2.4.3. PDSA Cycle 3 (Sept- Oct 2018) Medication Reconciliation and Brown Bag Review

Physicians completed the medication reconciliation with the patient in the examination room. Once the physician confirmed medication adherence by patient history and review of current medication list from the pharmacy, the physician optimized BP medications with shared decision making with patients [23]. Physicians referred the patient to a social worker to address the barriers of cost and transportation. Patients were asked to bring bottles of all medications during a clinic visit called "Brown Bag Review" of Medicine [24]. This method was used to confirm home medications and to complete medication reconciliation accurately. Patients were instructed to bring all medications during an appointment reminder text message.

2.4.4. PDSA 4 (Nov-Dec 2018) Patient and Physician Education Pamphlets

Team members placed ACC/AHA HTN guidelines pamphlets in physicians' task boxes as a reminder. Patient educational pamphlets were placed in the examination rooms. Nursing staff and physicians also reviewed HTN pamphlets with the patient. Stages of HTN, possible complications and life style modification were included in the patient pamphlets.

2.4.5. PDSA Cycle 5 (Jan- Feb. 2019) Reflection and Feedback to Stakeholders

A five-point Likert agreement scale was administered to measure nursing and residents' dissatisfaction. Continuous feedback to nursing

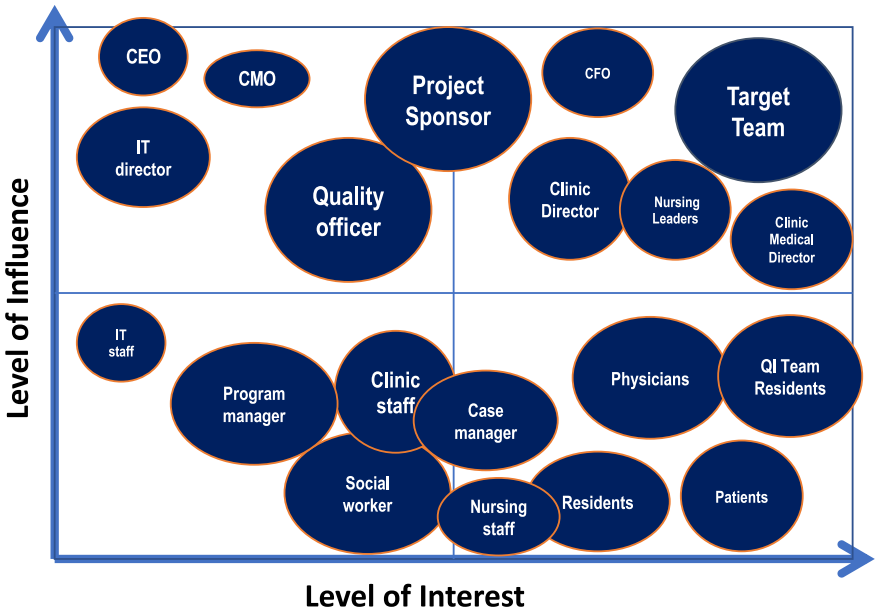

Fig. 3. Stakeholder analysis.

staff, residents and other stakeholders was provided.

2.4.6. PDSA Cycle 6 (March- April 2019) Pocket cards for Physician

The Resident leader designed pocket cards with a BP management algorithm based on ACC guidelines and a list of combination generic BP medications. Physicians utilized this card as a reminder to check medication adherence with the patient and offer medication optimization for uncontrolled BP.

2.5. Data analysis

This QI was performed utilizing historical trends (statistical process control chart) in data and not a control group for a comparison. Both methodologies use a comparative population to determine the effect of the intervention [25]. Data analysis was performed using monthly Statistical process control charts. The clinic EHR was unable to incorporate BP readings from telehealth visits in March and April 2020 due to the COVID-19 pandemic, therefore we reported 10 months post project data.

3. Results

3.1. Demographics and clinical characteristics

Demographics and clinical characteristics of the study population are displayed in Table 1a. We performed demographic and clinical comparisons of patients who achieved BP goal (less than 140/90) and those who did not achieve goal on last BP taken during study period (Table 1b). The study population at entry had multiple comorbidities. 56.03% had DM, 80.36% had hyperlipidemia, 25.03% had coronary artery disease, 26.71% had heart failure and 27.84% had chronic kidney disease. About 70% of patients had 3 or more of these diagnoses.

3.2. Outcome measures

1. BP goal <140/90
   a) We achieved 62.6% (n = 885/1426) for BP control <140/90 within the 12 months project period. We increased and sustained at 72.64% average (n = 945/1301) for BP control <140/90 during the post project period.
   b) For BP control <140/90, during one-year project period, the mean was 65.70% and during the post project period, the mean was 71.3% in a monthly P-chart (Fig. 4a).

Table 1
a) Demographic and clinical characteristics (all 1426 patients in Study Period). b) Demographic and clinical comparisons of patients who achieved BP goal (>140/90) and those who did not achieve goal on last BP taken during study period.

Characteristic	N (%); M±SD	Range
Age	58.2 ± 10.6	20–75
Sex (Male)	751 (52.7%)	
Race		
Black	1010 (70.8%)	
White	330 (23.1%)	
Asian	23 (1.6%)	
Multiracial	20 (1.4%)	
Other	43 (3.0%)	
BMI	32.2 ± 8.8	14.5–72.9
Attended visits – Study	4.12 ± 2.16	2–15
Attended visits (categorical)		
2	367 (25.7%)	
3-5	782 (54.8%)	
6-8	208 (14.6%)	
9+	69 (4.8%)	
Missed visits – Study	1.10 ± 1.44	0–10
ASCVD risk	16.3 ± 10.7	

Characteristic	Achieved (n = 885)	Not Achieved (n = 541)	p-value
Age	58.2 ± 10.5	58.1 ± 10.6	0.989
Sex (Male)	459 (51.9%)	292 (54.0%)	0.439
Race			0.148
Black	612 (69.2%)	398 (73.6%)	
White	219 (24.7%)	111 (20.5%)	
Asian	18 (2.0%)	5 (0.9%)	
Multiracial	11 (1.2%)	9 (1.7%)	
Other	25 (2.8%)	18 (3.3%)	
BMI	32.3 ± 8.8	32.1 ± 8.9	0.759
Attended visits – Study	4.22 ± 2.20	3.95 ± 2.09	0.025
Attended visits (categorical)			0.012
2	205 (23.2%)	162 (29.9%)	0.004
3-5	491 (55.5%)	291 (53.8%)	0.534
6-8	144 (16.3%)	64 (11.8%)	0.021
9+	45 (5.1%)	24 (4.4%)	0.580
Missed visits – Study	1.03 ± 1.44	1.22 ± 1.42	0.019
ASCVD risk	15.2 ± 10.1	18.3 ± 11.6	0.003

2. BP control <130/80
   a) 24.477% (n = 349/1426)) of the patients had BP control <130/80 within the 12 months project period. We continued to observe a steady increase and achieved 44.58% (n = 580/1301) for BP < 130/80 during the post project period.
   b) In monthly P-chart, during project period, the mean was 23.40% and during the post project period, the mean was 45.42% for BP < 130/80 (Fig. 4b).
2) Process Measures
   a) Resident and Nursing Education: 100% of the residents attended training in a small group setting with PowerPoint presentation about ACC HTN guidelines. Resident team leader conducted pre and post-tests consisting of 6 multiple choice questions, we observed improvement from 50% to 75% correct answers. 100% of the nursing staff (n = 20) attended the training.
   b) Medication Reconciliation Completion Rates: The average medication reconciliation completion rate was 641/1426 = 44.95% within project period. During the post project period, the average medication reconciliation competition rate was 45.20% (n = 427/1301).
   c) Care Guide Order Rates: The average care guide order rate was 16% (n = 228/1426) during the project period and 8.69% (n = 74/1301) during post project period.
3. Balancing Measures
   a) Average wait time: The average wait time remained stable during the pre-project, project and post project period. The average wait time was 43.57 min, 43.67 min and 40.42 min during the pre-project period, project and post project period respectively.
   b) Nursing and resident survey results: The five-point Likert scale was scaled from strongly disagree (1 point), disagree (2 points), neutral (3 points), Agree (4 points) and strongly agree (5 points). 26 residents and 8 nursing staff completed the survey. For satisfaction of delivering education, average was 3.7/5 and 4.3/5 among residents and nursing staff, respectively. For time constraint making it more stressful, the average was 2.4/5 and 2.1 among residents and nursing staff, respectively. For satisfaction with the new workflow, the average was 3.6/5 and 3.6/5 among residents and nursing staff, respectively. For comfort level with new HTN guidelines, residents scored 4/5.

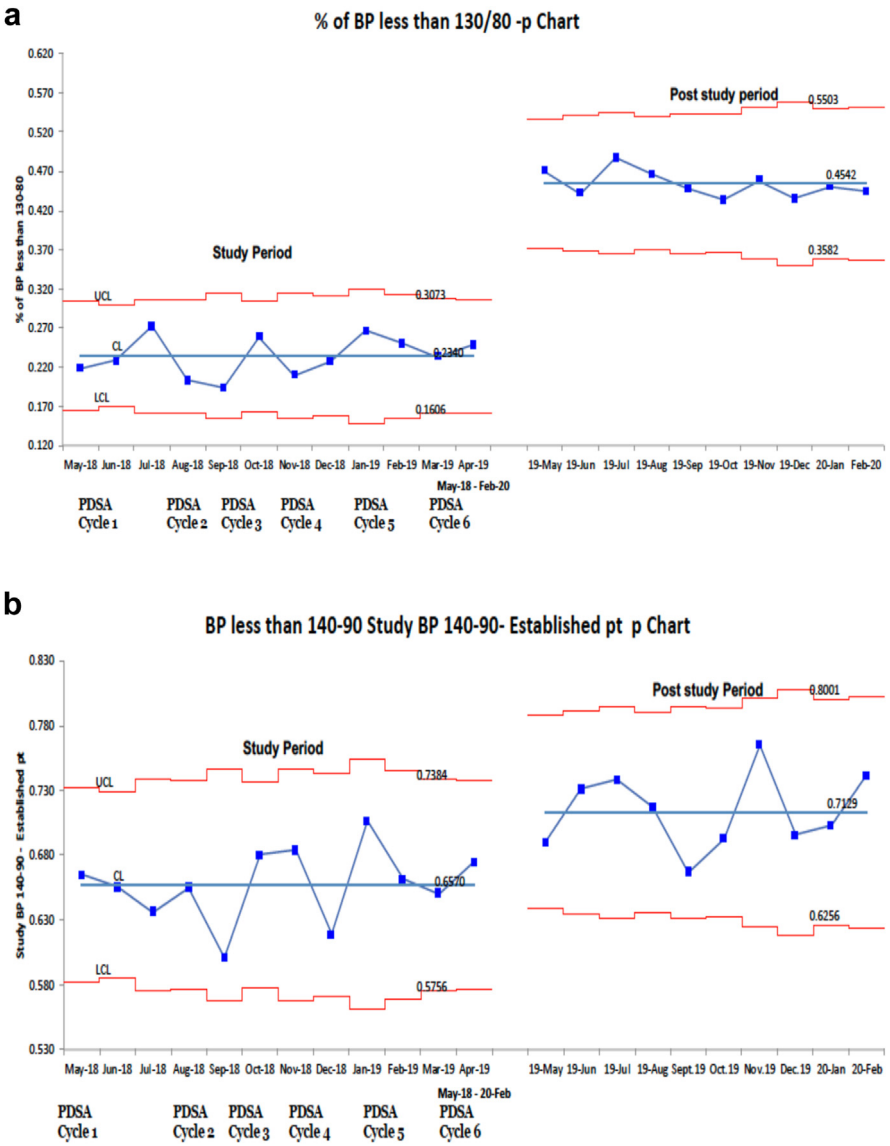

Fig. 4. Monthly P-charts. a) BP less than 130/80; b) BP less than 140/90.

4. Discussion

Currently, it is well documented that there are multiple barriers to achieving BP control, including patient adherence to medication, accuracy of BP measurement and lack of appropriate guideline based medical therapy [3]. In regards to patients, studies have found that lack of knowledge and importance of screening was the most common barrier to HTN management [3]. This QI project aimed to address identified barriers to optimal BP control in the safety-net clinic. Non-pharmacological therapy such as aerobic exercise and the Dietary Approach to Stop Hypertension (DASH) diet were strongly emphasized among our patient population during clinic visits. Physicians' knowledge gap about ACC/AHA HTN guidelines and clinical inertia in optimization of medications were found to be the major physicians' related barriers in this project. The uncertainty of medication adherence can inadvertently and mistakenly lead clinicians to modify patient medications and lead to decreased BP control [26]. In this project, the team utilized a "Brown Bag Review" of Medicine concept [24] and medication list from the pharmacy to perform accurate medication reconciliation and to assess medication adherence. However, pharmacy medication refill records may be more useful as previously demonstrated [27]. This study also focused on education to physicians, nursing staff and patients. A study by Cené et al. also addressed physician and patient education as a multicomponent intervention to lower BP within 12–24 months however, no differential effect was to improve medication adherence, home BP monitoring and lifestyle modifications [28]. Kronish et al., showed reduction in clinical inertia by providing clinicians with electronic reports summarizing medication adherence by patients and in return improved treatment of uncontrolled HTN [26]. Furthermore, Ferdinand et al. devised the main social determinants to medication non-adherence particularly in patients with HTN were suboptimal patient-provider communication and low socio-economic status [29].

Patients' non-adherence to medications and appointments were the most common patient related barriers in our population. We prioritized specific interventions to address these barriers. The BP less than 140/90 group attended more clinic visits and missed less appointments. Physicians implemented various strategies to overcome identified barriers for medication nonadherence in this project. These strategies included; 1) prescription of generic medications for BP to overcome cost barrier, 2) combination medications to improve medication adherence and to avoid poly pharmacy, and 3) prescription of 90 days' supply of medications at a time to overcome transportation barrier to pharmacy and to improve medication adherence. We enhanced patient engagement by empowering patients to engage in home blood pressure monitoring and improved patient-provider communication by increasing the number of clinic visits. This may have assisted in facilitating counseling for medication adherence and patient education. In a 2019 systematic review and meta-analysis, it was found that older patients that have been diagnosed with HTN for longer period of time as well as those with fewer medications had higher adherence in comparison to their younger counterparts [30]. A previous study showed that an effective phone coaching system wherein patients would have monthly phone calls served to improve medication adherence, home BP monitoring and lifestyle modifications [31].

Studies have previously shown that a week of home BP monitoring is likely a more accurate measurement of BP and has been shown to improve BP control and overall compliance to medical therapy; and has the advantage to diagnoses both white-coat HTN and masked HTN [31]. In the era of technological innovations and the abundancy of smartphones; the overall use of text messaging services has shown to increase patient adherence and follow up visits as seen in our patient population. A meta-analysis by Thakkar et al. showed an increase medication adherence rates from 50% to 67.8% by simply using text messaging services [32]. Digital pill boxes have also an important role in reminding patients to take their medications and have shown to increase medication adherence [29]. In this project, physicians prescribed home BP monitoring device to majority of the patients, however, some insurance company didn't pay for the device and patients could not afford it.

4.1. Lessons learned

4.1.1. Stakeholder Engagement

Increase in attendance rates of clinic visits resulted in patient education for HTN and counseling for medication adherence by nursing staff and physicians. Physicians focused on BP management and engaged in patient in shared decision-making process for medication optimization. Increase in patient interactions with physicians and nurses increased patient engagement. Patients appreciated the time and effort of the nursing staff and physicians to control their BP. The majority of patients were willing to check home BP and brought home BP logs to clinic visits. Stakeholder mapping was crucial to design stakeholder engagement strategy. Time constraints of information technology staff, nursing staff and physicians was a challenge during this project.

4.1.2. Medication Reconciliation

Physicians learned critical lessons regarding accurate completion of mediation reconciliation. About 35% of patients brought bottles of current medications and physicians found discrepancy between medications listed in EHR and home medications. Discrepancy included omission, duplication and incorrect dosing. Physicians instructed nursing staff to obtain a pharmacy medication list when physicians identified a discrepancy and when patients didn't bring bottles of current medications. Physicians recognized the barriers of patient knowledge and education regarding proper use of medications, and referred patients for home health nursing services for medication tray set up and to improve accuracy of medications. This was important in patients with transition of care from hospital discharge or emergency department and when patients were under care of multiple providers.

4.1.3. Health Information Technology

Lack of an automated decision support tool in EHRs was identified as a major barrier. Physicians and nursing staff didn't utilize the EHR templates to assess medication nonadherence due to time constraints. We observed about 30% completion rates for nursing staff and less than 10% completion rate for physicians. The medication adherence tool and care guide order required manual steps and there was a lack of EHR alert to remind physicians. Care guide order rates were suboptimal, however, nursing staff provided education in a different system in the EHR called "care notes". Care notes documentation didn't generate structured data to capture in the patient registry.

4.1.4. Study Limitations

Include: 1) Results cannot be generalizable to other settings, 2) We underestimated actual medication reconciliation performed by physicians during the clinic visit due to an extra manual step required to capture this in the database. Due to time constraints, most physicians forgot to complete this step after medication reconciliation completion, 3) We were unable to report accurate data on medication adherence, and 4) Due to the limited capability of the EHR and lack of resources to analyze data manually, we were unable to report a) actual change in prescriptions (increase in dose and/or addition of other agents, b) data specifically by medications and comorbidities. Patients with resistant hypertension or with comorbidities may not have gained full benefit from this intervention. The patient who did not achieve target BP attended fewer visits and had a higher ASCVD risk. Likely, these patients were under treatment for multiple conditions, and c) BP control rates in different ethnic groups and income groups. It may be likely that we may not have observed any differences in different income strata in rates of BP control as the majority of patients had Medicare, Medicaid or were uninsured.

4.2. Cost

There was no significant cost in conducting this project. Patients' clinic visits for BP control were paid by payors with costs being reimbursed by insurance. There was minimal cost involved in patient, physician and nursing staff education. Patient outreach to schedule clinic visits was done by clinic administrative staff as a part of their routine job. Furthermore, there may have been a cost saving by avoiding health care utilization (preventable emergency department visits and hospitalizations) for uncontrolled HTN.

4.3. Sustainability

Sustainability in any quality improvement remains a significant challenge. We incorporated factors that affect sustainability in the design of the QI project [33,34]. At ECMC, the organizational leadership is supportive and fosters a patient safety and quality culture. Continuous highly engaged front line staff, physicians and various stakeholders with frequent feedback of the project supports sustainability. The interventions that were designed in this study were incorporated in the routine workflow and have become a standard of care. We were able to show sustainability for 10 months post study period. March and April 2020 BP data were inaccurate due to lack of integration of remote patient monitoring with telehealth visits at the start of the COVID-19 pandemic in US. Integration of a telehealth approach with remote BP monitoring in EHR may improve efficacy of the intervention on patients with high risk and can ensure sustainability. This was not possible in the pre-COVID-19 era due to lack of reimbursement from various insurances/payors except under special circumstances (services provided in rural areas). During the COVID-19 pandemic, telehealth policy changes occurred that lifted these restrictions and now payment is covered for visits integrating telehealth and remote patient monitoring [35].

5. Conclusions

We achieved 62.6% (n = 885/1426) for BP < 140/90 and 24.47% (n = 349/1426) for BP < 130/80 within 12 months project period. We sustained and exceeded BP control <140/90 at 72.64% (n = 945/1301) and 44.58% (n = 580/1301) for BP < 130/80 during 10 months post project period. Overcoming physician clinical inertia, enhancing patient adherence to appointments and medications, and a high functioning multidisciplinary team were the key drivers for the success of this project. The multi-faceted strategies utilized in this project can be replicated in other settings.

5.1. Future directions

Future direction will include dissemination of various strategies utilized in this project at academic primary care sites of University at Buffalo to optimize BP goal, improving home BP monitoring to further diagnose mask and white coat HTN, and tracking ASCVD risk to optimize BP management based on ACC/AHA guidelines for stage 1 HTN. Additionally, integration of a telehealth approach with remote BP readings in EHR is planned as it may improve efficacy of the intervention on patients with high risk and may enhance sustainability.

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Author contributions

Cirous Sadeghi MD: Investigation, Writing - Original Draft
Hassan A. Khan MD: Investigation, Writing - Original Draft
Gregory Gudleski PhD: Formal analysis
Jessica L. Reynolds PhD: Formal analysis, Writing - Original Draft, Writing - Review & Editing, Visualization
Smita Y. Bakhai MD: Conceptualization, Methodology, Supervision, Project administration Writing - Original Draft, Writing - Review & Editing, Visualization

Declaration of competing interest

None.

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