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Article abstract

Background: Hypertension affects nearly 50% of adult Americans and can lead to serious cardiovascular complications, including myocardial infarction, stroke, and death. The Centers for Disease Control [CDC] (n.d.) noted that hypertension costs $131 billion a year in healthcare visits, medications to treat high blood pressure, and loss of productivity due to premature death.

Methods: The project consisted of four Plan-Do-Study-Act cycles that implemented two core interventions, with tests of change for each cycle driven by study of the data.

Results: Repeating blood pressure measurements improved from 14% to 69% over eight weeks, with a z-score calculated regarding the aim with a pre- and post-implementation $p < 0.0001$. Hypertension screening was used with 84% of eligible participants, and patient engagement was used with 39%.

Conclusions: This project improved hypertension screening and increased patient engagement. The interventions can be easily implemented in similar settings.

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Keywords: hypertension, quality improvement, screening, shared decision

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Introduction

Hypertension is known as the “silent killer” as it is associated with many life-threatening conditions, including cardiovascular disease and stroke (American Heart Association [AHA], 2019). One hundred and twenty million adult Americans are currently diagnosed with hypertension, with a mortality rate of 12.9 deaths per 100,000 (AHA, 2019). Hypertension costs $131 billion a year in healthcare visits, medications, and loss of productivity due to premature death (Centers for Disease Control, n.d.).

Available Knowledge

Uncontrolled hypertension plagues the American healthcare system. Hypertension-associated morbidity and mortality can be mitigated at multiple levels of prevention, including best practices associated with appropriate screening and diagnosis (Philip et al., 2022). Best practices include correct measurement of blood pressure and patient engagement through lifestyle modifications, pharmacologic interventions, or both (U.S. Preventive Services Task Force, 2021). Decision aids for hypertension management provide information about associated benefits and harms, and help clarify the congruence between decisions and personal values (Stacey et al., 2017).

Rationale

The Institute of Medicine (IOM) effective framework helps guide practitioners to use evidence-based practices consistently, avoiding the overuse of ineffective care and the underuse of effective care (IOM, 2001). The

project implemented workflows to improve standardized blood pressure screening and increase the utilization of shared decision-making tools (SDMT). The aim was to improve effective blood pressure assessment by obtaining secondary blood pressure measurements at the time of visit in 60% of patients across eight weeks. This involved eligible adults ages 18–85 years in a rural healthcare clinic.

Methods

North Country Primary Care is a healthcare clinic serving 9477 people in rural Vermont. The clinic has a 32% prevalence rate of hypertension, which is higher than the state average of 22% (Vermont Department of Health, 2023). In a chart audit, only 14% (*n* = 8 of 58) of charts documented a repeat blood pressure measurement if the first measurement was elevated. The audit found 5% (*n* = 3 of 58) of charts provided documentation of patient goals regarding lifestyle modifications for hypertension. A survey of patients revealed a mean of 2.7 on a Likert scale (1 = *no understanding of resources* to 5 = *very familiar with resources*) regarding knowledge of outpatient hypertension resources.

North Country Primary Care employs five physicians, four nurse practitioners, three physician assistants, eleven registered nurses, seven medical assistants, three dietitians, a clinical informatics nurse, a community health program manager, and two directors. The clinic is divided into four pods and serves approximately 144 patients a day. Most of the patient population is White (95%), and a majority have Medicare (37%) as a payor

source. Thirty two percent of patients supported by the clinic have been diagnosed with hypertension.

The project utilized the Plan-Do-Study-Act (PDSA) quality improvement process over an eight-week timeframe. Two core interventions were implemented, with one test of change (TOC) per intervention every two weeks. This doctoral project met the definition of quality improvement at Frontier Nursing University and does not qualify as human subjects research; thus, review by the institutional review board was not required. No external funding was received.

Interventions

The first core intervention was hypertension screening implemented using a rooming checklist (Table 1). The checklist was derived from the 2017 AHA guidelines for appropriate measurement techniques. The outcome of this tool was measured as compliance with 10 components of validated hypertension screening. Patients were asked three additional questions if their blood pressure was elevated above 140/90. These questions were associated with the project's aim of retaking blood pressure during the visit for eligible patients.

The second intervention was implemented with an SDMT to improve patient engagement in lifestyle modifications (Table 1). The SDMT was adapted from My Health Decisions (2024) and incorporated six evidence-based lifestyle modification options for improving blood pressure. A specific, measurable, achievable, relevant, time-bound (SMART) goal worksheet was

included (Meant2Prevent, 2020). The engagement tool outcome was measured as successful documentation of a SMART goal, the patient was offered a nutrition referral, appropriate follow-up was done, and a hypertension education packet was given.

Table 1

Core Interventions and Tests of Change

Core intervention	Plan-Do-Study-Act Cycle			
	1	2	3	4
Hypertension screening	Implement HTN rooming checklist	Implement visual aid for elevated BP	Display tobacco cessation posters	Spread HTN rooming checklist
Patient engagement	Implement HTN shared decision-making tool	Implement auto-text phrase for SMART goal	Display nutrition counselling posters	Make SMART goal documentation optional

Note. HTN = hypertension; BP = blood pressure; SMART = specific, measurable, achievable, relevant, time-bound

Measures

The project used one process measure and one outcome measure for each core intervention to evaluate tool utilization and the impact of the tools (Table 2). The first intervention process measure was the mean percent of hypertension screening tools used by rooming staff. The outcome measure evaluated compliance with the checklist items to ensure reliable blood pressure measurements.

The second intervention process measure evaluated the mean percent use of an SDMT between patients and providers. The outcome measure evaluated documentation of patient engagement to ensure tool effectiveness.

The project aim percentage was calculated using the number of patients with repeat blood pressures documented divided by the number of patients whose first blood pressure measurement was over 140/90. The balancing measure used a mean score of staff surveys about perception of workload using a Likert scale (1 = *strongly disagree* to 5 = *strongly agree*). Audits were completed throughout the project to ensure the accuracy and reliability of the data.

Study of Interventions and Analysis

The project team collected quantitative data through chart audits, rooming checklists, and staff surveys. Field notes were collected twice a week from the team, and patient feedback was gathered during the four PDSA cycles. All data were logged into Google Forms and Google Sheets. Aggregate data were noted on summary tables and plotted on run charts. Quantitative data were stratified every two weeks to explore disparities and healthcare gaps. Run charts were studied every two weeks for special-cause signals of change by noting shifts, trends, variability, and astronomical data points (Ogrinc et al., 2022). Run charts with a special cause signal of change indicated statistically significant change at a $p < 0.05$. The data were used to make iterative changes every two weeks throughout the project. The team

was evaluated in pre- and post-implementation surveys and balancing measure surveys.

Results

The aim of the project was to improve effective blood pressure assessment by obtaining a secondary blood pressure measurement in 60% of eligible patients. This improved from 14% (*n* = 8 of 58) to 69% (*n* = 116 of 169) over eight weeks. A z-score was calculated pre- and post-implementation and revealed a significance level of $p < 0.0001$. During four PDSA cycles over eight weeks, 317 eligible patients were identified. The demographics within the sample showed 99% (*n* = 314 of 317) identified as White, 0.5% (*n* = 1 of 317) as Asian, and 0.5% (*n* = 2 of 317) as Black/African American. This is congruent with Vermont's census data of predominantly White, at 61% (America Counts Staff, 2021). The mean age for the project was 60, with a median age of 62 and an age range of 19 to 84. The rural healthcare clinic serves a higher Medicare population than the state average. The project sample had 46% (*n* = 145 of 317) of patients enrolled in Medicare, higher than Vermont's 15% average (America Counts Staff, 2021). The balancing measure followed staff perception of workload with a six-question survey completed at the end of every week using a Likert scale (1 = *strongly disagree* to 5 = *strongly agree*). The mean score was calculated, with a total score of 4.2 and a goal of 4. Team members reported a mean score of 3.8 for the question "Rechecking an elevated blood pressure does not greatly impact the rooming process" in PDSA 1, which improved to 4.5 in PDSA 4.

Table 2

Core Intervention Measures and Results

Core interventions			Baseline			PDSA 4			Project total		
Intervention:	Tool:	Operational definitions	*N*	*n*	% or *M*	*N*	*n*	% or *M*	*N*	*n*	% or *M*
Hypertension screening	Hypertension rooming checklist	Process: no. of HTN visits with checklist used/no. of HTN patients seen				106	93	88	317	265	84
		Outcome: Hypertension checklist compliance [a]			10	106		81	317		78
Patient engagement	Hypertension shared decision-making tool	Process: no. of SDMTs used in HTN patient visits/no. of HTN patients seen				106	50	47	317	125	39
		Outcome: Patient engagement [b]			23	106		40	317		41

Note. PDSA = Plan-Do-Study-Act; HTN = hypertension; SDMT = shared decision-making tool Blank cells indicate no values were collected.
[a] Position (6) + Cuff size (1) + Environment quiet (1) + Nicotine/Caffeine (1) + Documentation (1) / 10; [b] SMART goal documented in chart (1) + Nutrition referral accepted (1) + Follow-up scheduled in appropriate interval (1) + Education packet given (1) / 4

Hypertension Screening

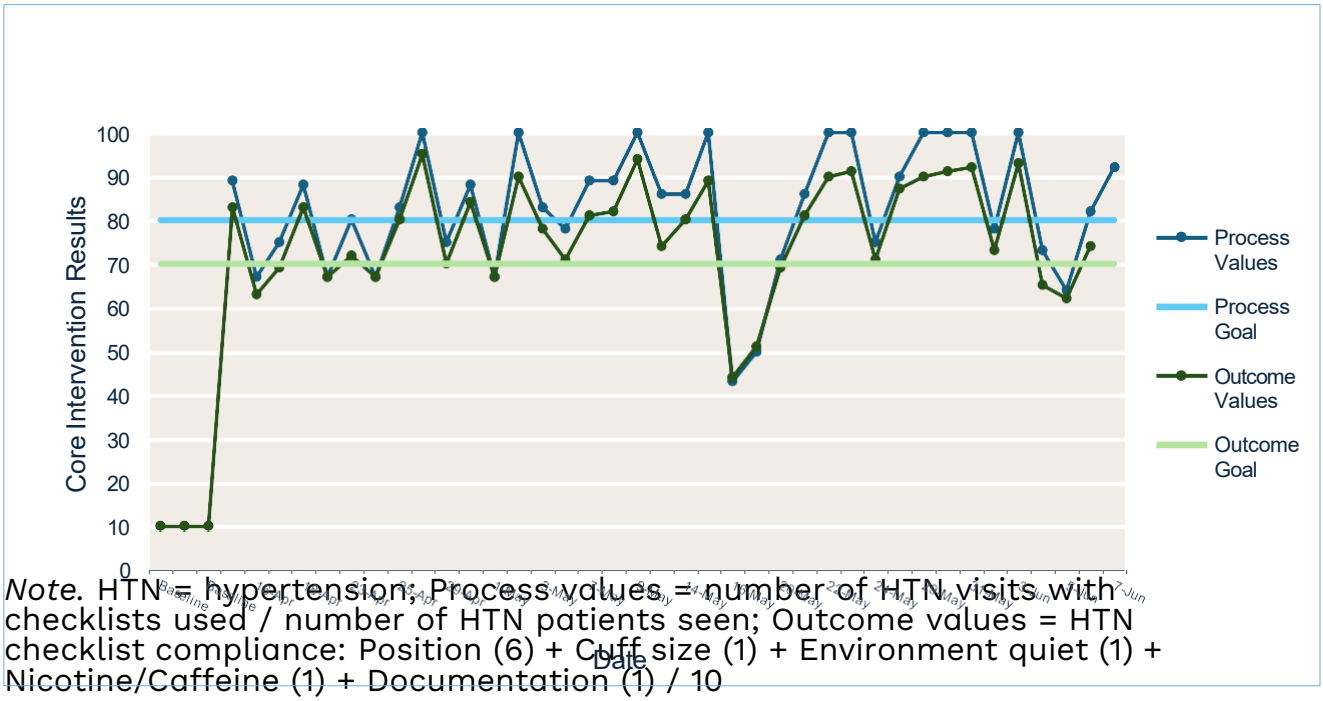
Hypertension screening, carried out with a rooming checklist, was used with 84% (*n* = 265 of 317) of eligible participants; the mean percent outcome

score for checklist compliance was 78% (Table 2). In PDSA 1, the screening tool was implemented with a process measure of 80% (*n* = 56 of 70) and an increase in outcome measure from 10% to 74%. The TOC for PDSA 2 was implementing a visual aid for elevated blood pressure readings that required a recheck because only 60% (*n* = 29 of 48) of patients had repeat blood pressure measurements. This increased the utilization of the rooming checklist to 86% (*n* = 59 of 69) and the outcome measure to 80%. The visual aid was the most successful TOC for the screening process measure and the project's aim (Figure 1). In PDSA 2, disparities were noted in patients with current tobacco use, as only 30% (*n* = 18 of 59) of smokers were screened appropriately. The TOC for PDSA 3 was displaying tobacco cessation posters in the clinic. PDSA 3 saw the process measure drop to 79% (*n* = 57 of 72) and the outcome measure decrease to 74% (Figure 1). The decrease was caused by a lack of tools utilized one day when the project lead was out of the clinic. The TOC for PDSA 4 was driven by clinic stakeholders, who requested the implementation of the checklist in another area. The process measure improved to 88% (*n* = 93 of 106) for PDSA 4, and the outcome improved to 81%. The process run chart had no shifts, and one trend was noted. This was considered a special-cause signal of change, indicating statistically significant change happened with the intervention (Figure 1). The outcome run chart showed two trends and no shifts (Figure 1). The trends in PDSA 3 and PDSA 4 represent special-cause signals of change, indicating that

significant change had occurred with the outcome of the hypertension screening tool.

Figure 1

Hypertension Screening Intervention Results



Note. HTN = hypertension; Process values = number of HTN visits with checklists used / number of HTN patients seen; Outcome values = HTN checklist compliance: Position (6) + Cuff size (1) + Environment quiet (1) + Nicotine/Caffeine (1) + Documentation (1) / 10

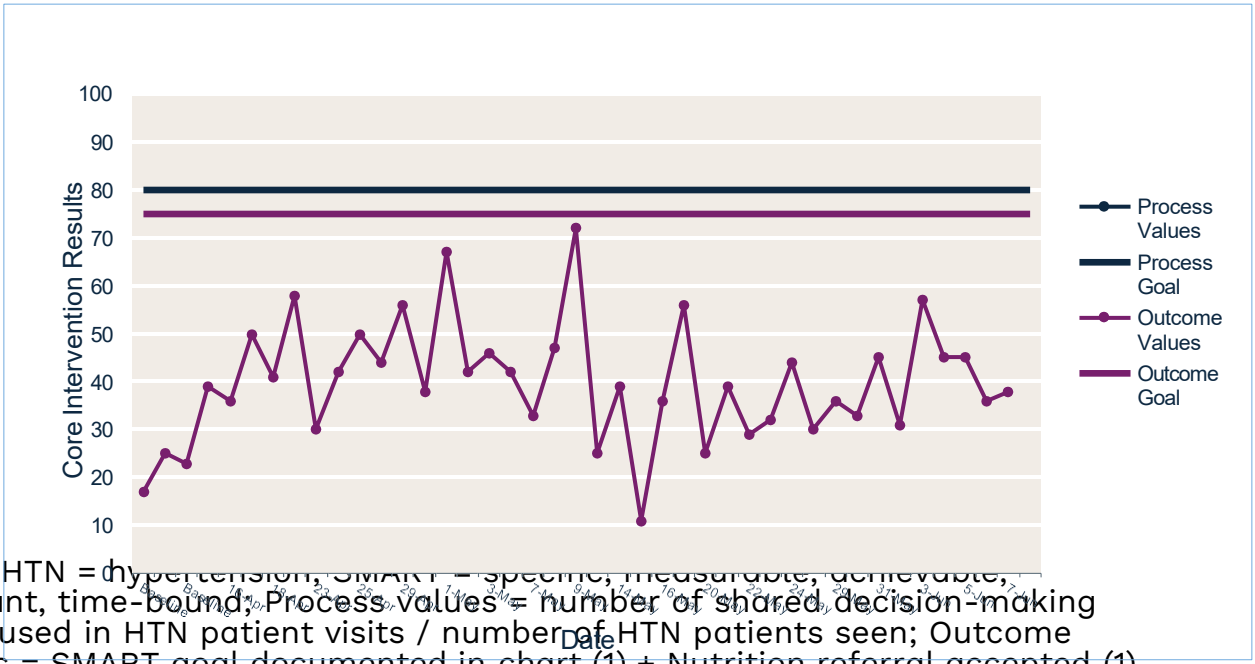
Patient Engagement

The second core intervention was patient engagement, carried out by an SDMT. The SDMT was used with 39% (*n* = 125 of 317) of patients during the implementation period. The mean outcome percentage was 41% (Table 2). In PDSA 1, the tool was implemented, resulting in a process measure of 37% (*n* = 26 of 70) and an outcome measure that improved from 23% to 43% (Figure 2).

The TOC for PDSA 2 implemented an auto-text phrase due to field notes of documentation burden. This increased the process measure to 42% (*n* = 29 of 69) and outcome measure to 49%. Upon further investigation, 80% (*n* = 51 of 64) of female patients and 62% (*n* = 38 of 61) of male patients chose dietary changes to improve blood pressure (Table 3). Chart audits noted a poor referral pattern for nutrition counselling; the TOC for PDSA 3 was to display nutrition counselling posters. The PDSA 3 cycle saw a decrease in the process measure to 28% (*n* = 20 of 72) and outcome measure to 35% (Figure 2). The decrease may have been due to providers not engaging patients in nutrition counselling, instead waiting for patients to inquire about services. Field notes showed a continued burden of documentation of the SMART goal noted by providers. In PDSA 4, the TOC made SMART goal documentation optional. This improved the process measure to 47% (*n* = 50 of 106) and outcome measure to 40%. This was the most successful TOC. Although the engagement gains were more modest than the screening gains, providers found the SDMT useful and positively impacted patient care. The project noted that 65% (*n* = 17 of 26) of patients who were seen in follow-up had decreased blood pressure readings, and of those patients, 77% (*n* = 20 of 26) were engaged with the SDMT at their initial visit. The process and outcome run chart had no shifts, trends, or astronomical data points. This was considered a common-cause variation (Figure 2).

Figure 2

Patient Engagement Intervention Results



Note. HTN = hypertension; SMART = specific, measurable, achievable, relevant, time-bound; Process values = number of shared decision-making tools used in HTN patient visits / number of HTN patients seen; Outcome values = SMART goal documented in chart (1) + Nutrition referral accepted (1) + Follow-up scheduled in appropriate interval (1) + Education packet given (1) / 4

Team Engagement

A pre- and post-implementation team survey about perceived workload and employee satisfaction was completed, asking seven Likert-type questions (1 = *strongly disagree* to 5 = *strongly agree*) and three open-ended questions. The mean for the Likert items was 3.5 in pre-implementation and 4.3 in post-implementation. A weekly balancing measure survey was utilized to monitor the perceived workload of staff. Field notes recorded initial

rooming staff dissatisfaction with the rooming checklist. Reeducation was done, reinforcing the importance of appropriate screening. Providers had a positive experience with the SDMT and requested tools for other chronic diseases. Adding both interventions did not impact the staff's perception of workload. The balancing measure for perceived workload improved from a mean of 4 in pre-implementation to 4.2 postimplementation.

Discussion

The goal of rechecking blood pressure at the time of the visit was surpassed throughout the project, exceeding the baseline within the first PDSA cycle. Blood pressure rechecks were completed at the time of the visit, more than five minutes after the initial measurement. The percentage of patients screened for hypertension exceeded the expected goal by the end of the project. The successful documentation of the hypertension screening process also exceeded the goal (Figure 1). Implementing the screening tool improved blood pressure measurement techniques and became a standardized protocol. The SDMT improved patient awareness of lifestyle modifications and clinic resources. The percentage of SDMT utilization showed modest improvement throughout the project. The documentation burden ultimately impacted the effectiveness of the SDMT. Effective care from the interventions was noted because the need for rechecking blood pressure decreased and patients had improved blood pressure measurements from the first appointment. The project can be generalized to similar rural

healthcare centres or outpatient clinics. The project noted a low cost in initiating the new protocols and SDMT tools.

Interpretation

Initiating the rooming checklist led to effective screening for hypertension, standardized protocols, and improved staff competency. A study done by Ganetzky et al. (2023) found that correct blood pressure measurement techniques were crucial for accurate diagnoses and interventions. Research has found that patients with hypertension are at risk for worsening disease if there are poor clinic workflows, staffing shortages, multiple competing patient concerns, and limited appointment availability in the clinic setting (Ganetzky et al., 2023). The project improved patient care and outcomes by establishing this protocol.

The project positively impacted provider and patient relationships with the SDMT. Healthcare systems should provide adequate resources to implement a standard process to engage patients and providers in shared decision making (Casey et al., 2022). Providers require extra time to educate and document an SDMT, which requires efficient documentation practices and workflows within the clinic. The project found that patient engagement helped patients be more active in choosing a lifestyle modification to improve their blood pressure (Table 3). Encouraging patients to engage in shared decision making helped strengthen patient-provider relationships and helped patients set practical goals for managing their chronic disease (Fang et al., 2022).

The project's aim was most influenced by the addition of a visual aid to increase secondary blood pressure measurements, which are important for accurate diagnosis and treatment of hypertension (AHA, 2019). A study by Choe et al. (2022) saw an increase in documentation compliance by using a visual infographic for patients during nonemergent visits. Utilizing a visual aid improved patient care by confirming blood pressure measurement and provided an opportunity for the patient and provider to discuss the management of hypertension thoroughly.

Table 3

Audit Summary Table of Patient Engagement Intervention

Outcome criteria	Gender (%)		Age in years (%)				Race (%)		
	Male (*N* = 185)	Female (*N* = 132)	17–30 (*N* = 10)	31–50 (*N* = 65)	51–80 (*N* = 225)	80+ (*N* = 17)	White (*N* = 314)	Black /AA (*N* = 2)	Asian (*N* = 1)
SMART goal documented[a]	22	35	60	39	24	6	27	0	100

Choice of SMART goal	Gender (%)		Age in Years (%)				Race (%)		
	Male (*N* = 61)	Female (*N* = 64)	17–30 (*N* = 7)	31–50 (*N* = 33)	51–80 (*N* = 81)	80+ (*N* = 4)	White (*N* = 124)	Black /AA (*N* = 2)	Asian (*N* = 1)
Diet to lower BP	62	80	71	64	73	100	71	0	100
Eat less salt	16	9	0	6	16	2	13	0	0
Lose weight	21	39	14	36	30	0	31	0	0
Drink less ETOH	7	6	29	9	2	25	6	0	0
Exercise regularly	26	19	0	21	26	0	23	0	0
Tobacco/ nicotine cessation	18	13	14	18	15	0	15	0	0

Note. AA = African American; SMART = specific, measurable, achievable, relevant, time-bound; BP = blood pressure; ETOH = alcohol
[a] SMART goal documented in the chart (1) + Nutrition referral accepted (1) + Follow-up scheduled in the appropriate interval (1) + Education packet given (1) / 4

Limitations

The limitations of the project included a lack of diversity noted with a mostly White, non-Hispanic, and English-speaking population. This may limit generalizability in other areas of the country with higher demographic diversity. Other limitations include that the rooming checklist and the SDMT were not validated tools. Although not validated, the tools were standardized from the AHA toolkit (2019) and My Health Decisions (2024). There may have been bias in chart audits regarding documentation and certain language necessary to capture data. To overcome these limitations, chart audits were standardized for all providers when capturing data. Although these limitations were noted, effective change was achieved from the project.

Conclusions

The project's aim was to improve effective hypertension care by obtaining secondary blood pressure measurement in 60% of eligible patients in eight weeks. Through the implementation of the two interventions, the goal was met and maintained throughout the project. Repeated blood pressure measurements have remained a standard practice within the clinic. Patients continue to be engaged through education and use of SDMT with certain providers. Low cost of implementation and minimal impact on existing operations demonstrate the potential to spread this practice to other sites. Further investigation is needed to determine if obtaining a secondary measurement increases the rooming process time and which team member should be responsible for obtaining the measurement.

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