

## Quality Improvement Initiatives Improve Hypertension Care Among Veterans

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**Background**—We implemented a quality improvement initiative to improve hypertension care at Veterans Affairs–Tennessee Valley Healthcare System.

**Methods and Results**—We implemented multiple interventions among 2 teaching hospitals, 5 community-based outpatient clinics, and 4 contract clinic sites. Goals of the program were to (1) improve measurement and documentation of blood pressure (BP), (2) initiate outpatient patient education, (3) emphasize VA/Department of Defense hypertension treatment algorithms to providers, (4) emphasize external peer review program performance goals, and (5) initiate feedback of each clinic's performance. The primary outcome was the proportion of patients seen each week with a diagnosis of hypertension who had their last available BP in control ( $\leq 140/90$  mm Hg). Observation time was 40 weeks (14 weeks preintervention, 8 weeks intervention implementation, and 18 weeks postintervention), during which there were 55 586 unique clinic visits for hypertension. After intervention deployment, there was an absolute improvement of 4.2% in BP control (preintervention 61.5% [12 245/19 908] versus postintervention 65.7% [15 809/24 059],  $P < 0.0001$ ). Teaching hospital A had an absolute improvement of 1.4% (63.4% [3544/5591] versus 64.8% [4581/7073],  $P = 0.108$ ). Teaching hospital B showed a 0.8% absolute improvement in BP control (59.7% [2577/4315] versus 60.5% [3416/5650],  $P = 0.456$ ). The community-based outpatient clinics had a combined absolute improvement of 8.6% (60.2% [5252/8728] versus 68.8% [6895/10025],  $P < 0.0001$ ). The contract clinics had a combined improvement of 1.5% (68.4% [872/1274] versus 69.9% [917/1311],  $P = 0.409$ ). Results were sustained 1 year after intervention.

**Conclusions**—After implementing small, focused, and inexpensive interventions, BP control improved 4.2%, thereby improving the quality of hypertension care. (*Circ Cardiovasc Qual Outcomes*. 2009;2:392-398.)

**Key Words:** hypertension ■ quality of healthcare ■ outcome assessment ■ guideline adherence

Currently, >50 million people in the United States have hypertension.<sup>1</sup> In 2000, an estimated 60% of adults in the United States carried a diagnosis of prehypertension or hypertension, an increase of approximately 10% from the previous decade.<sup>2</sup> If not properly controlled, elevated blood pressure (BP) can lead to serious patient morbidity and mortality, including stroke, coronary heart disease, myocardial infarction, congestive heart failure, and death.<sup>6</sup> *The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure* (JNC 7) advocates the use of effective therapies that promote BP goals of  $< 140/90$ <sup>3-6</sup> for patients without diabetes or renal disease. However, despite widespread guideline promotion, only  $\approx 35\%$  of people in the United States with hypertension are controlled to this goal.<sup>1,7-9</sup>

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Nationally, the Veterans Administration (VA) has set a performance goal that 75% of veterans with a diagnosis of hypertension have their last measured BP  $< 140/90$  mm Hg. In 2006, approximately 60% of the estimated 50 000 veterans with hypertension within the VA–Tennessee Valley Healthcare System (VA-TVHS) met this BP goal. Although more VA patients with hypertension have their BP controlled as compared with the private sector, there remains room for significant improvement.

A review of hypertension goal attainment in primary care found that multifaceted interventions yield the largest positive impact.<sup>10,3,11-16</sup> Frequently, these programs involve complex interventions intended to change clinician behavior, change organizational structure, deliver information to the

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provider, or increase patient awareness through educational programs. In an effort to improve the quality of hypertension care locally, the VA-TVHS and office of quality management began a quality improvement initiative to identify specific problems and implement improvements to hypertension care. The quality improvement initiative sought to (1) identify barriers in hypertension treatment, (2) implement targeted interventions to improve hypertension care, and (3) monitor the postintervention effect on BP control. We hypothesized that a multifaceted approach engaging all stakeholders, including patients, nurses, and providers, would improve hypertension performance.

### Local Challenges in Implementation

In August 2006, the office of quality management and chief of staff office were charged to improve hypertension care throughout the VA-TVHS. A voluntary hypertension quality improvement team was assembled, composed of physician leaders in primary care; a hypertension physician specialist; a cardiologist; nurses from primary care, endocrinology, and cardiology; and quality improvement experts. At the first meeting, a physician trained in quality improvement used a nominal group process<sup>17</sup> to query the group for barriers impeding hypertension performance goals. The nominal group process has been used as a method for goal setting in other quality improvement initiatives.<sup>18–20</sup> Because each provider has a unique perspective in daily primary care clinic operations, each member shared recurrent problems that impede the optimal delivery of outpatient hypertension care. The group identified several obstacles that needed to be overcome in an effort to improve the quality of hypertension care delivered within VA-TVHS; these barriers to BP control could be classified into 1 of 3 categories.

#### Patient-Level Factors

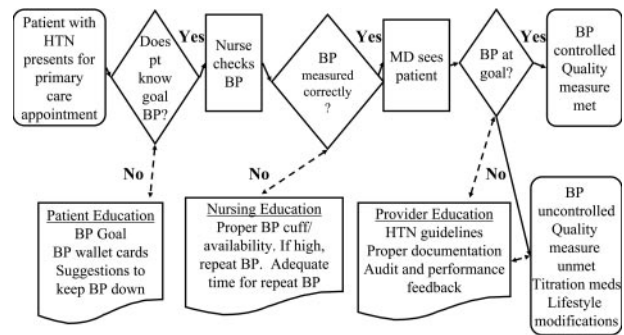
Barriers identified in this category included patient noncompliance with visits and medications, lack of knowledge about BP goals and medications, “white coat hypertension,” and complexity of comorbid illnesses. Many providers reported that the population of patients with hypertension who are cared for in the southeastern United States may be comparatively sicker than the general population, given the higher prevalence of obesity, diabetes, and cardiac disease.<sup>21</sup>

#### Clinic-Level Factors

One barrier identified at the clinic level was inaccurate measurement of patient BPs. When this barrier was explored further, it was deconstructed into many other barriers, including failure of the nurse to allow the patient a “rest period” before the BP measurement and failure to obtain and document at least 2 BP measurements per patient. Additionally, the team noted that there was underutilization of the clinical reminder system by healthcare providers. The reminder system highlights patients who have 2 elevated BPs and then recommends the provider to take action (such as medication initiation or titration).

#### Provider-Perceived Flaws Within the External Peer Review Performance Process

The barriers identified included inaccurate representation of clinical practice, small numbers of chart reviews within the



**Figure 1.** Current process map of hypertension treatment and proposed interventions.

external peer review performance process, and unawareness of external peer review performance process hypertension performance measures. Unawareness of hypertension performance measures was thought to be more pronounced among associate providers such as resident physicians and nurse practitioners.

### Design of the Initiative

Once the challenges to achieving successful hypertension treatment were identified, the committee designed specific interventions in response to these obstacles. Figure 1 depicts a process map of the current process and the intervention steps proposed by the improvement team. Interventions were targeted to 4 areas: nursing education, patient education, provider education about hypertension guidelines, and provider education about performance standards with audit and performance feedback.

#### Nursing Education

The goal of this intervention was to promote the proper measurement and documentation of BP in the computerized patient record system. To achieve this, a new nursing protocol and checklist for accurate BP measurement were created. They emphasized proper positioning of the patient; proper placement of the cuff, including correct cuff size; importance of allowing the patient to rest before the measurement; and checking a second BP measurement and recording it in the patient’s chart. A nurse leader was identified for each outpatient primary care clinic and certain specialty clinics (endocrinology, cardiology). Nursing in-services were conducted by each nurse leader to disseminate the new protocol. In addition, in one clinic with a particularly high patient volume, an exit nurse was assigned to measure an exit BP if the initial BP was elevated.

#### Patient Education

The goal of the intervention was to educate patients about their current BP and goal BP. Patients were educated at every primary care clinic visit by nursing staff, and this educational information was reinforced by the healthcare provider. A “take-home” BP wallet card was created (online-only Data Supplement), which included areas for documenting BP goal, tracking clinic visit BPs, maintaining an updated list of current antihypertensive medications, and writing patient-specific special instructions. The card also included the

provider name and emergency telephone number, pharmacy refill telephone number, an outline of appropriate lifestyle changes, and proposed questions to ask the provider at clinic visits. The card was completed by both the nurse and provider at the clinic visit and discussed with the patient. Patients were asked to keep the card, record their own BPs, and present it for review and updates at each visit. Twenty thousand patient BP wallet cards were printed and distributed among the primary care, cardiology, and endocrine clinics.

### **Provider Education About Hypertension Guidelines**

Our third intervention sought to make providers aware of VA/Department of Defense (DOD) recommendations for diagnosis, management, and treatment of hypertension through the creation and distribution of laminated pocket cards to all clinical primary care providers. Each card outlined the VA/DOD hypertension guidelines, algorithm, and treatment options. Additionally, posters demonstrating the VA/DOD algorithm were created and posted in all primary care clinics. These posters depicted the recommended medication table and were readily available for viewing by providers, nursing staff, and patients.

### **Provider Education About Peer Review Performance Goals With Audit and Performance Feedback**

The final intervention initiative sought to educate providers about the hypertension performance measure goals and provide insight into local performance results. This was done by conducting one-on-one provider educational in-services about the national performance measures and goals for hypertension treatment. Additionally, 2 physicians conducted audit and feedback of provider and firm performance data and presented the results to each individual provider. Approximately every month, all providers were presented with a spreadsheet that listed each provider's name, the number of patients each provider had seen with a diagnosis of hypertension, and percentage of patients that had achieved a goal BP. All presented data were aggregate deidentified data. If a provider wanted the specific list of patients that each month's extract was based on, they could request that at any time. This was designed to engage providers actively in the hypertension initiative and promote provider self-assessment and awareness.

### **Implementation of the Initiative**

This quality improvement initiative was designed to improve BP control in veterans who received primary care at the VA-TVHS. At the time of the intervention, the healthcare system comprised 2 teaching hospitals, 5 community-based outpatient clinics (CBOCs), and 4 contract community clinics. In fiscal year 2006, there were 624 640 outpatient visits by 79 279 veterans, and 41 581 carried a diagnosis of hypertension. All VA-TVHS patients >18 years of age with an outpatient visit for hypertension (visit associated with ICD-9 code of 401.0, 401.1, or 401.9) were included for the intervention. Any needed patient-specific information, such as vital signs and diagnoses, were obtained from the Mid-

South Data warehouse, a relational database of local and network data updated monthly from the Veterans Health Information System and Technology Architecture clinical information systems. Small rapid cycle interventions were implemented starting November 1, 2006. All interventions were implemented within 2 months throughout the 2 teaching hospitals, 5 CBOCs, and 4 contract clinics of VA-TVHS. Intervention adoption was favorable by the majority of key stakeholders (patients, nurses, and providers), but as anticipated, there was some local response by providers of denial, scrutiny, and disbelief to the performance data and need for intervention.

To measure the effects of our interventions it was essential to monitor our work.<sup>22</sup> The primary outcome was the proportion of patients seen with a hypertension diagnosis who had their BP controlled ( $\leq 140/90$  mm Hg) each week from August 1, 2006, through April 30, 2007 divided among the 3 intervention time periods. The 3 time periods were: August 1, 2006, through October 31, 2006 (14 weeks preintervention); November 1, 2006, through December 31, 2006 (8 weeks for the intervention deployment); and January 1, 2007, through April 30, 2007 (18 weeks postintervention). Given that patients may have had multiple visits for hypertension in each time period, only the patient's last recorded BP measurement was extracted from the data warehouse for each eligible time period. The secondary outcome was the proportion of patients seen with a hypertension diagnosis who were dispensed a thiazide-type diuretic during each of the intervention time periods.

The Pearson  $\chi^2$  test was used to compare proportions of BP control and proportions of thiazide-type diuretic use before and after intervention implementation. Analysis was conducted using Stata 10.0 (Stata Corp) and Statistical Process Control XL 2000. Statistical Process Control p-charts following proportion of patients with controlled BP per week during the observation period were generated, and data were interpreted according to the Western Electric decision rules<sup>23</sup> with 99% confidence intervals. The authors had full access to the data and take responsibility for the integrity of them. All authors have read and agree to the manuscript as written. This study was approved by the TVHS institutional review board and research and development committee.

## **Success of the Initiative**

### **Primary Outcome: Proportion of Patients With BP Controlled**

During the intervention study period, there were 55 586 unique clinic visits for hypertension: 19 908 unique visits for hypertension during the preintervention period, 11 619 unique visits during intervention deployment, and 24 059 visits in the postintervention period (Table). After interventions were implemented, there was an absolute improvement in BP control of 4.2% (preintervention 61.5% control versus intervention deployment 61.3% versus postintervention 65.7%,  $P < 0.0001$ ). As shown in Figure 2, the proportion of patients with BP at goal was significantly improved after the intervention was completed. Throughout the study period, the process was in statistical control.<sup>23</sup>

**Table. Volume of Patients With Hypertension and Proportion Controlled Among All Clinics at Each Intervention Stage**

	TVHS Total	Teaching Hospital A	Teaching Hospital B	CBOC Clinics	Contract Clinics
No. of clinics	18	5	4	5	4
Preintervention 8/1/06 to 10/31/06 (14 weeks)					
BP controlled, n* (%)	12 245 (61.5)	3544 (63.4)	2577 (59.7)	5252 (60.2)	872 (68.4)
Outpatients with HTN, n†	19 908	5591	4315	8728	1274
Intervention 11/1/06 to 12/31/06 (8 weeks)					
BP controlled, n* (%)	7128 (61.3)	1990 (62.8)	1613 (57.3)	3075 (61.9)	450 (67.7)
Outpatients with HTN, n	11 619	3170	2815	4969	665
Postintervention 1/1/07 to 4/30/07 (18 weeks)					
BP Controlled, n* (%)	15 809 (65.7)	4581 (64.8)	3416 (60.5)	6895 (68.8)	917 (69.9)
Outpatients with HTN, n†	24 059	7073	5650	10 025	1311
% change‡	+4.2	+1.4	+0.8	+8.6	+1.5
P value‡	<i>P</i> <0.0001	<i>P</i> =0.108	<i>P</i> =0.456	<i>P</i> <0.0002	<i>P</i> =0.409
1 Year Postintervention 1/1/08 to 4/30/08 (18 weeks)					
No. of Clinics	20 clinics	6 clinics	6 clinics	4 clinics	4 clinics
BP Controlled, n* (%)	12 312 (65.7)	4061 (66.7)	3255 (69.8)	4454 (63.0)	542 (59.6)
Outpatients with HTN, n†	18 732	6088	4661	7073	910
% change§	+4.2	+3.3	+10.1	+2.8	-8.8
P value§	<i>P</i> <0.0001	<i>P</i> <0.0001	<i>P</i> <0.0001	<i>P</i> <0.0001	<i>P</i> <0.0001

HTN indicates hypertension.

\*Defined as  $\leq 140/90$  mm Hg based on last recorded outpatient BP for patient in each timeframe.

†Outpatient visit in last 365 days with ICD-9 diagnosis of: 401.0 (malignant hypertension), 401.1 (essential hypertension), or 401.9 (unspecified hypertension).

‡Comparison between preintervention and postintervention.

§Comparison between preintervention and 1 year postintervention.

The proportion of patients who had their last BP controlled also varied by site. As seen in Figure 3, the 5 outpatient clinics (CBOCs) demonstrated the most clinically significant change in BP control beginning with 60.2% of patients with BP controlled (5252 of 8728 patients) and ending with 68.8% of patients with BP controlled after intervention (6895 of 10 025 patients, *P*<0.0001). This equates to an 8.6% absolute improvement in BP control for all CBOCs combined. Although one CBOC site had worse control after the intervention by 0.4%, the remaining 4 sites showed positive improvement in hypertension control ranging from 6% to +15.1%.

Teaching hospital A had an absolute improvement of 1.4% over the intervention study period. At baseline, 3544 of 5591 patients (63.4%) had a goal BP, and after intervention 4581 of 7073 patients (64.8%) had BP at goal (*P*=0.108). Teaching hospital B showed a somewhat less improvement in BP control, starting with 59.7% of patients in control (2577 of 4315 patients) and ending with 60.5% at goal (3416 of 5650, *P*=0.456). The 4 contract clinics also had a combined improvement of 1.5% (68.4% [872 of 1274 patients] versus 69.9% [917 of 1311], *P*=0.409).

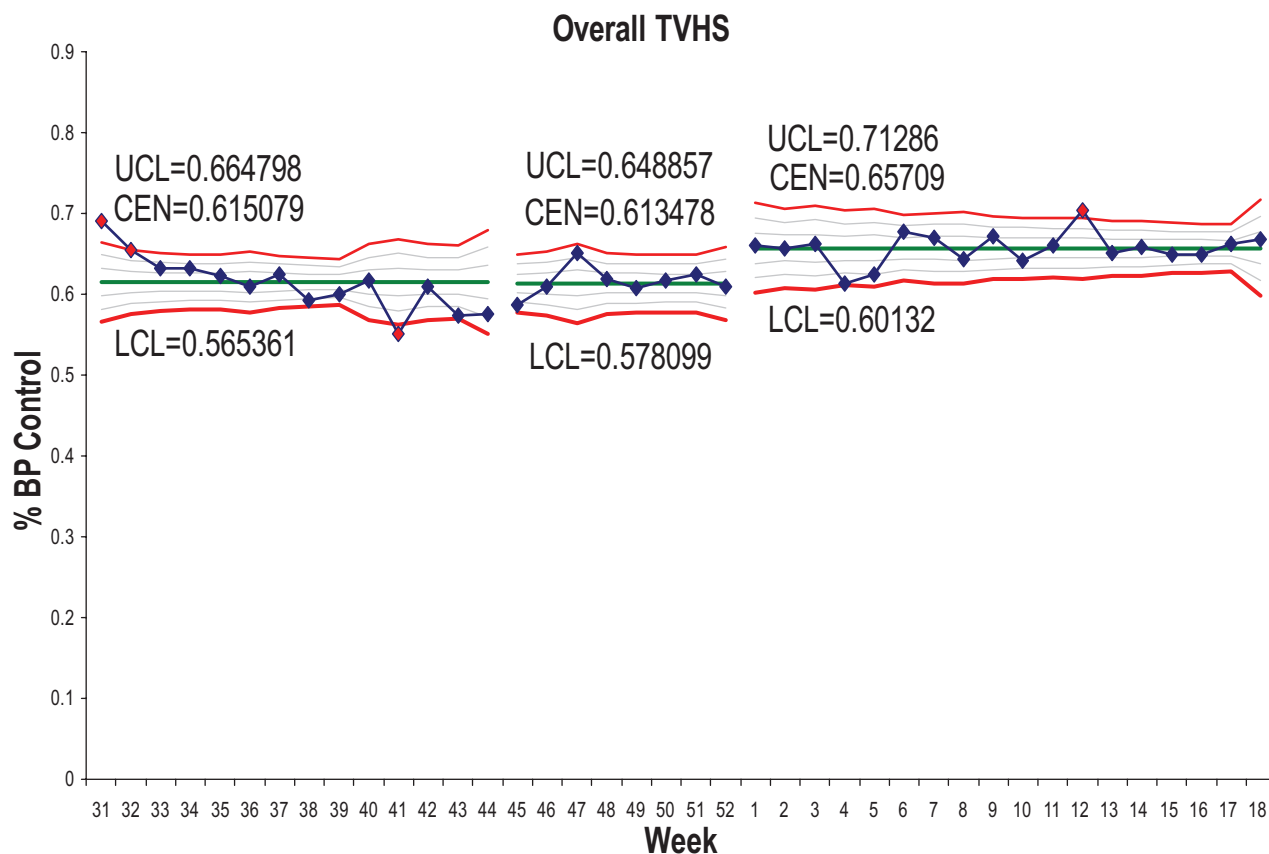
To examine intervention sustainability, the proportion of patients who had their BP controlled was assessed 1 year after intervention implementation, from January 1, 2008, to April 30, 2008 (Table). During this time period there was organizational restructuring and addition of primary care clinics within our healthcare system. Therefore during the 1-year

postintervention period teaching hospital A gained an additional clinic, teaching hospital B gained 2 additional clinics, and 1 of the CBOC sites was reassigned to another healthcare system.

Between January 1, 2008, and April 30, 2008, there were 37 464 unique visits for hypertension. One year after interventions were implemented, the 4.2% absolute improvement in BP control for TVHS remained (preintervention 61.5% control versus 1 year postintervention 65.7%, *P*<0.0001). Teaching hospital A experienced continued improvement with an absolute improvement in BP control of 3.3% (preintervention 63.4% control versus 1 year postintervention 66.7%, *P*<0.0001). Teaching hospital B also experienced continued improvement with a significant 10.1% positive change in BP control (preintervention 59.7% control versus 1 year postintervention 69.8%, *P*<0.0001). Although the contract clinic sites saw an 8.8% decline in BP control (preintervention 68.4% control versus 1 year postintervention 59.6%, *P*<0.0001), the CBOCs maintained a positive 2.8% change (preintervention 60.2% control versus 1 year postintervention 63.0%, *P*<0.0001).

### Secondary Outcome: Proportion of Patients With Hypertension Who Were Dispensed a Thiazide-Type Diuretic

Given that one of the points emphasized in the VA/DOD hypertension treatment guidelines and by the hypertension



**Figure 2.** Control chart of BP control preintervention, during intervention, and postintervention at TVHS. UCL indicates upper control limit; CEN, central tendency; LCL, lower control limit.

improvement committee was use of thiazide diuretics, we measured the proportion of patients with hypertension who were dispensed a thiazide-type diuretic for each intervention time period within TVHS. During the preintervention 14-week period, 18.53% of veterans were prescribed a thiazide or thiazide combination. During the intervention deployment period, 18.95% had a prescription for a thiazide, and in the postintervention 18 weeks 21.59% of veterans had an active prescription for a thiazide diuretic or thiazide combination. One year after intervention the proportion of patients prescribed a thiazide remained at 21.14%. There was a 3.06% ( $P < 0.0001$ ) increase in thiazide use between the preintervention time period and postintervention time period. One year after intervention, thiazide use remained elevated as compared with the preintervention phase at a +2.61% change ( $P < 0.0001$ ).

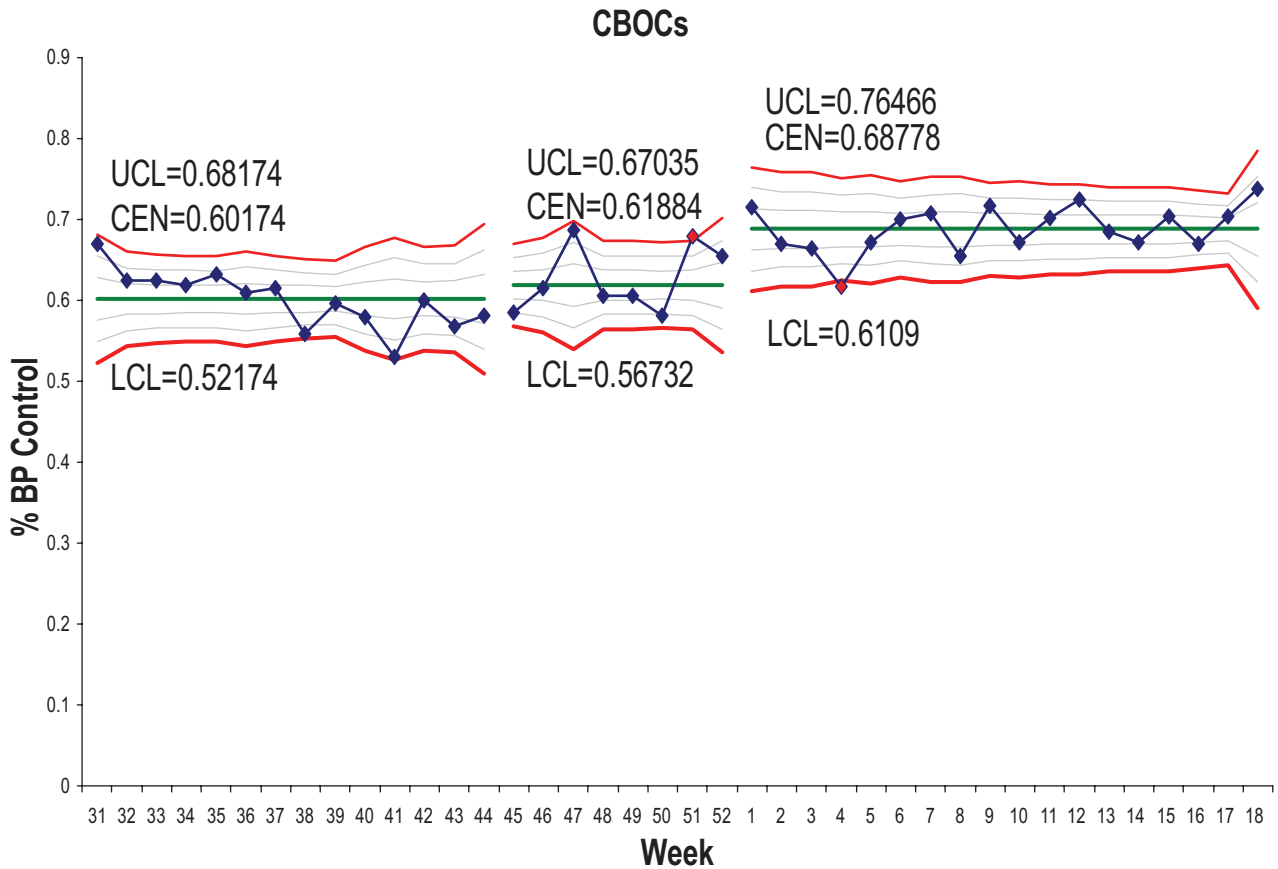
### Summary of the Experience, Future Directions, and Challenges

Patient-related, provider-related, and clinic-related factors contribute to suboptimal BP control. By conducting a series of small interventions aimed at these 3 areas, we observed substantial improvement in the quality of hypertension treatment in our healthcare system. BP control improved after just 8 weeks of intervention, and by the end of the study period we achieved an absolute improvement of 4.2%; this translates into an additional 2335 persons who achieved goal BP with

relatively inexpensive and simple interventions. Importantly, these interventions were sustained 1 year after intervention deployment.

Several factors contributed to the success of our initiative. Initially, local barriers were identified; this is a key step in any intervention because the effectiveness of interventions is partially dependent on the existence of baseline barriers.<sup>11</sup> Once key areas of improvement were outlined, manageable but important tasks were created. Small easy-to-accomplish interventions often facilitate change better than large overwhelming projects. The combined committee effort to create beneficial change was central in implementing our interventions. Educating and enlisting the help of key providers and buy-in from nurse leaders regarding the importance of the quality improvement initiative were imperative to achieving change in our large geographically diverse healthcare system. Finally, we ensured that we would be able to measure the effects of our interventions; if practice is to improve, it is essential that providers measure their own work.<sup>22</sup>

Lack of knowledge, lack of agreement with guidelines, and clinical inertia<sup>14</sup> all contribute to the role providers potentially play in suboptimal BP control.<sup>24</sup> In 2000, Hyman reported that 41% of physicians who treated hypertension had not heard of JNC-V guidelines.<sup>5</sup> He additionally found that some physicians continued to maintain higher BP thresholds for hypertension than the criteria recommended by the JNC and VA/DOD.<sup>5</sup> Clinical inertia, or the failure to initiate or titrate



**Figure 3.** Control chart of BP control preintervention, during intervention, and postintervention at CBOCs. UCL indicates upper control limit, CEN, central tendency; LCL, lower control limit.

medications when clinically indicated,<sup>14</sup> contributes to lack of goal attainment. Another study demonstrated that there is a <20% chance of a patient with uncontrolled BP having medications altered during an office visit.<sup>8</sup> Similar findings for veterans with hypertension were reported by Berlowitz and colleagues, who followed hypertensive veterans for 2 years. Therapy was increased during only 6.7% of visits, and often poor BP control was attributable to delays in medication change.<sup>25</sup>

We aimed our interventions toward patients and nurses. It has been shown that encouragement by physicians can help to enhance patient compliance.<sup>8,26,27</sup> Patients perceive their physicians as a “very/extremely” useful source of information,<sup>28</sup> and thus a third component of our intervention focused on improving patient knowledge.<sup>29</sup> The last component of our multifaceted intervention addressed the educational needs and time demands of our nursing staff. The belief that inaccurate BP measurements are obtained by clinical staff is common among physicians; meanwhile, support staff report being rushed while measuring BPs, and many request BP competence training.<sup>26</sup> We constructed our intervention to address both of these needs.

There were some limitations to our study and lessons learned. First, because all interventions were deployed at the same time, it is difficult to decipher whether our improvement in hypertension control was simply the result of more accurate measurement of BP versus actual improvement in

the treatment of hypertension. We believe that both intervention components ultimately played a role because we did witness an increase in the number of patients with hypertension who were on a thiazide diuretic in postintervention periods. Second, we recognize that our success was not of the same magnitude at all sites and at all provider levels. We hypothesize several reasons for this. If clinical providers do not believe a problem exists, efforts to change behavior will be limited. Some of the local response to the performance data and need for intervention were those of denial, scrutiny, and disbelief; this differential acceptance may have led to differential improvement. Third, resources needed to bring awareness to the problem of suboptimal BP control are limited. The additional funding for printed materials or extra staffing may be difficult to procure and impede efforts of change. Fourth, as the number of patients with hypertension increases, demands on providers will increase. The proper amount of time needed per encounter to educate patients about hypertension is often not available. Finally, we realize that the increase in BP goal attainment may represent the results of a more motivated population; those patients who present for follow-up may be those more inclined to change their health behavior positively.

Although we did see improvement after our interventions, further ideas to improve BP control include: patient self-management,<sup>30</sup> use of family involvement,<sup>31</sup> physician-pharmacist comanagement, and nurse-led care.<sup>32-34</sup> Future

research directions should focus on which interventions are the most cost-effective and widely applicable to all patients with hypertension.

The interventions implemented in this study were designed for our local processes of care.<sup>25</sup> Although many of our interventions can be applied to other healthcare systems, other institutions must identify their own unique opportunities to achieve sustained improvement in the quality of hypertension care more efficiently and effectively. Although physicians may not see success with every individual patient, each patient-level improvement contributes to success on a population level.<sup>5,11</sup> Our initiative demonstrates that implementing small, focused, and inexpensive interventions can increase the number of patients with hypertension who achieve recommended levels of control.

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### Disclosures

None.

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# “Supplemental Material”

### **Lifestyle changes to help reduce High Blood Pressure**

Talk with your doctor about the lifestyle changes that are appropriate for you.

- Maintain a healthy weight
- Do physical activity for 30 minutes most days
- Eat a diet high in fresh fruits and lowfat dairy products with reduced saturated and total fat
- Choose foods that are lower in salt and other forms of sodium. Read food labels.
- If you drink alcohol, have no more than one drink per day for women, two drinks a day for men
- Remember to take your blood pressure medicine

### **Questions to ask if you have High Blood Pressure**

- What is my goal blood pressure?
- Is there a healthy eating plan that I should follow to help lower my blood pressure and lose weight?
- Is it safe for me to do regular physical activity?
- What is the name of my medication?
- What time of day should I take my BP medicine?
- What should I do if I forget to take my blood pressure medication at the recommended time?



Department of Veterans Affairs  
Tennessee Valley Healthcare  
System

## **My Blood Pressure Wallet Card**

Dr. Name : \_\_\_\_\_

Dial-a-Refill: 615-321-6325: \_\_\_\_\_

Telephone Care: 1-800-228-4973 \_\_\_\_\_

## My Blood Pressure Diary

Date/Time	Location	Blood Pressure

MY BLOOD PRESSURE GOAL:

## It is important to take prescribed Blood Pressure Drugs

Ask your doctor to help you fill out the information below:

Blood Pressure Medicine:

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Special Instructions:

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