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Pharmacist Hypertension Management Using an Electronic Health Record–Based Approach

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Nearly 108 million (45%) American adults have a diagnosis of hypertension, yet only 1 in 4 patients (24%) has controlled blood pressure (BP).[1] African American patients have the highest rate of hypertension (56%) among all racial groups and higher mortality rates from hypertension-induced cardiovascular diseases.[1,2] African American patients may also encounter additional barriers to managing hypertension, such as less access to health care and a lack of routine care with a primary care physician (PCP).[3,4] Therefore, new strategies and interventions to improve BP control are still needed.[3]

Community-based trials have shown success in reaching traditionally challenging and high-risk populations.[3] The Los Angeles Barbershop Blood Pressure (LABBP) study found that when 52 community barbershops promoted hypertension care and referred older, African American male patrons to a pharmacist-led hypertension management program, systolic BP was reduced.[5] Other team-based care studies with a pharmacist demonstrated improved BP control as well.[6-8] Technology strategies such as telemedicine and mobile health have improved health outcomes through the use of BP telemonitoring and smartphone-based medical applications.[3,9]

Although the strategies seem promising, there are still limitations. First, the LABBP clinical trial focused on the community setting only and was not conducted within a large health care system.[5] Other team-based care studies largely lack representation of African American patients, which is especially concerning due to the higher prevalence of hypertension and poor outcomes in this population.[1,2,10] Although the technology interventions have led to potential improvements in self-management of hypertension, they may not be applicable to patients who do not use smartphones or seek routine care with their PCP.[9] More team-based interventions that efficiently address health care disparities and achieve clinically significant improvements in hypertension identification and outcomes are needed.[3]

The purpose of this study was to evaluate the impact of a pharmacist-led hypertension management program utilizing a novel technological approach for identifying and engaging patients with uncontrolled hypertension in a large, vertically integrated urban health system.

ABSTRACT

OBJECTIVES: To evaluate the impact of the chronic medication optimization pharmacist (CMOP) program on blood pressure (BP) control and time to goal compared with usual care in the ambulatory care setting.

STUDY DESIGN: This was a retrospective cohort study that included patients from June 2018 to June 2020 who were seen in an ambulatory care clinic for hypertension management.

METHODS: Patients aged 18 to 80 years were divided into 2 cohorts based on hypertension management by usual care or the CMOP program. Patients were enrolled in the CMOP program either by referral or identification via a data analytics tool. The primary outcome assessed the proportion of patients within BP goal (< 140/90 mm Hg) at 3 months. Secondary outcomes assessed the proportion of patients within goal at 6 months, time and number of visits to goal, and adherence (CMOP cohort only).

RESULTS: The primary end point demonstrated a greater proportion of patients within goal in the CMOP cohort compared with usual care (69.4% vs 42.3%; $P < .001$). The CMOP cohort also displayed a greater proportion of patients achieving goal within 6 months (75.7% vs 60.4%; $P = .014$) and faster time to goal (42.99 vs 63.12 days; $P = .002$), but more visits (1.67 vs 1.18; $P = .001$). Lastly, adherence improved from 50.4% to 72.1% in the patients with a documented adherence assessment in the pharmacist group ($P = .03$).

CONCLUSIONS: The pharmacist intervention improved BP control in a primarily African American patient population compared with usual care. Future studies should assess the sustainability of this intervention.

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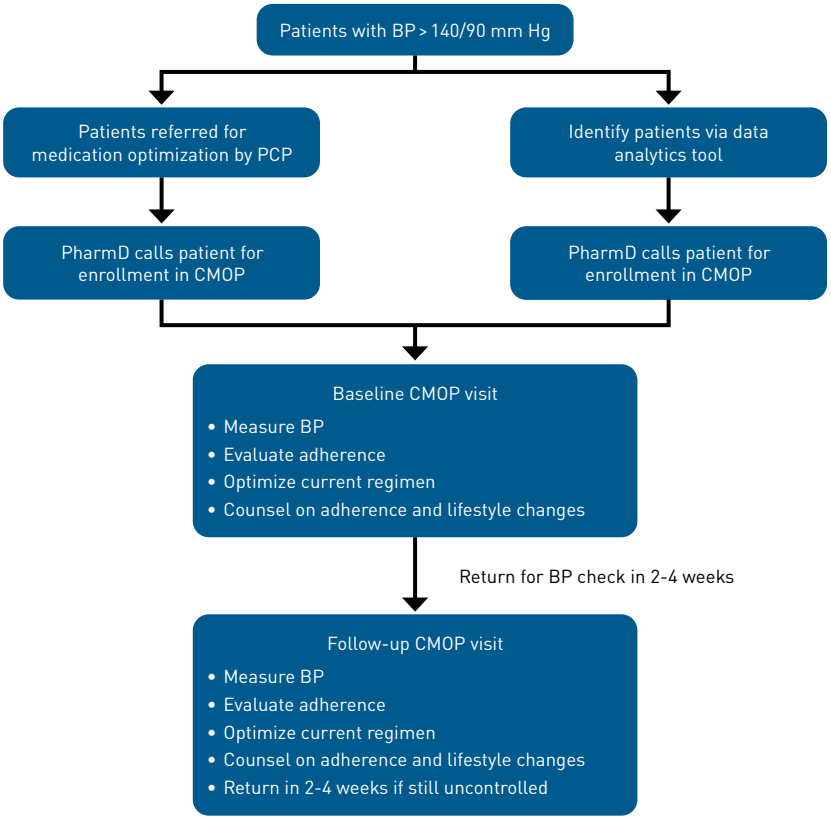
TAKEAWAY POINTS

Strategies to identify high-risk patients are needed for improved hypertension management. We studied the impact of a pharmacist intervention on blood pressure control, assessing time to goal and the proportion of patients at goal within 3 and 6 months compared with usual care.

- Suboptimal blood pressure control remains a widespread problem among American adults, especially in African American populations.
- Team-based interventions that efficiently address health care disparities and achieve clinically significant improvements in hypertension identification and outcomes are needed.
- Pharmacist intervention utilizing a data analytics tool may be an effective strategy for improving blood pressure control and outcomes.

FIGURE. Clinical Embedded Pharmacist Workflow



BP, blood pressure; CMOP, chronic medication optimization pharmacist; PCP, primary care physician.

METHODS

Study Design

This was a retrospective cohort study approved by our organization's institutional review board. Within this Midwest health system there are 30 primary care clinic sites, and 6 of these sites have an embedded clinical pharmacist as part of the chronic medication optimization pharmacist (CMOP) program. This program was established in 2016 and operates under a collaborative practice agreement (CPA). The CPA allows pharmacists to add, discontinue, and/or adjust any medications for the management of hypertension as well as of other chronic disease states, including diabetes and hyperlipidemia. The CPA does not restrict the pharmacist to specific medications or algorithms; rather, pharmacists follow the most recent guideline recommendations. All interventions are communicated with the provider after the pharmacist encounter.

In June 2019, the CMOP program began managing patients for hypertension via 1 of 2 ways: (1) identifying patients by proactively using a data analytics tool composed of an electronic report linked to the electronic health record (EHR) or (2) through referrals from other health care providers. This electronic tool generates a report of patients who have a PCP in the health system's primary care clinics, who are on the Epic hypertension registry, and who had a systolic BP (SBP) of at least 140 mm Hg and/or diastolic BP (DBP) of at least 90 mm Hg measured at the last ambulatory visit. Pharmacists are able to filter these patients down to either the clinic or provider level, and the tool was created in collaboration with a pharmacy analyst. The pharmacists review this report as time permits for their respective clinics, then reach out via telephone to the patient. The workflow is outlined in the **Figure**. The initial visit with the pharmacist includes measuring a baseline BP, evaluating medication adherence, optimizing the current medication regimen via adjusting doses or adding on new medications, and, lastly, counseling on diet and lifestyle changes. Follow-up is scheduled 2 to 4 weeks thereafter. Initial visits with the pharmacist were 60 minutes, whereas follow-up visits were 30 minutes. If patients monitored their BP at home, it was reviewed at the visit, but very few patients had access to their own monitor. Those patients with identified medication nonadherence received counseling and were offered a variety of adherence tools including pillboxes, enrollment in medication delivery services, or switching to combination therapy as appropriate for the individual patient's situation. Once patients achieved their BP goal, they were disenrolled from the pharmacist program.

Study Population

To be eligible for the study, patients had to be aged 18 to 80 years with an elevated BP, defined as SBP of at least 140 mm Hg and/or

DBP of at least 90 mm Hg. Patients were required to have 2 or more BP measurements at the study clinic locations and were stratified according to clinic location. Exclusion criteria included a diagnosis of end-stage renal disease, pregnancy, advanced dementia, or terminal illness. Patients were included only once in the study and were excluded if they had measurements in both cohorts. Patients included in the interventional CMOP cohort were managed between June 2, 2019, and June 1, 2020. Patients in the usual care cohort were managed by their PCP between June 1, 2018, and June 1, 2019, and served as the comparison control group. The usual care cohort was identified by running a report of patients seen by their PCP for hypertension. The first 111 patients who met inclusion criteria were included in the comparison group.

Data Collection, Outcomes, and Analyses

Data were extracted from the EHR (Epic). Demographic and baseline data were collected at the initial visit with the CMOP if in the CMOP cohort or with the PCP if in the usual care cohort. At each follow-up visit, BP measurements, number and classes of antihypertensive agents used, and types of medication changes (defined as the addition of a new BP medication, increase or decrease in the dose of an existing BP medication, and switching to a medication within the same or different class) were collected.

The primary outcome was the proportion of patients at the BP goal (< 140/90 mm Hg) within 3 months compared with usual care. Secondary outcomes included the proportion of patients at BP goal within 6 months and time and number of visits with CMOP or PCP to BP goal. Medication adherence data were described in the intervention group only and nonadherence was identified by patient report during an interview by the pharmacist.

All statistical analyses were conducted with IBM SPSS. To achieve 80% power and an α of 0.05, the calculated sample size was 136 patients per cohort. This calculation was based on an expected difference in BP control of 11% between groups and an assumed baseline rate of control of 64%. Categorical variables were compared via χ^2 test whereas continuous variables were assessed via the nonparametric Wilcoxon Mann-Whitney test. Adherence was assessed in the pharmacist group only using a McNemar test. Descriptive statistics were used to characterize the baseline demographics and adherence data.

TABLE 1. Baseline Demographic Information

Variable, n (%)	CMOP (n = 111)	Usual care (n = 111)	*P*
Age in years, median (IQR)	59 (29-80)	60 (32-79)	.309
Male sex, n (%)	60 (54.1)	35 (31.5)	<.001
BMI, mg/kg^2, mean (SD)	35.6 (11.58)	33.9 (8.97)	.205
Height in inches, mean (SD)	66.7 (4.33)	65.3 (4.45)	.022
Weight in kg, mean (SD)	97.2 (23.93)	94.3 (25.26)	.146
Ethnicity, n (%)			
African American	109 (98.2)	106 (95.5)	.25
Hispanic	1 (0.9)	1 (0.9)	>.999
Caucasian	1 (0.9)	4 (3.6)	.18
Comorbidities, n (%)			
Diabetes	96 (73.8)	41 (67.9)	<.001
Glycated hemoglobin A_{1c}, %, mean (SD)	8.3 (2.1)	6.6 (1.5)	<.001
CAD	7 (5.4)	2 (3.6)	.089
History of stroke/TIA	14 (11.5)	4 (7.1)	.014
Systolic heart failure	4 (3.1)	1 (1.8)	.096
Diastolic heart failure	0 (0.0)	2 (3.6)	.155
Smoking status, n (%)			
Former smoker	32 (28.8)	27 (24.3)	.447
Current smoker	20 (18.0)	24 (21.6)	.501
Never smoker	59 (53.2)	60 (54.1)	.893
Insurance status, n (%)			
Commercial	53 (47.7)	49 (44.1)	.59
No insurance	1 (0.9)	1 (0.9)	>.999
Government issued	57 (51.4)	67 (60.5)	.45
Baseline medications, n (%)			
ACE inhibitor or ARB	38 (34.2)	43 (38.7)	.486
CCB	61 (55.0)	55 (49.5)	.502
β-Blocker	29 (26.1)	31 (27.9)	.762
Diuretic	46 (41.4)	48 (43.2)	.786

ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; BMI, body mass index; CAD, coronary artery disease; CCB, calcium channel blocker; CMOP, chronic medication optimization pharmacist; TIA, transient ischemic attack.

RESULTS

A total of 794 patients were screened. Overall, 222 patients were included, with 111 patients in each cohort, all of whom had follow-up through 6 months. Reasons for exclusion were similar between each cohort, with the most common reasons being initial BP less than 140/90 mm Hg, less than 2 BP measurements in 6 months, or elevated BP not measured at the study clinic (usual care cohort only).

Baseline and demographic information is presented in **Table 1**. The median age and race were similar between each cohort, and both cohorts included a predominantly African American patient population. More patients had diabetes and a history of stroke/transient ischemic attack in the CMOP cohort. Within the CMOP cohort, there were 31 patients identified by the pharmacist using the electronic tool and 80 patients who were referred by other health care providers. All patients within the CMOP cohort were agreeable to the services provided by the pharmacist.

The primary end point and secondary end points are listed in **Table 2**. Within 3 months, 69.4% of patients in the CMOP group and 42.3% of patients in the usual care group had achieved goal BP ($P < .001$). Of the patients who achieved the goal BP, the CMOP patients achieved it more quickly. The magnitude of the effect was similar between patients who were referred to the pharmacist and those who were identified proactively by the pharmacist.

TABLE 2. Primary and Secondary End Points

Primary end point	CMOP (n = 111)	Usual care (n = 111)	*P*
Proportion of patients at BP goal within 3 months, n (%)	77 (69.4)	47 (42.3)	<.001
Secondary end points	**CMOP (n = 111)**	**Usual care (n = 111)**	***P***
Time to goal in days, mean (SD)	42.99 (38.4)	63.12 (46.2)	.002
Number of visits, mean (SD)	1.67 (1.10)	1.18 (0.39)	<.001
Patients at BP goal within 6 months, n (%)	84 (75.7)	67 (60.3)	.014
	CMOP (n = 111)		
	Baseline	**3 months**	***P***
Adherence, n (%)	56 (50.4)	80 (72.1)	.03

BP, blood pressure; CMOP, chronic medication optimization pharmacist.

TABLE 3. Antihypertensive Medication Changes

	CMOP (n = 111)	Usual care (n = 111)	*P*
No. of BP medications at baseline, mean (SD)	1.79 (1.15)	1.63 (1.06)	.34
No. of BP medications at 3 months, mean (SD)	2.15 (1.07)	1.76 (1.03)	.01
New antihypertensive added, n (%)	33 (29.7)	18 (16.2)	.017
Medications removed, n (%)	3 (2.7)	2 (1.8)	.651
Dose increase, n (%)	32 (28.8)	8 (7.2)	<.001
Dose decrease, n (%)	1 (0.90)	0 (0)	.316
Switched antihypertensive within same class, n (%)	5 (4.5)	7 (6.3)	.55
Switched to different antihypertensive class, n (%)	6 (5.4)	6 (5.4)	.99
No changes, n (%)	34 (30.6)	77 (69.4)	<.001

BP, blood pressure; CMOP, chronic medication optimization pharmacist.

The antihypertensive medication changes are listed in **Table 3**. There was a greater mean number of medications at 3 months in the CMOP group compared with usual care (2.15 vs 1.76; $P = .01$). The classes of medications were generally similar at baseline and 3 months. The CMOP group more frequently added a new antihypertensive agent or increased the dosage of an existing agent compared with usual care.

Lastly, adherence improved from 50.4% to 72.1% in patients with a documented adherence assessment in the CMOP group ($P = .03$). All patients received adherence education (n = 111) and were offered adherence tools including pillboxes/pill packs (n = 3), enrollment in medication delivery services (n = 2), switching to combination medications (n = 2), and switching medications due to cost or adverse effects (n = 5).

DISCUSSION

This study of a pharmacist-led hypertension intervention strategy enabled by an EHR-based tool demonstrated a 49% relative improvement in BP control compared with usual care. A greater proportion of patients met the BP goal at both 3 and 6 months. The CMOP cohort also achieved this goal within approximately 6 weeks compared with approximately 9 weeks in the usual care group. Although our predefined sample size was not met, a statistically significant improvement was nonetheless observed, because the magnitude of the effect size was greater than expected. The effect of this intervention is likely attributable to medication adjustments, adherence education, and efficient identification of patients with uncontrolled hypertension through the data analytics tool.

The overall findings of this study are consistent with the literature on pharmacist-led interventions on BP.[5-8] In a recently published systematic review comparing randomized controlled trials of pharmacist-led interventions, 82% (n = 29) of studies demonstrated a statistically and clinically significant improvement in BP control, and nearly 25% showed a statistically significant improvement in medication adherence.[8] Although our study did not assess clinical outcomes, the time to goal was significantly faster compared with usual care. Several trials have supported the concept that prompt BP control produces long-lasting BP reduction and decreases the incidence of cardiovascular events.[11] Furthermore, the types of medication changes conducted at baseline are consistent with the literature, as pharmacists are well equipped to intensify current therapy and utilize guideline-recommended agents.[12,13]

Other studies have reported the beneficial impact of either an EHR-based registry approach or a pharmacist-led approach to improving BP control within a primary care clinic population.[14,15] For example, Kaiser Permanente applied systemic implementation strategies to improve BP management that focused on a variety of systematic changes, including creating an EHR-based hypertension registry; however, pharmacists were a small part of this intervention.[14] Another study, conducted in the US Department of Veterans Affairs, reported very similar improvements in BP control associated with referral of patients with hypertension to a program led by clinical pharmacists, as we observed in our study.[15] Although these studies contained the key elements of our study—an EHR-based approach to identifying patients with hypertension and a pharmacist-led service targeting BP control—our study is unique in that we have combined these elements into 1 intervention and demonstrated improved results.

Limitations

Limitations of this study include a selection bias in the CMOP cohort. Nearly 3 of 4 (72%) patients were referred for medication optimization for hypertension and/or other comorbidities such as diabetes. However, no matter the reason for referral, the pharmacist still addressed hypertension when it was uncontrolled. The BP of referred patients may inherently be more challenging to bring under control, as the PCP

has likely already utilized standard approaches to achieve BP goals. Thus, the impact of the program may be multifactorial. If referrals had been for hypertension alone, there may have been different outcomes compared with usual care. Despite this, pharmacists were still able to improve BP control. Another limitation is that our study population did not reach the predetermined sample size due to the COVID-19 pandemic, preventing clinical face-to-face encounters between pharmacists and patients. In fact, half of patients not reaching BP goals had their initial BP visit conducted in the beginning of 2020 and would have returned for a BP encounter had the pandemic not led to the closure of face-to-face encounters in the clinics. Additionally, the pharmacist adherence assessment is based on patient-reported number of missed doses per week rather than objective data (ie, prescription fill history). Also, the usual care group did not have adherence vs nonadherence documented, so comparisons could not be made between the 2 groups with regard to adherence improvement. Although it is best practice to verify subjective data with objective measures, this may be time consuming and not always possible. The approach of our pharmacist-led clinic to educate patients and modify their behaviors appears to be an effective strategy given the increased rate of patient-reported adherence, coupled with greater achievement of BP goals. Lastly, we did not compare adverse events related to hypertension or adverse effects of medications between the usual care and CMOP cohorts.

CONCLUSIONS

This study demonstrated the success of utilizing pharmacists in the primary care setting, equipped with an EHR-based electronic tool, to manage patients with uncontrolled hypertension and achieve a higher rate of BP control compared with usual care. Additional studies are needed to assess the sustainability of our proactive identification strategy on long-term BP control. ■

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