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Research Article

Effectiveness of a multidisciplinary intervention to improve hypertension control in an urban underserved practice

Robert J. Fortuna, MD, MPH[a,b,*], Angela K. Nagel, PharmD, BCPS[c], Emily Rose, MBA, BSN[b], Robert McCann, MD[a], John C. Teeters, MD[d], Denise D. Quigley, PhD[e], John D. Bisognano, MD, PhD[d], Sharon Legette-Sobers, MHSA[f], Chang Liu, MA[g], and Thomas A. Rocco, MD[a,h]

[a]*Department of Internal Medicine, University of Rochester School of Medicine and Dentistry, Rochester, NY, USA;*
[b]*Center for Primary Care, University of Rochester School of Medicine and Dentistry, Rochester, NY, USA;*
[c]*Department of Pharmacy Practice & Administration, St. John Fisher College, Rochester, NY, USA;*
[d]*Department of Cardiology, University of Rochester School of Medicine and Dentistry, Rochester, NY, USA;*
[e]*RAND Corporation, Santa Monica, CA, USA;*
[f]*Greater Rochester Health Foundation, Rochester, NY, USA;*
[g]*Department of Biostatistics and Computational Biology, University of Rochester School of Medicine and Dentistry, Rochester, NY, USA; and*
[h]*Department of Cardiology, Canandaigua VA Medical Center, Canandaigua, NY, USA*

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Abstract

Patient-centered, multidisciplinary interventions offer one of the most promising strategies to improve blood pressure (BP) control, yet effectiveness trials in underserved real-world settings are limited. We used a multidisciplinary strategy to improve hypertension control in an underserved urban practice. We collected 1007 surveys to monitor medication adherence and used weighted generalized estimating equations to examine trends in BP control. We examined 13,404 visits from patients with hypertension between August 2010 and February 2014. Overall, BP control rates increased from 51.0% to 67.4% (adjusted odds ratio, 1.58; 95% confidence interval, 1.44–1.74) by the end of the intervention phase and were maintained during the postintervention phase (adjusted odds ratio, 1.60; 95% confidence interval, 1.41–1.82). Medication adherence scores increased across the intervention (5.9–6.6; $P < .001$), but were not sustained at the conclusion of the study (5.9–6.2; $P = .16$). A multidisciplinary team approach involving registered nurses, pharmacists, and physicians resulted in substantial improvements in hypertension control in a real-world underserved setting. J Am Soc Hypertens 2015;9(12):966–974.

Keywords: Effectiveness; multidisciplinary; nurse-managed protocols; pharmacist; underserved.

Introduction

Hypertension is one of the most important preventable contributors to morbidity and mortality throughout the world.[1,2] In the United States, approximately one-third of the adult population has hypertension, increasing to 65% in those older than 60 years.[3] Effective treatments exist, and structured guidelines are widely available to support treatment, yet these are not optimally used.[4] It is estimated that the full implementation of current recommendations offers the potential to prevent 56,000 cardiovascular events and 13,000 deaths annually in the

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*Corresponding author: Robert J. Fortuna, MD, MPH, Center for Primary Care, Culver Medical Group, University of Rochester School of Medicine and Dentistry, 913 Culver Road, Rochester, NY 14609. Tel: +1-585-654-5432; Fax: +1-585-288-7871.

E-mail: Robert_Fortuna@urmc.rochester.edu

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United States, without increasing the cost to the health care system.[2,5]

Despite the high prevalence of hypertension and the known benefits of treatment, only about half of hypertensive patients reach accepted goals.[3] Suboptimal management of hypertension is likely related to numerous factors at every level of care, including patient-level factors (eg, lifestyle choices, medication nonadherence), clinician-level factors (eg, therapeutic inertia), and system-level factors (eg, insurance coverage, fragmented systems).[6–10]

Patient-centered, multidisciplinary interventions offer one of the most promising strategies to improve blood pressure (BP) control,[11–25] yet effectiveness trials in underserved real-world settings are limited. Nurse- and pharmacist-led interventions, using structured algorithms, telephone monitoring, and community outreach, have been shown to improve hypertensive control and medication adherence in structured study environments.[14–20,26,27] Similarly, multidisciplinary teams have improved BP control rates in large-scale health care systems.[12,22]

Although randomized controlled trials and meta-analyses demonstrate the benefit of the team-based approach in hypertensive management, real-world effectiveness and sustainability experience are limited.[17] Furthermore, one study of a public health center failed to demonstrate benefit of a comprehensive intervention to improve hypertension in the primary care setting.[28]

This article describes the implementation of a multistage intervention involving an education phase, a pharmacist-led phase, and a nurse-led phase to improve hypertension control in an underserved urban practice. Our aim was to examine the effectiveness and sustainability of these interventions in an underserved urban setting. We hypothesized that a multidisciplinary team approach involving registered nurses, pharmacists, and physicians will result in improvements in hypertension control in a real-world urban setting.

Methods

We used a multidisciplinary strategy aimed at improving hypertension control in an urban practice between August 2010 and February 2014. The strategy used multiple concurrent clinical approaches, which are detailed in Table 1. Hypertension control was defined based on the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7).[1] The JNC 7 standards were used because these were the current recommendations at the initiation of the project and during most intervention.

Hypertension Identification and Definitions

Hypertensive patients were identified based on either having hypertension on their problem list in the electronic health record or having three consecutive BP readings above goal that were not explained by another factor.

We considered a BP as controlled if it was less than 130/80 mm Hg in those with diabetes or chronic kidney disease

Table 1
Key components of clinical approaches

Key Components	Description
Baseline/educational phase	
Provider teaching	Case-based discussions surrounding hypertension
Nurse/staff education	Didactic and case-based discussions
Standardization	Standardization of office protocols (BP measurements, medication titration protocols)
Team building	Development of teams, alignment of goals
Virtual consults	Established relations with local cardiologists
Intervention phase—pharmacy component	
Consultations with patients	Counseling regarding medication adherence and side effects
Outreach to nonadherent patients	Phone calls to patients and pharmacies to facilitate adherence
Consultations with physicians	Reinforcement of JNC 7 standards
Patient assistance with meds	Care coordination with pharmacies
Intervention phase—registered nurse-managed component	
Direct patient care	Direct patient care included BP checks, visits to titrate medications, and visits to promote adherence
Outreach to uncontrolled patients without appointments	Phone calls and letters sent to uncontrolled patients without recent appointment
Population-level management of hypertensive patients	Physicians provided population-level reports to identify hypertensive patient not meeting goals. Physicians and nurse teams performed outreach to uncontrolled patients. Transparent reports of team control rates were posted.

BP, blood pressure; JNC 7, the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure.

and less than 140/90 mm Hg in patients for all others. We defined Stage 1 hypertension as a systolic BP between 140 and 159 mm Hg or a diastolic BP between 90 and 99 mm Hg. We defined Stage 2 hypertension as a systolic BP greater than or equal to 160 mm Hg or a diastolic BP greater than or equal to 100 mm Hg. We also performed a sensitivity analysis using an alternative definition of hypertension control as a BP $<$ 140/90 mm Hg for all patients.

Practice Setting

We implemented this effectiveness project in an urban internal medicine practice in Rochester, New York, a city of ~211,000 inhabitants (37.6% non-Hispanic white and 41.7% black). The study site cares for a predominantly low-income and diverse, minority patient population located in a federally designated underserved community. The site included eight attending physicians and 28 resident physicians. The site did not include nurse practitioners or physician assistants.

Baseline and Educational Phase

The educational phase, outlined in Table 1, included multiple elements to (1) improve knowledge and awareness of current recommendations, (2) develop standardized methods to measure BP, (3) develop clinical teams focused on hypertension management, and (4) establish links with local cardiologists for virtual consultations related to hypertension. To improve knowledge and facilitate team building, the authors developed an evidence-based educational series for the nurses and providers. The educational series were delivered at three 1-hour-long sessions and were required for all office nurses and physicians. Separate educational sessions were developed for nurses and physicians. The educational series were delivered by a nurse-manager and physicians trained in hypertension management. The educational series incorporated JNC 7 recommendations, medication titration protocols, and discussed the fundamentals of working in a multidisciplinary team.

In addition to the education portion, the baseline hypertension population within the clinic was more clearly defined. We attempted to contact patients with hypertension who had not been seen in over 2 years. We made a minimum of three attempts, including phone calls and written letters, to determine if a patient was still attributed to the practice. If the patient was unable to be reached after several telephone calls, staff would mail a letter to the patient advising them to contact the office to be seen by their provider. Inactive patients were removed from the census if they were not able to be contacted over at least a 3 month time frame and the primary care physician agreed that the person was no longer an active patient.

Clinical Intervention

The pharmacist intervention and the nurse-managed intervention were delivered concurrently. Outcomes were analyzed collectively as the clinical intervention phase. Patients were comanaged by the pharmacist or registered nurse based on either (1) a referral from the rendering provider or (2) identification of the poorly controlled hypertension through population-level management.

Pharmacist Component

The pharmacist component incorporated consultation and education for both patients and physicians. Pharmacist consultation with patients occurred at either the time of the physician-patient encounter or at a scheduled follow-up appointment with the pharmacist (Table 1). The pharmacy-based consultation provided (1) patient education and (2) a self-management program (eg, medisets/pill boxes, automatic pharmacy refills) aimed at improving compliance. The pharmacist also engaged in direct consultation with providers to enhance optimal medical therapy. The consultations facilitated uptitration (and/or addition) of medication as recommended based of JNC7 standards.

Nurse-Managed Component

The nurse-managed component used a registered nurse to provide (1) intensive patient education in self-management, (2) follow-up for BP checks, (3) home BP monitoring using automated cuffs, (4) follow-up appointments for medication titration based on nurse-managed protocols, (5) phone outreach to poorly controlled patients, and (6) reports to physicians of their uncontrolled hypertensive patients (Table 1).

Intensively Followed Patients

Elements of the clinical intervention phase involved all hypertensive patients. Smaller subsets of patients with resistant hypertension, however, were followed more intensively. Patients determined to be at higher risk (eg, multiple comorbid conditions or psychosocial factors impairing their adherence) could be referred by their primary care physician for closer monitoring. A total of 134 patients received intensive monitoring, accounting for approximately 10% of patients with a clinical diagnosis of hypertension. This intense outreach included the following: (1) additional phone outreach, (2) additional appointment reminders, and (3) more intensive counseling, regarding adherence and lifestyle, at visits. The frequency of the outreach varied between several times a week to once a month based on the patient's needs. During the phone outreach, the pharmacist or registered nurse would ensure that patients were able to obtain their medications, assess any barriers to care (eg, insurance, transportation), and review home BP readings for

patients with a home monitor. The pharmacist or registered nurse was responsible for reporting any changes with the patient, identified via phone call or at the visit, to the primary care provider.

Postintervention Phase

At the conclusion of the clinical intervention phase, detailed reports of hypertensive patients remained available to individual providers on request, but the clinical hypertension nurse was no longer available to perform consultations or outreach to patients. During this phase, data were collected every 4–6 months to monitor BP control rates and medication adherence to monitor sustainability of the BP control established during the intervention phase.

Data Collection

We abstracted data from a hypertensive registry in the electronic health record. Data extraction occurred approximately every 4 months between August 2010 and February 2014. The intervals between data abstraction varied slightly based on the availability of information technology services. We used the patient's last recorded BP at the time of each abstraction.

Survey

A survey was administered to monitor medication adherence approximately every 4–6 months throughout the intervention (eg, seven survey waves). The survey used the Morisky Medication Adherence Scale (MMAS-8) and was administered to a convenience sample of patients with hypertension presenting for an appointment. The survey did not track respondents longitudinally. Surveys were available in English and Spanish and could be provided verbally on request by a staff member. A total of 1007 completed surveys were collected. The MMAS-8 is a validated eight-item survey to measure medication adherence.[29,30] An MMAS-8 score of 8 was defined as high adherence, 6–7 as medium adherence, and <6 as low adherence.[29,30] A $5 gift card was provided for completion of the survey. Surveys were double entered and compared for inaccuracies.

We examined the normality of the data for each phase of the survey using the Shapiro–Wilk test statistic and compared mean MMAS-8 scores using t-tests.

Statistical Analyses

We performed statistical analyses using R version 3.1.2 (R Development Core Team) and SAS version 9.3 (SAS Institute Inc, Cary, NC, USA). Our primary analyses used weighted generalized estimating equations (WGEEs) to examine changes in hypertension control across time within each of the phases of the intervention (baseline, clinical intervention, and postintervention). Because this was a longitudinal study, we accounted for the fact that time-varying outcomes and covariates are correlated for a particular patient, but independent between different patients. To address this intercorrelation and increase the efficiency of the parameter estimates, we fit a mixed model and obtained the parameter estimates using generalized estimating equations.

Within our real-world study, patients joined and left the practice throughout the study. To account for these changes, we used WGEEs. Using WGEE, we fit a logistic regression model to estimate the missing mechanism, from which we can obtain a vector of weights for each subject. Thus, we weighed the data for each patient differently based on the amount of data entries contributed to the data. To calculate weights, we used models controlling for the outcomes at previous time points, sex, race, and age as well as accounted for changes in insurance over time. The model weights were fitted as:

$$\begin{aligned}\operatorname{logit}\left[P\left(R_{ij}=1\right)\right] = {} & \psi_0+\psi_1 y_{i,j-1}+\psi_2\mathrm{sex_i}+\psi_3\mathrm{race}_i \\ & +\psi_4\mathrm{insurance}_{i,j-1}+\psi_5\mathrm{age}_i+\tau_{ij}\end{aligned}$$

for $j = 2,\ldots,10$, where R_{ij} equals 1 if we observe the outcome for subject i at time point j and 0 otherwise.

Our primary outcome analyses used generalized estimating equations based on the model:

$$\begin{aligned}\operatorname{logit}\left[P\left(y_{ij}=1\right)\right] = {} & \beta_0+\beta_1\mathrm{sex}_i+\beta_2\mathrm{race}_i \\ & +\beta_3\mathrm{insurance}_{ij}+\beta_4\mathrm{age}_i \\ & +\beta_5\mathrm{time}_{ij}+\beta_6\mathrm{stage}_{ij}+\beta_7\mathrm{time}_{ij} \\ & \times\mathrm{stage}_{ij}+\varepsilon_{ij}\end{aligned}$$

where y_{ij} are the primary outcomes depending on the specific analysis.

We also used WGEE to compare whether the end-control rates in the clinical intervention phase were different from baseline control rates and whether the end-control rates in the postintervention phase were different from baseline control rates.

To further assess the effect of patients leaving and entering the data set, we performed a sensitivity analysis using generalized linear mixed effects models with multiple imputations for missing data without any significant changes in results.

Institutional Review

This study was approved by the University of Rochester Research Subjects Review Board.

Results

We analyzed 45,323 visits from adult patients at seven intervals between August 2010 and February 2014. A total of 13,404 visits (29.6%) were from patients with hypertension. Table 2 demonstrates the characteristics of the visits from hypertensive patients.

Figure 1 and Table 3 demonstrate the percent of hypertensive patients treated to JNC 7 goals across periods and intervention phases. Overall, control rates increased from a baseline of 51.6%–67.4% ($P < .001$) by the end of the intervention phase. Similar increases were observed stratified by gender, race, and insurance. During the intervention phase, hypertension control steadily increased across each period (55.8%–67.4%; adjusted odds ratio [AOR], 1.18; 95% confidence interval [CI], 1.11–1.24; Figure 1). Control rates remained steady during the postintervention phase (AOR, 0.97; 95% CI, 0.91–1.03; Figure 1). Compared with the end-baseline rate, improvements in BP control were observed at the end of the intervention phase (51.0% vs. 67.4%; AOR, 1.58; 95% CI, 1.44–1.74) and were maintained at the conclusion of the postintervention phase (51.0% vs. 61.0%; AOR, 1.60; 95% CI, 1.41–1.82).

In addition to improvements in control rates, we also observed improvements in the severity of hypertension, as measured by hypertension stage (Table 4). At baseline, 10.8% of hypertensive patients had Stage 2 hypertension. Through the intervention phase, the percentage of patients with Stage 2 hypertension steadily decreased (AOR, 0.87; 95% CI, 0.78–0.97), with a nadir at 5.8%. Compared with the baseline rate, the percentage of those with Stage 2 hypertension was improved by the end of the intervention phase (AOR, 0.74; 95% CI, 0.62–0.87) and the improvements were maintained at the conclusion of the postintervention phase (AOR, 0.66; 95% CI, 0.51–0.85).

We also analyzed the subset of patients with resistant hypertension followed more intensively by a pharmacist or registered nurse (Figure 1). These patients had direct contact with the pharmacist or nurse within the clinical intervention phase. During the intervention phase, hypertension control increased across the period (44.1%–60.3%; AOR, 1.25; 95% CI, 1.09–1.44). Control rates at the end of the intervention were higher than at the end of the baseline/education phase (60.3% vs. 36.5%; AOR, 1.43; 95% CI, 1.13–1.81). Similarly, control rates were also higher at the end of the postintervention phase compared with baseline (52.5% vs. 36.5%; AOR, 1.60; 95% CI, 1.17–2.18).

We found similar results when analyzing the results based on a goal BP of less than 140/90 mm Hg for all patients. During the intervention phase, hypertension control based on the revised goals steadily increased across each period (66.5%–76.2%; AOR, 1.41; 95% CI, 1.13–1.75). Compared with the end-baseline rate, improvements in BP control were observed at the end of the intervention phase (AOR, 1.70; 95% CI, 1.53–1.88) and maintained at the conclusion of the postintervention phase (AOR, 1.95; 95% CI, 1.70–2.25).

We collected a total of 1007 surveys to monitor medication adherences across the study period (Table 5). Overall, the mean MMAS-8 score of medication adherence increased across the study period from 5.9 at baseline to a peak of 6.6 ($P < .001$). Over the same period, the percentage of respondent reports either high or medium medication adherences increased from 56.9%–69.7% ($P = .01$). Compared with the baseline, however, this increase was not sustained at the conclusion of the postintervention phase (5.9–6.2; $P = .16$).

Table 2
Characteristics of visits from hypertensive patients

Characteristic	Percentage (N)
Total hypertensive visits	100 (13,404)
Gender	
Female	55.2 (7399)
Male	44.8 (6005)
Race	
Black	43.8 (5866)
White	36.8 (4893)
Other*	19.7 (2645)
Ethnicity	
Hispanic	11.7 (1574)
Non-Hispanic	88.3 (11,830)
Insurance	
Private	29.6 (3971)
Medicaid	28.7 (3844)
Medicare	35.4 (4738)
No insurance	5.4 (734)
Other†	0.9 (117)

* Other race includes Asian, Native Hawaiian, missing race, and "others."

† Other insurance includes Champus, workers compensation, and school-based coverage.

Discussion

Overall, we found that the use of a multidisciplinary team approach involving registered nurses, pharmacists, and physicians resulted in substantial improvements in hypertension control in a real-world urban setting. The clinical intervention resulted in a 30% relative improvement in hypertension control in an urban underserved population. These benefits were sustained for more than a year after the conclusion of the formal intervention period with the incorporation of key practices into the workflow of the practice. In addition, the stage of hypertension improved considerably across the intervention.

Our results are similar to findings in randomized controlled trials and large well-resourced systems[11–25] but demonstrate the effectiveness of these processes in an urban

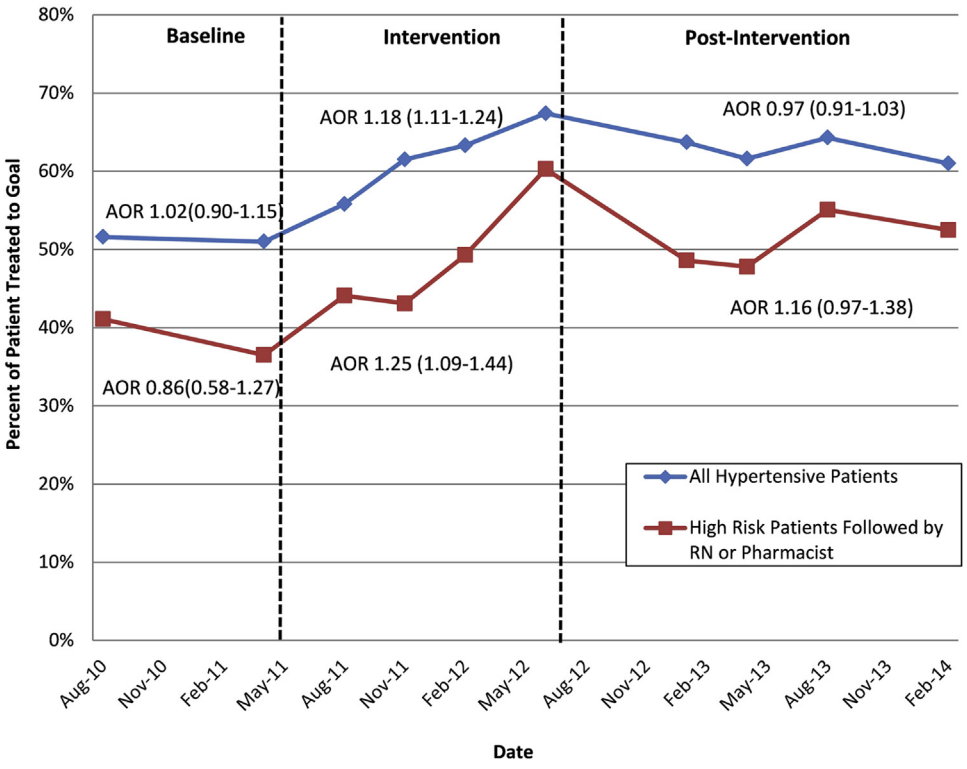

Figure 1. Control rates of all hypertensive patients and high-risk patients followed intensively by a registered nurse or pharmacist. AOR, adjusted odds ratio; RN, registered nurse.

underserved setting outside controlled trials. In addition, we found significant improvements independent of race, gender, and insurance status. Prior literature demonstrates that disparities in hypertension control contribute to differences in cardiovascular and cerebrovascular mortality among minority patients.[31] Thus, multidisciplinary team

Table 3
Percent of hypertensive patients treated to JNC 7 goals

Patients	Baseline/ Educational		Clinical Intervention Stage				Postintervention Stage			
	Time 1	Time 2	Time 3	Time 4	Time 5	Time 6	Time 7	Time 8	Time 9	Time 10
	8/2010	4/2011	8/2011	11/2011	2/2012	6/2012	1/2013	4/2013	8/2013	2/2014
All (%)	51.6	51.0	55.8	61.5	63.3	67.4	63.7	61.6	64.3	61.0
Gender (%)										
Female	53.5	52.6	58.0	61.5	64.4	68.1	63.7	61.5	64.6	62.3
Male	49.3	49.1	53.1	61.6	62.0	66.4	63.7	61.8	64.0	59.3
Race (%)										
White	52.9	53.8	58.0	65.1	63.3	68.7	66.3	63.5	65.6	67.7
Black	50.9	47.8	53.0	58.3	61.7	66.8	61.0	59.9	62.9	57.0
Other/unknown*	50.8	53.5	58.4	62.2	68.7	65.7	65.1	62.1	66.7	59.0
Insurance (%)										
Private	51.5	50.0	51.8	60.9	62.8	67.4	64.9	62.2	65.7	63.3
Medicaid	52.2	52.5	56.5	58.0	59.1	67.4	62.9	61.3	62.6	58.2
Medicare	54.9	53.2	61.5	67.7	67.3	66.7	63.2	61.4	64.8	61.3
No insurance	45.6	40.4	41.0	44.9	67.3	73.5	68.8	63.3	62.1	66.7
Other†	0.0	0.0	20.0	20.0	25.0	64.7	57.9	60.0	63.6	47.6

JNC 7, the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure.
* Other race includes Asian, Native Hawaiian, missing race, and "others."
† Other insurance includes Champus, workers compensation, and school-based coverage.

Table 4
Percent of hypertension patients with either Stage 1 or Stage 2 hypertension across the intervention

Hypertensive Patients	Baseline/ Educational Phase		Clinical Intervention Phase				Postintervention Phase			
	Time 1	Time 2	Time 3	Time 4	Time 5	Time 6	Time 7	Time 8	Time 9	Time 10
	8/2010	4/2011	8/2011	11/2011	2/2012	6/2012	1/2013	4/2013	8/2013	2/2014
Stage (%)										
Stage 1* or controlled	89.2	90.6	91.0	91.1	92.4	94.2	93.2	92.6	93.3	93.6
Stage 2†	10.8	9.4	9.0	8.9	7.6	5.8	6.8	7.4	6.7	6.4

BP, blood pressure.
* Stage 1 hypertension is defined as a systolic BP between 140 and 159 mmHg or a diastolic BP between 90 and 99 mmHg.
† Stage 2 hypertension is defined as a systolic BP $\geq$ 160 or a diastolic BP $\geq$ 100.

approaches allow for identification of comorbidities that may contribute to a lack of control and offer the potential to reduce disparities associated with hypertension care and subsequent morbidity.

We believe that each phase had important components that contributed to the overall improvements achieved. Although we did not observe direct improvements in hypertension control during the educational phase, provider education and team building were an essential component to set the stage for the future clinical interventions. Prior systematic reviews have similarly demonstrated inconsistent results with educational interventions directed at physicians.[25]

The substantial improvements observed during the clinical phase were attributed to several key components, including (1) prior team building, (2) enhanced counseling regarding medication adherence, (3) outreach to nonadherent patients, (4) management of population-level hypertension data, and (5) transparency of population-level hypertension data among physician teams. The use of a multidisciplinary team during the clinical phase of the study, including a blended pharmacy and nursing model, allowed for a substantial extension of clinical services to patients and physicians. These benefits included both direct patient care (eg, medication titration, BP checks, and home BP monitoring) and population-level management of poorly controlled patients. Population-level management was instrumental toward the improvements achieved, allowing providers to have more efficient use of their time by providing a list of identified patients requiring intervention. Population-level management is a key component of the evolving patient-centered medical home (PCMH) model and has led to improved outcomes across multiple chronic diseases.[32–36]

We found that the availability of population-level data for daily use among the clinical team allowed for the improvements in hypertension control to be sustained after the formal clinical phase of the study concluded. Moving forward, the expansion of PCMHs offers an important opportunity to support team-based care for hypertension. Within the context of the PCMH, the key components of our intervention may be replicated.

Our study has several important limitations. Our study was designed as an effectiveness trial of multiple combined interventions and was not designed to compare specific components within the intervention. Specifically, we were not able to compare differences between the nurse-managed components or pharmacist components. We defined hypertension based on JNC 7 standards, which

Table 5
Medication adherence scores across the intervention

MMAS-8 Score	Baseline	Clinical Intervention Phase			Postintervention Phase		
	Wave 1 3/2011 (N = 195)	Wave 2 8/2011 (N = 128)	Wave 3 4/2012 (N = 109)	Wave 4 8/2012 (N = 154)	Wave 5 4/2013 (N = 152)	Wave 6 8/2013 (N = 151)	Wave 7 3/2014 (N = 118)
Mean score (SE)	5.9 (0.13)	6.2 (0.16)	6.3 (0.17)	6.2 (0.15)	6.6 (0.12)*	6.5 (0.14)*	6.2 (0.16)
High/medium adherence† (%)	56.9	57.8	64.2	63.6	69.7*	70.9*	61.0
Low adherence‡ (%)	43.1	42.2	35.8	36.4	30.26*	29.1*	39.0

MMAS, Morisky Medication Adherence Scale; SE, standard error.
* $P < .05$ compared with baseline.
† High/medium adherence defined as an MMA score $\geq$6.
‡ Low adherence defined as an MMA score.

were the current recommendations at the initiation of the project and during most of the intervention. Sensitivity analyses, however, did not demonstrate any significant differences in outcomes using a definition of hypertension control of BP $<$ 140/90 mm Hg for all patients. As a real-life urban project, patients entered and left the practice through the course of the project. We accounted for this using both WGEE and also generalized linear mixed effects models with multiple imputations for missing data. The type of analyses did not change the overall conclusions of the project. Last, our MMAS adherence survey data were obtained from a convenience sample of participants and did not track respondents longitudinally.

Our study also has several important implications for the future practice. Overall, we found that a multidisciplinary team approach involving direct patient care and population-level patient management provides substantial improvements in hypertension control in a real-world urban setting, independent of race, gender, and insurance. In addition, we improved BP control in patients regardless of comorbidity status, via inclusion of patients with diagnosis beyond essential hypertension. These processes are key components of evolving PCMH models and offer the potential to substantially improve hypertension control and reduce associated morbidity and mortality in and underserved population of patients.

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