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Improving refill adherence and hypertension control in black patients: Wisconsin TEAM trial

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Abstract

Objective—To assess the effectiveness and sustainability of a 6-month Team Education and Adherence Monitoring (TEAM) intervention for black patients with hypertension in community chain pharmacies.

Design—Cluster randomized trial.

Setting—28 chain pharmacies (14 TEAM and 14 control) in five Wisconsin cities from December 2006 to February 2009.

Participants—576 black patients with hypertension.

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Intervention—Trained pharmacist–technician teams implemented a 6-month intervention using scheduled visits, Brief Medication Questionnaires (BMQs), and novel toolkits for facilitating medication adherence and pharmacist feedback to patients and physicians. Control participants received patient information only.

Main outcome measures—Refill adherence (≥80% days covered) and changes in systolic blood pressure (SBP), diastolic blood pressure, and blood pressure control using blinded assessments at 6 and 12 months.

Results—At baseline, all patients had blood pressure of 140/90 mm Hg or more. Of those eligible, 79% activated the intervention (mean 4.25 visits). Compared with control participants at 6 months, TEAM participants achieved greater improvements in refill adherence (60% vs. 34%, $P < 0.001$), SBP (−12.62 vs. −5.31 mm Hg, $P < 0.001$), and blood pressure control (50% vs. 36%, $P = 0.01$). Six months after intervention discontinuation, TEAM participants showed sustained improvements in refill adherence ($P < 0.001$) and SBP ($P = 0.004$), though the difference in blood pressure control was not significant ($P < 0.05$) compared with control participants. Analysis of intervention fidelity showed that patients who received the full intervention during months 1 through 6 achieved significantly greater 6- and 12-month improvements in refill adherence and blood pressure control compared with control participants.

Conclusion—A team-based intervention involving community chain pharmacists, pharmacy technicians, and novel toolkits led to significant and sustained improvements in refill adherence and SBP in black patients with hypertension.

Keywords

Hypertension; medication adherence; pharmacy services; black patients

Poor medication refill adherence is a significant predictor of stroke and death in patients with hypertension[1] and remains a significant problem in blacks, who suffer disproportionately from hypertension and experience poorer blood pressure control and cardiovascular outcomes than whites.[2–7] Studies also demonstrate that blacks experience significantly more barriers to antihypertensive medication adherence than whites, including greater concerns about drug efficacy, greater concerns about adverse effects, forgetting to take medications, and difficulty paying for medications.[8,9] Effective interventions are needed to address these barriers to medication adherence in this vulnerable population.[6,9]

Involving pharmacists in blood pressure management can have a positive effect on blood pressure control and improve medication adherence.[10–19] Despite these successes, many pharmacy studies have been criticized for involving only a few providers, few minority and low-income patients, poor statistical controls, unblinded blood pressure measurements, high patient drop out, and labor-intensive interventions that are complex, lack sustained effects, and are difficult to implement beyond teaching clinics and closed health systems.[20–22] Studies examining sustainability generally show deterioration in medication adherence[12,15,19,21] and blood pressure control[12,13,23] following intervention discontinuation. One clinic-based study[24] found sustained blood pressure control following intervention discontinuation; however, that intervention involved predominately white patients, and 57% of intervention participants (110 of 192) dropped out or declined to

participate in the postintervention study. To date, no cluster randomized trials have targeted barriers to adherence and blood pressure control among black patients with hypertension in community chain pharmacies, where most Americans obtain their medications.

Objective

The Team Education and Adherence Monitoring (TEAM) trial was a 28-pharmacy, cluster randomized trial funded by the National Heart, Lung, and Blood Institute.[9] Our goal was to determine whether medication adherence and blood pressure outcomes are improved and sustained in black patients assigned to an intervention involving community chain pharmacists, pharmacy technicians, and user-friendly toolkits for improving medication adherence and feedback to patients and physicians.

Methods

Our study methods and framework are detailed elsewhere.[9] The University of Wisconsin–Madison Institutional Review Board approved procedures for patient screening, 6-month intervention, and 6- and 12-month follow-up at 28 chain pharmacies in five Wisconsin cities. Investigators enrolled one pharmacist and one to two technicians per pharmacy and used computer software (Stata Release 11; Stata Corp, College Station, TX) to randomize pharmacies into two arms (14 TEAM and 14 control). Pharmacies were owned by Walgreens or Aurora Pharmacy (mean 327.5 prescriptions/day). Of 14 TEAM sites, 10 had good pharmacist continuity (no change in study pharmacist) and 4 sites required pharmacist replacement as a result of medical leaves or transfers. All pharmacies completed the trial.

Patients were enrolled from December 2006 until August 2007, with data collection completed in 2009. Investigators scheduled free blood pressure screenings in 28 study pharmacies. Black patients who took at least one blood pressure prescription were encouraged to attend one of the screenings using study posters, flyers, gift card incentives, and interest forms distributed at study pharmacies and several churches.[9] All screenings were conducted by project assistants, who were hired and supervised by investigators, blinded to pharmacy allocation, and trained to obtain consents and three blood pressure readings with 30-second intervals between readings. The second and third readings were averaged to determine eligibility. Blood pressure values were measured using American Heart Association (AHA) guidelines and an automatic monitor validated by the British Hypertension Society (Microlife Model 3AA1-2; Microlife, Clearwater, FL). Project assistants were assigned to several pharmacies at a time. After meeting enrollment goals at their sites, project assistants moved to the next subset of pharmacies assigned by the researchers. Investigators verified patient eligibility by reviewing medication profiles and contacting primary care physicians who could recommend exclusion.

Patients had to be 18 years or older and self-identified as black, have one or more blood pressure prescriptions, obtain all blood pressure medications from Walgreens or Aurora pharmacies, have a mean blood pressure of 140/90 mm Hg or more, and be able to read and return for six visits. Exclusion criteria included blood pressure greater than 210/115 mm Hg, kidney dialysis, liver disease, organ transplant, serious memory loss, terminal illness,

pregnancy, alcohol/substance use problem, heart failure symptoms, arm circumference greater than 16.5 in, physician exclusion, or employment at the pharmacy. Pharmacy allocation was concealed from patients until investigators verified that enrollment goals were met at their pharmacy.

Control group

Control participants received patient information only, including a 14-page guide for lowering blood pressure, pamphlet about hypertension in black patients, cards showing their blood pressure at baseline and follow-up interviews, and instructions to seek immediate medical care for a blood pressure value greater than 210/115 mm Hg at 6- or 12-month follow-up. Primary care physicians received an introductory letter; Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7). guidelines[25]; and names of eligible patients. Pharmacy staff received a study description, posters, interest forms, JNC-7 guidelines, and no additional tools or training.

TEAM intervention

In addition to the materials given to control participants, TEAM participants were invited to participate in the 6-month intervention. After receiving a list of eligible patients, intervention teams attempted to contact and invite patients to activate the intervention by completing a team intake and initial pharmacist consultation. Pharmacists attempted to complete one team intake and five follow-up visits per patient and to fax an introductory letter and feedback to physicians if patients did not achieve blood pressure control by month 3 (or earlier if necessary).

The intervention was based largely on the Health Collaboration Model and involved several unique strategies.[9] First, we developed and provided clinical toolkits for pharmacists and technicians. These user-friendly toolkits included modified Brief Medication Questionnaires (BMQs)[26] and other patient self-report tools for easy identification and monthly assessment of the “core” barriers targeted in this trial (patient misunderstandings of blood pressure goals and regimen; patient doubts or concerns about drug efficacy, adverse effects, and long-term effects; and difficulties remembering, paying, or refilling on time). Pharmacy technicians asked patients to complete these self-report tools in the waiting area before they met with pharmacists, saving time for staff and patients.

In addition to patient self-report tools, the clinical toolkits included simple algorithms for addressing identified barriers, one-page checklists for documenting and tracking barriers and interventions, structured tools for faxing feedback to physicians (if needed), and validated blood pressure monitors and portable furniture for a semiprivate blood pressure station.

Second, we developed and provided one take-home toolkit for each patient. This patient toolkit included a wallet card for recording blood pressure readings, 7-day medication box for remembering doses, easy-to-read leaflets for increasing patient awareness and involvement in the TEAM program, and a pedometer for reinforcing lifestyle change. Pharmacists used various tools to facilitate two-way communication during the initial visit and encouraged patients to read the leaflets and try various tools before the next visit.

Third, investigators provided a 7-hour joint training session for intervention teams using multiple methods (i.e., lecture, discussion, demonstration, role play with tools). Technicians were trained to assist pharmacists in setting up their blood pressure station, measuring blood pressure values, administering BMQs and other self-report tools, confirming appointments, and rescheduling no-shows (without clerical assistance). Pharmacists were trained to identify and address the targeted barriers to medication adherence and blood pressure control using BMQs and other tools.

Fourth, the participating corporations were contracted by the study director to implement the 6-month intervention at TEAM sites. Intervention teams received release time for training and generally scheduled one 2-hour blood pressure clinic per week during hours of overlapping staff, allowing them to focus on study patients. Participating corporations received modest compensation for documented interventions and training; patients received no compensation for keeping TEAM appointments. To address potential barriers to implementation, district managers and supervisors served on a protocol advisory group led by the study director.

Outcomes

The primary behavioral outcomes were refill adherence rates during months 1 through 6 (intervention) and months 7 through 12 (postintervention). Pharmacy corporations retrieved electronic refill data from centralized records for 522 patients (90.6%) who filled 8,991 antihypertensive medication prescriptions at any of their locations during months 1 through 12. Using refill dates and days supplied for each refill, we characterized every day as having available any major antihypertensive medication. We summed days with available medication for each period and computed proportion of days covered with any antihypertensive medication.[27] Good refill adherence was defined as 80% days covered or greater, with fewer days or no refills defined as nonadherent.

The primary clinical outcomes were changes in systolic blood pressure (SBP) and diastolic blood pressure (DBP) and proportion of patients achieving blood pressure below 140/90 mm Hg after 6 months (end of intervention) and 12 months (6 months after intervention discontinuation). The University of Wisconsin Survey Center (UWSC) was contracted by the study director (B.L.S.) to relocate all patients and perform the 6- and 12-month interviews according to protocol. UWSC is nationally recognized for state-of-the-art methods of tracking, relocating, and interviewing participants in longitudinal studies (www.uwsc.wisc.edu). UWSC interviewers were blinded to pharmacy allocation, were not involved in recruitment or intervention, and were trained by an investigator (J.M.K.) to obtain three blood pressure readings using the same monitor and AHA guidelines used at baseline. The second and third readings were averaged and used in analyses.

Secondary outcomes included intensification of blood pressure therapy and patient perceptions of pharmacist monitoring and support during months 1 through 6. Research pharmacists reviewed patient medication profiles to determine whether therapy was intensified (defined as a net increase in the number of prescribed blood pressure drugs or dosage during months 1 through 6). Patient perceptions of pharmacist monitoring and

support were assessed using 10 items that were developed for this trial and included in the questionnaire completed by all patients at the 6-month interview.

Data analysis

We used the Optimal Design version 1.77 application[28,29] to estimate the sample size for maintaining statistical power at 0.80 with a two-tailed alpha value of 0.05. Due to hierarchical data, we projected varying participant response dependencies ($\rho = 0.02–0.08$). The results indicated that 28 pharmacies and 18 patients per site ($n = 504$) were needed to maintain statistical power with an effect size of 0.40 (based on previous studies) and pharmacy dependency of $\rho = 0.08$. We attempted to enroll 25 patients per site, allowing for attrition.

A random-effects, three-level, hierarchical, fixed-occasion/longitudinal profile analysis[30–32] was used to assess refill adherence and blood pressure outcomes as a function of the intervention and covariates. The analysis was hierarchical, with 6- and 12-month measures after baseline nested under each patient and in turn under each pharmacy. Binary outcomes were assessed using hierarchical logistic regression models for longitudinal data.[31]

Laird[33] suggested that a random-effects model for longitudinal data provides valid inferences in the presence of ignorable nonresponse. We used pattern mixture modeling,[34] with the pattern defined as completers versus noncompleters (partial respondents). Treatment effects across time did not vary by completion status. Thus, effects were not adjusted, following Hogan and Laird.[34]

The primary analysis included all patients based on the intent-to-treat concept. Following the Behavior Change Consortium,[35] we also analyzed the effects of intervention “fidelity” by comparing control participants with intervention participants who received a “full” versus “partial” intervention. A full intervention was defined as completing at least five of six TEAM visits using relevant tools during months 1 through 6; a partial intervention was defined as completing one to four TEAM visits. The fidelity analysis used the same hierarchical modeling techniques and covariates used in primary analyses. Intervention records were used to count the number of TEAM visits using relevant tools.

TEAM website

Recruitment and intervention tools, blood pressure measurement procedures, photographs of a typical blood pressure station, research questionnaires, and publication links are available at www.pharmacy.wisc.edu/ team-study.

Results

Interviewers screened 1,250 black patients at 28 pharmacies (Figure 1). Nearly 64% had uncontrolled blood pressure of 140/90 mm Hg or more and 576 were eligible for the trial (276 TEAM and 300 control). Blinded interviewers reassessed 94.8% of all patients at 6 months and 85.6% at 12 months.

At baseline, all patients had treated but uncontrolled blood pressure of 140/90 mm Hg or more. Study groups were similar on demographics, blood pressure, number of drugs, missed doses, and barriers to adherence (Table 1). Physical activity level varied by group and was entered into all models. Approximately 52% had household incomes less than $20,000 per year. On average, patients reported 2.8 physician visits in the previous 6 months and 4.1 barriers to adherence in the previous week. The most common barriers to adherence were patient doubts about how well their drug works (53.8%), worries about long-term effects (40.1%), unwanted adverse effects or bothersome features (33.9%), and difficulty paying (28.3%). Nearly 50% stated that they did not know what their blood pressure values should be.

Team intervention

Pharmacy technicians contacted and encouraged 218 patients (79%) to complete the team intake, thereby activating the intervention. The remaining patients could not be reached (n = 23), moved or changed pharmacies before the team intake (n = 17), or did not complete the intake for other reasons (n = 18). Sites with good pharmacist continuity were more successful in activating the intervention; however, patient activation was unrelated to patient demographics and other baseline characteristics (data not shown).

Pharmacists documented an average of 4.25 visits per activated patient, including at least one follow-up visit for 180 patients (82.6%) and feedback to physicians for 111 patients (50.9%). Of 218 activated patients, 125 (57%) received the full intervention. Pharmacist–patient encounters using TEAM tools averaged 25.7 minutes per intake and 11.2 minutes per follow-up.

Refill adherence and blood pressure outcomes

Table 2 shows the primary analysis for all participants after the 6-month intervention. Good refill adherence rates were 34% for control participants and 60% for TEAM participants—a 76.5% increase ($P < 0.001$ for between-group comparison adjusting for cluster randomization and covariates). Compared with control participants, TEAM participants achieved a net reduction of 7.31 mm Hg in SBP ($P < 0.001$) and 2.95 mm Hg in DBP ($P = 0.01$) and a net increase of 14% in blood pressure control ($P = 0.01$). None of the TEAM participants and 10 (3.3%) control participants had a severely elevated blood pressure above 210/115 mm Hg at 6 months (data not shown). Thus, 10 control participants were instructed to see their physician or go to an urgent care center immediately after the 6-month interview.

Table 2 also shows the refill adherence and blood pressure outcomes for all participants at month 12 (6 months after intervention discontinuation). Compared with control participants at 12 months, TEAM participants showed greater refill adherence (62% vs. 44%, $P < 0.001$), lower SBP (137.46 vs. 143.37 mm Hg, $P < 0.001$), and greater SBP reduction (−13.64 vs. −8.30 mm Hg, $P = 0.004$), controlling for cluster randomization and covariates. Between-group differences in DBP and blood pressure control were not significant at 12 months due to improvements in control participants. None of the participants had severely elevated blood pressure values at 12 months.

Analysis of intervention fidelity

Figure 2 shows the refill adherence rates for control participants (patient information only) versus those who received partial or full intervention. During months 1 through 6, refill adherence was significantly lower in control participants (34%) than in those who received partial intervention (49%, $P < 0.05$) or full intervention (68%, $P < 0.01$). After intervention discontinuation, good adherence rates were similar for control participants (44%) and those who received partial intervention (45%). Compared with control participants, refill adherence remained significantly higher for those who received full intervention (74% vs. 44%, $P < 0.001$).

Figure 2 also shows the blood pressure control rates for control participants versus those who received partial or full intervention. Compared with control participants at month 6, there was a trend for improved blood pressure control in those who received partial intervention (47% vs. 37%, $P = 0.08$) and significant improvement in those who received full intervention (58% vs. 37%, $P < 0.01$). At month 12, blood pressure control rates were similar for control participants (44%) and those who received partial intervention (43%). In contrast, participants who received full intervention achieved sustained improvement in blood pressure control relative to control participants after intervention discontinuation (59% vs. 44%, $P < 0.01$). These findings suggest a dose–response relationship or greater intervention effects associated with the full intervention.

Changes in prescribing and patient perceptions of pharmacy care

Pharmacy records for months 1 through 6 showed a net increase in the prescribed daily dosage or number of prescribed blood pressure drugs for 33% (n = 72) of TEAM participants and 25% (n = 75) of control participants ($P = 0.045$ for between-group comparison using chi-square test). The 6-month patient survey results further demonstrated a significant improvement in the patient's perception of pharmacist monitoring and support during months 1 through 6 (Table 3). Compared with control participants, TEAM participants reported greater pharmacist effort to assess adherence and barriers to adherence, encourage medication use, and encourage keeping track of blood pressure readings (items 1–4; $P < 0.001$) and greater pharmacist effort to help patients understand blood pressure readings, organize or remember medications, and reduce adverse effects or costs (items 5–8; $P < 0.001$). TEAM participants were more likely to report that their pharmacist contacted their physician or suggested a medication change compared with control participants (items 9–10; $P < 0.001$). Thus, intervention participants generally experienced a higher level of adherence monitoring and support by their pharmacists than control participants during months 1 through 6.

Discussion

To our knowledge, this is the first cluster randomized trial targeting poor medication adherence among black patients with hypertension in chain pharmacies and one of the first controlled trials to demonstrate significant and sustained improvement in refill adherence and SBP reduction among black patients with hypertension after intervention discontinuation. Similar to previous studies,[12,13] the between-group difference in blood

pressure control was not significant after intervention discontinuation. However, TEAM participants achieved significant net improvements in SBP after the intervention (−7.31 mm Hg, $P < 0.001$) and 6 months after intervention discontinuation (−5.24 mm Hg, $P = 0.004$) compared with control participants. These findings suggest that good refill adherence is sustainable, is linked to SBP reduction and blood pressure control in black patients, and can be achieved by implementing relatively simple tools and a team-based model of care involving chain pharmacists and pharmacy technicians.

Team intervention studies often report the number of pharmacist–patient encounters, but intervention fidelity and dose–response findings are rarely evaluated. In this trial, patients who received the full intervention achieved more sustained improvement in refill adherence, SBP, and blood pressure control than those who received partial intervention or patient information only. These dose–response findings are very important and highlight the need to keep staff and patients engaged in a team intervention. They also highlight the need to critically evaluate data in future studies because lack of sustained effects in medication adherence and/or blood pressure control do not always mean that the intervention is ineffective or that it must be continued in all patients.

Control participants received printed information, blood pressure readings, and instructions to seek immediate medical care for a severely elevated blood pressure at follow-up. These research activities likely contributed to control group improvements and blunted intervention effects, especially after the 6-month interview when a subset of control participants were instructed to seek immediate medical care. Nevertheless, only 34% of the control participants had good refill adherence in months 1 through 6 and only 44% had good refill adherence in months 7 through 12. These remarkably low rates of adherence are consistent with the low rates of antihypertensive refill adherence among Medicaid recipients in New Jersey (23%),[4] Maryland (24.8%),[5] and Tennessee (39.4%)[1] and are a stark reminder about the profound gaps in hypertension care and need for systematic assessment of barriers to adherence before advocating intensification of therapy for minority and low-income patients.

Our intervention was unique in relying on community chain pharmacists, technicians, and patient self-report tools. Several reasons could explain why this intervention had a more sustained effect on medication adherence than previous interventions. First, the intervention protocol required the the routine use of a one-page BMQ at all team intake visits and the routine use of a five-item abbreviated BMQ at all follow-up visits. As a result, patients were encouraged to express their views about the most common and modifiable barriers known to influence adherence in patients with hypertension.[9,26] In our experience, these adherence barriers often go undetected in busy clinics and pharmacies, especially in minority and low-income patients who may be more reluctant than other patients to ask questions or volunteer their concerns. Second, regular use of BMQs along with “tailored” counseling, team outreach, and good pharmacist continuity likely increased pharmacists’ awareness and patients’ trust and/or willingness to communicate with pharmacy staff during and after the intervention. In any case, a substantial number of TEAM participants responded favorably to increased pharmacist monitoring and support.

Our results are consistent with blood pressure studies involving pharmacists in other populations and settings.[10–23] Several studies achieved higher blood pressure control rates,[14,17] but they involved pharmacists who provided face-to-face feedback to physicians or were authorized to adjust medications. The strengths of our study included (1) intervention by nonacademic pharmacists in busy community chain pharmacies; (2) a large, diverse sample of black patients with hypertension; (3) rigorous methodologies (cluster randomization, blood pressure measurements using blinded interviewers, low patient drop out, objective refill data, hierarchical modeling, control of covariates, and intent-to-treat analysis); and (4) an intervention requiring less pharmacist time, increasing potential spread or "scalability." In this trial, pharmacist–patient encounters averaged 26 minutes per intake and 11 minutes per follow-up compared with 50 to 60 minutes per intake and 30 minutes per follow-up in previous studies.[15,20]

Limitations

This study had several limitations. First, four TEAM sites had to replace their pharmacist as a result of medical leaves or transfers. The inevitable delays made it difficult for these sites to activate and complete the intervention for all patients in a timely manner. Training backup pharmacists or several pharmacist–technician teams may be helpful. Second, pharmacies were owned by the nation's largest pharmacy chain and a regional chain. Although this study feature increased generalizability, studies are needed in other settings. Third, some patients may have obtained medications from other sources after enrollment, though bias is unlikely because we did not find between-group differences in the use of hospitals, clinics, or other pharmacies after enrollment. Fourth, research is needed to evaluate the optimal duration of intervention for different subgroups, validity of items for measuring patient perceptions of pharmacist performance, and cost effectiveness of different strategies and incentives for engaging different employers, staff, and patients.

Conclusion

In this TEAM trial, trained pharmacist–technician teams using novel toolkits achieved significant and sustained improvements in refill adherence and SBP in black patients with hypertension. Our findings suggest that community chain pharmacists and their technicians are underused given their knowledge and skills, access to refill records, convenient location, and ability to successfully implement a new model and tools in busy settings where they have limited space and competing demands. This team-based approach may contribute to further research and ongoing efforts to improve the process of care for black patients with hypertension and possibly other patients.

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At a Glance

Synopsis

A team-based intervention involving community chain pharmacists, pharmacy technicians, and novel tools led to significant and sustained improvements in antihypertensive medication refill adherence and systolic blood pressure in black patients with hypertension. At baseline, all patients had blood pressure of 140/90 mm Hg or more. Compared with control participants at 6 months, intervention patients achieved greater improvements in refill adherence (60% vs. 34%), systolic blood pressure (SBP; −12.62 vs. −5.31 mm Hg), and blood pressure control (50% vs. 36%). The intervention patients also demonstrated sustained improvements in refill adherence and SBP 6 months after intervention discontinuation.

Analysis

These findings suggest that good refill adherence is sustainable, is linked to SBP reduction and blood pressure control in black patients, and can be achieved by implementing relatively simple tools and a team-based model of care involving chain pharmacists and pharmacy technicians. Regular use of Brief Medication Questionnaires, along with tailored counseling, team outreach, and good pharmacist continuity, likely increased patient trust and improved two-way communication between patients and pharmacy staff during and after the intervention. A strength of this study is that the intervention required less pharmacist time, which could lead to increased scalability.

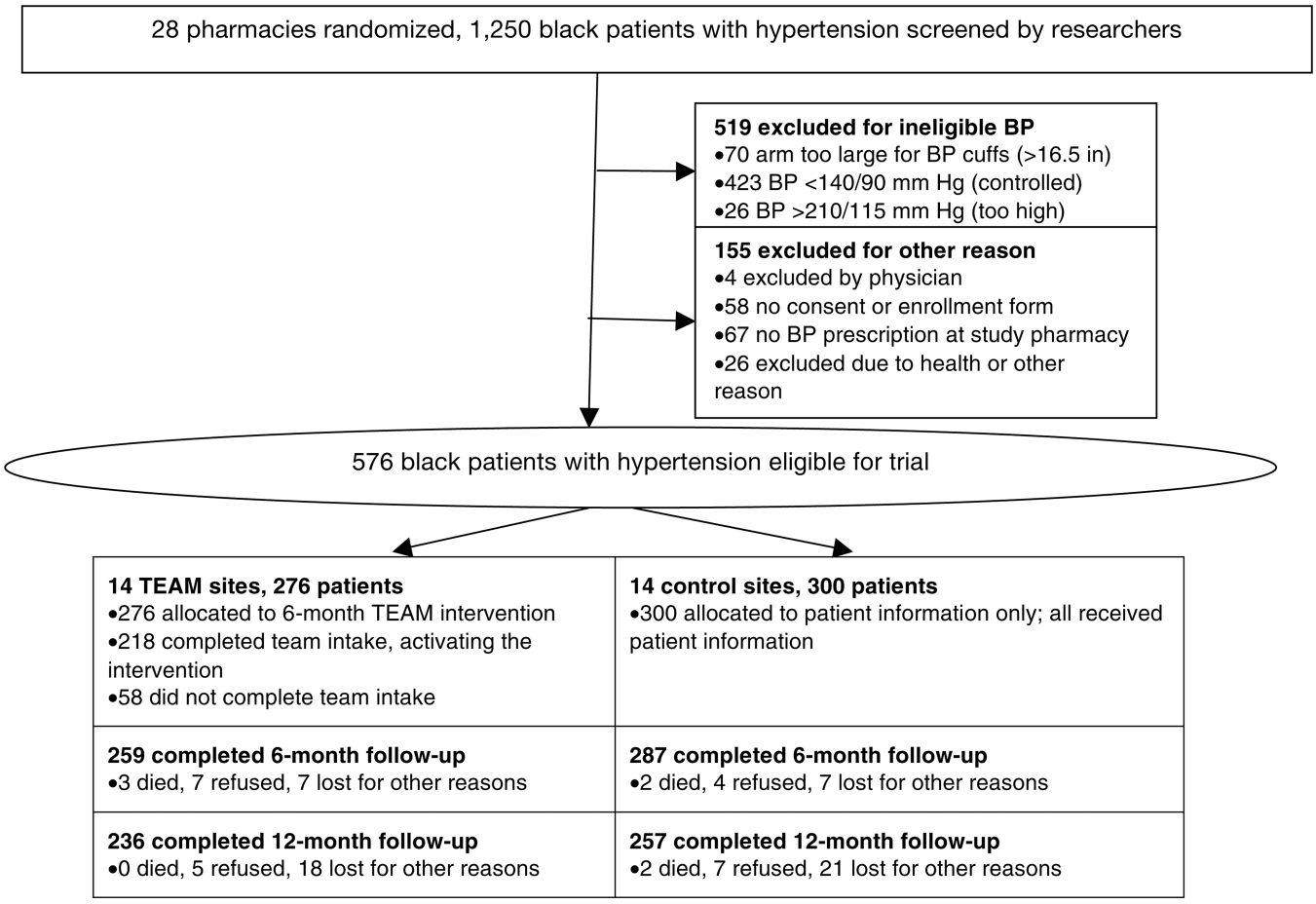

Figure 1.

Patient flow in the TEAM trial

Abbreviations used: BP, blood pressure; TEAM, Team Education and Adherence Monitoring.

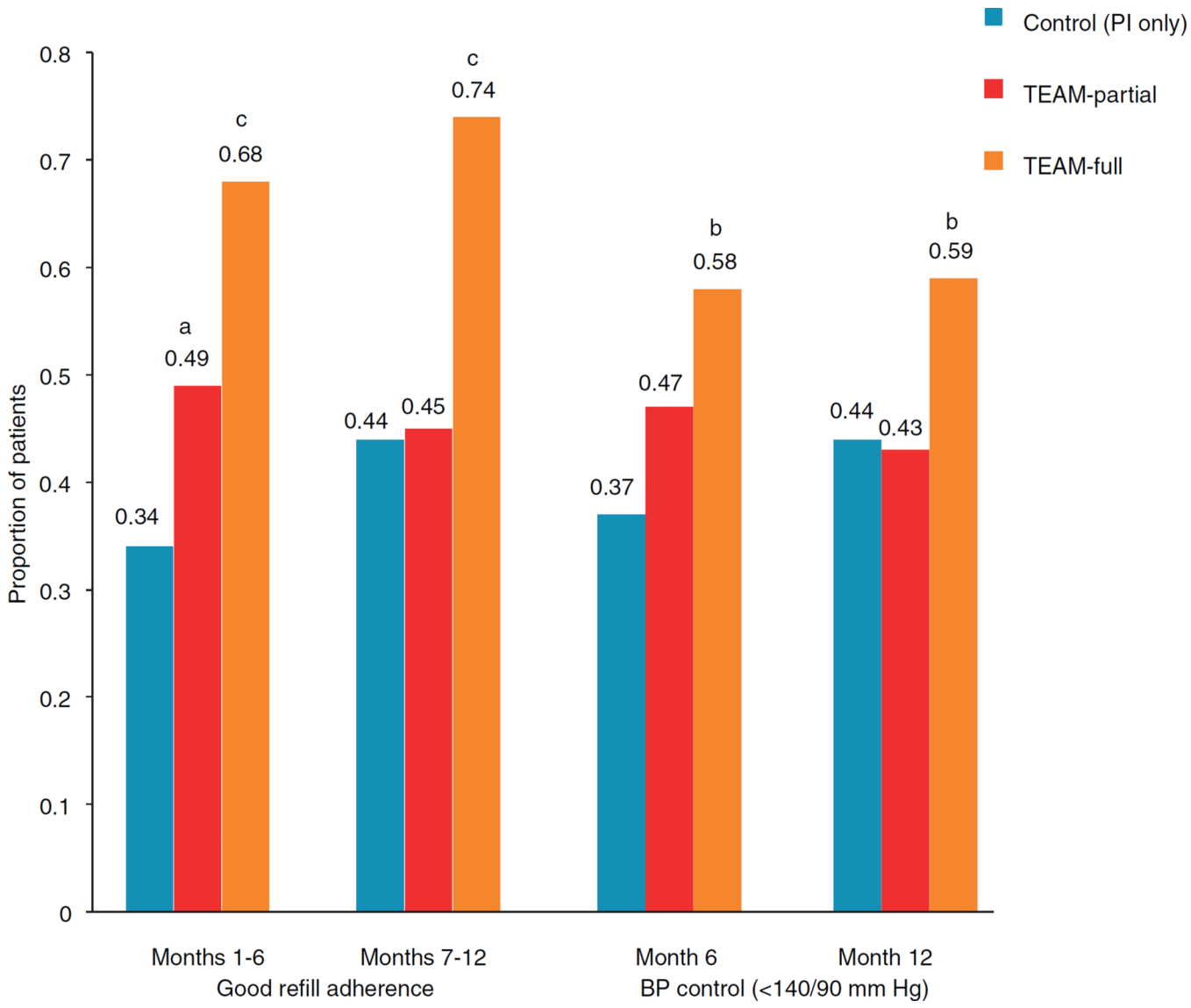

Figure 2.

Refill adherence and blood pressure control, by intervention received

Abbreviations used: BP, blood pressure; PI, patient information; TEAM, Team Education and Adherence Monitoring.

Results based on hierarchical models controlling for cluster randomization and covariates. TEAM-partial refers to partial intervention (less than 5 visits); TEAM-full refers to full intervention (five or more visits using TEAM tools); good refill adherence refers to coverage for ≥80% days covered.

[a] $P < 0.05$, TEAM subgroup vs. control.

[b] $P < 0.01$, TEAM subgroup vs. control.

[c] $P < 0.001$, TEAM subgroup vs. control.

Table 1

Baseline patient characteristics and barriers to medication adherence, by study group

	Overall No. (%)	Control: PI only No. (%)	TEAM No. (%)
n	576	300	276
BP ≥140/90 mm Hg	576 (100)	300 (100)	276 (100)
Systolic BP (mm Hg), mean ± SD	152.2 ± 15.9	153.1 ± 16.6	151.2 ± 15.2
Diastolic BP (mm Hg), mean ± SD	92.5 ± 10.0	92.9 ± 10.0	92.0 ± 10.1
No. of drugs currently used (mean ± SD)	1.79 ± 1.03	1.78 ± 1.06	1.79 ± 1.01
Reported ≥ 1 missed doses/previous week	153 (26.6)	80 (26.7)	73 (26.4)
Women	381 (66.1)	202 (67.3)	179 (64.9)
Age (years), mean ± SD	52.9 ± 11.4	52.8 ± 11.9	53.2 ± 11.0
<12 years education	157 (27.5)	91 (30.6)	66 (24.1)
Household income <$20,000/y	281 (52.4)	152 (53.7)	129 (50.9)
Unemployed	330 (58.3)	178 (60.5)	152 (55.9)
Medicaid eligible	118 (20.6)	61 (20.5)	57 (20.7)
Reported diabetes	142 (24.7)	68 (22.7)	74 (26.8)
Smoker	213 (37.3)	114 (38.1)	99 (36.4)
Alcoholic drinks/day (mean ± SD)	0.96 ± 1.43	1.04 ± 1.47	0.86 ± 1.38
Activity score/week (mean ± SD)	4.43 ± 3.99	3.96 ± 3.96	4.73 ± 3.95[a]
Reported at least one visit to general physician in previous 6 months	487 (88.7)	259 (90.6)	228 (86.7)
No. of reported visits to general physician in previous 6 months (mean ± SD)	2.80 ± 3.46	2.76 ± 2.73	2.85 ± 4.12
Reported barriers to medication adherence in previous week			
Has misunderstanding of BP drug regimen or purpose	89 (15.5)	47 (15.7)	42 (15.2)
Has doubt or concern about how well BP drug works	310 (53.8)	156 (52.0)	154 (55.8)
Is bothered by drug or has unwanted adverse effect	195 (33.9)	108 (36.0)	87 (31.5)
Is worried about long-term drug effect or problem	231 (40.1)	122 (40.7)	109 (39.5)
Has difficulty remembering doses for BP drug	75 (13.0)	38 (12.7)	37 (13.4)
Has difficulty paying for BP drug	163 (28.3)	80 (26.7)	83 (30.1)
Has difficulty getting BP refills on time	82 (14.2)	49 (16.3)	33 (12.0)

	Overall No. (%)	Control: PI only No. (%)	TEAM No. (%)
Total no. of adherence barriers reported (mean ± SD)	4.07 ± 4.43	4.07 ± 4.43	4.06 ± 4.43
No. of adherence barriers reported per BP drug (mean ± SD)	2.24 ± 2.24	2.24 ± 1.82	2.24 ± 1.80
States that he/she does not know what BP values should be	283 (50.4)	152 (51.7)	131 (49.1)

Abbreviations used: BP, blood pressure; PI, patient information; TEAM, Team Education and Adherence Monitoring.

All patients (n = 576) were self-identified as black.

Baseline patient characteristics were measured using a questionnaire administered at the baseline research interview; patient-reported barriers to adherence were measured using a modified Brief Medication Questionnaire completed by all patients at the baseline research interview.

[a]Between-group difference significant at $P < 0.01$; no significant between-group difference in other categories.

Table 2

Refill adherence and blood pressure outcomes at 6 and 12 months, by study group

	Month 6 (end of intervention) (95% CI)			Month 12 (6 months after intervention discontinuation) (95% CI)		
Outcome	**Control: PI only**	**TEAM**	***P***	**Control: PI only**	**TEAM**	***P***
n	287	207		252	187	
Good refill adherence[a,b]	0.34 (0.28–0.40)	0.60 (0.52–0.67)	<0.001	0.44 (0.38–0.50)	0.62 (0.54–0.68)	<0.001
Systolic BP (mm Hg)						
Unadjusted (mean ± SD)	146.92 ± 22.18	137.93 ± 16.92	<0.001	143.37 ± 20.41	137.46 ± 16.16	<0.001
Unadjusted Change from baseline[c]	−5.31 (−7.52 to −3.10)	−12.62 (−15.21 to −10.03)	<0.001	−8.30 (−10.76 to −5.84)	−13.64 (−16.43 to −10.85)	0.004
Diastolic BP (mm Hg)						
Unadjusted (mean ± SD)	86.71 ± 13.57	82.67 ± 10.27	0.001	84.71 ± 13.03	82.69 ± 11.69	0.09
Change from baseline[c]	−5.68 (−7.18 to −4.18)	−8.63 (−10.25 to −7.01)	0.01	−7.14 (−8.54 to −5.73)	−8.57 (−10.16 to –6.98)	0.20
BP <140/90 mm Hg[b]	0.36 (0.31–0.43)	0.50 (0.42–0.58)	0.01	0.43 (0.35–0.52)	0.51 (0.41–0.59)	0.26

Abbreviations used: BP, blood pressure; PI, patient information; TEAM, Team Education and Adherence Monitoring.

[a]Good refill adherence defined as ≥80% days covered with BP medication; patients with fewer days or no refills defined as nonadherent.

[b]Estimated proportion using hierarchical logistic model adjusting for cluster randomization and patient covariates.

[c]Estimated change from baseline in hierarchical linear model adjusting for cluster randomization and patient covariates.

Table 3

Patient perceptions of pharmacist monitoring and support after 6 months, by study group

	Control: PI only % yes (n)	TEAM % yes (n)	Net difference %	*P*
In the previous 6 months, did your pharmacist(s):				
1. Ask how you are taking your blood pressure medication?	12.5 (36)	72.9 (151)	60.4	≤0.001
2. Ask about your concerns and difficulties in taking blood pressure medication?	17.8 (51)	70.4 (145)	52.6	≤0.001
3. Encourage you to take your blood pressure medication every day?	27.2 (78)	81.6 (169)	54.4	≤0.001
4. Encourage you to keep track of your blood pressure numbers?	11.5 (33)	78.7 (163)	67.2	≤0.001
5. Help you understand what your blood pressure numbers should be?	11.5 (33)	81.2 (168)	69.7	≤0.001
6. Help you organize or remember your blood pressure medication?	13.2 (38)	63.1 (130)	49.9	≤0.001
7. Help you reduce a medication adverse effect?	7.3 (21)	29.1 (60)	21.8	≤0.001
8. Help you reduce medication costs?	13.3 (38)	24.6 (51)	11.3	≤0.001
9. Contact your physician about your blood pressure?	15.0 (43)	41.2 (84)	26.2	≤0.001
10. Suggest a change in blood pressure medication or dosage?	5.2 (15)	31.9 (66)	26.7	≤0.001
No. of patients completing 6-month survey/total no. of activated patients	257/300	207/218		

Abbreviations used: PI, patient information; TEAM, Team Education and Adherence Monitoring.

[a] *P* values for chi-square test comparing control group with TEAM group.