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Team-Based Care and Improved Blood Pressure Control:

A Community Guide Systematic Review

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Abstract

Context—Uncontrolled hypertension remains a widely prevalent cardiovascular risk factor in the U.S. team-based care, established by adding new staff or changing the roles of existing staff such as nurses and pharmacists to work with a primary care provider and the patient. Team-based care has the potential to improve the quality of hypertension management. The goal of this Community Guide systematic review was to examine the effectiveness of team-based care in improving blood pressure (BP) outcomes.

Evidence acquisition—An existing systematic review (search period, January 1980–July 2003) assessing team-based care for BP control was supplemented with a Community Guide update (January 2003–May 2012). For the Community Guide update, two reviewers independently abstracted data and assessed quality of eligible studies.

Evidence synthesis—Twenty-eight studies in the prior review (1980–2003) and an additional 52 studies from the Community Guide update (2003–2012) qualified for inclusion. Results from both bodies of evidence suggest that team-based care is effective in improving BP outcomes. From the update, the proportion of patients with controlled BP improved (median increase=12 percentage points); systolic BP decreased (median reduction=5.4 mmHg); and diastolic BP also decreased (median reduction=1.8 mmHg).

Conclusions—Team-based care increased the proportion of people with controlled BP and reduced both systolic and diastolic BP, especially when pharmacists and nurses were part of the

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team. Findings are applicable to a range of U.S. settings and population groups. Implementation of this multidisciplinary approach will require health system–level organizational changes and could be an important element of the medical home.

Context

Hypertension, defined as having systolic blood pressure (SBP) \geq 140 mmHg or diastolic blood pressure (DBP) \geq 90 mmHg at two or more office visits or current use of BP-lowering medications,^{1,2} remains the predominant risk factor for cardiovascular mortality in the U.S.^{3,4} The prevalence of hypertension among U.S. adults (aged \geq 18 years) from 2003 to 2010 was 30.4%—approximately 66.9 million adults.⁵ Estimated annual costs of hypertension are \$93.5 billion per year¹ and are projected to increase to \$130.4 billion in 2030 if the status quo is maintained.⁶ Because 90% of adults with uncontrolled hypertension have a usual source of health care with insurance coverage, improving the quality of care for high BP is a priority, as reflected in the *Healthy People 2020* objectives.^{5,7}

Interventions aimed at improving hypertension care need to target both provider-related and patient-related barriers in order to accrue health benefits at the population level.^{1,8,9} One way is through innovative care delivery models such as the Chronic Care Model^{10,11} and the Patient-centered Medical Home (PCMH),¹² which attempt to deliver effective interventions to all patients.¹³ A key feature of these care models is the incorporation of a multidisciplinary team for delivery of healthcare services. This team-based approach organizes care around patients' needs and is frequently implemented with systems support for clinical decision making, collaboration, and patient self-management.^{10–12} Team-based care provides opportunities for care to be more patient centered by being more personalized, timely, collaborative, and empowering while also allowing providers more time to manage complex and critical issues.¹⁴

Previous systematic reviews have found team-based care to be effective in improving BP outcomes.^{15–17} Building on that foundation, this Community Guide systematic review examined current evidence on the effectiveness of team-based care in improving BP outcomes and the applicability of findings to various U.S. populations and settings using methods developed for The Community Guide.^{18,19} Important implementation aspects, such as the type of team member added and role of team members related to medication management, were evaluated, as was the potential benefit of team-based care extending to other cardiovascular disease (CVD) risk factors, such as high cholesterol and diabetes.

Evidence Acquisition

Systematic review methods used by The Community Guide can be found at www.thecommunityguide.org/about/methods.html.^{18,19} For this review, a coordination team was constituted, including subject matter experts on CVD from various agencies, organizations, and institutions together with qualified systematic reviewers from The Community Guide. The team worked under the oversight of the Community Preventive Services Task Force.

Conceptual Approach and Analytic Framework

The coordination team defined team-based care as adding new staff or changing the roles of existing staff to work with a primary care provider. Each team includes the patient, the patient's primary care provider, and other professionals such as nurses, pharmacists, dietitians, social workers, and community health workers. These professionals complement the activities of the primary care provider by providing process support and sharing the responsibilities of hypertension care, which include medication management, active patient follow-up, and adherence and self-management support. Team-based care aims to facilitate communication and coordination of care support among various team members; enhance use of evidence-based guidelines by providers; establish regular, structured follow-up mechanisms to monitor patients' progress and schedule additional visits as needed; and actively engage patients in their own care by providing them with education about hypertension medication, adherence support (for medication and other treatments), and tools and resources for self-management (including health behavior change).

Organizing health system staff such as primary care providers, pharmacists, and nurses to work with patients diagnosed with hypertension leads to better patient support, team member collaboration, and quality of hypertension care. This organizational change is expected to improve outcomes for BP, CVD morbidity and mortality, patient-centered outcomes such as satisfaction with care and treatment adherence, and comorbid CVD risk factors such as diabetes and high cholesterol. Systems-level support, such as use of electronic health records, clinical decision support, and surveillance, frequently accompany team-based care efforts (Figure 1).

Search for Evidence

The search for evidence consisted of two steps (Figure 2). Step 1 involved locating existing systematic reviews on team-based care for BP control. Although multiple high-quality systematic reviews on this topic were identified,¹⁵⁻¹⁷ the systematic review by Walsh and colleagues¹⁷ had a conceptualization and methods similar to the Community Guide approach.^{18,19} Further, the scope adopted for the Walsh review reflected the team's goal of examining the effectiveness of team-based care from a population health perspective. The literature search from this prior review¹⁷ ended in July 2003. Step 2 consisted of an updated search adopting the Walsh review's search terms and databases.¹⁷ This Community Guide update covered the period from July 2003 to May 2012. The complete search strategy is available at www.thecommunityguide.org/cvd/supportingmaterials/SS-team-based-care.html. The remainder of this section discusses the methodology for the Community Guide review.

Inclusion Criteria

Studies were included if they

- met the definition of team-based care as described in the conceptual framework;
- were in English;
- were not in the Walsh et al.¹⁷ review;

- were conducted in a high-income economy²⁰ consistent with Community Guide methods;
- reported at least one BP outcome of interest (i.e., proportion of patients with controlled BP, reduction in SBP, or reduction in DBP);
- included a comparison group or had an interrupted time-series design with at least two measurements before and after the intervention;
- targeted populations with primary hypertension or populations with comorbid conditions such as diabetes as long as the primary focus of the intervention was BP control; and
- did not include populations with secondary hypertension (e.g., pregnancy) or with a history of CVD (e.g., myocardial infarction).

Data Abstraction and Quality Assessment

Each study included in the current review was evaluated independently by two reviewers. Abstraction was based on the standard Community Guide process (www.thecommunityguide.org/methods/abstractionform.pdf). Disagreements between reviewers were resolved by consensus.

Using Community Guide methods, each study was assessed for threats to internal and external validity.¹⁸ Threats to validity—such as poor descriptions of the intervention, population, sampling frame, and inclusion/exclusion criteria; poor measurement of exposure or outcome; lack of appropriate analytic methods; incomplete data sets; high attrition; or intervention and comparison groups not being comparable at baseline—were used to characterize studies as having good (0–1 limitations); fair (2–4); or limited (> 4) quality of execution. Studies judged to be of limited quality of execution were excluded from analysis.

Conclusions on the strength of evidence on effectiveness are based on evidence from both reviews (Walsh and colleagues¹⁷ and this Community Guide update), taking into account the number of studies, quality of available evidence, consistency of results, magnitude of effect estimates, and applicability considerations.¹⁸

Primary Outcomes of Interest

Three BP-related outcomes were the primary variables used to determine intervention effectiveness: proportion of patients with controlled BP and reduction of SBP and DBP (Figure 1). CVD-related morbidity (e.g., incidence of heart attacks and strokes) and mortality were also considered primary outcomes, if available.

Proportion of patients with controlled BP—The minimum requirements for this outcome were established standards for BP control (< 140/90 mmHg or < 130/80 mmHg for people with diabetes).² Using data from the last available time point with ongoing team-based care, the absolute percentage point change in the proportion of patients receiving team-based care achieving BP control compared to patients in usual care was calculated for each study.

$$\text{Absolute percentage point change} = (\text{TBC Prop}_{\text{post}} - \text{TBC Prop}_{\text{pre}}) - (\text{UC Prop}_{\text{post}} - \text{UC Prop}_{\text{pre}}),$$

where

post=measurement from the last available time point with ongoing team-based care

pre=the last measurement before the intervention

prop=the proportion of patients with controlled BP

TBC=team-based care

UC=usual care.

An intent-to-treat analysis method was adopted wherein patients in both intervention and usual care groups that did not complete follow-up were considered to have uncontrolled BP. For a study with multiple team-based care intervention arms, a single effect estimate was calculated comparing the combined data from all intervention arms to usual care.

Reduction in SBP and DBP—For each study, the difference-in-differences of mean SBP or DBP was calculated based on the last time point measured while the intervention was in progress for patients receiving team-based care compared to patients receiving usual care. For studies with multiple team-based care intervention arms, the median individual effect estimate from each intervention arm represented a single data point in the analysis.

$$\text{Difference-in-differences of mean BP} = (\text{TBC Mean}_{\text{post}} - \text{TBC Mean}_{\text{pre}}) - (\text{UC Mean}_{\text{post}} - \text{UC Mean}_{\text{pre}}),$$

where

mean=average SBP or DBP level for each patient group

post=measurement from the last available time point with ongoing team-based care

pre=the last measurement before the intervention

TBC=team-based care

UC=usual care.

For the overall summary measure, the median of effect estimates from individual studies with the interquartile interval (IQI) was reported for each BP outcome.

Secondary Outcomes

Outcomes from one additional area were also analyzed when reported in included studies: patient-oriented outcomes, including medication adherence and satisfaction with care. Calculation of study-level and summary effect estimates followed the same methods as those for BP outcomes with comparable metrics, using proportions for dichotomous variables and means for continuous variables.

Evidence Synthesis

The existing systematic review by Walsh et al.¹⁷ included 28 studies published between January 1980 and July 2003. For the current Community Guide review (July 2003–May 2012), 1,628 potentially relevant titles and abstracts were found, of which 77 articles^{21–97} representing 59 unique studies of team-based care were eligible for inclusion. Seven studies^{35,46,59,60,66,67,70} were judged to be of limited quality and excluded from all analyses. There-fore, 52 studies^{21–34,36–45,47–58,61–65,68,69,71–76,95–97} were included in the Community Guide review (Figure 2).

Both reviews indicated that team-based care resulted in substantial improvements in all BP outcomes (Table 1). The remainder of this paper provides detailed results from analysis of the 52 studies in the current Community Guide review.

Study and Intervention Characteristics

Limitations identified in the included studies showed significant differences in patient demographics between intervention and comparison groups at baseline, possible contamination within intervention and comparison groups, and issues related to inadequate description of populations and implemented interventions (Figure 3).

Thirty-eight studies were conducted in the U.S.^{21–31,33,36–45,47–51,55,58,63–65,69,74,76,95–97} and the remaining studies in Europe^{34,52,54,56,57,61,73,75}, Canada,^{32,53,62,68,72} and Japan.⁷¹ Forty-one studies^{21,22,24–27,30,31,33,34,36–45,47,49–52,54–58,61,63,64,68,69,71–75,95,96} were implemented solely within healthcare settings and nine studies^{23,28,29,32,48,53,65,76,97} were implemented in community settings. One study was conducted both in a healthcare system and a community setting.⁶² Interventions were usually implemented across multiple settings in the healthcare system^{24–27,29–31,34,36–38,40,41,44,45,50,52,54–56,58,61,62,64,68,69,71,75} and in the community, where they were implemented in pharmacies^{32,53,76} and through home outreach visits.^{28,48,65,76,97} The median duration of team-based care interventions was 12 months (IQR=6–12 months). Only six studies^{29,39,40,57,63,75} addressed team-based care interventions delivered to more than 500 patients.

Team members who collaborated with patients and primary care providers were predominantly pharmacists, nurses, or both. Twenty-eight interventions^{21–23,25–28,34,36,38,40,41,43–45,49,50,52,56,57,64,65,72–75,95,97} included nurses, 15 interventions^{29–32,37,39,42,47,51,54,55,61,68,71,76} included pharmacists, and five interventions^{33,53,62,63,96} included both nurses and pharmacists. Detailed evidence tables are available at www.thecommunityguide.org/cvd/SETteambasedcare.pdf.

Population Characteristics

Study populations included adults and older adults and were balanced across gender (Table 2). For most studies, the majority of patients were either white or African American. Eight studies^{21,22,32,34,38,41,50,58} focused predominantly on populations where 450% of participants identified as low-income. In studies providing information on education level, the majority of participants identified as having a high school education or less.^{21,22,25,26,30,32,34,38,48,50,54,58} In six studies,^{36,38,41,42,50,58} more than half the

population received either Medicare or Medicaid or were uninsured. In almost all studies^{22,23,25,28,30–33,37,40–44,48–54,56,57,62,68,71,75,76,95–97} that reported the proportion of patients with BP control as an outcome, most patients did not have their BP under control at baseline.

BP Outcomes

Proportion of patients with controlled BP—Figure 4 displays effect estimates and 95% CIs for the absolute percentage point (pct pt) change in patients with controlled BP from 33 studies^{22,23,25–28,30,31,33,37,39,41–44,48–54,56,57,61,62,68,69,71,75,76,95,96} comparing team-based care to usual care. Studies are shown chronologically by year of publication on the y-axis. Effect estimates displayed to the right of zero indicate improvement for patients receiving team-based care compared with usual care. The median effect estimate was 12 pct pts (IQR=3.2–20.8 pct pts). Most individual effect estimates in the favorable direction were significant ($p < 0.05$).^{23,28,30,31,33,37,41–44,50,52–54,61,62,68,96}

Reduction in SBP—Forty-four studies^{21–28,30–34,36–39,41,42,44,45,47,48,50–55,57,58,62–65,68,69,71–76,96} reported changes in SBP (Figure 5). Effect estimates to the left of zero indicate improvement in SBP for patients receiving team-based care compared with usual care. The median reduction in SBP was 5.4 mmHg (IQR=2.0–7.2 mmHg). Most individual effect estimates were significant ($p < 0.05$).^{21,23,24,28,31,33,36–38,41,42,44,45,47,50,53,54,64,68,96}

Reduction in DBP—The overall median reduction in DBP was 1.8 mmHg (IQR=0.7–3.2 mmHg) from 38 studies.^{21–24,26–28,30–34,37–39,41,42,44,47,48,50–52,54,55,57,58,62–65,68,69,71–73,75,76}

Additional evidence—Owing to differences in reporting, three studies could not be included in the main analyses.^{32,40,97} One study⁴⁰ found that groups receiving team-based care had poorer BP outcomes than those receiving usual care ($p > 0.05$). Another study³² found high-income patients significantly more likely to have BP control with team-based care ($p < 0.05$), and the third⁹⁷ reported slight improvements in BP control ($p = 0.23$) and SBP ($p = 0.12$) and no change in DBP ($p = 0.37$) for patients receiving home health visits.

Stratified Analyses for BP Outcomes

Setting—Improvement in the proportion of patients with controlled BP was similar for studies from both healthcare and community settings. The median effect estimate from studies within the Veterans Affairs (VA) system^{25,27,33,43,47,51,74,96} was 5.9 pct pts; an investigator involved in two VA studies^{25,27} postulated (H. Bosworth, Duke University School of Medicine, personal communication, 2012) that this lower number is likely due to elements of team-based care already instituted in usual care processes at the VA and high baseline levels of patients with controlled BP. Median reductions in SBP and DBP from these studies were similar to overall estimates (Table 3).

Type of team member added—When pharmacists were added to teams, the median improvement in the proportion of patients with controlled BP was considerably higher than

the overall estimate, but median reductions in SBP and DBP were similar to overall estimates (Table 3). When nurses alone or both nurses and pharmacists were added, median estimates for all BP outcomes were comparable to overall estimates. Only four studies^{24,48,58,69} examined the effectiveness of adding other team members, such as community health workers, integrated care managers, or behavioral interventionists without nurses or pharmacists, finding smaller effect estimates than those overall.

Type of team member role related to medication—Team member involvement in medication management was conceptualized as three levels: (1) team members could make changes to medications independent of the primary care provider (16 studies)^{21,23,27,33,36–38,40,41,43,49–51,64,72,96}; (2) team members could provide medication recommendations and make changes with the primary care provider’s approval (15 studies)^{29–31,42,45,53–57,61,68,71,76,97}; or (3) team members only provided adherence support and information on medication and hypertension (22 studies).^{22,24–28,32,34,39,44,47,48,52,58,62,63,65,69,73–75,95} One study examined multiple levels of team member roles using multiple study arms.²⁷ The first two levels of medication management demonstrated larger improvements in BP outcomes than overall estimates (Table 3).

Number of team members added—Thirty-three interventions^{22,24–28,30–32,37,39,40,42–44,47,49,51,52,54–58,61,64,65,68,71–75} included one team member in addition to the primary care provider, 11^{21,23,27,29,38,44,48,53,62,69,76} had two additional members, and 10^{33,34,36,41,45,50,63,95–97} involved three or more. Two studies^{27,44} with multiple study arms had different numbers of team members in each arm. Adding two or more members demonstrated larger improvements in the proportion of patients with controlled BP and reduction in DBP compared to adding only one; median reductions in SBP were similar regardless of team size (Table 3).

Baseline BP level—Fifteen studies^{22,30,31,33,37,42,44,51,52, 56,57,62,68,76,97} focused exclusively on patients with uncontrolled BP at baseline. In 14 studies,^{23,25,28,41,43,48–50,53,54,71,75,95,96} 50% of the patients had controlled BP at baseline. Larger improvements in this outcome were found for these two groups compared to studies^{26,27,39,61,69} where > 50% of patients already had controlled BP at baseline. Similarly, 26 studies^{22,24,30–34,36–38,41,42,44,48,51–55,57,58,62,64,72,73,76} that reported an average SBP 140 mmHg at baseline had a greater reduction in SBP than those where the average SBP was < 140 mmHg at baseline. This trend was also seen in six studies^{41,42,44,52,62,73} that had an average DBP reading 90 mmHg at baseline (Table 3).

Morbidity and Mortality

Two studies reported on morbidity and mortality from CVD-related events. One²⁹ found significant decreases in both myocardial infarctions and any CVD-related event (OR=0.24 and 0.47, respectively, $p < 0.05$). Another study⁵⁷ found that the team-based care group had 25 deaths compared to 36 deaths in the control group (OR=0.55, $p < 0.05$) after 12 months.

Medication Adherence and Patient Satisfaction with Care

Compared with patients in usual care, the proportion of patients receiving team-based care with “high” medication adherence (defined as taking medications as prescribed > 80% of the time) increased by a median of 16.3 pct pts.^{24,32,33,42,47,51,52,54,76} Two studies^{42,45} reported “satisfaction with care” at 12 months. In one study,⁴² high patient satisfaction scores were seen for hypertension care in both the team-based and usual care groups ($p = 0.75$) with no significant association between satisfaction and BP goal achievement ($p = 0.40$). The other study,⁴⁵ comparing a team-based care approach that focused on diabetes, heart disease, or both with usual care, found an improvement of 14.0 pct pts in the proportion of patients reporting satisfaction with care ($p < 0.001$).

Applicability of Findings

Findings from this review are applicable to the U.S. healthcare system in both clinic- and community-based settings, especially when nurses and pharmacists are part of the team. Larger improvements in BP were found when team members could prescribe medications independent of the primary care provider or with their approval. However, improvements were also found when team members could only provide patients with hypertension information and support, indicating applicability to all levels of medication management.

White and African American populations were well represented across the included studies. Findings should be broadly applicable to various populations and settings in the U.S. Team-based care models are likely applicable in addressing BP control in patients with comorbidities such as diabetes: nine studies^{33,49,53,56,57,68,72,74,95} targeted BP control in people with diabetes and four studies^{45,50,51,97} had study populations in which the majority also had diabetes.

Additional Benefits and Potential Harms

Outcomes for diabetes and cholesterol, other CVD risk factors often comorbid with hypertension, also were analyzed. Team-based care resulted in improvements for most lipid- and diabetes-related outcomes, suggesting potential benefits for comprehensive CVD risk reduction (Table 4). Key features of interventions that improved outcomes other than BP were a team-based focus on multiple risk factors and addition of nurse practitioners who could prescribe medications independently, based on standard clinical protocols. Going beyond CVD prevention, two studies^{24,45} reported a reduction in depressive symptoms from team-based care interventions.

No harm to patients were identified from team-based care interventions in the included studies or the broader literature. Team-based care is well suited to addressing potential adverse effects from hypertension medications through providing support for patients about medications as well as proactive follow-up and monitoring.

Considerations for Implementation

Team-based care implementation must be considered at multiple overlapping levels. In most U.S. health systems, successful implementation will likely require reorganization of patient care roles and responsibilities. An important consideration is resource allocation to support

providers who implement team-based care. Reimbursement mechanisms need to support key elements that sustain benefits from team-based care. These include incentives for improving patient outcomes, training, performance feedback, clinical decision support systems, and communications support.

Findings suggest that team member roles that allow for changes to medication regimens using evidence-based clinical protocols, either independent of primary care providers or with their approval, are more effective than merely providing information and adherence support to patients. Health systems will need to make decisions about team size, the number and type of team members, and team member roles that are best suited for their specific needs.

Providing patient support for participation in self-management activities is vital. Support can range from educational resources on health behavior change to community-based peer support groups. This support could also be facilitated via various modalities for communication, such as mobile phones, smartphones, and patient web portals.⁹⁸

Conclusions

Summary of Findings

There is strong evidence that team-based care is effective in improving BP outcomes, especially when pharmacists and nurses are part of the team. These findings are broadly applicable to various U.S. settings and population groups. Further, an independent Community Guide review⁹⁹ of economic evidence indicates that team-based care for BP control is cost-effective. Implementation of this multidisciplinary team-based approach requires organizational change within the healthcare system.

Evidence Gaps

Although African Americans were well represented in included studies, more evidence is needed on team-based care for other minorities and low-SES populations. Included studies rarely analyzed outcomes by variables such as race, ethnicity, income level, education level, and insurance status. Further, patient-centered outcomes such as satisfaction with care and adherence to behavioral change activities need further study.

Regarding team composition, more studies are needed to evaluate team-based care models that incorporate other providers, such as community health workers and dietitians. Another vital aspect that was missing from most studies is information on the types of interactions between team members.

Evidence on scalability of team-based care was sparse. More evidence is needed on the implementation of team-based care in large populations covering multiple sites and from multi-year evaluations.

Discussion

Team-based care is a complex intervention with considerable heterogeneity in implementation for different populations and settings. A formal meta-analysis was,

therefore, not considered ideal for this review because sufficient homogeneity is required for meta-analysis estimates to be useful by themselves.¹⁰⁰ This review used descriptive statistics that facilitate simple and concise summaries of the distribution of study results. In addition, to be useful to public health decision makers, findings on the applicability of results to various U.S. populations and settings were based on stratified analyses, albeit in a univariate manner (Table 3).

Although observational studies with concurrent comparison groups in addition to RCTs were included in this review, only five included studies employed an observational study design. The lack of observational studies in this review could limit understanding of team-based care in real-world settings, as well as barriers to implementation. Examination of a funnel plot suggests potential publication bias, with two of the largest studies reporting small improvements in the proportion of patients with controlled BP. However, this needs to be considered within the complex nature of team-based care implementation. Finally, the focus of this review was to assess the effectiveness of team-based care in preventing CVD from ever happening by controlling BP at the population level; therefore, populations with a history of CVD were excluded.

A recent evidence report¹⁴ on team-based care for hypertension reached conclusions similar to this review: It called for teams of primary care providers, pharmacists, nurses, and other healthcare professionals to work with patients, especially in a medical home context. This push for coordinated care is furthered by the advent of accountable care organizations that operate on reimbursement models tied to quality metrics and targeting lower costs.¹⁰¹ Team-based care is central to the medical home and accountable care approaches and can help health systems provide a method to improve the efficiency of care delivery, offer a platform of support for patient access to resources for self-management activities, and achieve a comprehensive approach to treating comorbidities such as hypertension, diabetes, high cholesterol, and obesity. In addition, team-based care can facilitate progress toward achieving the triple aim: improved health, a better care experience for patients, and reduced per capita costs.¹⁰²

A recent IOM report¹⁰³ explores both individual and organizational values behind successful teams in health care and calls for “investments in the people and processes that lead to improved outcomes.” The Community Guide team attempted to collect information on strategies used to address potential barriers to implementation and increase motivation for team-based care. Strategies included involvement of providers in designing the intervention, stakeholder and patient engagement, basing implementation on “models of best practice” or “effective trials,” putting business models in place, including reimbursement mechanisms and incentives, use of resources to implement team-based care (i.e., by restructuring existing resources or investment in new resources); making tools available for patients (e.g., websites) and providers (e.g., electronic health records); implementing motivational processes for team members (e.g., team-building sessions); and establishing systems to monitor and evaluate processes. Although available information on any of these elements was sparse in the included studies, it is crucial that these factors be considered by implementers of team-based care.

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Current and previous author affiliations are shown at the time the research was conducted. The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the CDC.

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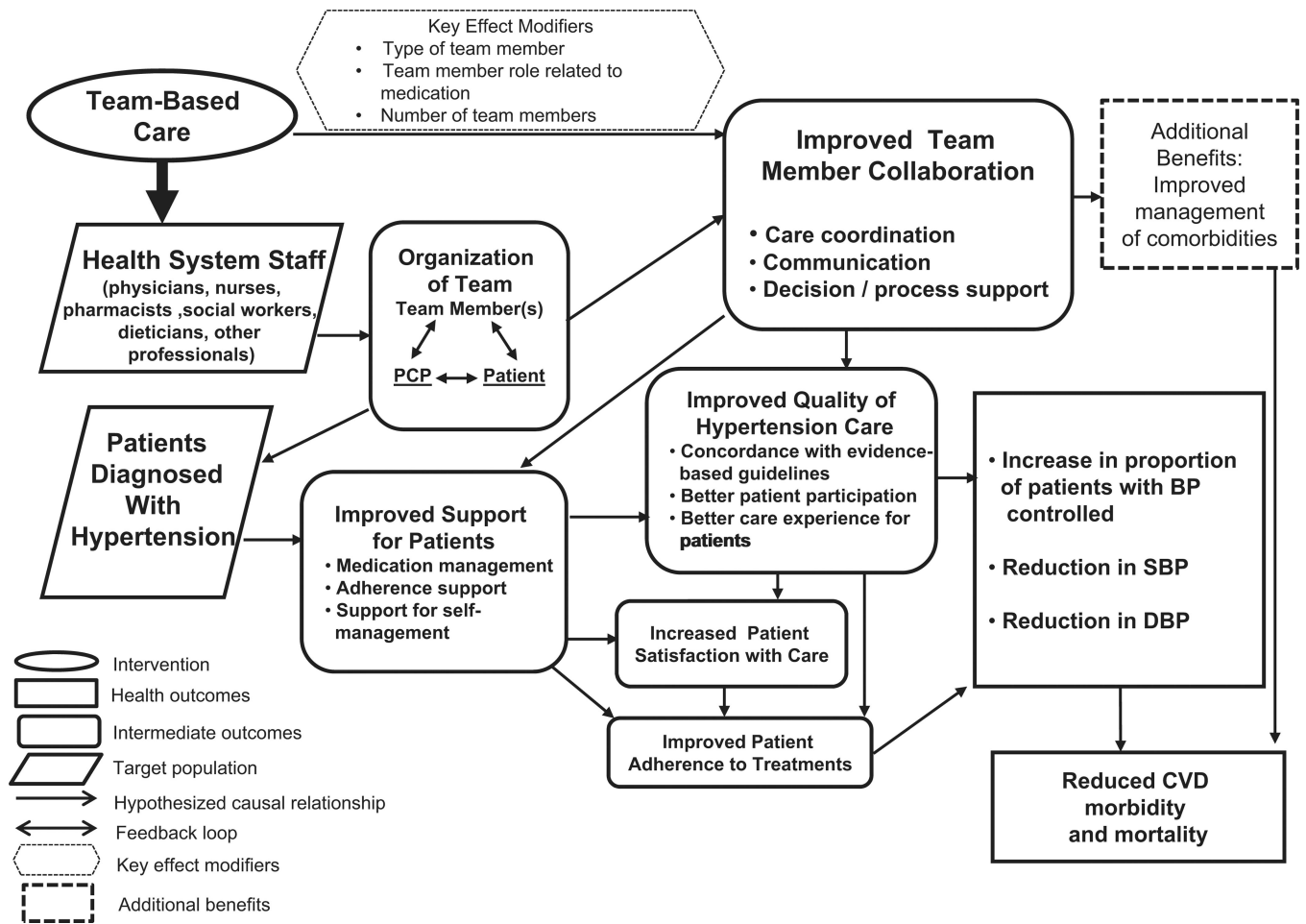


Figure 1. Analytic framework: team-based care for improved blood pressure control
 DBP, diastolic blood pressure; PCP, primary care provider; SBP, systolic blood pressure

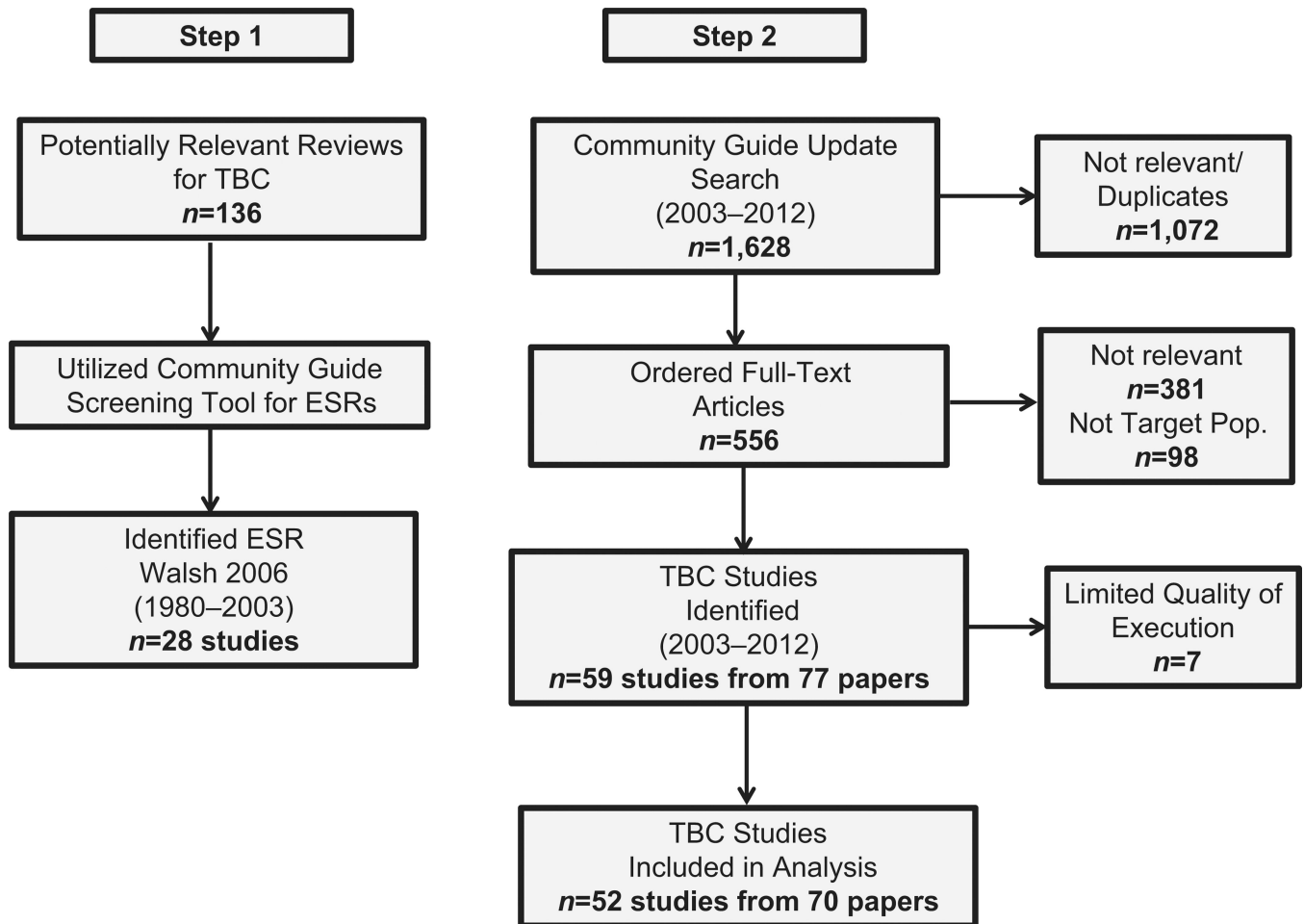


Figure 2.
Search process
ESR, existing systematic review; TBC, team-based care

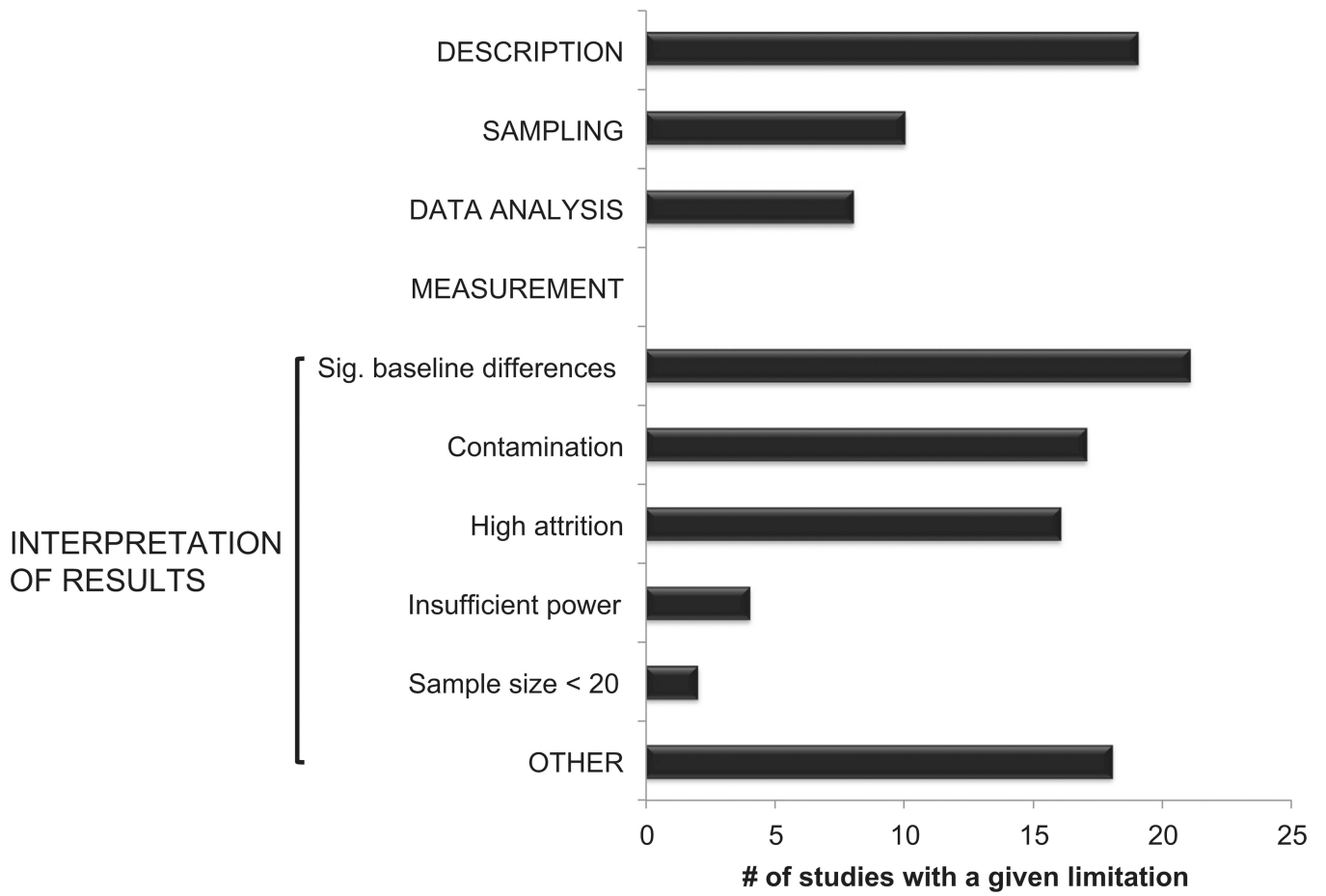


Figure 3. Study limitations from Community Guide review (2003–2012, $n=52$)

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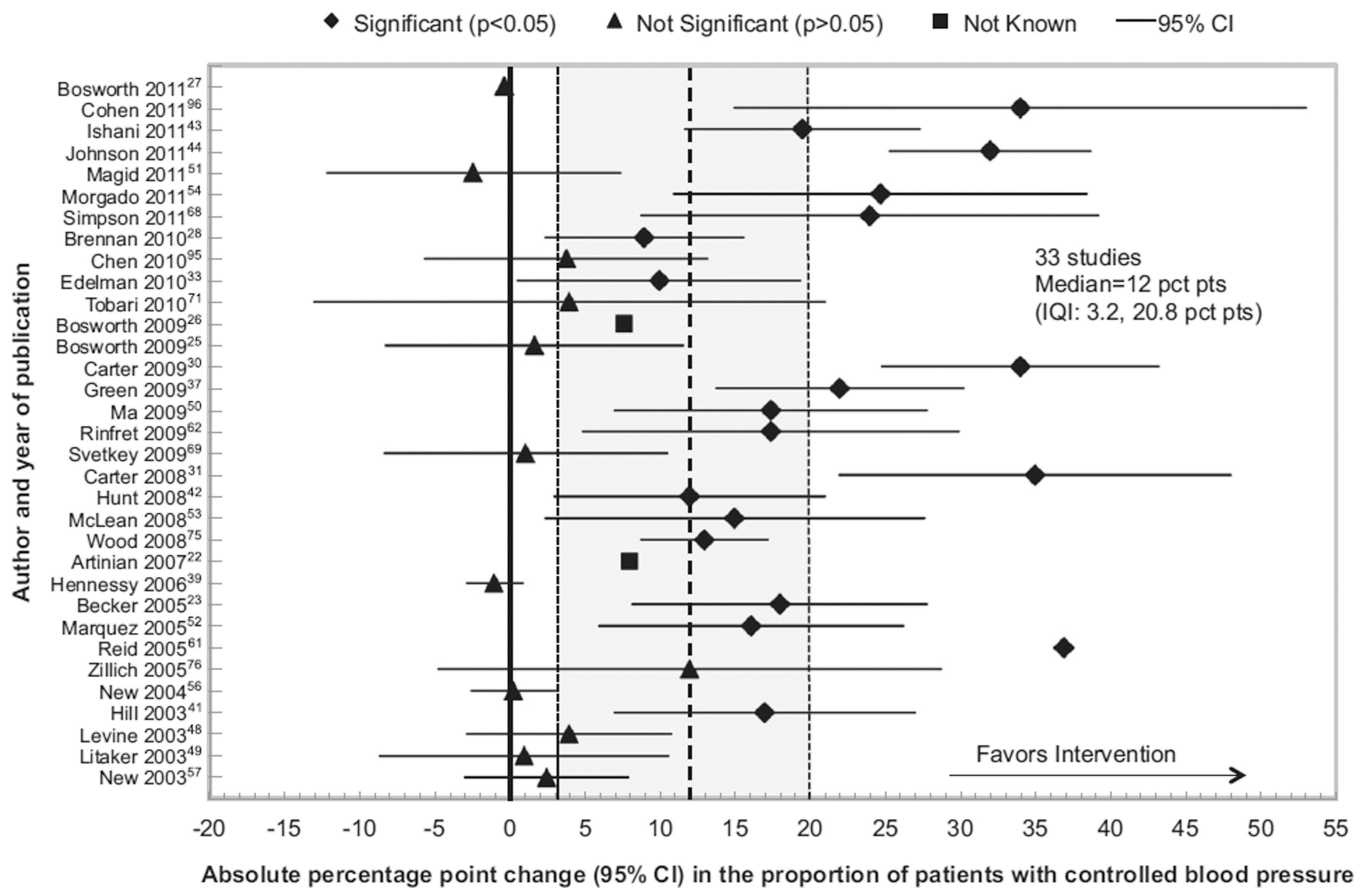


Figure 4. Changes in proportion of patients with controlled blood pressure attributable to team-based care, Community Guide review, 2003–2012
 IQI, interquartile interval; pct pts, percentage points

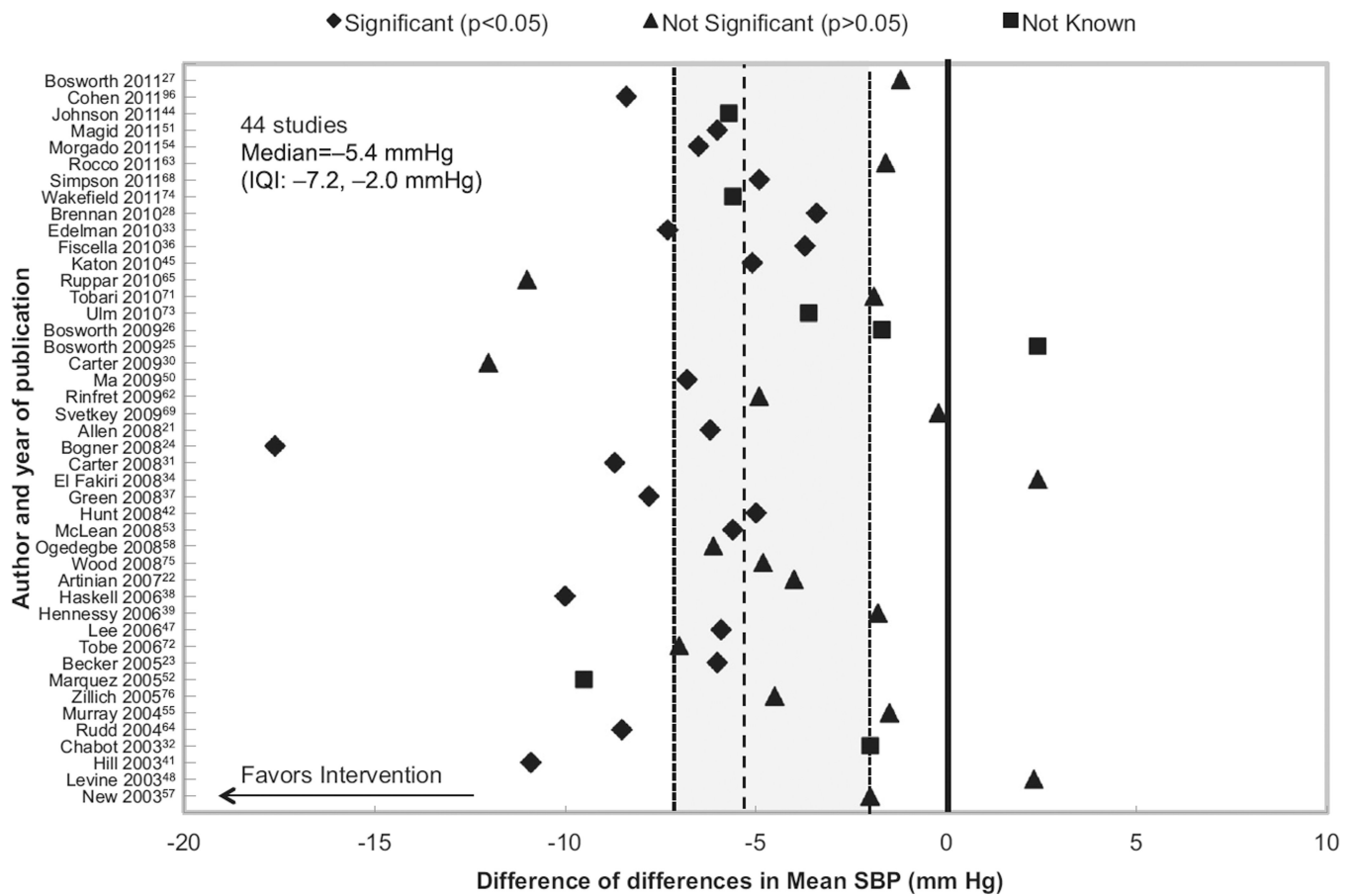


Figure 5. Changes in mean systolic blood pressure attributable to team-based care, Community Guide review, 2003–2012
 IQI, interquartile interval; SBP, systolic blood pressure

Table 1Results from the systematic reviews of Walsh et al.¹⁷ and the Community Guide

Outcome	Walsh (2006) ¹⁷ 1980–2003		Community Guide 2003–2012	
	Number of studies	Median effect estimate (IQI)	Number of studies	Median effect estimate (IQI)
Improvement in proportion of patients with controlled BP ^a	9 (SBP) 6 (DBP)	21.8 pct pts (9.0, 33.8) 17.0 pct pts (5.7, 24.5)	33 (SBP+DBP)	12.0 pct pts (3.2, 20.8)
Reduction in SBP	17	9.7 mmHg (4.2, 14.0)	44	5.4 mmHg (2.0, 7.2)
Reduction in DBP	21	4.2 mmHg (0.2, 6.8)	38	1.8 mmHg (0.7, 3.2)

^a Absolute percentage point increase in proportion of patients achieving BP control

BP, blood pressure; DBP, diastolic blood pressure; IQI, interquartile interval; pct pts, percentage points; SBP, systolic blood pressure

Table 2

Population characteristics from included studies

Characteristic	Number of studies (%) ^a
Age	
Adult (18–64 years)	40 (78)
Older adult (≥ 65 years)	11 (22)
Gender	
75% female	5 (10)
75% male	7 (14)
Race/ethnicity	
Majority white	17 (47)
Majority African American	15 (41)
Majority Hispanic	2 (6)
Majority other	2 (6)
Income level	
Majority low-income	8 (57)
Education level	
Majority high school or less	11 (44)
Insurance status	
Majority with public insurance ^b or uninsured	6 (27)
BMI	
Majority <30	6 (26)
Majority ≥ 30	17 (74)
Baseline level of percentage with controlled BP	
0	15 (42)
50	16 (44)
> 50	5 (14)
Baseline mean SBP (mmHg)	
Majority ≥ 140	27 (61)
Majority < 140	17 (39)
Baseline mean DBP (mmHg)	
Majority ≥ 90	6 (16)
Majority < 90	32 (84)

^aTotal number of studies (and proportion) that reported specific demographic characteristics

^bPublic insurance refers to Medicare and Medicaid.

BP, blood pressure; DBP, diastolic blood pressure; SBP, systolic blood pressure

Table 3

Blood pressure outcomes stratified by study and intervention characteristics

Variable	Proportion of patients with BP controlled			Reduction in SBP			Reduction in DBP		
	Number of studies	Median estimate ^a (pct pts)	Median estimate (mmHg)	Number of studies	Median estimate (mmHg)	Number of studies	Median estimate (mmHg)	Number of studies	Median estimate (mmHg)
Location									
U.S.	23	10.0	5.8	32	5.8	27	1.8		
Non-U.S.	10	15.6	4.9	12	4.9	11	1.7		
SETTING									
Health-care /Clinical system									
All ^b	27	12.0	5.7	36	5.7	31	1.8		
VA System	6	5.9	5.9	7	5.9	4	1.8		
Community-based ^b	5	12.0	4.5	7	4.5	6	0.5		
Type of team member added									
Nurse	16	8.5	5.4	22	5.4	18	2.9		
Pharmacist	11	22.0	5.0	13	5.0	13	1.7		
Nurse + Pharmacist	4	16.2	5.6	5	5.6	3	3.5		
Other	2	2.6	3.2	4	3.2	4	0.4		
Type of team member role related to medication									
Independent ^{c,d}	9	17.4	7.2	12	7.2	10	3.5		
PCP approval ^e	11	15.0	5.0	11	5.0	9	1.7		
Support only ^{d,f}	12	7.9	3.8	20	3.8	18	1.0		
Number of team members added^g									
PCP + 1 team member ^h	20	10.5	5.6	25	5.6	24	1.4		
PCP + 2 team members ^h	6	13.5	5.3	8	5.3	7	3.2		
PCP + 3 or more team members	5	17.0	5.9	8	5.9	5	3.0		

Variable	Proportion of patients with BP controlled			Reduction in SBP			Reduction in DBP		
	Number of studies	Median estimate ^a (pct pts)	Median estimate (mmHg)	Number of studies	Median estimate (mmHg)	Number of studies	Median estimate (mmHg)	Number of studies	Median estimate (mmHg)
Baseline level of percentage with controlled BP									
0	14	14.0	NA	NA	NA	NA	NA	NA	NA
50	14	14.0	NA	NA	NA	NA	NA	NA	NA
>50	5	1.1	NA	NA	NA	NA	NA	NA	NA
Baseline SBP (mmHg)									
140	NA	NA	26	5.9	NA	NA	NA	NA	NA
< 140	NA	NA	16	5.0	NA	NA	NA	NA	NA
Baseline DBP (mmHg)									
90	NA	NA	NA	NA	NA	6	3.3	NA	NA
< 90	NA	NA	NA	NA	NA	30	1.6	NA	NA

^a Absolute percentage point increase in proportion of patients achieving BP control

^b One intervention took place equally in the clinic and community.

^c Medication changes could be made by the team member independent of the PCP.

^d One study had multiple arms, each with a different type of team member role related to medication.

^e Team member could make medication recommendations and changes with PCP approval.

^f Team member could only provide adherence support and information on medication and hypertension.

^g Number of team members added refers to the type of team member (e.g., PCP þ pharmacist þ two nurses/4PCP þ 2 team members).

^h Two studies had multiple arms with different number of team members in each arm.

BP, blood pressure; DBP, diastolic blood pressure; NA, not applicable; PCP, primary care provider; pct pts, percentage points; SBP, systolic blood pressure; VA, Veterans Affairs

Table 4

Changes in lipid and diabetes outcomes attributable to team-based care

Variable	Change in mean	Change in proportion of patients at goal
Lipid outcome		
Total cholesterol	−.3 mg/dL (6 studies) ^{21,34,38,49,50,56}	13.0 pct pts (3 studies) ^{41,57,75}
LDL cholesterol	−4.3 mg/dL (11 studies) ^{21,23,25,34,36,38,45,47,50,63,90,96}	3.2 pct pts (5 studies) ^{23,43,75,95,96}
HDL cholesterol	1.3 mg/dL (6 studies) ^{21,23,34,38,49,50}	−6.0 pct pts (1 study) ⁴¹
Triglycerides	−7.9 mg/dL (5 studies) ^{21,23,34,38,50}	No studies
Diabetes outcome		
A1C level	−0.3% (11 studies) ^{21,25,33,36,45,49,50,63,72,74,96}	10.0 pct pts (6 studies) ^{33,41,43,75,96}
Blood glucose	−7.0 mg/dL (5 studies) ^{23,34,38,44,50}	NA

HDL, low-density lipoprotein; LDL, low-density lipoprotein; NA, not applicable; pct pts, percentage points