The Patient-Centered Medical Home

A Systematic Review

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Background: The patient-centered medical home (PCMH) describes mechanisms for organizing primary care to provide high-quality care across the full range of individuals' health care needs. It is being widely implemented by provider organizations and third-party payers.

Purpose: To describe approaches for PCMH implementation and summarize evidence for effects on patient and staff experiences, process of care, and clinical and economic outcomes.

Data Sources: PubMed (through 6 December 2011), Cumulative Index to Nursing & Allied Health Literature, and the Cochrane Database of Systematic Reviews (through 29 June 2012).

Study Selection: English-language trials and longitudinal observational studies that met criteria for the PCMH, as defined by the Agency for Healthcare Research and Quality, and included populations with multiple conditions.

Data Extraction: Information on study design, populations, interventions, comparators, financial models, implementation methods, outcomes, and risk of bias were abstracted by 1 investigator and verified by another.

Data Synthesis: In 19 comparative studies, PCMH interventions had a small positive effect on patient experiences and small to moderate positive effects on the delivery of preventive care services (moderate strength of evidence). Staff experiences were also improved by a small to moderate degree (low strength of evidence). Evidence suggested a reduction in emergency department visits (risk ratio [RR], 0.81 [95% CI, 0.67 to 0.98]) but not in hospital admissions (RR, 0.96 [CI, 0.84 to 1.10]) in older adults (low strength of evidence). There was no evidence for overall cost savings.

Limitation: Systematic review is challenging because of a lack of consistent definitions and nomenclature for PCMH.

Conclusion: The PCMH holds promise for improving the experiences of patients and staff and potentially for improving care processes, but current evidence is insufficient to determine effects on clinical and most economic outcomes.

Ann Intern Med. 2013;158:169-178. www.annals.org
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This article was published at www.annals.org on 27 November 2012.

The United States spends a greater proportion of its gross domestic product on health care than any other country in the world (1) yet often fails to provide high-quality and efficient care (2–6). At the same time, satisfaction among primary care physicians has waned amid the increasing demands of office-based practice (7). There has been growing concern that current models of primary care will not be sustainable for meeting the health care needs of the population.

The patient-centered medical home (PCMH) is a model of primary care transformation that seeks to meet the health care needs of patients and to improve patient and staff experiences, outcomes, safety, and system efficiency (8–11). The term "medical home" was first used by the American Academy of Pediatrics in 1967 to describe the concept of a single centralized source of care and medical record for children with special health care needs (12). Building on other widely promulgated efforts, such as the chronic care model (13), the current concept of PCMH has been greatly expanded and is based on 40 years of previous efforts to redesign primary care to provide the highest quality of care possible (14, 15).

As defined by physician and consumer groups, the core principles of the PCMH are the following: wide-ranging, team-based care; patient-centered orientation toward the whole person; care that is coordinated across all elements of the health care system and the patient's community; enhanced access to care that uses alternative methods of communication; and a systems-based approach to quality and safety (9). Although these principles are frequently cited in relation to PCMH, it should be recognized that specific PCMH definitions vary widely, reflecting the rapid expansion of the use of PCMH concepts in the past decade (16). This review was conducted as part of the Agency for Healthcare Quality and Research's (AHRQ's) "Closing the Quality Gap: Revisiting the State of the Science" series (17) and sought to describe how studies conducted to date have implemented PCMH and to evaluate the current evidence of the effect of PCMH interventions on patient, staff, and economic outcomes.

Methods

A technical report that details our methods and results for all 4 original research questions is available at www.ahrq.gov (18). Topics for the "Closing the Quality Gap" series were solicited from the portfolio leads at AHRQ. Investigators at the Duke Evidence-based Practice Center refined the research questions through discussions with the Stanford Evidence-based Practice Center, which coordinated the series, and with representatives of AHRQ. A panel of experts knowledgeable in PCMH principles provided input during the protocol development process.

Research Questions

The present review addresses 3 of the 4 research questions included in the original AHRQ evidence report

Figure 1. **Definition of the patient-centered medical home.**

1. Team-based care, defined as a team-based structure in which 2 or more clinicians work together to provide care. The team may be virtual.

2. The intervention includes ≥2 of the following 4 elements:
   i. Enhanced access to care (e.g., advanced electronic communications, such as Internet or telephone visits, open-access scheduling, group visits, 24/7 coverage).
   ii. Coordinated care (care coordinated across settings, such as inpatient and outpatient, or across specialty and nonspecialty care, such as mental health, or subspecialty medicine and primary care; care management; or referral tracking).
   iii. Comprehensiveness—that is, care that is accountable for addressing a large majority of personal health needs (e.g., preventive care, acute care, chronic disease care, and mental health).
   iv. A systems-based approach to improving quality and safety (e.g., care planning process, evidence-based medicine/clinical guidelines, point-of-care resources, electronic prescribing, test tracking, performance measurement, self-management support, accountability, and shared decision making).

3. A sustained partnership and personal relationship over time oriented toward the whole person (e.g., designating a primary point of contact who coordinates care, a personal physician, and shared decision making).

4. The intervention involves structural changes to the traditional practice, reorganizing care delivery (e.g., new personnel, new role definitions, functional linkages with community organizations and/or other health care entities, such as hospitals, specialists or other service providers, and disease registries).

Based on the Agency for Healthcare Research and Quality's definition (8). Includes each of categories 1 through 4.

(omitting a horizon scan of ongoing research) (18). We sought to describe PCMH interventions that have been studied in the peer-reviewed literature and the effectiveness of PCMH in studies that included a comparison group. Specifically, we addressed the following questions:

1. In published, primary care–based evaluations of comprehensive PCMH interventions, what individual PCMH components have been implemented?

2. In published, primary care–based evaluations of comprehensive PCMH interventions, what financial models and implementation strategies have been used to support uptake?

3. In published, primary care–based evaluations of comprehensive PCMH interventions, what are the effects of the PCMH on patient and staff experiences, process of care, clinical outcomes, and economic outcomes?

Definition of PCMH

We created an operational definition of a PCMH intervention based on the AHRQ's definition of PCMH (8). To be considered a PCMH intervention required the following: 1) team-based care, 2) having at least 2 of 4 elements focused on how to improve the entire organization of care (enhanced access, coordinated care, comprehensiveness, systems-based approach to improving quality and safety), 3) a sustained partnership, and 4) having an intervention that involves structural changes to the traditional practice. Interventions that did not use the term "medical home" but that met this definition were categorized as "functional PCMH" interventions. Specific items included in the definition can be found in **Figure 1**.

Data Sources and Searches

We searched PubMed, Cumulative Index to Nursing & Allied Health Literature, and the Cochrane Database of Systematic Reviews. Our search strategy used the National Library of Medicine's Medical Subject Headings keyword nomenclature and text words for the medical home and related concepts and for eligible study designs. We included studies published in English and indexed from database inception through 29 June 2012. The exact search strings are given in the **Appendix** (available at www.annals.org). We supplemented these electronic searches with a manual search of citations from a set of key primary and review articles (19–26).

Study Selection

To be included in the review, studies had to 1) be peer-reviewed; 2) have interventions that met the preceding PCMH definition; 3) have interventions delivered to patient populations representing multiple diseases (that is, no single-disease care management studies); 4) be conducted among adult or child primary care patients; 5) have follow-up of at least 6 months; and 6) be a randomized, controlled trial or an observational study. Studies describing PCMH interventions in the published literature did not require a comparison group. However, studies examining the effectiveness of PCMH were required to have such a group.

Two investigators independently reviewed each title and abstract for potential relevance to the research questions; articles included by either investigator underwent full-text screening. At the full-text screening stage, 2 investigators independently reviewed the full text of each article for inclusion. Disagreements were resolved through review and discussion among investigators.

Data Extraction and Quality Assessment

One researcher abstracted the data, and a second overread the abstracted data to check for accuracy and completeness. Disagreements were resolved by consensus or by obtaining a third reviewer's opinion if consensus could not be reached by the first 2 investigators. To aid in reproducibility and standardization of data collection, researchers received data abstraction instructions directly on each form created specifically for this project within the DistillerSR software program (Evidence Partners, Manotick, Ontario, Canada). Abstraction forms were pilot-tested with a sample of included articles to ensure that all relevant data elements were captured and that there was consistency and reproducibility across abstractors. Data abstraction forms included information on study design, study population, interventions, comparators, financial models, implementa-

tion methods, study outcomes, and study quality. Results of interest examined for PCMH effectiveness included patient experiences, staff experiences, process of care, clinical outcomes, and economic outcomes.

We evaluated the quality/risk of bias of individual studies addressing the effectiveness question by using the approach described in AHRQ's "Methods Guide for Effectiveness and Comparative Effectiveness Reviews" (hereafter called the "Methods Guide") (27) by applying predefined criteria for methodological quality and adequacy of reporting for each study type to arrive at a summary judgment of the study's quality (good, fair, or poor).

Data Synthesis and Analysis

Studies were categorized into those that explicitly tested the PCMH model and those that met our functional definition for PCMH but did not use the terms "PCMH" or "medical home"; we refer to the latter as "functional PCMH" studies. Outcomes described below were broadly categorized as relating to the following: 1) the quality of both patient and staff experiences with care, 2) clinical quality (that is, provision of evidence-based care and health outcomes), or 3) the economic effect of PCMH initiatives. Because of the wide variability in recommended measures for evaluating PCMH, we analyzed outcomes that were reported across studies, focusing on those collected by using validated instruments or methods. With the exception of inpatient and emergency department utilization, studies were too heterogeneous in design and in outcomes reporting for quantitative syntheses. We used a random-effects model using the DerSimonian–Laird method (28) to compute summary estimates of effect for hospitalizations and emergency department visits for the subset of studies that used randomized, controlled trial designs. Summary estimates were calculated by using Comprehensive Meta-Analysis software, version 2 (Biostat, Englewood, New Jersey) and are reported as summary risk ratios (RRs).

For other outcomes, the study populations, designs, and outcomes were too variable for quantitative analysis. We computed effect sizes, represented as the standardized mean difference (SMD, a summary statistic that uses a common scale) (27), to aid in interpretation of the qualitative synthesis. The SMD is useful when studies assess the same outcome but with different measures or scales. The SMDs were calculated for each study by using the Hedges g (which corrects for small sample sizes) by subtracting (at posttest) the average score of the control group from the average score of the experimental group and dividing the result by the pooled standard deviations of the experimental and control groups (29). Beneficial effects are presented as positive effect sizes.

The strength of evidence for the highest-priority effectiveness outcomes was assessed by using the approach described in the Methods Guide (27, 30). In brief, the Methods Guide recommends assessment of 4 domains: risk of bias, consistency, directness, and precision. Additional domains are to be used when appropriate: coherence, dose–response association, impact of plausible residual confounders, strength of association (magnitude of effect), and publication bias. These domains were considered qualitatively and a summary rating was assigned, after discussion by 2 reviewers, as "high," "moderate," or "low" strength of evidence. In some cases, such ratings were impossible or imprudent to make (for example, when no evidence was available or when evidence on the outcome was too weak, sparse, or inconsistent to permit any conclusion to be drawn). In these situations, a grade of "insufficient" was assigned.

Role of the Funding Source

Funding was provided by AHRQ. Representatives of the funding source provided technical assistance during the conduct of the review and commented on draft versions of the full technical report. The funding source did not, however, directly participate in the literature search; determination of study eligibility criteria; data analysis; or interpretation, or preparation, review, or approval of the manuscript for publication. The AHRQ granted copyright assertion.

Results

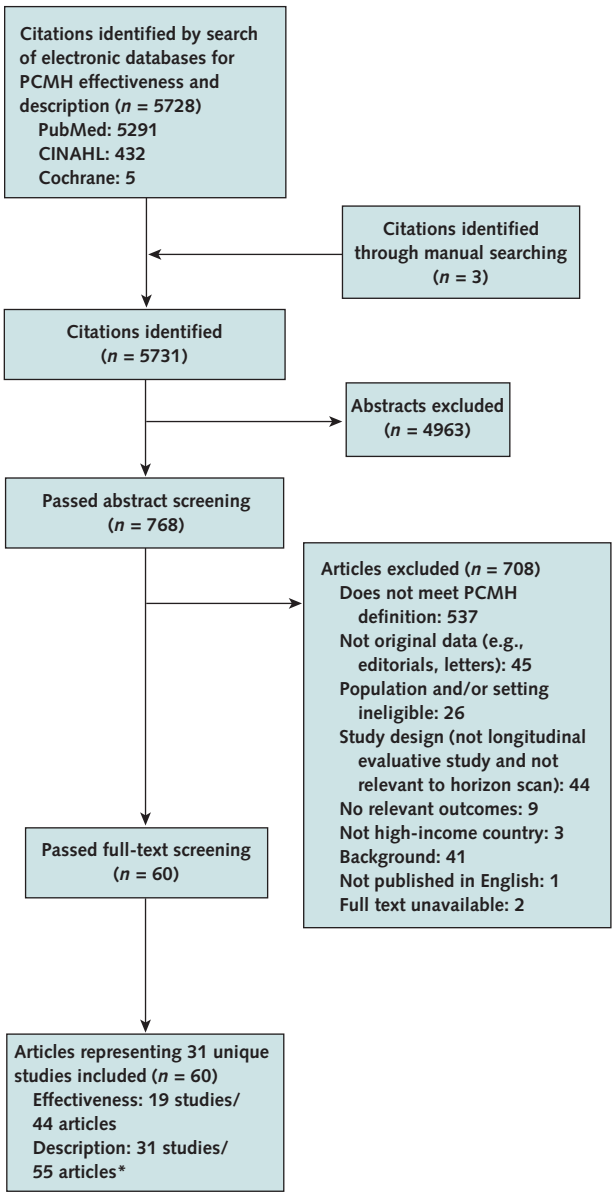
Study Selection

We identified 5731 citations from all sources. After applying inclusion and exclusion criteria at the title-and-abstract level, 768 full-text articles were retrieved and screened. Of these, 708 were excluded at the full-text screening stage, leaving 60 articles representing 31 unique peer-reviewed studies. Nineteen studies were comparative studies of the effects of PCMH; these 19, plus 12 noncomparative studies, described aspects of studied PCMH interventions. With 1 exception (31), all studies were rated as being of good or fair quality (**Figure 2** and **Appendix Tables 1** to **3**, available at www.annals.org).

Implemented PCMH Components

The PCMH interventions tended to involve comprehensive changes in the delivery of primary care, with 24 of 31 studies describing interventions that included all 7 major PCMH components. However, studies varied greatly in the number and types of specific approaches used to implement these core components; overall, 51 different strategies or approaches were used (**Appendix Table 4**, available at www.annals.org). The PCMH studies used more strategies than did functional PCMH studies. Most studies addressed chronic illness, preventive care needs, and acute care needs; used multidisciplinary teams that included a designated primary care provider and defined roles (such as who manages specific aspects of care); and coordinated care transitions (for example, follow-up of patients who have been hospitalized). Three quarters reported adding new staff (such as a case manager). All but 4 studies used strategies to enhance access, such as home or telephone

Figure 2. **Summary of evidence search and selection.**



CINAHL = Cumulative Index to Nursing & Allied Health Literature; PCMH = patient-centered medical home.
* All studies/articles included for effectiveness studies were also included in the analysis of PCMH intervention descriptions.

visits, but no single strategy was used in most studies. Identifying high-risk patients and using evidence-based clinical guidelines, performance monitoring, and electronic health records were the most commonly used approaches to improving quality and safety (**Appendix Table 4**).

Financial and Implementation Strategies

Implementation of PCMH requires significant restructuring for most primary care practices. Recognizing the increased range of services required, some definitions of the medical home include a financial component, but this was not a requirement for inclusion in our review. Among the 31 included studies, only 13 described aspects of their financial model, including fewer than half of the studies specifically designed to test PCMH. These studies used a variety of methods to fund PCMH implementation, including receipt of external study funding, capitation payments, enhanced fee-for-service, or a hybrid approach. Although not a PCMH-specific financial mechanism, it should be noted that most studies were conducted in integrated delivery systems, such as staff- or group-model HMOs, led by payer organizations, or conducted outside the United States. Little information is available on financial models for using PCMH principles in independent fee-for-service primary care practices.

Although it is likely that both organizational learning and implementation strategies are necessary for implementation of complex interventions (13, 32), we recognize that these concepts can overlap substantially. The most commonly used organizational learning strategy, applied in most studies ($n = 19$ of 24 studies reporting information on learning strategies), was a formal learning collaborative or collaborative program planning forums for practice team members to learn about PCMH or its components. For implementation, more than half of 20 studies reporting information on implementation strategies used audit and feedback, usually involving quality improvement methods. The largest trial found that facilitated PCMH was associated with better staff experience than nonfacilitated PCMH (33); facilitation was qualitatively shown to be important for PCMH implementation (34). This suggests that the effect of PCMH on practices may go beyond simply having the identified elements in place. The process of facilitation may also represent an important part of the process for making PCMH successful (**Appendix Table 5**, available at www.annals.org).

Effects of PCMH Interventions

Only 7 studies explicitly evaluated PCMH; an additional 12 studies evaluated functional PCMH interventions. Studies included both observational designs ($n = 10$) and randomized, controlled trials ($n = 9$). Older adults in the United States with multiple chronic conditions were the most commonly studied population (primary focus of 10 of the 19 studies). Most studies were conducted in integrated health care systems (10 of 19 studies). Studies varied widely in the range of outcomes reported and the specific measures used. With the exception of 1 study that examined facilitated versus nonfacilitated PCMH implementation (35), all studies compared PCMH interventions to usual care (**Table 1**).

For most outcomes, the small number of studies conducted among children precluded formal comparison with studies conducted in adults. However, results in these 2 populations were similar. **Table 2** summarizes the strength of evidence for each of the 5 outcome domains. Further-

Table 1. **Comparative Study Characteristics and Reported Outcomes**

Study Characteristic	Total Studies (*n* = 19), *n*	PCMH Studies (*n* = 7), *n*	Functional PCMH Studies (*n* = 12), *n*
Study design (studies)	19	7	12
RCT	9	2	7
Observational	10	5	5
Country (studies/patients)			
United States	18	7	11
Canada	1	0	1
Comparator (studies/patients)			
Usual care	18	6	12
Nonfacilitated PCMH	1	1	0
Setting/population (studies/patients)			
Older adults	10	1	9
General adults	3	2	1
Children	4	3	1
All ages	1	1	0
All ages (high utilizers)	1	0	1
Setting/organizations (studies/patients)			
Integrated delivery system—private	9	3	6
Integrated delivery system—U.S. federal	1	0	1
Independent primary care providers	4	2	2
Payer-based (e.g., Medicaid)	4	2	2
Canadian health care system	1	0	1
Duration of follow-up			
6–11 mo	2	1	1
12–23 mo	2	1	1
24–26 mo	11	3	8
>26 mo	3	1	2
Monthly estimates based on 4 y of data	1	1	0
Overall study quality (studies/patients)			
Good	5	1	4
Fair	13	6	7
Poor	1	0	1
Patient (or caregiver) experiences outcomes reported*	8	4	4
Overall experience†	5	3	2
Coordination of care	7	3	4
Staff experiences outcomes reported*	3	2	1
Overall experience	3	2	1
Process-of-care outcomes reported*‡	9	4	5
Preventive services§	6	2	4
Chronic illness care services§	7	3	4
Clinical outcomes reported*	7	2	5
Biophysical markers	2	1	1
Health status	4	1	3
Mortality	2	0	2
Economic outcomes reported*	14	4	10
Inpatient utilization	11	4	7
Emergency department utilization	9	4	5
Total cost	10	3	7

PCMH = patient-centered medical home; RCT = randomized, controlled trial.
* Subcategories in each cell do not necessarily add up to the total number of studies because each study may have reported multiple outcome types.
† Includes 1 measure focusing on satisfaction with mental health services.
‡ Does not include process outcomes not related to the provision of guideline-concordant preventive or chronic illness care.
§ One study reported a summary Health Plan Employer Data Set (HEDIS) composite measure that includes aspects of both preventive and chronic illness care services.

more, **Appendix Table 6** (available at www.annals.org) summarizes findings grouped by individual study.

Patient and Staff Experiences

Patient-centered medical homes have the goal of improving the experience of the key partners in health care: patients and staff. In this domain, evidence suggests short-term (with 3 exceptions, 2 years or less) benefits of PCMH for both patient (35–42) and staff experience (35, 36, 38). Moderate-strength evidence indicates that interventions meeting PCMH criteria are associated with small improvements in patient experiences, on both overall measures of patient satisfaction and measures of patient-reported or patient-perceived level of care coordination. These studies included a variety of patient populations, indicating broad applicability of this finding. Although less compelling than evidence related to patient experiences, some studies (low strength of evidence) support the hypothesis that primary care staff may be more satisfied in PCMH practices (35, 36, 38). Two of these were PCMH studies, and 1 evaluated a functional PCMH intervention. Two of the 3 studies were conducted in an older adult population; none was conducted in pediatric practices. Overall, relatively few practices and few clinicians have been involved in these studies, and these practices may not be representative of the wider primary care practices in the United States.

Clinical Quality

Clinical quality can be considered to encompass both the provision of evidence-based care processes and the resulting health outcomes. We categorized process-of-care outcomes into preventive services and chronic illness care services (35, 36, 40, 42–47). Prioritization was given to generally accepted, guideline-recommended care processes.

Our summary of clinical outcomes is divided into biophysical markers (3 studies), patient-reported health status (4 studies), and mortality (2 studies).

Evidence suggests that PCMH may improve care processes, especially for preventive services. This is based on a combination of moderate evidence of an effect for prevention services and insufficient evidence to evaluate effects on care for patients with chronic illness. Although results are mixed in terms of whether differences are statistically significant, the point estimates for all but 2 of the process-of-care comparisons are in the direction of the intervention. A lack of power may account for the lack of statistical significance for at least some of the differences. Although there is a possibility that PCMH may lead to more appropriate care, more research is needed to examine this possibility, especially in relation to chronic illness care.

Insufficient evidence is available to determine the effect of PCMH implementation on clinical outcomes. Only 1 of the studies had a stated goal of testing PCMH, and that study compared facilitated PCMH against nonfacilitated implementation (35). Most studies were conducted in an older adult population; none were conducted among

Table 2. **Summary of the Strength of Evidence for Effects of PCMH**

Studies (Participants), *n* (*n*)	Domains Pertaining to Strength of Evidence				Strength of Evidence and Magnitude of Effect*
	Risk of Bias: Study Design/Quality	Consistency	Directness	Precision	Effect Estimate (Range or 95% CI)
Patient experiences					Moderate strength of evidence: small positive effects
5 (6884)	RCT/fair	Consistent	Direct	Precise	Effect size median (range): 0.27 (−0.36 to 0.42)
3 (7653)	Observational/fair	Inconsistent	Direct	Precise	Effect size: 0.13†
Staff experiences					Low strength of evidence: small to moderate positive effects
2 (NR)	RCT/fair	Inconsistent	Some indirectness	Imprecise	Effect size median (range): 0.18 (0.14 to 0.22)
1 (82)	Observational/fair	Unknown	Direct	Imprecise	Effect size median (range): 0.49 (0.32 to 0.61)
Process of care for preventive services					Moderate strength of evidence: small to moderate positive effects
3 (8377)	RCT/fair	Consistent	Direct	Precise	RD median (range): 1.3% (−0.4% to 7.7%)
3 (65 444)	Observational/fair	Consistent	Direct	Precise	RD median (range): 9.9% (2.2% to 20.6%)
Process of care for chronic illness care services					Insufficient
3 (28 617)	RCT/fair	Inconsistent	Some indirectness	Precise	RD median (range): 4.7% (0.2% to 20.8%)
3 (455 832)	Observational/fair	Inconsistent	Some indirectness	Precise	RD median (range): 7.1% (−7.1% to 21.4%)
Clinical outcomes: biophysical markers, health status, mortality					Insufficient
3 (2586)	RCT/good	Consistent	Some indirectness	Imprecise	Not reliably estimated
4 (63 533)	Observational/fair	Consistent	Some indirectness	Imprecise	Not reliably estimated
Economic outcomes: hospital inpatient admissions, ED visits, total costs‡					Low strength of evidence for lower ED visits in older adults and no reduction in admissions; insufficient for total costs in adults; insufficient for all economic outcomes in children
5 (8001)	RCT/fair	Consistent	Some indirectness	Imprecise	Admissions: RR, 0.96 (95% CI, 0.84 to 1.10) in adults ED visits: RR, 0.81 (95% CI, 0.67 to 0.98) in adults Total costs: No summary estimate
6 (229 883)	Observational/fair	Consistent	Direct	Precise	Admissions: RD median (range): −0.2% (1.4% to −8.9%) ED visits: RD median (range): −1.2% (3.1% to −8.3%) Total costs: No summary estimate
Unintended consequences or other harms					Insufficient
0	NA	NA	NA	NA	No estimate

ED = emergency department; NA = not applicable; NR = not reported; PCMH = patient-centered medical home; RCT = randomized, controlled trial; RD = risk difference; RR = risk ratio.

* Strength-of-evidence ratings are provided for outcomes overall (incorporating evidence from all studies), whereas magnitude of effect estimates are provided for RCTs vs. observational studies. The effect size for economic outcomes represents a summary estimate of effect from meta-analysis. Other effect sizes are presented as the range across individual studies for which effect sizes or RDs could be calculated. In 1 study (35), a program of facilitated PCMH (intervention) was compared with providing practices with information on PCMH but not facilitating the implementation (control). This study generally showed no differences on key outcomes that were addressed, potentially because practices in both groups implemented PCMH. The small number of studies conducted among children precluded formal comparison with studies conducted in adults. However, results in these 2 populations were generally congruent.

† The effect size for 2 of the 3 available observational studies could not be calculated with available information (42, 60). As a result, an effect size median and range could not be calculated.

‡ One additional study (46) reports information about chronic illness care without point estimates. As a result, it did not inform the summary effect estimate for chronic illness–related process of care reported in this table. Three of the studies that reported economic outcomes—2 RCTs (48, 73) and 1 observational study (40)—reported only total costs and so did not inform the summary effect estimates reported in this table.

children. Only 2 observational studies reported effects on biophysical markers, finding a higher rate of improved hemoglobin A_{1c} and low-density lipoprotein cholesterol values in intervention patients (44) in 1 study and no difference in composite diabetes and coronary artery disease outcomes in another (42). Four studies examined effects on patient-reported health status. None of the 3 randomized, controlled trials (35, 41, 48) found a statistically significant benefit on health status, but the single observational study (31) found a lower rate of functional decline (31% vs. 49% of patients) at 1-year follow-up in older adults receiving functional PCMH care. In the older adult population, limited data show that PCMH may have a positive effect on mortality. A single good-quality observational study found a mortality benefit at 1 year that was no longer significant at 2 years (49). Two other studies (1 RCT, 1 observational) had non–statistically significant findings also in the direction of lower mortality (31, 41), pointing to the potential benefit of continuing to examine intensive PCMH-type interventions targeting frail seniors and the effect on mortality.

Economic Effects

The most studied potential effect of PCMH involves the hypothesis that PCMH interventions will reduce health care utilization and costs (36, 38–41, 43–45, 47–52). Our summary of economic outcomes is divided into differences in inpatient utilization, emergency department utilization, and total costs. There is a low strength of evidence that PCMH does not lead to uniformly lower utilization of 2 areas hypothesized to be affected: inpatient and emergency department utilization. Moreover, total costs were not consistently decreased in the reviewed studies. The 5 randomized, controlled trials of functional PCMH interventions did not find a statistically significant effect on inpatient utilization (combined RR, 0.98 [95% CI, 0.86 to 1.12]) (38, 40, 41, 45, 47). Three of these trials reported on emergency department utilization (38, 40, 41), finding no effect (combined RR, 0.93 [CI, 0.72 to 1.20]), but the CI was wide. However, a subgroup analysis of the 2 trials among older adults (38, 41) pointed to the possibility of an association with lower emergency department utilization (combined RR, 0.81 [CI, 0.67 to 0.98]). These trial results are summarized in **Appendix Table 5**. In contrast to the trial results, 3 observational studies (1 each in a general adult population, older adults, and children) found small to moderately decreased inpatient and emergency department utilization (43, 50, 53, 54). With the exception of 1 subanalysis, no studies, including the 3 observational studies showing lower inpatient and emergency department utilization, reported statistically significant cost savings among PCMH patients during 6 to 24 months of follow-up. In fact, when program costs were considered, 1 good-quality trial and 1 fair-quality observational study reported greater total costs among PCMH intervention patients (43, 55). Despite these findings, 1 study, a subgroup analysis of expected cost differences among patients enrolled in the PCMH clinics of the Geisinger Health System, indicates that savings may occur with lengthy exposure to the PCMH system of greater than 1 year (56). This hypothesis may be taken up by future work in PCMH.

DISCUSSION

Although few studies have evaluated the effects of the PCMH, a moderately well-developed series of randomized, controlled trials and observational studies have tested interventions meeting the functional definition of the medical home. Moderately strong evidence suggests that the medical home has a small positive effect on patient experiences and small to moderate positive effects on preventive care services. Staff experiences are also improved by a small to moderate degree (low strength of evidence), but no study reported effects on staff retention. Current evidence is insufficient to determine effects on clinical and most economic outcomes. Given the relatively small number of studies directly evaluating the medical home and the evolving approaches to designing and implementing the medical home model, these findings should be considered preliminary (**Table 2** and **Figure 3**).

It is not surprising that the approaches to implementing the various components of PCMH varied widely. Interventions explicitly developed from the PCMH model used more approaches than those simply meeting our operational definition of "functional PCMH." As the evidence base expands, analyses of the relative effect of PCMH components will be important for clarifying the key approaches and could inform certifying agencies' criteria for medical home practices. Clinical practices and policymakers also need better information on the financial context and implementation strategies required for successful spread and sustainability of the PCMH model. Fewer than half of the studies included in this report described any new payment model, such as enhanced fee-for-service or additional per-member, per-month payments to PCMH practices. Further, there were no data on direct financial consequences to the practice implementing PCMH. This information—possibly through the mechanism of detailed case studies—could inform implementation efforts and the design of enhanced payment mechanisms for medical home practices.

Our review identified important gaps in currently available evidence on the effects of PCMH. Most studies evaluated effects in older adults with multiple chronic illnesses; few studies were conducted in pediatric or general adult primary care populations. Effects on quality indicators for chronic illness care and on clinical outcomes are uncertain. These are among the most important outcomes to patients, clinicians, and policymakers. Other gaps in evidence include the absence of data on staff retention and unintended consequences. If the improvements in staff ex-

Figure 3. **PCMH take-home points.**

What is PCMH?

The PCMH model describes mechanisms for organizing primary care to provide high-quality care across the full range of an individual's health care needs. It focuses on teams of health care professionals providing coordinated and accessible care to an identifiable group of patients.

Despite generally agreed-upon core concepts, exact definitions of PCMH vary widely. This review is based on an adaptation of what is used by the Agency for Healthcare Research and Quality (www.pcmh.ahrq.gov).

What do studied PCMH models look like?

In the published literature, PCMHs tended to:

- Be organized around multidisciplinary teams (e.g., designated primary care provider, defined roles of team members)
- Address comprehensive health needs of patients (e.g., multiple chronic illnesses)
- Develop ongoing relationships between the care team and individual patients (e.g., comprehensive assessments; care plans)
- Engage in care coordination (community liaison or referral to resources; coordinating transitions between care settings)
- Work to enhance access to services (e.g., telephone visits; home visits)
- Have a systems-based approach to improving quality and safety (e.g., identifying high-risk patients; use of evidence-based guidelines)
- Have new structures of care organization (e.g., new staff; new services)

No models of PCMH look exactly the same. The operationalization of the above concepts varied widely, making assessment of PCMH effectiveness a challenge.

Does PCMH work?

There is some evidence that PCMH may improve care experiences for both patients and staff.

There is some evidence that PCMH may improve care processes, especially for preventive services.

There is some evidence that PCMH may be associated with reduced emergency department admissions for older adults.

Evidence is not yet sufficient to comment on evidence related to 1) chronic illness care processes, 2) clinical outcomes, 3) effect on hospital admissions, and 4) effect on costs of care.

Bottom line

PCMH is a promising model for organizing primary care. However, there are open questions about its effect on patients and health care organizations.

PCMH = patient-centered medical home.

periences translate into improved staff retention and greater attractiveness of primary care practice, then PCMH would have met 1 of its goals. The potential for unanticipated consequences has not received much attention in the literature and was not evaluated in any of our included studies.

A horizon scan conducted for this review (results reported in AHRQ evidence-synthesis report) (18) identified 31 ongoing PCMH studies that are broadly representative of the U.S. health care system, both in geography and in the complexity of private and public health care payers and delivery networks. Many of these studies are being done in cooperation with payer organizations, and most are expected to be completed in the next 2 years. As a result, the evidence base related to PCMH will soon be greatly expanded. We encourage investigators to report the interventions in detail (that is, specific tasks, roles, and activities; detail on study setting; information on how the program is financed; and detail on how the team encouraged implementation), adjust for clustering when appropriate, report meaningful quality indicators for chronic illness (both processes and clinical outcomes), and provide data on the effect of PCMH on staff (including both survey data and staff turnover). We also encourage long-term follow-up of results. Outcomes examined in this report rarely had follow-up periods longer than 2 years. For certain outcomes, data from the electronic health record may provide the ability to examine long-term outcomes after the conclusion of formal funded studies.

Our review has important limitations. The PCMH is a model of care with considerable flexibility, not a narrowly defined intervention or manualized protocol. There is no standard nomenclature for components of the PCMH model. Further, various professional and patient organizations have proposed multiple definitions of the PCMH model (16). We developed an operational definition derived from the AHRQ definition of the medical home (8), which does not require an enhanced payment model. Because we used this definition, our review was more inclusive of studies that tested the critical principles that embody the Institute of Medicine concept of patient-centered care (57). However, greater inclusivity came with the trade-off of greater variability in study interventions. Although our search of ClinicalTrials.gov and other research databases did not suggest completed but unpublished studies, publication and selective outcomes reporting remain possible and could bias results. Related to this issue is the fact that PCMH models may be evaluated by organizations that do not routinely produce publications for peer review (such as consulting firms). Such results would then not be reflected in an analysis such as ours. Finally, heterogeneity in study designs, populations, and outcomes meant that standard quantitative summary methods were generally not possible.

The PCMH model is being widely implemented in various health care systems and includes key principles that are encouraged in the Affordable Care Act and required for recognition as an Accountable Care Organization (58, 59). Despite this impetus for implementation and agreement on broad concepts, such as enhancing team-based care and patient access, the exact approaches to PCMH implementation vary broadly. This review indicated that PCMH is a conceptually sound approach to organizing patient care and appears to hold promise, especially for improving the

experiences of patients and staff involved in the health care system. Evidence points to the possibility of improved care processes; however, ongoing and future studies are needed to determine whether these improvements translate into improved clinical outcomes or economic benefit. Although implementing the PCMH principles is something to be considered by organizations seeking to enhance patient experience and quality of care, no menu is yet available for specific actions that are most likely to enhance benefits to patients, staff, and organizations.

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Acknowledgment: The authors thank Christine Chang, MD, MPH; Janice Genevro, PhD, MSW; and Kathryn McDonald, MM, for their suggestions on improving the clarity of the AHRQ Evidence Report on which this article is based; and Connie Schardt, MSLS, for help with the literature search and retrieval.

Grant Support: This project was funded under contract 290-2007-10066-I from AHRQ, U.S. Department of Health and Human Services, as part of the series "Closing the Quality Gap: Revisiting the State of the Science."

Potential Conflicts of Interest: Disclosures can be viewed at www.acponline.org/authors/icmje/ConflictOfInterestForms.do?msNum=M12-1295.

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Appendix: Exact Search Strings

The PubMed search strategies described here (updated search date 29 June 2012) were adapted for use in the Cumulative Index to Nursing & Allied Health Literature database (CINAHL, search date 29 June 2012) and the Cochrane Database of Systematic Reviews (CDSR, search date 29 June 2012–30 March 2011). Results from searches A and B, described below, were combined to form the full citation set.

Search A (29 June 2012)

1. "medical home" OR "health-care home" OR "advanced primary care" OR "guided care" OR "patient aligned care team" OR "pcmh[tiab]

2. Clinical[tiab] AND trial[tiab]

3. clinical trials[MeSH] OR clinical trial[PT] OR random*[tiab] OR random allocation[MeSH] OR "time points"[tiab]

4. "time series AND interrupt[tiab]

5. pretest[tiab] OR pre-test[tiab] OR posttest[tiab]

6. quasi-experiment*[tiab] OR quasiexperiment*[tiab] OR quasirandom*[tiab] OR quasi-random*[tiab] OR quasi-control*[tiab] OR quasicontrol*[tiab]

7. cluster[tiab] AND trial[tiab]

8. (study[tiab] AND continuing[tiab] OR follow-up[tiab] OR longitudinal[tiab] OR demonstration[tiab] OR intervention[tiab])

9. treatment outcome[MeSH] OR multicenter study[PT] OR comparative study[PT] OR clinical trial OR comparative[tiab] OR comparison[tiab] OR matched[tiab] OR "Evaluation Studies as Topic"[MeSH:noexp] OR ""Program Evaluation"-[MeSH] OR "Validation Studies as Topic"[MeSH] OR "Multicenter Studies as Topic"[MeSH] OR "Controlled Clinical Trials as Topic"[MeSH:noexp] OR "evaluation studies"[PT]

10. #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9

11. #1 AND #10

Limits:

Language: English

Not: Editorial, Letter, Practice Guideline

Search B (29 June 2012)

1. "Patient-Centered Care"[MeSH] OR "Delivery of Health Care, Integrated"[MeSH] OR "Patient Care Team"[MeSH:noexp] OR "chronic care model" or "system redesign" OR "systems redesign" OR "disease management"[mh] OR "patient care management"[MeSH:noexp] OR collaboratives

2. "Primary Health Care"[Mesh:noexp] OR "family practice"[mesh] OR "internal medicine"[Mesh] OR "physicians, family"[mesh] OR geriatrics[Mesh] OR "primary care"[tiab] OR chronic disease[mh] OR "ambulatory Care"[Mesh] OR "Health Services for the Aged"[MeSH] OR "Community networks"-[mesh] OR "pediatrics"[Mesh] OR "Child Health Services"-[Mesh] OR "Health Care Coalitions"[Mesh] OR (child*[tiab] AND special[tiab] AND health*[tiab]) OR "diabetes mellitus"-[Mesh] OR "diabetes mellitus"[tiab] OR "depressive disorder"[Mesh] OR "major depression"[tiab] OR "heart failure"-[Mesh] OR "heart failure"[tiab] OR "coronary disease"[Mesh] OR "angina pectoris"[Mesh:noexp] OR hypertension[Mesh] OR hypertension[tiab] OR hyperlipidemias[Mesh] OR hyperlipidemia[tiab]

3. clinical[tiab] AND trial[tiab]) OR clinical trials[MeSH] OR clinical trial[PT] OR random*[tiab] OR random allocation-[MeSH] OR "time points"[tiab] OR ("time series" AND interrupt[tiab]) OR pretest[tiab] OR pre-test[tiab] OR post-test[tiab] OR posttest[tiab]

4. quasi-experiment*[tiab] OR quasiexperiment*[tiab] OR quasirandom*[tiab] OR quasi-random*[tiab] OR quasi-control*[tiab] OR quasicontrol*[tiab]

5. (cluster[tiab] AND trial[tiab]) OR (study[tiab] AND continuing[tiab] OR follow-up[tiab] OR longitudinal[tiab] OR demonstration[tiab] OR intervention[tiab])

6. treatment outcome[Mesh] OR multicenter study[pt] OR comparative study[pt] OR clinical trial OR comparative[tiab] OR comparison[tiab] OR matched[tiab] OR "Evaluation Studies as Topic"[Mesh:noexp] OR "Program Evaluation"[Mesh] OR "Validation Studies as Topic"[Mesh] OR "Multicenter Studies as Topic"[Mesh] OR "Controlled Clinical Trials as Topic"[Mesh:noexp] OR "evaluation studies"[pt]

7. #3 OR #4 OR #5 OR #6

8. #1 AND #2 AND #7

Limits:

Language: English

Not: Editorial, Letter, Practice Guideline

Not: Citations from Search A

Appendix Table 1. **Characteristics of Included Studies—Comparative Randomized, Controlled Trials (Questions 1–3)**

Study, Year (Reference)	Country/ Organization	Explicitly PCMH? Intervention Components	Practices, *n*	Participants, *n**	Outcomes Reported	Follow-up Duration†	Study Quality‡
Farmer et al, 2011 (37)	USA Insurance: Medicaid managed care plan	Yes 1. Coordinated care 2. Team 3. Sustained partnership 4. Comprehensive 5. Enhanced access 6. Structural changes	Intervention, 32 Usual care, 0 (crossover design)	CSHCN, 100 Practice staff, NR	Patient experiences	6 mo	Fair Randomization process not described Blinding of outcomes assessment unclear
Jaen et al, 2009, 2010 (33–35, 64–68)	USA Stand-alone primary care provider: Physician and hospital/health system–owned	Yes 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, 18 Usual care, 17	Adults, 1983 Practice staff, NR	Patient experiences; staff experiences; process of care; clinical	26 mo	Fair Outcomes assessment not blinded Incomplete data not adequately addressed Potentially significant conflict of interest
Boult et al, 2008–2011 (38, 61, 69–73)	USA HMO: Kaiser-Permanente Mid-Atlantic States Integrated delivery system: Johns Hopkins Community Physicians Stand-alone primary care provider: MedStar Physician Partners (multisite group practice)	No 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, 7 PC teams; 8 practices Usual care, 7 PC teams; 8 practices	Older adults with chronic illness, 904 Practice staff, 49	Patient experiences; staff experiences; economic	26 mo	Good
Rubin et al, 1992 (52)	USA Parkland Memorial Hospital	No 1. Coordinated care 2. Team 3. Sustained partnership 4. Comprehensive 5. Structural changes	Intervention, 1 Usual care, NR	Older adults at high risk for rehospitalization, 200 Practice staff, NR	Economic	26 mo	Fair Outcomes not assessed using validated procedures/instruments Significant differences in baseline characteristics across groups
Rula et al, 2011 (47)	USA Medicare Advantage Plan	No 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	1 Medicare Advantage Plan (number of providers NR)	Older adults with diabetes and/or congestive heart failure, 36 275	Process of care; economic	3 y	Fair Outcomes assessment not blinded Possible selection bias
Schraeder et al, 2005 (45, 55)	USA Integrated delivery system: Carle Health System in Urbana, IL	No 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, 12 Usual care, 0	Older adults with COPD, CAD, DM, CHF, or AF, 2657 Practice staff, NR	Process of care; economic	2 y	Fair Outcomes assessment not blinded

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Appendix Table 1—**Continued**

Study, Year (Reference)	Country/ Organization	Explicitly PCMH? Intervention Components	Practices, *n*	Participants, *n**	Outcomes Reported	Follow-up Duration†	Study Quality‡
Sommers et al, 2000 (48)	USA Stand-alone primary care provider	No 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, 9 Usual care, 9	Older adults with chronic illness, 543 Practice staff, NR	Clinical; economic	2 y	Good
Toseland et al, 1996, 1997 (41, 62)	USA–Federal: Department of Veterans Affairs	No 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, 1 Usual care, 1	Older adults with chronic illness, 160 Practice staff, NR	Patient experiences; clinical; economic	2 y	Good
Zuckerman et al, 2003, 2004, 2007 (40, 63, 74)	USA Multiple separate primary care practices across 14 states	No 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, 15 Usual care, 15	Young children, 3737 Practice staff, NR	Patient experiences; process of care	5.5 y	Fair Blinding of outcomes assessment unclear Unclear whether incomplete data adequately addressed Significant differences in baseline characteristics across groups

AF = atrial fibrillation; CAD = coronary artery disease; CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease; CSHCN = children with special health care needs; DM = diabetes mellitus; NR = not reported; PC = primary care; PCMH = patient-centered medical home.

* The number of patients for specific study analyses may vary from the summary number presented here for each study.

† Based on longest follow-up among abstracted outcomes.

‡ The most significant quality limitations are listed for all "fair" and "poor" studies.

Appendix Table 2. **Characteristics of Included Studies—Comparative Observational Studies (Questions 1–3)**

Study, Year (Reference)	Country/ Organization	Explicitly PCMH? Intervention Components	Practices, *n*	Participants, *n**	Outcomes Reported	Follow-up Duration†	Study Quality‡
Domino et al, 2009 (43)	USA Statewide medical home network	Yes 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, NR Usual care, NR	Children with asthma, 207 439 Practice staff, NR	Process of care; economic	Monthly estimates based on 4 y of data	Good
Martin et al, 2007 (51)	USA Stand-alone primary care provider: Family practice	Yes 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, 1 Usual care, NR	CSHCN, 199 Practice staff, NR	Economic	2 y	Fair Possible selection bias; possible detection bias
Reid et al, 2009, 2010, 2012 (36, 53, 75, 76)	USA HMO: Group Health Cooperative of Puget Sound	Yes 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, 1 Usual care, 19	Adults, 3353 Practice staff, 82	Patient experiences; staff experiences; process of care; economic	2 y	Fair Possible selection bias; possible detection bias
Solberg et al, 2011 (42)	USA HMO: HealthPartners of Minnesota	Yes 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, 1 primary care medical group with 21 clinics Usual care, 19–22 medical groups	All primary care patients, 217 936 in intervention clinics; control patients vary by measure (highest reported in this review was for 22 medical groups for coronary artery disease [287–528]; median, 346)	Patient experiences; process of care; clinical	2–4 y	Fair Possible selection bias
Steele et al, 2010, 2012 (50, 54, 56)	USA HMO: Geisinger	Yes 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, 11 Usual care, 75	Older adults with chronic illness, 15 310 Practice staff, NR	Economic	1 y	Fair Possible detection bias
Boyd et al, 2007, 2008 (39, 60, 77)	USA Integrated delivery system Health plan for military retirees Other: University-affiliated community primary care practices	No 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, 1 Usual care, 1	Older adults with chronic illness, 150 Practice staff, 2	Patient experiences; economic	6 mo	Fair Possible selection bias; possible attrition bias; analysis not adjusted for clustering

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Appendix Table 2—**Continued**

Study, Year (Reference)	Country/ Organization	Explicitly PCMH? Intervention Components	Practices, *n*	Participants, *n**	Outcomes Reported	Follow-up Duration†	Study Quality‡
Dorr et al, 2006, 2008 (49, 78)	USA Integrated delivery system: Intermountain Group Health	No 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, 7 Usual care, 6	Older adults with chronic illness, 3432 Practice staff, NR	Clinical; economic	2 y	Good
Hebert et al, 2003 (31)	Canada (Quebec) Non-U.S. government: Canadian health care system	No 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, 1 region; number of clinics NR Usual care, 1 region; number of clinics NR	Older adults with chronic illness, 482 Practice staff, NR	Clinical	2 y	Poor Possible selection bias; possible performance bias; possible detection bias
Taplin et al, 1998 (46)	USA HMO: Group Health Cooperative of Puget Sound	No 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Structural changes	Intervention, 1 Usual care, 27	Adults, 398 000 Practice staff, NR	Process of care	2 y	Fair Possible selection bias; possible performance bias
Wise et al, 2006 (44)	USA Other insurance organization: Partnership Health in partnership with University of Michigan's Medical Management Center	No 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive	Intervention, NR Usual care, NR	All ages; high utilizers, 54 479 Practice staff, NR	Process of care; clinical; economic	1 y	Fair Possible performance bias

CSHCN = children with special health care needs; NR = not reported; PCMH = patient-centered medical home.
* The number of patients for specific study analyses may vary from the summary number presented here for each study.
† Based on longest follow-up among abstracted outcomes.
‡ The most significant quality limitations are listed for all "fair" and "poor" studies.

Appendix Table 3. **Characteristics of Included Studies—Noncomparative Studies (Questions 2 and 3)**

Study, Year (Reference)	Country/ Organization	Explicitly PCMH? Intervention Components	Practices, *n*	Participants, *n**
Farmer et al, 2005 (79)	USA University-affiliated PC clinics	Yes 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, 3 Usual care, NA	CSHCN, 51 Practice staff, NR
Lee et al, 2011 (80)	USA Insurance organization: Employer-based insurance program	Yes 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Structural changes	NR—describes pre–post results for health plan members	High-risk adults, 46 Practice staff, NR
Palfrey et al, 2004, 2008 (81, 82)	USA Pediatric Alliance for Coordinated Care	Yes 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, 6 Usual care, NA	CSHCN, 150 Practice staff, NR
Rankin et al, 2009 (83)	USA Stand-alone PC provider	Yes 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access	Intervention, 6 Usual care, NA	CSHCN, 47 Practice staff, NR
Treadwell et al, 2009 (84)	USA Stand-alone PC provider: 47 PC practices	Yes 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, 47 Usual care, NA	Children with asthma, DM, or ADHD, NR Practice staff, NR
Chandler et al, 1997 (85)	USA Department of Veterans Affairs Other: Northwestern Memorial Hospital	No 1. Coordinated care 2. Team 3. Sustained partnership 4. Comprehensive 5. Enhanced access 6. Structural changes	Intervention, 2 Usual care, NA	Adults, 16 000 Practice staff, 3
Farris et al, 2004 (86)	Canada Government-operated health system outside USA; private delivery, but government-funded health care system	No 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, 6 Usual care, NA	Adults with chronic illness, 199 Practice staff, NR
Peleg et al, 2008 (87)	Israel Non-U.S. government: Israel—PC clinic	No 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, 1 Usual care, NA	Older adults, 4620 Practice staff, NR
Schifalacqua et al, 2000 (88)	USA Integrated delivery system: Aurora Health Care of Wisconsin	No 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, NR Usual care, NA	Older adults at medium to high health risk, NR Practice staff, NR

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Appendix Table 3—**Continued**

Study, Year (Reference)	Country/ Organization	Explicitly PCMH? Intervention Components	Practices, *n*	Participants, *n**
Vedel et al, 2009 (89)	Paris, France Non-U.S. government: French health care system	No 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, NR Usual care, 2	Older adults with chronic illness, 100 Practice staff, NR
Waxmonsky et al, 2011 (90)	USA Colorado Access	No 1. Quality included 2. Coordinated care 3. Team 4. Sustained partnership 5. Comprehensive 6. Enhanced access 7. Structural changes	Intervention, NR Usual care, NA	Adults, 3314 Practice staff, 14

ADHD = attention-deficit/hyperactivity disorder; CSHCN = children with special health care needs; DM = diabetes mellitus; NA = not applicable; NR = not reported; PC = primary care; PCMH = patient-centered medical home.
* The number of patients for specific study analyses may vary from the summary number presented here for each study.

Appendix Table 4. PCMH Components Implemented and Implementation Strategies Used (Questions 2 and 3)*

Strategies*	PCMH (n = 13)†	Functional PCMH (n = 18)†
Team-based care‡	13	18
Designated primary care provider for patients§	10	16
Designated primary contact for patients	4	8
Defined roles for team members	9	12
Dedicated time for PCMH activities	7	14
Team meetings	8	12
Enhanced access	12	15
Home visits	4	9
Telephone visits	4	6
Enhanced communication options—electronic or telephone	6	6
Advanced clinic access	5	2
Disease management—online or by telephone	4	4
Group visits	2	1
24/7 coverage	1	1
Expanded office hours	1	0
Coordination of care	12	18
Community liaison or referral to resources	7	13
Coordinated care transitions	5	14
Coordinated home health	1	6
Previsit planning	2	4
Referral tracking	4	3
Inclusion of pharmacist activities	3	4
Test tracking	2	2
Integrated mental health	0	3
Comprehensiveness	13	18
Chronic illness care	11	17
Prevention services	9	10
Acute care	9	11
Specialty care	1	5
Systems-based approaches to improving quality and safety	12	16
Identification of high-risk patients	8	10
Evidence-based guidelines	6	7
Performance monitoring	5	6
Electronic health record	6	8
Registry or methods to track care/health	5	6
Decision support	2	5
Strategies reported to facilitate a sustained partnership	13	18
Comprehensive assessment	5	13
Care plan	9	11
Shared decision making	1	2
Self-management support	5	7
Family caregiver support	5	6
Structural changes	13	18
New staff	7	16
New staff roles	6	7
New location of care	0	2
New organizational affiliations or entities	2	3
New services	12	6
New electronic health record	1	4
New payment or financial model	5	7
Financial models	6 report information	7 report information
Bundled payments for most health services	0	0
PCMH per member, payment for PCMH activities per month	1	1
Pay-for-performance	1	1
Enhanced fee-for-service compensation	3	0
Accountable care organization	0	0
Revised pharmacy benefits	0	0
Other	3	6
Implementation strategies	10 report information	10 report information
Audit and feedback/quality improvement measures	6	7
Academic detailing/lectures and classes for staff	5	6
Designated clinical champion or project manager	4	1
Plan-do-study-act cycles/rapid cycle improvement mechanisms	3	1
Flow mapping of care system	0	0
Total quality management/continuous quality improvement	0	0
Strengths-weakness-opportunities-threats analysis	0	0
External benchmarking at the organizational level	0	1
Organizational learning strategies	10 report information	14 report information
Formal learning collaborative/collaborative program planning	8	11
Designated research/project team assistance	2	3
Community of practice	3	3
Implementation toolkits	3	2

PCMH = patient-centered medical home.

* Number of studies specifically reporting an individual strategy that could be identified during data abstraction.

† Because any given study may contain multiple specific components or strategies, the number of studies listed as reporting specific PCMH components or implementation strategies should not be expected to add to the total number of studies reporting some aspect of each category.

‡ Detail on reported team composition is available in the evidence report prepared for the Agency for Healthcare Research and Quality (18).

§ Overlaps with strategies to facilitate a sustained partnership.

Appendix Table 5. **Meta-analyses for Inpatient and Emergency Department Utilization Reported in Randomized, Controlled Trials**

Study, Year (Reference)*	Explicitly PCMH?	Population	Quality	Follow-up Duration	Risk Ratio (95% CI)
Inpatient utilization					
Boult et al, 2008 (38) Boult et al, 2011 (61)	No	Older adults	Good	Up to 26 mo	0.83 (0.64–1.08)
Schraeder et al, 2005 (45) Peikes et al, 2009 (55)	No	Older adults	Fair	2 y	1.06 (0.97–1.15)
Toseland et al, 1997 (41) Toseland et al, 1996 (62)	No	Older adults	Good	8 mo	1.06 (0.72–1.58)
Sommers et al, 2000 (48)	No	Older adults	Good	2 y	0.86 (0.71–1.05)
Zuckerman et al, 2004 (40) Minkovitz et al, 2003 (63)	No	Young children	Fair	3 y	1.23 (0.85–1.77)
Combined†	–	0.98 (0.86–1.12)			
Combined (adult studies only)	–	0.96 (0.84–1.10)			
Emergency department utilization					
Boult et al, 2008 (38) Boult et al, 2011 (61)	No	Older adults	Good	Up to 26 mo	0.85 (0.62–1.17)
Toseland et al, 1997 (41) Toseland et al, 1996 (62)	No	Older adults	Good	8 mo	0.79 (0.62–1.00)
Zuckerman et al, 2004 (40) Minkovitz et al, 2003 (63)	No	Young children	Fair	3 y	1.13 (0.98–1.29)
Combined‡	–	0.93 (0.72–1.20)			
Combined (older adults only)	–	0.81 (0.67–0.98)			

PCMH = patient-centered medical home.
* Where more than 1 study is cited, the first citation is to the primary study report and the second is to the secondary report that actually provided data for this table.
† Test of heterogeneity: $P = 0.149$.
‡ Test of heterogeneity: $P = 0.022$. Note that there is no evidence of an effect of treatment. There was evidence of heterogeneity ($P = 0.022$).

Appendix Table 6. **Reported Outcomes by Study**

Study, Year (Reference)	Type of Study	Explicitly PCMH?	Population	Quality	Outcome Category	Outcome (Follow-up Duration)	Calculated Effect Size
Farmer et al, 2011 (37)	Trial	Yes	Children	Fair	Patient experience: overall experience	Satisfaction with mental health care (6 mo)	ES: 0.33 (95% CI, −0.15 to 0.80)
					Patient experience: coordination of care	Satisfaction with care coordination (6 mo)	ES: 0.42 (95% CI, −0.05 to 0.90)
Jaen et al, 2009, 2010 (33–35, 64–68)	Trial	Yes‡	Adults	Fair	Patient experience: overall experience	Overall practice experience (26 mo)	ES: −0.36 (95% CI, −1.10 to 0.37)
					Patient experience: coordination of care	Coordination of care: based on select questions from the Components of Primary Care Index (26 mo)	ES: 0.33 (95% CI, −0.40 to 1.07)
					Staff experience	Practice adaptive reserve (26 mo)	ES: 0.14 (95% CI, −0.53 to 0.80)
					Process of care: prevention	Prevention Score: percentage of eligible patients receiving services recommended by the USPSTF (26 mo)	RD: 1.3%
					Process of care: chronic illness	Chronic Care Score: percentage of eligible patients receiving services recommended based on 17 guideline-recommended processes (26 mo)	RD: 11.4%
Boult et al, 2008–2011, (38, 61, 69–73)	Trial	No	Older adults	Good	Patient experience: overall experience	Overall score: patient assessment of chronic illness (18 mo)	ES: 0.21 (95% CI, 0.07 to 0.34)
					Patient experience: coordination of care	Coordination of care: patient assessment of chronic illness (18 mo)	ES: 0.28 (95% CI, 0.15 to 0.42)
					Staff experience	Physician satisfaction with chronic illness care (1 y)	ES: 0.22 (95% CI, −0.42 to 0.86)
					Economic: inpatient utilization	RR used for meta-analysis	RR: 0.83 (95% CI, 0.64 to 1.08)
					Economic: ED utilization	RR used for meta-analysis	RR: 0.85 (95% CI, 0.62 to 1.17)
					Economic: total costs	Total cost (not including cost of guided care program) (18 mo)	−$170.90 difference in total cost (intervention minus control); 95% CI, −$339.9 to $55.0
					Economic: total costs	Total cost (including $95.90 cost of guided care program) (18 mo)	$75.00 difference in total cost (intervention minus control); 95% CI, −$244.00 to $150.90
Rubin et al, 1992 (52)	Trial	No	Older adults	Fair	Economic: total costs	Medicare Parts A and B charges during the 26-mo enrollment period (variable follow-up per individual)	$8931 per patient (intervention) vs. $11 664 (control) ($P \geq 0.05$)
Rula et al, 2011 (47)	Trial	No	Older adults	Fair	Process of care: chronic illness	Twice-yearly hemoglobin A_{1c} testing for diabetic patients (year 3 of 3-y study)	RD: 2.1% (P = NR)
					Process of care: chronic illness	Annual LDL cholesterol testing for diabetic patients (year 3 of 3-y study)	RD: 1.4% (P = NR)
					Economic: total costs	Total adjusted expenditures (cohort 1, patients with heart failure diagnosis; cohort 2, patients with heart failure and/or diabetes diagnosis, with enrollment priority given to patients with both heart failure and diabetes diagnosis) (3 y)	Cohort 1: 975 701 659 (intervention) vs. 979 506 891 (control); 0.39% savings (P = NR) Cohort 2: 181 485 383 (intervention) vs. 187 168 976 (control); 3.04% savings (P = NR)

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Appendix Table 6—**Continued**

Study, Year (Reference)	Type of Study	Explicitly PCMH?	Population	Quality	Outcome Category	Outcome (Follow-up Duration)	Calculated Effect Size
Schraeder et al, 2005 (45, 55)	Trial	No	Older adults	Fair	Process of care: prevention	Percentage of patients receiving influenza vaccine (2 y)	RD: −0.4%
					Process of care: prevention	Percentage of patients receiving pneumococcal vaccine (2 y)	RD: 0.5%
					Process of care: prevention	Percentage of patients receiving colon cancer screening from claims data (2 y)	RD: 0.2%
					Process of care: prevention	Percentage of patients receiving mammography (women only) (2 y)	RD: 3.6%
					Process of care: chronic illness	Diabetic patients: percentage of patients receiving lipid testing (2 y)	RD: 6.2% ($P < 0.01$)
					Process of care: chronic illness	Diabetic patients: percentage of patients receiving urine microalbuminuria (2 y)	RD: 20.8% ($P < 0.01$)
					Process of care: chronic illness	Diabetic patients: percentage of patients receiving eye examinations (2 y)	RD: 3.2%
					Process of care: chronic illness	Diabetic patients: percentage of patients receiving hemoglobin A_{1c} testing (2 y)	RD: 0.2%
					Process of care: chronic illness	Patients with coronary artery disease: percentage of patients receiving lipid testing (2 y)	RD: 6.9% ($P < 0.01$)
					Economic: inpatient utilization	RR used for meta-analysis	RR: 1.06 (95% CI, 0.97 to 1.15)
					Economic: total costs	Total Medicare expenditures (regression adjusted difference), not including program fee (1–2 y)	Treatment minus control difference, $61 (90% CI, $4 to $117); difference, 8.7% ($P = 0.08$)
					Economic: total costs	Total Medicare expenditures (regression adjusted difference), including program fee (1–2 y)	Treatment minus control difference, $209 (90% CI, $153 to $265); difference, 30.1% ($P < 0.001$)
Sommers et al, 2000 (48)	Trial	No	Older adults	Good	Clinical outcomes: health status	SF-36 (higher score = poorer function) (2 y)	Not calculable Mean score, 3.2 intervention vs. 3.3 control; 95% CI, −0.27 to 0.02 ($P = 0.08$)
					Clinical outcomes: health status	Health Activities Questionnaire (higher score = poorer function) (2 y)	Not calculable Mean score, 0.44 intervention vs. 0.50 control ($P = 0.14$)
					Economic: inpatient utilization	RR used for meta-analysis	RR: 0.86 (95% CI, 0.71 to 1.05)
Toseland et al, 1996, 1997 (41, 62)	Trial	No	Older adults	Good	Patient experience: overall experience	Patient satisfaction scale (8 mo)	ES: 0.27 (95% CI, −0.06 to 0.61)
					Patient experience: coordination of care	Satisfaction with help obtaining services (8 mo)	ES: 0.42 (95% CI, 0.09 to 0.76)
					Clinical outcomes: health status	SF-20 (2 y)	No statistically significant difference over 24 mo (specific numbers not given)
					Clinical outcomes: mortality	Mortality (2 y)	RD: −7.5%
					Economic: inpatient utilization	RR used for meta-analysis	RR: 1.06 (95% CI, 0.72 to 1.58)
					Economic: ED utilization	RR used for meta-analysis	RR: 0.79 (95% CI, 0.62 to 1.00)
					Economic: total costs	Total costs incurred during the study for the 80 patients in each study group (2-y)	$25 844 (intervention) vs. 24 995 (control) ($P \geq 0.05$)

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Appendix Table 6—**Continued**

Study, Year (Reference)	Type of Study	Explicitly PCMH?	Population	Quality	Outcome Category	Outcome (Follow-up Duration)	Calculated Effect Size
Zuckerman et al, 2003, 2004, 2007 (40, 63, 74)	Trial	No	Young children	Fair	Patient experience: coordination of care	Percentage of parents reporting receiving needed support from their pediatrician/nurse practitioner (5–5.5 y)	ES: 0.12 (95% CI, 0.01 to 0.24)
					Process of care: prevention	Percentage of children with age-appropriate well child care (1 and 2 y)	1 y: RD: 8.6% ($P < 0.05$) 2 y: RD: 6.5% ($P < 0.05$)
					Process of care: prevention	Percentage of children with age-appropriate vaccines (2 y)	RD: 7.7% ($P < 0.05$)
Domino et al, 2009 (43)	Observational	Yes	Children (asthma used as tracer condition for PCMH)	Good	Process of care: chronic illness	Monthly percentage use of maintenance medication for asthma	RD: 3.6% ($P < 0.01$)
					Economic: inpatient utilization	Inpatient utilization rate use for all diagnoses: differences in monthly utilization rate	18% lower inpatient utilization than fee-for-service patients (0.47/2.6) ($P < 0.01$)
					Economic: ED utilization	ED use for all diagnoses: differences in monthly utilization rate	10% lower inpatient utilization use than fee-for-service patients (0.03/0.3) ($P < 0.01$)
					Economic: total costs	Mean monthly total costs among those with a cost	$43 (9% [42.95/470.46]) lower total costs than fee-for-service patients ($P < 0.01$)
					Economic: total costs	Total per capita mean Medicaid; considers both reduced mean expenditures among users and 58% (37.56/63.5) rate of having a Medicaid expense in 1 mo (including program fees)	$148 (95% CI, $140 to $158) greater per capita costs than fee-for-service patients ($P < 0.01$)
Martin et al, 2007 (51)	Observational	Yes	Children	Fair	Economic: inpatient utilization	Inpatient yearly utilization rates (1 and 2 y after implementation)	Year 1: 7.7% (intervention) vs. 3.4% (control); $P > 0.10$ Year 2: 4.0% (intervention) vs. 2.6% (control); $P = 0.09$
					Economic: ED utilization	ED yearly utilization rates (1 and 2 y after implementation)	Year 1: 14.5% (intervention) vs. 17.8% (control); $P =$ NR Year 2: 12.3% (intervention) vs. 16.6% (control); $P =$ NR
Reid et al, 2009, 2010, 2012 (36, 53, 75, 76)	Observational	Yes	Adults	Fair	Patient experience: coordination of care	Care coordination: Ambulatory Care Experiences Survey-Short Form (2 y)	All patients (basis of summary estimates) ES: 0.13 (95% CI, 0.05 to 0.21) Patients aged ≥65 y ES: 0.13 (95% CI, 0.05 to 0.21)
					Staff experience	Emotional exhaustion: Masslach Burnout Inventory (lower score is better) (2 y)	ES: 0.61 (95% CI, 0.16 to 1.06)
					Staff experience	Depersonalization: Masslach Burnout Inventory (lower score is better) (2 y)	ES: 0.32 (95% CI, −0.12 to 0.76)
					Staff experience	Lack of personal accomplishment: Masslach Burnout Inventory (lower score is better) (2 y)	ES: 0.49 (95% CI, 0.05 to 0.94)
					Process of care: prevention and chronic illness	Healthcare Effectiveness Data and Information Set (2 y)	All patients (basis of summary estimates) RD: 5.6% Patients aged ≥65 y RD: 5.8%

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Appendix Table 6—**Continued**

Study, Year (Reference)	Type of Study	Explicitly PCMH?	Population	Quality	Outcome Category	Outcome (Follow-up Duration)	Calculated Effect Size
					Economic: inpatient utilization	Inpatient admissions for all causes: rate per 1000 patients per month (all patients: over first 12, first 18, and first 21 mo of implementation; patients aged ≥65 y: over first 12 and first 21 mo of implementation)	All patients (basis of summary estimates) 12 mo: 4.7 (95% CI, 4.5 to 5.0) (intervention) vs. 4.8 (95% CI, 4.7 to 4.8) (control); relative difference, 99% (95% CI, 94% to 104%) ($P = 0.605$) 18 mo: 5.1 (95% CI, 4.8 to 5.3) (intervention) vs. 4.3 (95% CI, 5.2 to 5.4) (control); relative difference, 96% (95% CI, 91% to 101%) ($P = 0.091$) 21 mo: 5.4 (95% CI, 5.4 to 5.5) (intervention) vs. 4.8 (95% CI, 4.7 to 4.8) (control); relative difference, 94 (95% CI, 89% to 98%) ($P = 0.007$) Patients aged ≥65 y 12 mo: 13 (95% CI, 11 to 14) (intervention) vs. 13 (95% CI, 13 to 13) (control); relative difference, 98% (95% CI, 89% to 107%) ($P = 0.625$) 21 mo: 14 (95% CI, 13 to 15) (intervention) vs. 15 (95% CI, 14 to 15) (control); relative difference, 95% (95% CI, 88% to 104%) ($P = 0.265$)
					Economic: inpatient utilization	Inpatient admissions for ambulatory care–sensitive conditions (not defined): rate per 1000 patients per month (over first 12, first 18, and first 21 mo of implementation); patients aged ≥65 y (over first 12 and first 21 mo of implementation)	All patients 12 mo: 0.22 (95% CI, 0.20 to 0.24) (intervention) vs. 0.26 (95% CI, 0.25 to 0.27) (control); relative difference, 84% (95% CI, 78% to 90%) ($P < 0.001$) 18 mo: 0.25 (95% CI, 0.23 to 0.26) (intervention) vs. 0.28 (95% CI, 0.27 to 0.29) (control); relative difference, 88% (95% CI, 82% to 94%) ($P < 0.001$) 21 mo: 0.24 (95% CI, 0.23 to 0.26) (intervention) vs. 0.28 (95% CI, 0.27 to 0.28) (control); relative difference, 87% (95% CI, 81% to 93%) ($P < 0.001$) Patients aged ≥65 y 12 mo: 1.1 (95% CI, 1.0 to 1.3) (intervention) vs. 1.5 (95% CI, 1.5 to 1.6) (control); relative difference, 75% (95% CI, 65% to 87%) ($P < 0.001$) 21 mo: 1.5 (95% CI, 1.3 to 1.7) (intervention) vs. 1.8 (95% CI, 1.7 to 1.8) (control); relative difference, 82% (95% CI, 72% to 93%) ($P = 0.002$)

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Appendix Table 6—Continued

Study, Year (Reference)	Type of Study	Explicitly PCMH?	Population	Quality	Outcome Category	Outcome (Follow-up Duration)	Calculated Effect Size
					Economic: ED utilization	ED/urgent care use: rate per 1000 patients per mo (over first 12, first 18, and first 21 mo of implementation); patients aged ≥65 y (over first 12 and first 21 mo of implementation)	All patients (basis of summary estimates) 12 mo: 26 (95% CI, 24 to 27) (intervention) vs. 36 (95% CI, 36 to 36) (control); relative difference, 71% (95% CI, 67% to 74%) ($P < 0.001$) 18 mo: 27 (95% CI, 26 to 28) (intervention) vs. 38 (95% CI, 38 to 38) (control); relative difference, 71% (95% CI, 68% to 74%) ($P < 0.001$) 21 mo: 27 (95% CI, 26 to 29) (intervention) vs. 39 (95% CI, 38 to 39) (control); relative difference, 71% (95% CI, 68% to 74%) ($P < 0.001$) Patients aged ≥65 y 12 mo: 39 (95% CI, 36 to 43) (intervention) vs. 50 (95% CI, 49 to 51) (control); relative difference, 78% (95% CI, 72% to 84%) ($P < 0.001$) 21 mo: 44 (95% CI, 41 to 47) (intervention) vs. 56 (95% CI, 55 to 57) (control); relative difference, 79% (95% CI, 73% to 85%) ($P < 0.001$)
					Economic: total costs	Total costs (over first 12, first 18, and first 21 mo of implementation; patients aged ≥65 y over first 12 and first 21 mo of implementation)	All patients 12 mo: $466 (95% CI, $453 to $480) (intervention) vs. $477 ($471 to $483) (control); relative difference, −10.20% (95% CI, −22.85% to 2.45%) ($P = 0.114$) 18 mo: $480 (95% CI, $468 to $491) (intervention) vs. $490 (95% CI, $485 to $495) (control); relative difference, −10.40% (95% CI, −21.19% to 0.38%) ($P = 0.059$) 21 mo: $488 (95% CI, $476 to $500) (intervention) vs. $498 (95% CI, $493 to $503) (control); relative difference, −10.31% (95% CI, −21.69% to 1.08%) ($P = 0.076$) Patients aged ≥65 y 12 mo: $806 (95% CI, $765 to $846) (intervention) vs. $803 (95% CI, $787 to $819) (control); difference, $2.79 (95% CI, −$37.33 to $42.91) ($P = 0.892$) 21 mo: $849 (95% CI, $807 to $890) (intervention) vs. $854 (95% CI, $841 to $868) (control); difference, −$5.92 (95% CI, −47.61 to 35.78) ($P = 0.781$)

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Appendix Table 6—**Continued**

Study, Year (Reference)	Type of Study	Explicitly PCMH?	Population	Quality	Outcome Category	Outcome (Follow-up Duration)	Calculated Effect Size
Solberg et al, 2011 (42)	Observational	Yes	Adults and children	Fair	Patient experience: overall experience	Patients report being very satisfied with clinic (comparison of yearly change in measure over 4 y)	Yearly change: 4.9% (intervention) vs. 0.7% (control) ($P < 0.01$)
					Process of care: prevention	Optimal preventive services (composite of screening for chlamydia, colorectal cancer, breast cancer, cervical cancer and hyperlipidemia; comparison of yearly change in measure over 4 y)	Yearly change: 4.2% (intervention) vs. 1.5% (control) (RD: 2.7% used for evidence summary) ($P = 0.26$)
					Clinical outcomes: biophysical markers	Optimal diabetes care (composite of control of hemoglobin A_{1c}, blood pressure, and lipids; comparison of yearly change in measure over 3 y)	Yearly change: 3.1% (intervention) vs. 1.8% (control) ($P = 0.42$)
					Clinical outcomes: biophysical markers	Optimal coronary artery disease care (composite of control of lipids and blood pressure, lack of smoking, and day aspirin use; comparison of yearly change in measure over 3 y)	Yearly change: 7.4% (intervention) vs. 1.2% (control) ($P = 0.12$)
Steele et al, 2010, 2012 (50, 54, 56)	Observational	Yes	Older adults	Fair	Economic: inpatient utilization	Difference in expected inpatient admissions: rate per 1000 patients per year	257 (with PCMH) vs. 313 (without PCMH), 18% difference (95% CI, −30% to −5%) ($P < 0.01$)
					Economic: inpatient utilization	Difference in expected inpatient admissions among clinics not operated by the health system: rate per 1000 patients per year for Medicare beneficiaries in 2009	227.5 (with PCMH) vs. 316.7 (without PCMH), 28.0% difference (P = NR)
					Economic: inpatient utilization	Difference in expected inpatient admissions among clinics not operated by the health system: rate per 1000 patients per year for commercial insurance beneficiaries in 2009	40.5 (with PCMH) vs. 65.2 (without PCMH), 37.9% difference (P = NR)
					Economic: ED utilization	ED use: rate per 1000 patients per year for Medicare beneficiaries in 2009	282.2 (with PCMH) vs. 307.0 (without PCMH), 8.1% difference (P = NR)
					Economic: ED utilization	ED use: rate per 1000 patients per year for commercial insurance beneficiaries in 2009	157.5 (with PCMH) vs. 240.0 (without PCMH), 34.4% difference (P = NR)
					Economic: total costs	Difference in expected total costs per member per month	$107 (with PCMH) vs. $116 (without PCMH), 7% difference (95% CI, −18% to 5%) ($P = 0.21$)
					Economic: total costs	Estimated percentage cost savings (larger number is better; 1–6, 7–12, 13–24, and >24 mo of PCMH enrollment for an individual patient)	Does not take into account prescription coverage 1−6 mo: 3.0% (95% CI, −0.8% to 6.8%) 7−12 mo: 2.8% (95% CI, −1.4% to 6.9%) 13−24 mo: 4.3% (95% CI, −0.1% to 8.6%) >24 mo: 6.7% (95% CI, 1.2% to 12.1%) Takes into account prescription coverage 1−6 mo: 4.6% (95% CI, −1.1% to 10.3%) 7−12 mo: 4.5% (95% CI, −1.0% to 9.9%) 13−24 mo: 7.1% (95% CI, 2.0% to 12.3%) >24 mo: 10.8% (95% CI, 4.7% to 17.0%)

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Appendix Table 6—**Continued**

Study, Year (Reference)	Type of Study	Explicitly PCMH?	Population	Quality	Outcome Category	Outcome (Follow-up Duration)	Calculated Effect Size
Boyd et al, 2007, 2008 (39, 60, 77)	Observational	No	Older adults	Fair	Patient experience: coordination of care	Integration of services: Primary Care Assessment Survey (1–100, higher is better) (6 mo)	Not calculable Between-group difference in change, 0.10 (95% CI, −5.72 to 5.92)
					Economic: inpatient utilization	Mean inpatient admissions (6 mo)	0.24 (95% CI, 0.09 to 0.39) (intervention) vs. 0.43 (95% CI, 0.19 to 0.67) (control) ($P = 0.185$)
					Economic: ED utilization	Mean ED visits (6 mo)	0.15 (95% CI, 0.00 to 0.32) (intervention) vs. 0.31 (95% CI, 0.12 to 0.49) (control) ($P = 0.200$)
					Economic: total costs	Mean total insurance expenditures (6 mo)	$4586 (95% CI, $2678 to $6493) (intervention) vs. $5964 (95% CI, $3759 to $8171) (control) ($P = 0.347$)
Dorr et al, 2006, 2008 (49, 78)	Observational	No	Older adults (with complex chronic illness)	Good	Clinical outcomes: mortality	Mortality: all patients (1 and 2 y)	1 y: RD: −2.7% ($P < 0.05$) 2 y: RD: −3.7% ($P > 0.05$)
					Clinical outcomes: mortality	Mortality: all patients (1 and 2 y)	1 y: RD: −4.4% ($P < 0.05$) 2 y: RD: −5.3% ($P > 0.05$)
					Economic: inpatient utilization	All hospitalizations: all patients (1 and 2 y)	1 y: 22.2% (intervention) vs. 23.3% (control) 2 y: 31.8% (intervention) vs. 34.7% (control)
					Economic: inpatient utilization	All hospitalizations: diabetes patients (1 and 2 y)	1 y: 21.2% (intervention) vs. 25.7% (control) 2 y: 30.5% (intervention) vs. 39.2% (control)
					Economic: inpatient utilization	Ambulatory care–sensitive condition† hospitalization: all patients (1 and 2 y)	1 y: 4.7% (intervention) vs. 5.3% (control 2 y: 8.9% (intervention) vs. 8.7% (control)
					Economic: inpatient utilization	Ambulatory care–sensitive condition† hospitalizations, diabetic patients (1 and 2 y)	1 y: 5.5% (intervention) vs. 7.1% (control) 2 y: 8.1% (intervention) vs. 11.7% (control)
					Economic: ED utilization	ED visits: all patients (1 and 2 y)	1 y: 33.3% (intervention) vs. 32.3% (control) 2 y: 49.9% (intervention) vs. 43.8% (control)
					Economic: ED utilization	ED visits: diabetic patients (1 and 2 y)	1 y: 32.8% (intervention) vs. 35.3% (control) 2 y: 51.3% (intervention) vs. 48.5% (control)
Hebert et al, 2003 (31)	Observational	No	Older adults	Poor	Clinical outcomes: health status	Decline in functional status (1 and 2 y)	1 y: RD: −18% ($P = 0.002$) 2 y: RD: −10% ($P = 0.06$)
					Clinical outcomes: health status	Institutionalization (2 y)	RR (referent = intervention): 1.44 ($P = 0.066$)
Taplin et al, 1998 (46)	Observational	No	Adults	Fair	Process of care: prevention	Percentage of patients with mammograms in the past 2 y (1 and 2 y)	1 y: RD: 12.5% ($P < 0.05$) 2 y: RD: 20.6% ($P < 0.05$)
					Process of care: prevention	Percentage of patients with colon cancer screening (fecal occult blood test) in the past 18 mo (1 and 2 y)	1 y: RD: 8.7% ($P < 0.05$) 2 y: RD: 14.2% ($P < 0.05$)
					Process of care: chronic illness	Percentage of patients with appropriate warfarin monitoring (2 y)	No change from baseline in study group of health system as a whole
					Process of care: chronic illness	Diabetic patients: percentage of patients with appropriate eye examinations (2 y)	No statistically significant improvement among intervention patients, but improvement for health system as a whole ($P < 0.0001$)

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Appendix Table 6—**Continued**

Study, Year (Reference)	Type of Study	Explicitly PCMH?	Population	Quality	Outcome Category	Outcome (Follow-up Duration)	Calculated Effect Size
Wise et al, 2006 (44)	Observational	No	All ages (high utilizers)	Fair	Process of care: chronic illness	Diabetic patients: Hemoglobin A_{1c} testing (1 y)	RD: 12.9% (P = NR)
					Process of care: chronic illness	Diabetic patients: Lipid profile (1 y)	RD: 8.5% (P = NR)
					Process of care: chronic illness	Diabetic patients: Monitoring for nephropathy (1 y)	RD: 21.4% (P = NR)
					Process of care: chronic illness	Diabetic patients: Eye examination done (1 y)	RD: −7.1% (P = NR)
					Clinical outcomes: biophysical markers	Diabetic patients: Hemoglobin A_{1c} ≤9.5% (1 y)	RD: 11.5% (P = NR)
					Clinical outcomes: biophysical markers	Diabetic patients: LDL cholesterol ≤130 mg/dL (1 y)	RD: 26.7% (P = NR)
					Economic: total costs	Total insurance costs (1 y)	$63 less per member per month for intervention patients (2.4 to 1 return on investment, no P value calculated)

ED = emergency department; ES = effect size; LDL = low-density lipoprotein; NR = not reported; PCMH = patient-centered medical home; RD = risk difference; RR = risk ratio; SF-36/SF-20 = Medical Outcomes Study Short Form, 36-Item/20-Item; USPSTF = U.S. Preventive Services Task Force.