

## 2. The Patient-Centered Medical Home

### Closing the Quality Gap: Revisiting the State of the Science

#### Executive Summary

#### Background

The United States spends a greater proportion of its gross domestic product on health care than any other country in the world (17.6 percent in 2009),<sup>1</sup> yet often fails to provide high-quality and efficient health care.<sup>2-6</sup> U.S. health care has traditionally been based on a solid foundation of primary care to meet the majority of preventive, acute, and chronic health care needs of its population; however, the recent challenges facing health care in the United States have been particularly magnified within the primary care setting. Access to primary care is limited in many areas, particularly rural communities. Fewer U.S. physicians are choosing primary care as a profession, and satisfaction among primary care physicians has waned amid the growing demands of office-based practice.<sup>7</sup> There has been growing concern that current models of primary care will not be sustainable for meeting the broad health care needs of the American population.

The patient-centered medical home (PCMH) is a model of primary care transformation that seeks to meet the variety of health care needs of patients and to improve patient and staff experiences, outcomes, safety, and system efficiency.<sup>8-11</sup> 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

#### Evidence-based Practice Program

The Agency for Healthcare Research and Quality (AHRQ), through its Evidence-based Practice Centers (EPCs), sponsors the development of evidence reports and technology assessments to assist public- and private-sector organizations in their efforts to improve the quality of health care in the United States. The reports and assessments provide organizations with comprehensive, science-based information on common, costly medical conditions and new health care technologies. The EPCs systematically review the relevant scientific literature on topics assigned to them by AHRQ and conduct additional analyses when appropriate prior to developing their reports and assessments.

AHRQ expects that the EPC evidence reports and technology assessments will inform individual health plans, providers, and purchasers as well as the health care system as a whole by providing important information to help improve health care quality.

The full report and this summary are available at [www.effectivehealthcare.ahrq.gov/reports/final.cfm](http://www.effectivehealthcare.ahrq.gov/reports/final.cfm).

needs.<sup>12</sup> 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.<sup>13,14</sup> The chronic care model,<sup>15,16</sup> a conceptual model for organizing chronic illness care that is associated with improved health outcomes, is the cornerstone of PCMH.<sup>17</sup> Interventions based on the chronic care model (CCM) and focused on single conditions such as diabetes mellitus, asthma, chronic obstructive pulmonary disease, or depression have been shown to improve patient outcomes and/or quality of care.<sup>18-21</sup> PCMH builds on this model and is intended to address the full range of patient-focused health care needs.<sup>8</sup> As defined by physician and consumer groups, the core principles of the PCMH are 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.<sup>9</sup> While 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 last decade.<sup>22</sup> As described below, we based the operational definition of PCMH for this review on the definition outlined by the Agency for Healthcare Research and Quality (AHRQ).<sup>8</sup>

It has been hypothesized that comprehensive PCMH interventions hold promise as a pathway to improved primary health care quality, safety, efficiency, and effectiveness. The PCMH has also been described as a “lifeline for primary care” that has the potential to transform and increase the appeal and viability of primary care practice.<sup>23</sup> Given the conceptual promise of PCMH, professional societies have endorsed the model,<sup>24</sup> and payers (e.g., Medicare) and large health systems have begun to implement PCMH-based programs. These include health maintenance organizations (HMOs), networks of Medicaid providers, community health centers, private integrated delivery systems, private practices, the U.S. Department of Veterans Affairs (VA) health care system, and components of the Department of Defense military health care system.<sup>25-28</sup> The goal is to improve the care of patients across the continuum of prevention and treatment of chronic and acute illness, while potentially improving both patient and provider experiences with the health care system. Further, it has been hypothesized that PCMH may introduce efficiencies in care that help contain rising health care costs.<sup>25</sup>

Although PCMH is built on a solid foundation, the evidence for benefit of comprehensive PCMH interventions is uncertain. Therefore, AHRQ commissioned a systematic review to evaluate the current state of the evidence for a range of outcomes and to identify ongoing studies that could address current gaps in evidence. Medical homes can be established in specialty settings, but for the purposes of this review we chose to focus on evaluations of the model in the primary care–based setting, the setting of broadest applicability and with the most extant research. Further, we developed an operational definition of a comprehensive PCMH intervention that is based on the AHRQ definition of PCMH, which does not require an enhanced payment model.<sup>8</sup> Using the AHRQ definition made our review more inclusive of studies that tested the critical principles that embody the Institute of Medicine (IOM) concept of patient-centered care.<sup>29</sup>

## Objectives

As part of the Closing the Quality Gap: Revisiting the State of the Science series of reviews by Evidence-based Practice Centers (EPCs), this systematic review was commissioned to identify completed and ongoing efforts to evaluate the comprehensive PCMH model, summarize current evidence for this model, and identify gaps in the evidence. Because the PCMH model is being implemented widely but the number of completed studies was expected to be small, the identification of ongoing studies was an important goal of this review. This “horizon scan” component of the review helped to identify forthcoming studies that may address gaps in the currently available evidence.

The Key Questions (KQs) for the review are listed below. For clarification, KQs 1–3 concern published studies, while KQ 4 is a horizon scan question that relates to unpublished comparative studies now in progress.

- KQ 1:** 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?
- Are specific PCMH components associated with greater effects on patient and staff experiences, process of care, clinical outcomes, and economic outcomes?
  - Is implementation of comprehensive PCMH associated with unintended consequences (e.g., decrease in levels of indicated care for nonpriority conditions) or other harms?

**KQ 2:** In published, primary care–based evaluations of comprehensive PCMH interventions, what individual PCMH components have been implemented?

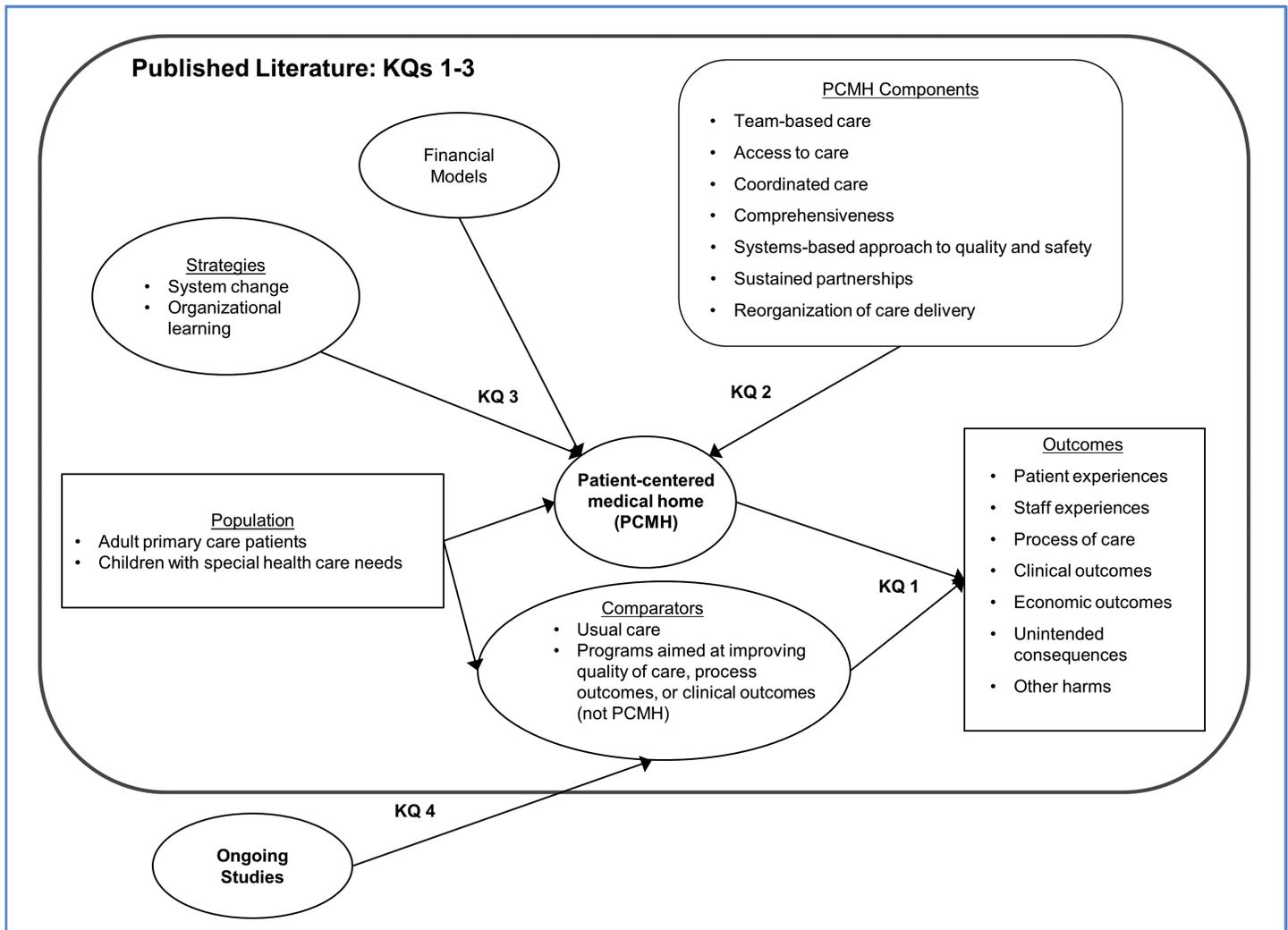
**KQ 3:** In published, primary care–based evaluations of comprehensive PCMH interventions, what financial models and implementation strategies have been used to support uptake?

**KQ 4:** What primary care–based studies evaluating the effects of comprehensive PCMH interventions on patient and staff experiences, process of care, clinical outcomes, or economic outcomes are currently underway? In these ongoing studies, what are the study designs, PCMH components, comparators, settings, financial models, and outcomes to be evaluated?

## Analytic Framework

Figure A shows the analytic framework for the review.

**Figure A. Analytic framework**



KQ = Key Question; PCMH = patient-centered medical home

The figure illustrates how we hypothesized the potential mechanism by which comprehensive PCMH interventions (the combination of PCMH elements taken as a group, not just the individual components) and their comparators may impact outcomes of interest (KQ 1), including patient and staff experiences, process of care, clinical outcomes, and economic outcomes. This hypothesis motivated the search for potentially relevant published literature. In addition, we searched the literature to determine if there have been any reports of an association between PCMH and unintended consequences or other harms. The individual components of PCMH and their incorporation and/or implementation in PCMH evaluations were examined (KQ 2), as well as the financial models and strategies for system change or organizational learning used to support uptake (KQ 3). Finally, the figure illustrates the way in which these outcomes and moderators were identified in ongoing studies (KQ 4).

## Methods

1. **Input From Stakeholders.** Topics for the Closing the Quality Gap: Revisiting the State of the Science series were solicited from the leads of AHRQ portfolios (areas of research). Nominations included a brief background and context, the importance of and/or rationale for the topic, the focus or population of interest, relevant outcomes, and references to recent or ongoing work. The EPC performing the review refined the KQs via discussions with the EPC coordinating the Closing the Quality Gap: Revisiting the State of the Science series and with AHRQ. A Technical Expert Panel with experts knowledgeable in PCMH as a primary care model provided input during the protocol development process.
2. **Data Sources and Selection.** For KQs 1–3, we searched PubMed®, the Cumulative Index to Nursing & Allied Health Literature (CINAHL®), and the Cochrane Database of Systematic Reviews (CDSR). Our search strategy used the National Library of Medicine’s medical subject heading (MeSH) 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 December 6, 2011 (PubMed), or March 30, 2011 (CINAHL and CDSR). All searches were designed and conducted in collaboration with an experienced search librarian. We supplemented these

electronic searches with a manual search of citations from a set of key primary and review articles.<sup>30,31</sup>

For KQ 4, we used the term “medical home” to search for ongoing or recently completed studies in the following databases: ClinicalTrials.gov, Commonwealth Fund, Robert Wood Johnson Foundation, and databases of federally funded studies—AHRQ, Centers for Disease Control and Prevention, Health Services Research Projects in Progress, National Institutes of Health (NIH) Reporter (NIH Research Portfolio Online), Health Resources and Services Administration, VA, and Department of Defense. All databases were searched using the enGrant Scientific interface. In addition, we conducted manual searches of Web-based resources that did not have searchable databases, exploring all Web links that showed promise for relevant information, including the Patient-Centered Primary Care Collaborative, American College of Physicians, National Academy for State Health Policy, and Centers for Medicare & Medicaid Services (CMS). To supplement electronic sources, we sent letters to 10 contacts involved in State-level projects funded by CMS and a letter to the VA Director of PCMH (designated Patient Aligned Care Teams within the VA environment) demonstration labs, requesting information about any ongoing or recently completed studies. Finally, we identified a published horizon scan that included interviews with key informants designed to collect detailed information about the participants, design, and implementation of ongoing PCMH programs.<sup>31</sup> We used information from this horizon scan to verify and augment data obtained from the above-mentioned databases/study registries.

Using the criteria described in Table A, two investigators independently reviewed each title and abstract for potential relevance to the KQs; articles included by either investigator underwent full-text screening. At the full-text screening stage, two investigators independently reviewed the full text of each article and indicated a decision to include or exclude the article for data abstraction. When the paired reviewers arrived at different decisions about whether to include or exclude an article, or about the reason for exclusion, we reached a final agreement through review and discussion among investigators. Articles meeting eligibility criteria were included for data abstraction. For KQ 4, these procedures were modified such that a single screener initially reviewed all citations; final eligibility for data abstraction was determined by duplicate review.

**Table A. Inclusion/exclusion criteria**

Study Characteristic	Inclusion Criteria	Exclusion Criteria
Population	<ul style="list-style-type: none"> <li>• Adult primary care patients, selected to represent the practice rather than on the basis of a particular chronic illness.</li> <li>• Children with special health care needs according to the HRSA definition.</li> </ul>	<p>Studies where PCMH transformation was focused on a small proportion of patients being cared for in the practice; for example, studies restricted to patients with diabetes or asthma.</p>
Interventions	<p><b>KQs 1–3:</b> A comprehensive PCMH intervention that includes items 1, 3, and 4, below, along with at least two components of item 2:</p> <ol style="list-style-type: none"> <li>1. Team-based care (team may be virtual).</li> <li>2. At least 2 of the following 4 components:               <ol style="list-style-type: none"> <li>a. Enhanced access to care</li> <li>b. Coordinated care across settings</li> <li>c. Comprehensiveness</li> <li>d. A systems-based approach to improving quality and safety</li> </ol> </li> <li>3. A sustained partnership and personal relationship over time oriented toward the whole person.</li> <li>4. Structural changes to the traditional practice, reorganizing care delivery.</li> </ol> <p><b>KQ 4:</b> PCMH intervention should meet the above definition; however, because descriptions of ongoing studies were often sparse, we accepted the designation of “medical home” as meeting our intervention criteria without explicit documentation that the study truly met our functional definition.</p>	<p><b>KQs 1–3:</b> Studies that were self-identified as pertaining to “medical home” but did not describe the intervention sufficiently to meet the AHRQ definition.</p>
Comparators	<p><b>KQs 1–4:</b></p> <ul style="list-style-type: none"> <li>• Usual care.</li> <li>• Programs aimed at improving the quality of care, process outcomes, or clinical outcomes that do not meet the operational definition of a comprehensive PCMH intervention (above).</li> </ul> <p><b>KQ 4:</b> For this question, we also accepted comparisons across different levels of PCMH implementation (high vs. low adopters).</p>	<p><b>KQs 1 and 4:</b> No comparator. Analyses for KQs 2–3 include studies without comparators, while KQ 1 and KQ 4 analyses include only studies with comparison groups).</p>

**Table A. Inclusion/exclusion criteria (continued)**

Study Characteristic	Inclusion Criteria	Exclusion Criteria
Outcomes	<p><b>KQ 1:</b> PCMH interventions may lead to a variety of effects on the health care system and patient health status. We prioritized and abstracted a specific subset of these outcomes that had face validity and were reported across studies, and/or were collected using validated instruments or methods. These included:</p> <ol style="list-style-type: none"> <li>1. Patient experiences:               <ol style="list-style-type: none"> <li>a. Global/overall patient experiences</li> <li>b. Coordination of care (as perceived by patients)</li> <li>c. Patient-provider interaction</li> </ol> </li> <li>2. Staff experiences:               <ol style="list-style-type: none"> <li>a. Global/overall staff experiences</li> <li>b. Staff retention rates</li> <li>c. Staff burnout</li> </ol> </li> <li>3. Process of care:               <ol style="list-style-type: none"> <li>a. Preventive services</li> <li>b. Chronic illness care services</li> </ol> </li> <li>4. Clinical outcomes:               <ol style="list-style-type: none"> <li>a. Health status</li> <li>b. Laboratory tests</li> <li>c. Mortality</li> </ol> </li> <li>5. Economic outcomes:               <ol style="list-style-type: none"> <li>a. Inpatient use</li> <li>b. Emergency department use</li> <li>c. Overall costs</li> </ol> </li> <li>6. Unintended consequences or other harms</li> </ol> <p><b>KQ 2:</b> PCMH components as listed in the Interventions section.</p> <p><b>KQ 3:</b></p> <ol style="list-style-type: none"> <li>1. Financial models.</li> <li>2. System change, along with any theoretical basis provided.</li> <li>3. Organizational learning strategies and any theoretical basis provided for these strategies.</li> </ol> <p><b>KQ 4 (horizon scan of ongoing studies):</b></p> <ol style="list-style-type: none"> <li>1. Study design</li> <li>2. PCMH components</li> <li>3. Settings (e.g., practice size, geographic location)</li> <li>4. Financial models</li> <li>5. Outcomes assessed (if reported):               <ol style="list-style-type: none"> <li>a. Patient experiences</li> <li>b. Staff experiences</li> <li>c. Process of care</li> <li>d. Clinical outcomes</li> <li>e. Economic outcomes</li> </ol> </li> </ol>	No outcomes of interest reported.

**Table A. Inclusion/exclusion criteria (continued)**

Study Characteristic	Inclusion Criteria	Exclusion Criteria
Timing	Studies had to have at least 6 months longitudinal followup.	Less than 6 months longitudinal followup.
Setting	<p>Primary care settings, for example family medicine, general internal medicine, primary care pediatrics, general medical clinics such as Federally Qualified Health Centers, general medical clinics primarily staffed by midlevel providers, general practices/practitioners, geriatric practices providing longitudinal care rather than consultative services.</p> <p><b>KQ 1–3:</b> Studies conducted in a high-income economy<sup>a</sup> as defined by the World Bank.</p> <p><b>KQ 4:</b> Studies underway in the United States.<sup>b</sup></p>	<ul style="list-style-type: none"> <li>• Geriatric practices providing consultative services.</li> <li>• Medical subspecialties.</li> </ul>
Study design	<p><b>KQ 1, KQ 4:</b> Patient or cluster RCT, nonrandomized clustered controlled trial, controlled before-and-after study.</p> <p><b>KQ 2, KQ 3:</b> Patient or cluster RCT, nonrandomized clustered controlled trial, controlled before-and-after study, uncontrolled pre- and postintervention study.</p>	Not a clinical study (e.g., editorial, nonsystematic review, letter to the editor, case series).
Publications	<p><b>KQs 1–4:</b> English-language only.<sup>c</sup></p> <p><b>KQs 1–3:</b> Publication date from database inception to present. Peer-reviewed article.</p> <p><b>KQ 4:</b> Studies had to be ongoing or scheduled to be completed on or after April 2010.<sup>d</sup></p>	<ul style="list-style-type: none"> <li>• Non-English-language publication.<sup>c</sup></li> <li>• Not peer reviewed (e.g., letter to editor).</li> </ul>

<sup>a</sup>We restricted studies for KQs 1–3 to high-income economies—i.e., to countries that have greater cultural and health care system similarities to the United States—to improve applicability of the study results to the United States.

<sup>b</sup>KQ 4 studies were restricted to those conducted in the United States to maximize applicability to our target audience and because our knowledge of gray literature sources is good within the United States but poor outside it.

<sup>c</sup>We excluded non-English-language publications for two reasons: (a) we are most interested in health care systems that are similar to U.S. health care, and reports from these countries are likely to be published in English; and (b) it is the opinion of the investigators that the resources required for translation of non-English articles would not be justified by the low potential likelihood of identifying relevant data unavailable from English-language sources.

<sup>d</sup>Our rationale was that studies completed prior to April 2010 should already have been published.

AHRQ = Agency for Healthcare Research and Quality; HRSA = Health Resources and Services Administration; KQ = Key Question; PCMH = patient-centered medical home; RCT = randomized controlled trial

3. **Data Extraction and Quality Assessment.** The investigative team created forms for abstracting the data elements for the KQs. Based on clinical and methodological expertise, a pair of researchers was assigned to abstract data from the eligible articles. One researcher abstracted the data, and the second reviewed the completed abstraction form alongside the original article to check for accuracy and completeness. Disagreements were resolved by consensus or by obtaining a third reviewer’s opinion if the first two investigators could not reach consensus.

To aid in both reproducibility and standardization of data collection, researchers received data abstraction instructions directly on each form. Forms were created specifically for this project using the DistillerSR data synthesis software program (Evidence Partners Inc., Manotick, ON, Canada). The abstraction form templates were pilot tested with a sample of included articles to ensure that all relevant data elements were captured and that there were consistency and reproducibility across abstractors. Data abstraction forms for KQs 1–3 included descriptions of the study design, study population, interventions and comparators, financial models, implementation methods, study outcomes, and study quality. Outcomes of interest included patient experiences, staff experiences, process of care, clinical outcomes, and economic outcomes. For KQ 4, we developed a less detailed data abstraction form that included basic study design; geographic location; study setting, including health care system; number of practices/physicians; payment reform/financial model; major components of the intervention/PCMH model; comparator; types of outcomes being assessed; study dates; and source of funding.

We assessed the quality/risk of bias of studies included for KQ 1 based on their reporting of relevant data. We evaluated the quality of individual studies using the approach described in AHRQ’s Methods Guide for Effectiveness and Comparative Effectiveness Reviews.<sup>32</sup> To assess quality, we (1) classified the study design, (2) applied predefined criteria for quality and critical appraisal, and (3) arrived at a summary judgment of the study’s quality. To evaluate methodological quality, we applied criteria for each study type derived from core elements described in the Methods Guide. To indicate the summary judgment of the quality of the individual studies, we used the summary ratings of good, fair, and poor, based on the studies’ adherence to well-accepted standard methodologies and the adequacy of the reporting. For each study, one investigator assigned a summary quality rating, which was then reviewed by a second investigator; disagreements were resolved by consensus or by a third investigator if agreement could not be reached.

The strength of evidence for the highest priority outcomes in KQ 1 was assessed using the approach described in AHRQ’s Methods Guide.<sup>32,33</sup> In brief, the Methods Guide recommends assessment of four domains: risk of bias, consistency, directness, and precision. Additional domains, to be used when appropriate, are 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 two reviewers, as “high,” “moderate,” or “low” strength of evidence. In some cases, high, moderate, or low 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. This four-level rating scale consists of the following definitions:

- *High:* High confidence that the evidence reflects the true effect. Further research is very unlikely to change our confidence in the estimate of effect.
- *Moderate:* Moderate confidence that the evidence reflects the true effect. Further research may change our confidence in the estimate of effect and may change the estimate.
- *Low:* Low confidence that the evidence reflects the true effect. Further research is likely to change the confidence in the estimate of effect and is likely to change the estimate.
- *Insufficient:* Evidence either is unavailable or does not permit estimation of an effect.

We did not rate the strength of evidence for KQs 2–4 because these questions were purely descriptive.

4. **Data Synthesis and Analysis.** We summarized key features of the included studies by KQ. For published studies, we created an overview table of basic study characteristics, an intervention table giving details of the intervention, and a summary table of implementation strategies. 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.” (The latter are referred to as “functional PCMH” studies in the report.) Studies were evaluated initially in aggregate, and then by PCMH versus functional PCMH studies and adult versus pediatric studies. For KQ 1, we used a random-effects model to compute summary estimates of effect for hospitalizations and emergency department visits for the subset of studies using randomized controlled trial (RCT) designs. Summary estimates were calculated

using Comprehensive Meta-Analysis software and are reported as summary risk ratios.<sup>34</sup> For other outcomes, the study populations, designs, and outcomes were too variable for quantitative analysis, and results were accordingly synthesized qualitatively. Because the continuous measures used for most outcomes reported varied greatly across studies, we computed effect sizes, represented as the standardized mean difference (SMD), to aid interpretation. The SMD is useful when studies assess the same outcome with different measures or scales. In this circumstance, it is necessary to standardize the results for the studies to a uniform scale to facilitate comparisons. We calculated the SMD for each study, using Hedges' *g*, by subtracting (at post-test) the average score of the control group from the average score of the experimental group and dividing the result by the pooled standard deviations (SDs) of the experimental and control groups. To aid interpretation, we standardized presentation such that beneficial effects for the medical home are presented as positive effect sizes. We planned to use cross-case analyses to evaluate the association between independent variables

(e.g., specific components of comprehensive PCMH) and study effect, using methods based on Miles and Huberman.<sup>35</sup> However, there were too few studies and too little variability to complete this exploratory analysis.

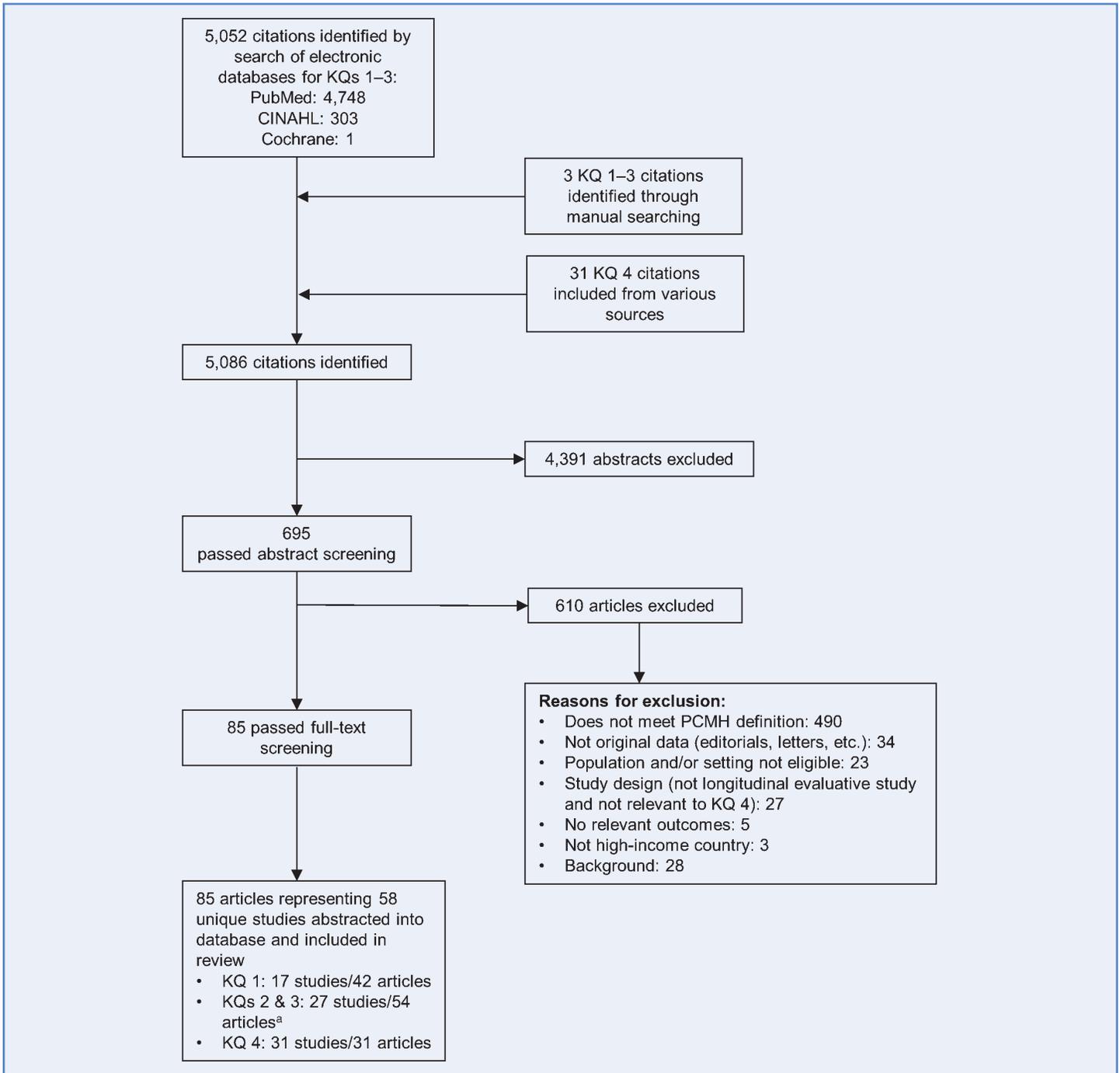
## Results

### Results of Literature Searches

Figure B depicts the flow of articles through the literature search and screening process.

We identified 5,086 citations. After inclusion/exclusion criteria were applied at the title and abstract level, 695 full-text articles were retrieved and screened. Of these, 610 were excluded at the full-text screening stage, leaving 85 articles (representing 58 unique studies) for data abstraction. We included 27 studies from the published peer-reviewed literature (17 were comparative and 10 descriptive) and 31 ongoing studies identified from the horizon scan.

**Figure B. Literature flow diagram**



<sup>a</sup>All studies/articles included for KQ 1 were also included for KQs 2 and 3.

KQ = Key Question; PCMH = patient-centered medical home

## KQ 1. Effects of PCMH Interventions

Only 6 studies explicitly evaluated PCMH; an additional 11 studies evaluated functional PCMH interventions. Studies included both observational designs (n = 9) and RCTs (n = 8). Older adults in the United States with multiple chronic conditions were the most commonly studied population (8 of the 17 studies). Most studies were conducted in integrated health care systems (10 of 17 studies). Studies varied widely in the range of outcomes reported and the specific measures used. With the exception of one study, which examined facilitated versus nonfacilitated PCMH implementation, all studies compared interventions meeting the definition of PCMH to usual care.

Table B summarizes the findings and strength of evidence (SOE) for each major outcome. The SOE is a summary rating of the confidence in the estimate of effect for each outcome that incorporates evidence across all relevant

studies. Rating the SOE for this body of evidence was challenging because the range of study designs, populations, and outcomes precluded quantitative summaries for most outcomes. We thus did not have the usual quantitative tools that are part of meta-analyses for assessing consistency and precision. In brief, there was moderately strong evidence that the medical home has a small positive impact on patient experiences and small to moderate positive effects on preventive care services. Staff experiences were also improved by a small to moderate degree (low SOE), 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 B. Summary of the strength of evidence for KQ 1**

Outcome [SOE & Magnitude of Effect <sup>a,b,c</sup> ]	Number of Studies (Subjects)	SOE Domain–Risk of Bias: Study Design/Quality	SOE Domain–Consistency	SOE Domain–Directness	SOE Domain–Precision	Effect Estimate (Range or 95% CI)
Patient Experiences [Moderate SOE: small positive effects]	5 (6,884)	RCT/Fair	Consistent	Direct	Precise	ES median (range): 0.27 (-0.36 to 0.42)
	2 (3,513)	Observational/Fair	Inconsistent	Direct	Precise	ES: <sup>d</sup> +0.13
Staff Experiences [Low SOE: small to moderate positive effects]	2 (NR)	RCT/Fair	Inconsistent	Some indirectness	Imprecise	ES median (range): 0.18 (0.14 to 0.87)
	1 (82)	Observational/Fair	Unknown	Direct	Imprecise	ES median (range): 0.49 (0.32 to 0.61)
Process of Care for Preventive Services [Moderate SOE: small to moderate positive effects]	3 (8,377)	RCT/Fair	Consistent	Direct	Precise	RD median (range): 1.3% (-0.4% to +7.7%)
	2 (57,832)	Observational/Fair	Consistent	Direct	Precise	RD median (range): 14.2% (5.6% to 20.6%)
Process of Care for Chronic Illness Care Services [Insufficient]	2 (4,640)	RCT/Fair	Inconsistent	Some indirectness	Precise	RD median (range): 6.6% (0.2% to 20.8%)
	3 (455,832)	Observational/Fair	Seriously inconsistent	Some indirectness	Precise	RD median (range): 7.1% (7.1% to 21.4%)
Clinical Outcomes: Biophysical Markers, Health Status, Mortality [Insufficient]	3 (2,586)	RCT/Good	Consistent	Some indirectness	Imprecise	Not reliably estimated
	3 (58,393)	Observational/Poor	Consistent	Some indirectness	Imprecise	Not reliably estimated

**Table B. Summary of the strength of evidence for KQ 1 (continued)**

Outcome [SOE & Magnitude of Effect <sup>a,b,c</sup> ]	Number of Studies (Subjects)	SOE Domain–Risk of Bias: Study Design/Quality	SOE Domain–Consistency	SOE Domain–Directness	SOE Domain–Precision	Effect Estimate (Range or 95% CI)
Economic Outcomes: Hospital Inpatient Admissions, ED Visits, Total Costs <sup>e</sup> [Low SOE 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 (8,001)	RCT/Fair	Consistent	Some indirectness	Imprecision	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

<sup>a</sup>SOE ratings are provided for outcomes overall (incorporating evidence from all studies), while 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.

<sup>b</sup>In one study, 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 the key outcomes addressed. Both arms implemented components of the PCMH model, and this may be why there were no significant differences between them.

<sup>c</sup>The small number of studies conducted among children precluded formal comparison with studies conducted in adults. However, results in these two populations were generally congruent.

<sup>d</sup>The effect size for one of the two available observational studies could not be calculated with available information. As a result, an effect size median and range could not be calculated.

<sup>e</sup>Two of the 13 studies that reported economic outcomes—1 RCT and 1 observational study—reported only total costs and so did not inform the summary effect estimates reported in this table.

CI = confidence interval; ED = emergency department; ES = effect size; KQ = Key Question; NA = not applicable; NR = not reported; RCT = randomized controlled trial; RD = risk difference; RR = risk ratio; SMD = standardized mean difference; SOE = strength of evidence

For KQ 1a, there were too few studies in each outcome domain that also had appropriate variation in PCMH elements to conduct a planned qualitative analysis. As a result, we concluded that there is insufficient evidence to evaluate whether specific PCMH components are associated with greater effects on patient and staff experiences, process of care, clinical outcomes, and economic outcomes. For KQ 1b, no study reported unintended consequences; therefore, we concluded that the effects of PCMH on unintended consequences or other harms are uncertain.

**KQs 2–4**

We included 27 studies of PCMH or functional PCMH that described the intervention components and the financial models and implementation strategies used to support uptake. These studies included comparative and descriptive designs. Most studies were conducted in older adults or children with special health care needs. In addition, we identified 31 ongoing studies that are evaluating the medical home. These studies are being carried out in all major regions of the United States, and the majority are being fielded with participation

by a commercial insurer. Only two of these studies are RCTs. Compared with the published literature, more of these studies plan comparisons across different levels of PCMH implementation. Because we limited inclusion to comparative studies and study descriptions were often incomplete, we believe the number of studies reporting the impact of PCMH in the next few years will exceed the list cataloged in this horizon scan. Table C summarizes these findings.

<b>Table C. Summary of findings for KQs 2–4</b>	
<b>KQ 2—PCMH Components Implemented</b>	
<b>Variability in components:</b>	Although most studies reported implementing most of the 7 major medical home domains, studies varied considerably in their approach to implementing major components (e.g., variable approaches to enhancing access to care).
<b>Evaluation of specialty care:</b>	Few medical home studies directly address medical specialty care (n = 6) or mental health specialty care (n = 3).
<b>KQ 3—Financial Models and Implementation Strategies</b>	
<b>Financial models:</b>	Few medical home studies (n = 11) provided detailed information about the financial models used to support the medical home. Financial models described included enhanced fee-for-service, additional per-member per-month payments, stipends to support aspects of the intervention, and payments linked to quality and efficiency targets.
<b>Organizational implementation strategies:</b>	Audit and feedback were the most commonly used specific strategies to implement the medical home, described in 13 studies.
<b>Organizational learning strategies:</b>	Learning collaboratives and collaborative program planning were the most commonly used organizational learning strategies, described in 19 studies.
<b>KQ 4—Horizon Scan of Ongoing PCMH Studies</b>	
<b>Ongoing studies:</b>	A relatively large number of studies evaluating the medical home are scheduled to conclude within the next 2 years. However, only 2 of the 31 studies are RCTs. Most studies report planned outcomes of patient or staff experiences, process-of-care outcomes, and economic outcomes. These studies appear to have the potential for improving our understanding and the strength of evidence for a range of important outcomes.

KQ = Key Question; PCMH = patient-centered medical home; RCT = randomized controlled trial

## Discussion

### Summary of Findings

In summary, our review found moderately strong evidence that PCMH improves patient experiences and preventive care services. For staff experience, the evidence was less robust but suggests benefit. We judged the SOE as low for an association between PCMH and lower health care use (combination of inpatient and primarily emergency department use), but estimated effects were imprecise. Further, we did not find evidence of an effect of PCMH on total costs. These findings do not exclude an economic benefit of PCMH, and in fact, current studies are likely underpowered for this outcome.<sup>36</sup> Overall, these findings are encouraging and build on prior reviews showing that CCM-based interventions that focus on single conditions have improved health outcomes across a range of chronic conditions, including congestive heart failure, diabetes mellitus, asthma, and major depression.<sup>17,37,38</sup>

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. Individuals with chronic medical illness consume the most health care resources, and this is a particularly important set of outcomes for this group. Other gaps in evidence include the absence of data on staff retention and unintended consequences. If the improvements in staff experiences translate into improved staff retention and greater attractiveness of primary care practice, then PCMH will have met one 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. Because PCMH requires substantial change for primary care practices, unanticipated consequences, such as increased provider burden (e.g., enhanced access through 24/7 coverage and email) and potential patient safety risks (e.g., patients using email for emergent medical issues), are possible and should be examined.

Given inclusion criteria that allowed for a relatively broad set of interventions, it is not surprising that there was wide variability in the approaches to implementing the various components of PCMH. Interventions explicitly developed from the PCMH model used more approaches than those simply meeting our operational definition of “functional PCMH.” More robust implementation of the model and/or specific strategies to address a particular model

component may be associated with greater benefit, but there were too few studies to conduct even an exploratory analysis to test this hypothesis. As the evidence base expands, these analyses will be important to clarify the key approaches and could provide information for efficient implementation and certifying agencies’ criteria for medical home practices. In addition to the need to identify the key approaches, practices and policymakers need better information on the financial context and implementation strategies needed 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 was an absence of data on direct financial consequences to the practice of implementing PCMH. This information, possibly gained through the mechanism of detailed case studies, could inform implementation efforts and the design of enhanced payment mechanisms for medical home practices.

Finally, our horizon scan identified ongoing studies with specified comparator groups that, when published, should more than double the size of the published literature. In contrast to the majority of studies included in our review, all of these studies describe explicit plans to test the medical home, and most are being conducted with the participation of a commercial insurer. These studies have the potential to add substantially to our knowledge about the medical home, particularly if some of the evaluations can be tailored to address the gaps in evidence identified by our report.

### Limitations of the Review Process

The PCMH is a model of care with considerable flexibility, not a narrowly defined intervention or manualized protocol. Further, multiple definitions of the PCMH model have been proposed by various professional and patient organizations.<sup>22</sup> We developed an operational definition—derived from the AHRQ definition of the medical home,<sup>8</sup> which does not require an enhanced payment model—to identify eligible interventions. Because we used the AHRQ definition, our review was more inclusive of studies that tested the critical principles that embody the IOM concept of patient-centered care.<sup>29</sup> However, greater inclusivity came with the trade-off of greater variability in study interventions. Heterogeneity in study designs, populations, and outcomes meant that standard quantitative summary methods were generally not possible. The general nature of the intervention also complicated our literature search, given the potential for relevant studies that did not use the term “medical home” and the lack of MeSH terms for this topic. Finally, no standard nomenclature or measures exist

for many of the concepts that form part of the definition. The lack of a standard nomenclature and the often sparse reporting of interventions made uniform data abstraction and classification of intervention components particularly challenging.

## Implications for Future Research

The horizon scan conducted for this review 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, adjust for clustering when appropriate, report meaningful quality indicators for chronic illness (both processes and clinical outcomes), and provide data related to the impact of PCMH on staff. If researchers clearly link intervention components to the core components of PCMH, this could greatly improve our understanding of the conceptual basis for interventions tested and, ultimately, the key features of successful models. Finally, we encourage long-term followup of results. Outcomes examined in this report rarely had followup periods longer than 2 years. In addition to addressing the impact of PCMH on specific outcomes, we encourage the expanded use of both quantitative and qualitative methods to address the processes used to implement the PCMH model.

Although ongoing studies have the potential to fill important gaps, the lack of detail contained in published research plans generates uncertainty about how well these studies will address these gaps. We therefore describe a series of research priorities in this report.

## Missing Outcomes

The strength of evidence was judged to be low or insufficient for most outcomes. Studies that address quality indicators for chronic illness care and clinical outcomes (e.g., symptom status or functional status) are urgently needed. Because PCMH is oriented toward broad populations of patients and not focused on specific illnesses, the impact on chronic illness could be attenuated. Studies assessing staff retention and the impact of PCMH on practice costs or patient out-of-pocket costs would provide an important new perspective on economic outcomes. Evaluators should also carefully consider the outcomes most relevant to the population studied, particularly considering differences in the emphasis of the

medical home and relevant outcomes for pediatric versus adult populations.<sup>39</sup>

## Most Important PCMH Components

We were unable to determine the PCMH components most associated with benefit. Understanding the “active ingredients” of PCMH is important to help practices with limited resources realize the greatest return on investment and to assist organizations developing certifying standards for medical home practices. Observational studies from natural experiments comparing differing levels of PCMH and different approaches to PCMH could address this gap. In addition, as the evidence base grows, an updated systematic review could be valuable. For this latter approach to succeed, studies will need to report the details of the PCMH intervention and, ideally, use a more consistent set of outcome measures and nomenclature for PCMH components and measures of PCMH components.

## Most Effective Implementation Approaches

PCMH is a complex intervention that requires substantial changes to most practices. Understanding the level of support needed to implement and sustain the model, including the necessary financial context, is critical to any long-term success. Our horizon scan identified a number of studies that planned formative evaluations to identify factors associated with successful implementation. Additional studies that examine long-term sustainability are needed.

## Effects of PCMH in More Representative Populations

Most PCMH studies were conducted in older adults with multiple chronic health conditions or in children with special health care needs. Studies that examine the effects in more broadly representative primary care samples are needed to fully understand the impact of this care model. Because PCMH has the potential to reduce health disparities, evaluating effects in important subgroups (e.g., the socioeconomically disadvantaged) is important.

## Conclusions

The PCMH model 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. If ongoing and future studies indicate that these improvements translate into improved clinical outcomes or economic benefit, the health care value would be increased.

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## Full Report

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