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RESEARCH ARTICLE

Do Patient-Centered Medical Homes Improve Health Behaviors, Outcomes, and Experiences of Low-Income Patients? A Systematic Review and Meta-Analysis

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Objectives. To examine: (1) what elements of patient-centered medical homes (PCMHs) are typically provided to low-income populations, (2) whether PCMHs improve health behaviors, experiences, and outcomes for low-income groups.

Data Sources/Study Setting. Existing literature on PCMH utilization among health care organizations serving low-income populations.

Study Design. Systematic review and meta-analysis.

Data Collection/Extraction Methods. We obtained papers through existing systematic and literature reviews and via PubMed, Web of Science, and the TRIP databases, which examined PCMHs serving low-income populations. A total of 434 studies were reviewed. Thirty-three articles met eligibility criteria.

Principal Findings. Patient-centered medical home interventions usually were composed of five of the six recommended components. Overall positive effect of PCMH interventions was $d = 0.247$ (range -0.965 to 1.42). PCMH patients had better clinical outcomes ($d = 0.395$), higher adherence (0.392), and lower utilization of emergency rooms ($d = -0.248$), but there were apparent limitations in study quality.

Conclusions. Evidence shows that the PCMH model can increase health outcomes among low-income populations. However, limitations to quality include no assessment for confounding variables. Implications are discussed.

Key Words. Patient-centered medical home, underserved patients, poverty, implementation

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The patient-centered medical home (PCMH) has been a key intervention for improving the quality of care in primary care settings and to decreasing escalating costs. In order to better align care processes to patient needs, PCMHs' core components include the following: team-based care, care coordination, patient-centered orientation, enhanced access to care, and quality improvement (Arend et al. 2012). PCMHs models have been applied broadly to all different kinds of primary care patients, regardless of condition or resources. They also can be applied more narrowly, to a specialized program of coordinated care for a specific population, such as those with certain insurance or employer status or patients with a specific chronic disease.

The Affordable Care Act (ACA) and the U.S. Department of Health and Human Services have used incentives to increase the use of PCMHs among low-income populations, which include providing financial incentives to state Medicaid programs that shift patients into medical homes, changing reimbursement rates for providers, supporting infrastructure and technology investments required by the PCMH model, and expanding resources for PCMH in Federally Qualified Health Centers (FQHCs; Hoff, Weller, and DePuccio 2012). More important, the ACA section 2703 establishes specialized "health homes" in states that choose to implement them (Davis, Abrams, and Stremikis 2011). Health homes have many of the characteristics of PCMH interventions, except that they emphasize the integration of public health outreach with advancing the use of practice nurses, over access to care and team-based services. ACA health home programs essentially provide comprehensive care management, care coordination, health promotion, transitional care between hospital and primary care, referral to community and social services, patient and family engagement, and use of information technology to link services.

The Commonwealth Fund estimated that by 2014, approximately 20 million individuals would become eligible for health home interventions through Medicaid (Davis, Abrams, and Stremikis 2011). Because health homes essentially use principal components of PCMHs (and whether states use these health homes, PCMHs, or nothing at all is based on their own discretion; Wherry and Miller 2016), it is useful to understand whether PCMHs and health homes benefit low-income populations. It is also useful to understand whether such interventions effectively reduce cost of care among low-income populations specifically.

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Patient-centered medical home models were originally developed by the American Academy of Pediatrics in 1967 to fit the needs of mainstream, insured middle-class children with special needs. In 2007, multiple primary care organizations (e.g., American College of Physicians [ACP], American Academy of Family Physicians [AAFP], American Academy of Pediatrics [AAP], and American Osteopathic Association [AOA]) adapted the model to adult U.S. populations. Over the years, and through multiple iterations, the concept grew to a central set of tenets for providing comprehensive health care for all (Arend et al. 2012). The National Center for Quality Assurance (NCQA) created a set of standards for achieving a PCMH with core elements required to receive recognition and most states have put significant amounts of resources into expanding the use of PCMHs, especially in the Medicare and Medicaid programs (Davis, Abrams, and Stremikis 2011). A number of studies have shown that PCMHs are effective when it comes to improving health outcomes as well as reducing costs of care of general populations (Hoff, Weller, and DePuccio 2012; Jackson et al. 2013). A study by Reibling (2016), however, shows that PCMHs do not actually reduce health disparities among vulnerable populations, particularly low-income populations.

Much of the constructs of PCMHs have been developed according to theories of health service utilization by Andersen (1995). His well-known behavioral model of health care utilization has assisted researchers and providers for decades (original model was developed in 1968), and it has established the current understanding of why individuals utilize health services. The model suggests that there are certain factors that "predispose" individuals to health service utilization, factors that "enable" or "prevent" utilization, and factors related to "need." PCMH programs essentially reinforce patients' perception of need for health services (through self-management programs) and enable them to get the health services they specifically need.

A revised model focused on vulnerable populations, including low-income individuals, has been called the Behavioral Model for Vulnerable Populations (Gelberg, Andersen, and Leake 2000). This model is unique because it focuses on the role of competing needs related to housing, transportation, food security, employment, and so on, which occur alongside access to health insurance. It also focuses on the role of stressors like acculturation, immigration status, living conditions, and problems with the criminal justice system, etc. These vulnerable populations may also have different perceptions about health need—such as need for treatment or prevention interventions for sexually transmitted diseases or chronic health conditions. It is unclear how well PCMH interventions deal with these needs, much less whether these interventions can effectively reduce health disparities by enabling access and adherence among low-income populations. PCMH, after all, is agnostic to socioeconomic and health status. Health homes, via their use of coordination with social services, may be more appropriate, but the efficacy of the intervention at this point is poorly understood. Also because health homes are not universal, and low-income populations are more likely to be exposed to PCMHs or nothing at all, it is necessary to have a clear understanding of their efficacy and acceptability to patients and providers.

The factors mentioned by Gelberg, Andersen, and Leake (2000) will affect the utilization of health care by low-income patients who have medical homes, but thus far, there has been no formal review of the literature, stating whether and how PCMH improve health outcomes in this population. Thus, the purpose of this article is to focus on PCMH interventions for low-income populations and (1) determine which components of the PCMH model are implemented in practices serving low-income/uninsured patient populations, (2) determine the efficacy of the PCMH model when it comes to health outcomes (i.e., clinical outcomes, utilization, follow-up, and cost) among low-income/uninsured patient populations, and (3) determine whether the PCMH model improves both patient and provider satisfaction and quality of care in health organizations serving low-income/uninsured patient populations.

METHODS

We conducted a systematic literature review to identify studies which assess the implementation of PCMH interventions among low-income populations. A literature search was first conducted using Cochrane and via already existing systematic reviews of the PCMH model (see Appendix SA2). Next, we expanded our literature search using three databases (PubMed, Web of Science, and TRIP). We performed citation reviews of articles found in recovered articles and used the following search terms to search via database to capture both studies explicitly studying the PCMH model and studies utilizing a "functional PCMH" (see Jackson et al. 2013): "medical home," "integrated care," and "chronic disease management." We also filtered for "low income," "poverty," "federally qualified health center," "Medicaid," and "uninsured." For inclusion, studies needed to focus on U.S. adult civilian populations (19 or older), take place after January 2005, and include a sample of individuals at or below 200 percent of the FPL (or at least 50 percent at 100 percent of the FPL), on Medicaid or uninsured.

Three of the authors reviewed abstracts to confirm the use of the PCMH model, and whether the study evaluated PCMH for research objectives two and three. Articles were excluded if they were guidelines, theoretical papers, or did not report the use of PCMH to improve health or organizational outcomes, were qualitative, or which had no comparison group. Articles included by any of the investigators underwent a full-text screening. At the full-text screening, two investigators independently reviewed the full text of each article for inclusion. To ensure cohesion between two investigators, peer debriefing was utilized to resolve disagreements.

For objective one, we reviewed articles for four of the core PCMH components: team-based care, care coordination, enhanced access to care, quality improvement (QI) evaluations, plus two additional components also associated with PCMH models in recent years: electronic medical records (EMR) and use of self-management interventions. We also assessed whether the study referenced the use of other types of intervention that were less formal versions of the PCMH model. We reviewed the full-text article to determine whether components were listed in the intervention description. If all six PCMH components were not mentioned in the intervention description, we reported a lower fidelity score for the study. At this point, we assigned a quality score of high bias, medium bias, and low bias using the Agency for Healthcare Research and Quality (AHRQ) methods guide for assessing risk of bias in observational, case/control, and randomized control studies (RCTs; Viswanathan et al. 2012).

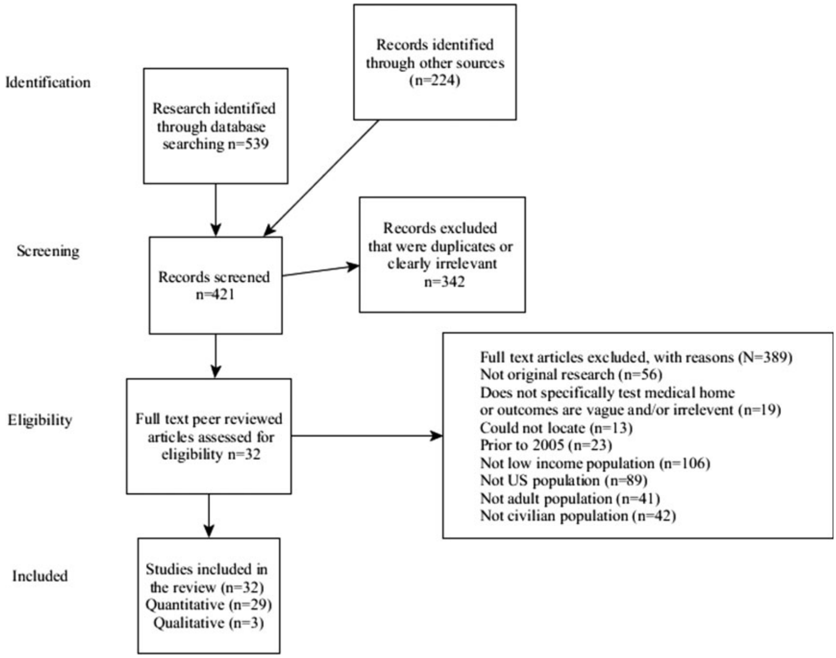
For objective two, we computed descriptive, bivariate, and multivariate differences in a range of clinical outcomes of patients utilizing PCMH interventions, including reduction of alcohol use, hemoglobin A_{1c} values ($HgbA_{1c}$), total cholesterol, LDL, blood pressure, hypertension, diabetes, quality of life, and general health/mental health. We also computed differences in emergency room (ER) use, hospitalizations or inpatient use, other types of utilization (i.e., primary care use, outpatient use, specialist, telephone encounters, and secure messaging threads), follow-up/adherence (i.e., prevention/screening (cholesterol, mammogram, foot examination, etc.), treatment (mastectomy, use of ACE inhibitors, etc.), medication adherence and show rate), and overall cost. Last, we determined whether PCMH improved patient, provider, and staff satisfaction (objective four). We also assessed quality of care by determining the number of medical guidelines which providers followed in regard to different chronic disease groups. Provider satisfaction included whether the providers regarded the intervention as successful and whether they thought that the intervention improved organizational morale.

Effect sizes were computed using Cohen's *D*. Positive effect sizes denoted improvement among the following variables: clinical outcomes, other types of utilization, follow-up/adherence, patient/provider satisfaction, and quality of care. Negative effect sizes denoted improvement when it came to ER utilization, inpatient utilization, and cost. When we summed effect sizes across variables, negative effect sizes for ER utilization, inpatient utilization, and cost were changed to positive. We constructed a forest plot to show the range of different effect sizes for each of the measures, and a funnel plot to examine the effect of bias and sample size.

RESULTS

We identified 870 citations from all sources. As described in Figure 1, after removing duplicates and articles that were clearly irrelevant (n = 403), we reviewed the abstracts and/or full text of 467 articles. Of these, 434 were

Figure 1: Article Identification and Selection Process for Patient-Centered Medical Home Articles Included in the Systematic Review



excluded at the full-text screening stage, leaving a total of 33 articles. The majority of studies either tested interventions funded by state Medicaid programs (13 studies) or the Commonwealth Fund (six studies) (see Appendix SA3). As stated in Table 1, there were a total of ten RCTs (Counsell et al. 2006, 2007; Lee et al. 2009; Weaver et al. 2009; Doty et al. 2010; Schmidt et al. 2013; Sen et al. 2014; Stevens et al. 2014, 2015; Pyne et al. 2015), nine case/control studies(Landon et al. 2007; Counsell et al. 2009; Coleman and Phillips 2010; Gilmer 2011; Hochman et al. 2013; Wheeler et al. 2013; Chu et al. 2016; Rhodes et al. 2016; Shane et al. 2016), nine longitudinal studies (Chin et al. 2007; Balaban et al. 2008; Chan et al. 2009; Rittenhouse et al. 2012; Congdon et al. 2013; Beadles et al. 2015; Maeng et al. 2016; Rivo et al. 2016; Sabik et al. 2016), and five cross-sectional studies (Gill et al. 2005; Coleman et al. 2010; Roby et al. 2010; Lewis et al. 2012; Solberg et al. 2014).

A total of 18 studies utilized either chart or administrative while the rest used some form of observation or self-report/survey data. About 70 percent of RCT studies used cluster randomization and 30 percent of studies used patient randomization. Studies ranged from 0 months to 4 years postintervention and had between 1 and 48 time points. About 2,440,065 patients were included in these studies who were served by over 2,500 providers. Patients included low-income/underserved populations utilizing FQHCs and safety net hospitals, underserved patients with chronic health conditions (e.g., diabetes, cancer, and heart disease), Medicaid recipients, and low-income elderly.

Study Quality

Using the AHRQ methods guide for assessment, we measured selection bias, performance bias, detection bias, attrition bias, and reporting bias. Given the relative nature of scoring according to methodological criteria, the AHRQ recommended using high, medium, and low bias to describe study quality. We scored fifteen studies as low bias, eleven studies as medium bias, and seven studies as high bias. As expected, RCT studies were most likely to be designated as low bias (about 66 percent), then case/control and longitudinal (both around 40 percent), and then cross-sectional (20 percent). Of those seven studies using cluster randomization, one was scored as having high bias, one scored medium, and the rest were low. One of the major factors leading to high or medium bias was the lack of similarity of groups at baseline, combined with no statistical measures to reduce confounding. Six of the 33 studies were

Table 1: Percentage of Studies Satisfying Agency for Healthcare Research and Quality Measures

Risk of Bias	*Criterion*	*RCTs (n = 10)*	*Case/Control (n = 9)*	*Longitudinal (n = 9)*	*Cross-Sectional (n = 5)*
Selection bias	Was the allocation sequence generally adequately (e.g., random number table, computer-generated randomization)?	30%	n/a	n/a	n/a
	Adequate concealment method used	40%	n/a	n/a	n/a
	Specific inclusion/exclusion criteria for all groups	100%	100%	100%	100%
	Criteria equally applied to all groups	n/a	100%	78%	100%
	Comparability of groups at baseline with regard to disease status and prognostic factors	30%	25%	33%	20%
	Study of groups comparable to nonparticipants with regard to confounding factors	n/a	25%	22%	0%
	Use of concurrent controls	n/a	25%	0%	0%
	Comparability of follow-up among groups at each assessment	n/a	63%	78%	n/a
	Explicit case definition	n/a	100%	0%	0%
	Case ascertainment not influenced by exposure status	n/a	38%	n/a	n/a
	Controls similar to cases except without condition of interest	n/a	38%	n/a	n/a
Performance bias	Clear definition of exposure	n/a	88%	89%	20%
	Double-blinding (e.g., investigators, caregivers, subject) to treatment allocation	0%	n/a	n/a	n/a
	Measurement method standard, valid and reliable	100%	100%	67%	80%
	Dose–response assessment, if appropriate	n/a	25%	44%	60%
	Interventions clearly detailed for all study groups (dose, route, timing)	70%	n/a	n/a	n/a
	Exposure measured equally in all study groups	100%	75%	22%	80%
	Fidelity of intervention	70%	75%	78%	80%
Detection bias	Primary/secondary outcomes clearly defined	100%	100%	78%	80%
	Outcomes assessed blind of exposure or intervention status	n/a	25%	56%	60%
	Method of outcome assessment standard, valid and reliable	100%	100%	78%	80%
	Length of follow-up adequate for question	n/a	50%	89%	40%

continued

Table 1 *Continued*

Risk of Bias	*Criterion*	*RCTs* (*n* = 10)	*Case/Control* (*n* = 9)	*Longitudinal* (*n* = 9)	*Cross-Sectional* (*n* = 5)
	Statistical tests appropriate	n/a	88%	89%	80%
	Multiple comparisons taken into consideration	n/a	75%	56%	0%
	Modeling and multivariate techniques appropriate	n/a	88%	78%	40%
	Power calculation provided	0%	13%	0%	0%
	Assessment of confounding	60%	38%	56%	20%
	Measure of effect of outcomes and appropriate measure of precision	60%	63%	44%	20%
Attrition bias	Adequacy of follow-up for each group	n/a	63%	56%	60%
	Appropriate analytic techniques that address study withdrawals, loss to follow-up	60%	n/a	n/a	n/a
	Proportion of eligible subjects recruited into study and followed up at each assessment	83%	n/a	n/a	n/a
Reporting bias	Conclusions supported by results with biases and limitations taken into consideration	90%	88%	78%	40%
	Type and source of funding for the study should not cause conflict or bias results	70%	37%	44%	40%

funded by the health systems in which they were situated which might also have increased bias in those studies.

PCMH Fidelity

Patient-centered medical home interventions were evaluated in the following states: Alabama, Arkansas, California, Colorado, Delaware, District of Columbia, Florida, Idaho, Illinois, Indiana, Iowa, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Mississippi, Nebraska, New York, North Carolina, Oklahoma, Oregon, Pennsylvania, Rhode Island, Texas, Virginia, Washington, and West Virginia. Organizational settings included safety net health centers, FQHCs, university-affiliated health networks, and private practices, but most PCMH interventions were implemented in either large hospital systems or FQHCs. Most of the health organizations appeared to implement the majority of PCMH core components listed in the manuscripts' Methods section. Additional interventions included transportation, either patient or provider incentives, outreach to ER patients, payment reform, home visits, decision support, mental health counseling, and previsit preparation.

Only four studies described all six PCMH core components. The majority (63 percent) described five components. Using a cutoff of five components, we found that about 25 percent of studies did not describe the full PCMH intervention. Items missing were similar across the six components.

Health Care Outcomes

A total of seven studies assessed a variety of measurable health outcomes. Overall effect size was small to intermediate ($d = 0.395$, with studies ranging from 0.028 to 1.19) (Figure 2). Studies with a higher effect size included Chin et al. (2007) ($d = 1.19$) and Congdon et al. (2013) ($d = 0.348$). In Chin et al. (2007), the Health Disparities Collaborative chronic disease management interventions reduced $\mathrm{HgbA_{1c}}$ and low-density lipoprotein cholesterol among patients of Midwestern and western FQHCs. Among a subgroup of Hispanics whose baseline $\mathrm{HgbA_{1c}}$ was poorly controlled (>9 percent) in Congdon et al. (2013), $\mathrm{HgbA_{1c}}$ was significantly decreased compared to controls.

Health care utilization was assessed in a total of 10 studies: ER use was negative for cases in nine of the ten studies (but lower ER use only showed an effect over $d = -0.200$ in two studies); inpatient hospitalizations also had a negative effect but for all five studies, only two showed effect sizes over -0.200 (see Figure 3). Other types of use, such as increased primary care use,

Figure 2: Forest Plot of Average Effect Sizes of Clinical Outcomes, Utilization, Costs, Patient Adherence and Satisfaction, Quality of Care, and Provider Satisfaction

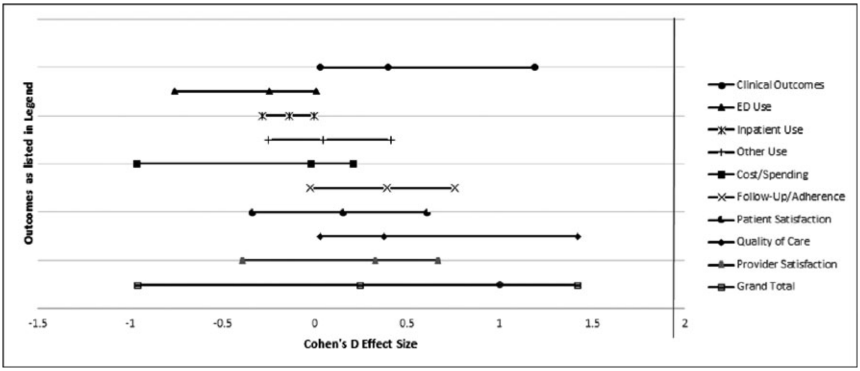
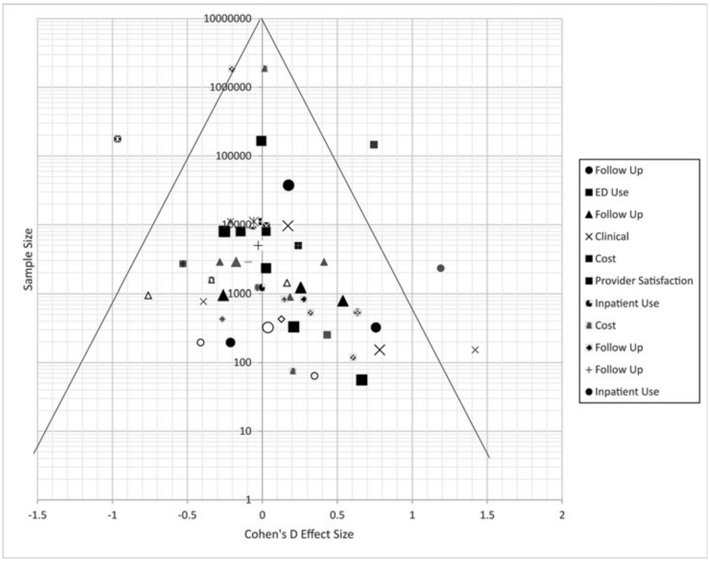


Figure 3: Funnel Plot of Average Effect Sizes of Clinical Outcomes, Utilization, Costs, Patient Adherence, and Satisfaction, Quality of Care, and Provider Satisfaction



Notes. Larger point markings signify higher quality studies.

were split between positive effect sizes (two studies) and negative effect sizes (three studies). Of these studies, effect sizes over −0.200 were only found in Gilmer (2011) and Coleman et al. (2010).

Follow-up and adherence were generally better in cases. Of the six studies that assessed follow-up/adherence, only one showed lower levels of follow-up/adherence in the experimental group (Rivo et al. 2016) and this study's essentially showed no effect for follow-up/adherence. An intermediate effect size (0.500 to 0.700) was found in three studies. Gill et al. (2005) found increased follow-up in a number of preventative services including cholesterol tests ($d = 0.769$), mammograms ($d = 0.505$), breast examinations ($d = 0.750$), pap smears ($d = 1.24$), flu shots ($d = 0.249$), and sigmoidoscopy ($d = 0.303$) in Delaware's Chap program. Diabetic patients in the study by Stevens et al. (2014) also were more likely to get an $\mathrm{HgbA_{1c}}$ test in the past 6 months ($d = 0.833$), to plan to manage care at home ($d = 2.09$), to have diabetes education outside ($d = 0.600$), and to have visited a dietitian ($d = 0.634$), all standards of diabetes care.

Seven studies assessed whether PCMH interventions created cost savings and five of the seven studies showed lower costs, while two of the seven studies showed higher costs. The study of Geisinger's system care in Pennsylvania (Maeng et al. 2016) appeared to be the most successful with an effect of $d = -0.965$. Like the other studies showing cost savings, the highest savings seemed to come from inpatient costs, followed by ER costs. Outpatient costs sometimes decreased, sometimes not. Pharmacy costs had increased across all studies.

Satisfaction

A total of 13 studies assessed whether the PCMH improved patient satisfaction (three), provider satisfaction (three), and quality of care (seven; Figure 2). Overall, patients and providers who were involved in a PCMH intervention were more satisfied with PCMH intervention. Providers also tended to regard the interventions as successful and as improving organization morale. There were two exceptions, however. In Schmidt et al. (2013), patients perceived clinics in post-Katrina New Orleans with higher PCMH scores as less accessible and had lower confidence in their quality and safety. In Lewis et al. (2012), providers were more likely to get burnt out in clinics with higher PCMH scores.

All 10 studies, which focused on quality of care, showed an improvement in outcomes. However, the effect sizes were not especially large, except for Lee et al. (2009), which showed higher access to substance abuse treatment for at-risk drinkers, and the Coleman and Phillips (2010) study, which showed that PCMH interventions with a higher “teamness” score were more likely to be better at scheduling patients, coordinating visits with multiple clinicians, scheduling same-day appointments, and providing telemedicine.

Differences before and after Medicaid Expansion

We compared mean effect sizes and found that before 2014, the average effect size of studies was $d = 0.318$, and after 2014, average effect size was $d = 0.226$. There were improvements from before 2014 and after 2014 when it came to cost and patient satisfaction. However, declines were noted in health outcomes, ER utilization, inpatient utilization, and quality of care. Only three studies focused on PCMH interventions in states that did not expand Medicaid after 2014 and they showed steep reductions in follow-up/adherence and ER use, compared to PCMH interventions in states that did expand Medicaid after 2014 (eight studies). The one study (Shane et al. 2016) of health homes was focused on providers in Iowa and showed a high effect of the program when it came to reduction of costs.

Findings from a Subgroup of Studies Showing That Intervention Had High Fidelity

As mentioned previously, about 70 percent of studies (23/33) had a high fidelity, meaning that the intervention utilized at least five components of PCMH interventions. The average effect size in these studies was still small to medium (mean $d = 0.281$, reflecting a positive outcome with a range from $d = -0.926$ to 0.745). When broken down by type of outcomes, results are as follows: clinical (mean $d = 0.225$, range 0.028 to 0.248), cost (mean $d = -0.262$, range −0.965 to 0.164), ED use (mean $d = -0.199$, range−0.203 to −0.016), inpatient use (mean $d = -0.132$, range −0.260 to −0.003), other use (mean $d = -0.045$, range −0.253 to 0.147), follow-up (mean $d = 0.265$, range −0.027 to 0.634), patient satisfaction (mean $d = 0.291$, range −0.339 to 0.606), provider satisfaction (mean $d = 0.235$, range −0.393 to 0.664), and quality (mean $d = 0.244$, range 0.026 to 0.745).

Findings from a Subgroup of Low-Bias Studies with Large Sample Sizes

As shown in Figure 3, there are about 11 low-bias studies with 500 or more participants. Average effect size for all these studies combined is 0.192

(reflecting a positive outcome), with a range between −0.792 and 1.19. Clinical studies had a mean effect size of $d = 0.513$ (range 0.028 to 1.19) (all focused on diabetes outcomes). Studies focused on cost, inpatient utilization, and other utilization which had low bias and high sample sizes showed little effect of PCMH interventions on cost of overall care among low-income populations. However, there does appear to be a significant level of improvement when it comes to ER utilization (mean $d = -0.205$, range −0.530 to −0.016) and cost in one study. A couple of studies show a higher effect when it came to follow-up (Stevens et al. 2014; : diabetes patient outcomes) and quality of care (Rivo et al. 2016: diabetes patient outcomes with previsit interventions).

DISCUSSION

We reviewed studies evaluating PCMH interventions among low-income populations in order to better understand the extent to which PCMH core components were implemented, whether they reduced health care costs, and whether they improved patient outcomes and experience. We found that for the most part, many of the core components were being implemented across studies. However, we found that 88 percent of studies did not list all six components, and only 63 percent of studies listed five of the six components.

Also of interest, there was moderate improvement when it came to health outcomes, especially health outcomes related to diabetes and addiction. Better outcomes were also observed when it came to utilization, with small improvements in ER use and inpatient use. Patients were also more likely to follow up with treatment and to use primary care. Although there were moderate improvements to quality of care, especially when it came to reducing disparities in the number of preventative practices, studies showed mixed results when it came to both patient and provider satisfaction.

Currently, the PCMH model has been implemented in many different states, by many different health care providers serving low-income patients from FQHCs to university health systems to social service agencies. However, practice resources are vital to fully implementing PCMHs and implementation of PCMHs can be costly, not only in terms of additional staff needed, but also increased workload of existing staff.[43] PCMH components are also not always fully reimbursed (i.e., practices are not always paid for PCMH services), which results in lower PCMH fidelity (Hoff, Weller, and DePuccio 2012). For example, a study by Rittenhouse et al. (2011) showed that many smaller practices implemented only one or two core PMCH components.

This study, however, did not focus on challenges of safety net clinics and hospitals which rely on some funding from the federal government but must make up for shortfalls in their budgets via less reliable funding sources, like foundation and personal funders (see DeSalvo and Kertesz 2007). Nevertheless, this review shows that certain features of PCMHs like interventions that increase access (e.g., telemedicine, next-day appointments, home visits, and transportation) and that coordinate care likely serve as important enablers of health utilization.

The ACA, while encouraging conservation of health care resources, does not offer support directly for this broad model of care. Some funding support is available for Medicaid Health Homes for Chronic Conditions (Berwick 2010), but as implementation of these programs is state-dependent, they have not been widely adopted thus far. The Accountable Care Organization concept, in theory, would also support coordination, but there is little direct incentive to physician practices to implement these changes, as the benefit is primarily directed to the overarching health care organization. Berwick, during testimony to support adoption of the ACA, envisioned a broader role for the medical home, but to date, this has not come to regulatory fruition.

These results point toward the need for further testing of PCMH interventions among low-income, vulnerable populations using random assignment and control groups. One problem is that there are many ethnical issues that arise when randomization is utilized in social and health service demonstration programs. One strategy for overcoming this is through the use of propensity score matching, a statistical technique that matches case and control groups along variables which could confound the exposure variable.

In addition, given the vast literature on interventions to improve health outcomes, a medical home is only one of the many interventions needed to ensure better health outcomes, especially among low-income patients who face other types of constraints when it comes to utilizing and accessing health care. There are two major gaps that are often not considered in comparative studies of efficacy, usefulness, and acceptability of PCMHs for low-income populations: (1) organizations that serve these populations often deal with significant problems related to acquiring resources and dealing with demand, and (2) low-income populations have many complex needs (see Gelberg et al.'s help seeking model for vulnerable populations) and need to be able to access other means of support—or as stated by DeSalvo and Kertesz (2007), establish additional types of "homes," which include an "insurance home" and a "social" or "community home."

As mentioned previously, the problem of resource limitations and demand continues to be a problem for many providers, which affects not only the fidelity and sustainability of PCMHs but organizational capacity to even provide traditional primary care services to patients. An insurance home (e.g., employer-based health insurance, Medicare, or Medicaid) resolves some of the problems related to resources and demands. One, patients need to be able to have more freedom to choose different health providers to better suite their needs. The way this can be accomplished is by attaching funding to patients rather than facilities. Two, if funding follows patients, then health facilities are actually awarded for increased demand, rather than penalized. Increased demand then brings in additional resources, rather than depletes them. Insurance homes have essentially been provided to a number of low-income patients in the United States through the expansion of Medicaid and other health insurance subsidies. We found in our analysis that for ER use and follow-up/adherence, PCMH programs located in states where Medicaid has been expanded have better outcomes. However, for many states where Medicaid has not been expanded, insurance homes, which clearly are a large enabler for health care utilization, including PCMH utilization, are not accessible to many low-income residents.

To improve access to primary care, some local governments have created insurance packages, like the St. Louis Regional Health Commissions' Gateway to Better Health initiative, which has provided a primary care insurance package. Preliminary reports of the program have shown that it has been associated with modest reductions in emergency department use (Regional Health Commission 2014). Gateway to Better Health revenues also benefited local safety net health facilities, allowing them to better respond to demand.

The social home is the physical space and social networks which "protect individuals from disruptions to health care" (DeSalvo and Kertesz 2007, p. 1378). That is, competing needs for housing, food, security, employment, and so on are major barriers to health care and are associated with increased emergency department use and other associated costs. They also are associated with declining health. In this review, we found that when health organizations offered "social home" type interventions, like transportation and patient incentives, they had significantly higher levels of follow-up/adherence. The study by Shane et al. (2016), which examined a health home intervention in Iowa, found substantial reductions in cost after implementation in the experimental group. However, it is unclear what role connection to social service played when it came to PCMH outcomes in this study. Another study showed that when PCMH implemented home visits, their low-income elderly patients with chronic health conditions had much higher social functioning (Counsell et al. 2007). An abundance of evidence has already shown that "service-rich" permanent supportive housing significantly improves physical and mental health among homeless individuals (Culhane and Metraux 2008). It also leads to lower emergency department and inpatient utilization. However, among nonhomeless populations who still struggle with competing needs, little research has been done to determine how systematic partnerships are being established between PCMH providers and social service agencies, especially given the substantial gap in services available for that population. Future study is needed to assess the extent and limitations of collaborations between social service providers and health systems to provide cohesive care.

Included studies had some substantial limitations. First of all, because PCMH interventions are composed of a "basket" of different services, assessing true intervention fidelity is beyond the scope of this article. Studies by Coleman et al. (2010) and Berry et al. (2013) showed 21–48 percent of practices had EMR. Berry et al. (2013) also showed that only about 57 percent of providers used QI. The study by Rittenhouse et al.(2012) showed components were implemented fully in the beginning of the study when funding was secure; however, as funding ran out, many of the components were only partially implemented. In addition, inconsistent definitions and implementations of PCMH core components, such as "advanced access," include a number of different subcategories, like extended hours, use of web/email/phone interface, and even next-day appointments. These subcomponents are better contextualized via PCMH scores, yet only five studies utilized a score. Overall PCMH score in five of the studies under review tended to be in the middle range (e.g., 50 of 100). Thus, except for determining fidelity based on how well interventions were described in studies, this paper cannot make any conclusions about the true level of fidelity of PCMH interventions for low-income populations.

Second, the majority of studies using a case/control design did not randomize and showed significant demographic and health differences between case and control groups. Other problems included the focus on FQHCs and large hospital systems with little information about the effect of PCMHs in smaller private practices. Only one study conducted in New Orleans (Schmidt et al. 2013) made multiple comparisons of practices by size and showed worse outcomes in smaller practices. Third, despite the fact that mental illness is prevalent in low-income populations (Culhane and Metraux 2008), few studies assessed mental illness or depression, nor did they determine how well PCMHs worked with these individuals. We also focused more heavily on peer-reviewed articles as opposed to gray literature as a result of our focus on more recent publications and our use of scholarly databases. This surely would bias results.

The PCMH model has been used widely to improve health outcomes of low-income populations and its further use has been encouraged by the ACA (Davis, Abrams, and Stremikis 2011). This review indicated that PCMH can be helpful with low-income populations, but small effect size and high bias show that more rigorous research is needed to further reassess its effects on this patient population.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the supporting information tab for this article:

Appendix SA1: Author Matrix.
Appendix SA2: Systematic Reviews Evaluated for Relevant Studies.
Appendix SA3: Funder/Model of Primary Care Medical Home.
Appendix SA4: PRISMA Checklist.