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RESEARCH ARTICLE

Patient-Centered Medical Home Recognition and Clinical Performance in U.S. Community Health Centers

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Introduction. America's community health centers (HCs) are uniquely poised to implement the patient-centered medical home (PCMH) model, as they are effective in providing comprehensive, accessible, and continuous primary care. This study aims to evaluate the relationship between PCMH recognition in HCs and clinical performance.

Methods. Data for this study came from the 2012 Uniform Data System (UDS) as well as a survey of HCs' PCMH recognition achievement. The dependent variables included all 16 measures of clinical performance collected through UDS. Control measures included HC patient, provider, and practice characteristics. Bivariate analyses and multiple logistic regressions were conducted to compare clinical performance between HCs with and without PCMH recognition.

Findings. Health centers that receive PCMH recognition generally performed better on clinical measures than HCs without PCMH recognition. After controlling for HC patient, provider, and practice characteristics, HCs with PCMH recognition reported significantly better performance on asthma-related pharmacologic therapy, diabetes control, pap testing, prenatal care, and tobacco cessation intervention.

Conclusion. This study establishes a positive association between PCMH recognition and clinical performance in HCs. If borne out in future longitudinal studies, policy makers and practices should advance the PCMH model as a strategy to further enhance the quality of primary care.

Key Words. Patient-centered medical home, clinical performance, community health centers, vulnerable population, quality of care

Patient-centered medical homes (PCMHs) seek to achieve the "triple aim" of better quality, cost, and experience of care (National Committee for Quality Assurance [NCQA] 2014). Consensus on the approach to accomplish improved, comprehensive care was reached by a joint statement of the American Academy of Family Physicians, the American Academy of Pediatrics, the American College of Physicians, and the American Osteopathic Association,

as having: (1) a personal primary care physician, (2) a physician-directed medical practice, (3) whole person orientation, (4) coordinated or integrated care, (5) quality and safety, (6) enhanced access, and (7) payment reform (American Academy of Family Physicians, American Academy of Pediatrics, American College of Physicians, and American Osteopathic Association 2007). In applying these principles, the PCMH model was developed to create a strong physician–patient relationship that results in more personal, coordinated, effective, and efficient primary care (National Committee for Quality Assurance [NCQA] 2011).

Since the first national demonstration project among 36 family practices (Porter 2008; Crabtree et al. 2010), implementation of the PCMH model of health care delivery has expanded across a number of additional demonstration projects, as well as state and private sector initiatives. As of 2009, there were at least 26 active demonstrations with external payment reform being conducted in 18 states. These pilots included over 14,000 physicians caring for nearly 5 million patients (Bitton, Martin, and Landon 2010). As of early 2014, more than 90 health plans were leading PCMH initiatives and 25 states were providing care to Medicaid beneficiaries through patient-centered primary care (Nielsen et al. 2014). The expansion of PCMH has been further encouraged by the Patient Protection and Affordable Care Act (ACA) of 2009, which contained multiple provisions related to the implementation and expansion of the PCMH model (Robert Wood Johnson Foundation 2011; Davis, Abrams, and Stremikis 2011; Health Resources and Services Administration [HRSA] 2015).

The ACA promoted the adoption of the PCMH model in U.S. community health centers (HCs) supported by the Health Resources and Services Administration [HRSA]. The federal government authorized the creation of HCs during the 1960s, primarily to reach medically underserved regions of the United States. These centers are required by law to be located in medically underserved areas and to provide services to

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anyone seeking care, regardless of insurance status or ability to pay (McAlearney 2002). America's HCs include Community, Migrant, Homeless, and Public Housing Health Centers and are also known as Federally Qualified Health Centers. They are nonprofit, community-directed health care providers serving low-income and medically underserved communities. HCs are required to meet certain criteria under the Medicare and Medicaid Programs (Sections 1861(a)(4) and 1905(l)(2)(B) of the Social Security Act) and receive funds under HRSA's Health Center Program (Section 330 of the Public Health Service Act) (Health Resources and Services Administration [HRSA] 2013). Overseen by the Bureau of Primary Health Care (BPHC), HCs have been a crucial component of the nation's safety net system by providing comprehensive primary care services to predominantly low-income, racial/ethnic minority patients in medically underserved urban and rural areas for over 50 years (Health Resources and Services Administration [HRSA] 2015). According to BPHC, in 2014, 1,278 of these centers were funded and provided care to approximately 22.9 million people through a network of nearly 9,000 service delivery sites. Approximately 27.9 percent of these patients were uninsured and an additional 47.3 percent were covered under Medicaid. The vast majority (92.4 percent) of patients who visited HCs had income less than 200 percent of the federal poverty level, and more than 1.2 million were homeless (Bureau of Primary Health Care 2014a). In addition to clinical care, HCs provide enabling services, such as transportation, translation, and health education to facilitate access to care for vulnerable populations. HCs coordinate with other community services and are governed by boards with the majority of their members from the HC patients (Shi and Singh 2015). Studies over the last decade have credited the HC model with providing accessible, cost-effective, and high-quality primary care and reducing health disparities (Shi, Stevens, and Politzer 2007; Shi et al. 2009, 2012a,b; Beal and Hernandez 2010; Shi, Lebrun, and Tsai 2010). HCs emphasize cultural competence, teamwork, and patient-centrism, all of which are aligned with the PCMH model. The comprehensive and collaborative approach applied by HCs in the provision of health care makes them uniquely poised to successfully implement the PCMH model.

To facilitate the adoption of the PCMH model among HCs, HRSA provides education, training, technical assistance, and fee waivers for gaining recognition under its Patient-Centered Medical/Health Home Initiative, Accreditation Initiative, PCMH supplemental fund, and through a partnership with the Centers for Medicare and Medicaid Demonstration

project (Shi et al. 2009; Health Resources and Services Administration [HRSA] 2012). These initiatives seek to support the adoption of PCMH features in order to further bolster their efforts to improve access to quality care and services, transitioning HCs from emphasizing volume to value (Health Resources and Services Administration [HRSA] 2011). Currently, the most common body through which HCs seek recognition is the National Committee for Quality Assurance (NCQA), which operates a recognition program that assesses medical practices' adoption of the PCMH model according to eligibility criteria (Carrier, Gourevitch, and Shah 2009).

Preliminary evaluations indicate that PCMHs promote some improvements in health care quality (Beal et al. 2007; Reid et al. 2009; Gilfillan et al. 2010; Bielaszka-DuVernay 2011; Bodenheimer 2011; Gabbay et al. 2011; Strickland et al. 2011). However, some report inconclusive results due to insufficient sample sizes to detect statistically significant effects (Peikes et al. 2012), and some have reported mixed results. While a few studies have noted desirable changes in emergency department use (Raskas et al. 2012; Driscoll et al. 2013; Werner et al. 2013), other studies have found no measurable impact (Rittenhouse et al. 2012; Friedberg et al. 2014; Cole et al. 2015). Many studies have specifically evaluated the effect of care provided by PCMH on a subgroup population, such as military veterans and diabetes patients (Yoon et al. 2013; Nelson et al. 2014a,b), or only assessed the impact of a few individual features of PCMH model (Hall et al. 2014; Paustian et al. 2014; Stockbridge, Philpot, and Pagan 2014; Wang et al. 2014; Markovitz et al. 2015). Therefore, large-scale evaluations of the application of the PCMH model, particularly in safety net settings such as HCs that serve large proportions of low-income individuals, are needed. Research has demonstrated that when low-income people have both health insurance and a medical home, they are less likely to report cost-related access problems, more likely to be up-to-date with preventive screenings, and report greater satisfaction with the quality of their care (Berenson et al. 2012). In addition, gaps in health care between lower income and higher income populations could be reduced with the medical home care delivery model (Berenson et al. 2012). To further advance the literature, the current study aimed to evaluate the relationship between PCMH recognition in HCs and clinical performance measures among the universe of HRSA-funded HCs, to determine if complete achievement of PCMH recognition was associated with higher clinical performance and health outcomes.

METHODS

Data

Data for this study came from Health Resources and Services Administration [HRSA] 2012 Uniform Data System (UDS) and PCMH tracking data from HRSA's Patient-Centered Medical/Health Home Initiative, the latest information available at the time of the study was conducted. The UDS is a core set of information collected annually from HC Program grantees and look-alikes. UDS data track a variety of information, including patient demographics, services provided, staffing, clinical indicators, utilization rates, costs, and revenues. In an effort to engage in continuous quality improvement and to assess the progress of HCs and the Program toward quality and performance goals, grantees are required to submit data on patient demographics, costs, revenue, provision of services, staffing, utilization rates, and clinical indicators (Bureau of Primary Health Care 2014b). Clinical performance encompasses both patient health outcomes and process measures of health service delivery, consistent with the approach adopted by the PCMH Evaluators' Collaborative that includes a balance between the two types of measures (Rosenthal, Abrams, and Britton 2012). The performance measures selected by HRSA for inclusion in the UDS aim to provide a comprehensive representation of HC services, as well as assess conditions that are clinically prevalent in underserved populations (Bureau of Primary Health Care 2012a).

Health center achievement of PCMH recognition was measured by verification through a PCMH accrediting body. HCs are currently supported by HRSA to achieve PCMH recognition under either the Accreditation Initiative, through contracts with the Accreditation Association for Ambulatory Health Care and The Joint Commission, or under the PCMH Initiative, through a contract with NCQA (Bureau of Primary Health Care 2012b). HRSA monitors the status of PCMH recognition by all its HC Program grantees and updates the information through its HC project officer. Currently, the following types of PCMH recognition are recorded for HCs: NCQA, Joint Commission, AAAHC, and some state programs (e.g., Minnesota, Oregon) with NCQA accounting for over 80 percent of the PCMH recognition.

Measures

PCMH Recognition. Patient-centered medical home recognition was the key independent variable of interest. HCs were considered to have PCMH recognition if they obtained PCMH certification from any of the agencies that

provide such certification. HCs were considered to not have PCMH recognition if they did not yet obtain PCMH certification.

Clinical Performance Measures. Clinical performance measures included in the analysis were those clinical quality measures required of all participants of the HC Program for the year of the analysis. We did not make further selection on these measures to avoid potential selection bias. These measures included (1) percent of adults (18 years or older) that received weight screening and follow-up; (2) percent of adults (18 years or older) with ischemic vascular disease that received aspirin or antithrombotic therapy; (3) percent of patients (ages 5–40) with persistent asthma that received pharmacologic therapy; (4) percent of adults (ages 50–74) that received colorectal cancer screening; (5) percent of children (less than 18 years old) fully compliant with recommended vaccines by their 2nd birthday; (6) percent of children and adolescents (ages 2–17) that received weight assessment and nutrition and physical activity counseling; (7–9) percent of patients (ages 18–75) diagnosed with diabetes with HbA1c <7 percent, <8 percent, or <9 percent; (10) percent of patients (ages 18–85) diagnosed with hypertension with blood pressure less than 140/90; (11) percent of deliveries that are low birth weight (LBW) (<2,500 g); (12) percent of adults (18 years or older) with coronary artery disease receiving lipid-lowering therapy; (13) percent of female adults (ages 21–64) that are current on cervical cancer screening; (14) percent of female patients with early entry into prenatal care; (15) percent of adults (18 years or older) assessed for tobacco use; and (16) percent of adults (18 years or older) who were known tobacco users that received tobacco cessation counseling and/or pharmacologic intervention. All measures are part of the NCQA Healthcare Effectiveness Data and Information Set tool. All measures, with the exception of prenatal care and low birth weight, have been identified by the PCMH Evaluators' Collaborative as core recommended quality measures (Rosenthal, Abrams, and Britton 2012). Low birth weight has been identified by the Agency for Healthcare Research and Quality as a prevention quality indicator and has been endorsed by the National Quality Forum (AHRQ 2010; Agency for Healthcare Research and Quality (AHRQ) 2012).

Control Measures. Control measures included patient characteristics, provider characteristics, financial characteristics, and practice characteristics. Patient characteristics included percent of racial/ethnic minority patients (including

non-Hispanic Asian, non-Hispanic Native Hawaiian/Other Pacific Islander, non-Hispanic black/African American, non-Hispanic American Indian/Alaska Native, and Hispanic/Latino); percent of homeless patients; and percent of migrant/seasonal farmworker patients.

Provider characteristics included primary care team (physician, nurse practitioner, physician assistant, certified nurse midwife, or nurse) full-time equivalent (FTE) per 10,000 total patients and enabling service provider (case manager or health educator) FTE per 10,000 total patients. Financial characteristics included types of HC Program funding (i.e., Migrant Health Center [MHC], Community Health Center [CHC], Health Care for the Homeless [HCH], and Public Housing Primary Care [PHPC] programs) and net revenue. Practice characteristics included rural/urban status and method used for reporting clinical quality measures (either use of electronic health records [EHR] to report all patients or chart review to report a sample of patients). The justification for including a reporting method variable was that compared with EHRs reporting process, HCs using the chart review process might overlook the process of scientific random sampling and select all the charts from one site/provider with better performance, which would result in selection bias and could compromise generalizability.

Analysis

Both bivariate and multivariate analyses were conducted. First, patient, provider, financial, and practice characteristics were compared according to PCMH recognition achievement. Differences in characteristics were assessed through paired *t*-tests for continuous measures and chi-squared tests for categorical measures. Next, bivariate analyses were conducted to identify potential relationships between HCs with PCMH recognition versus HCs without PCMH recognition for all listed covariates. Finally, multivariate linear regressions were performed of PCMH recognition achievement on clinical performance measures, adjusting for patient, provider, financial, and practice characteristics. All analyses were performed using *SAS, version 9.3* (SAS Institute Inc., Cary, NC, USA).

RESULTS

Health Center Characteristics

Table 1 compares the patient, provider, financial, and practice characteristics between HCs having achieved PCMH recognition and those that have not. A

Table 1: Health Center Characteristics and PCMH Recognition

	PCMH Recognition	
	Yes (N = 539)	*No (N = 548)*
Health center characteristics		
% minority patients	53.86	54.56
% uninsured patients***	34.56	40.02
% homeless patients	7.61	8.29
% migrant/seasonal patients	2.73	3.69
Net revenue (in $10,000)***	873.74	444.27
Physician team FTE per 10,000 medical patients**	6.04	5.45
Enabling service provider FTE per 10,000 medical patients	9.35	9.59
Type of funding[†]	*N*(%)	*N*(%)
MHC	86 (15.94)	72 (13.12)
CHC*	513 (95.29)	502 (91.65)
HCH*	137 (25.36)	102 (18.66)
PHPC	41 (7.61)	28 (5.10)
Rural**	219 (40.58)	275 (50.22)
Use of EHR to report each of the clinical measures[‡] (*N*/%)		
Adult receiving weight screening***	254 (47.1)	180 (32.86)
Aspirin therapy***	283 (52.54)	153 (27.87)
Asthma patients receiving pharmacologic therapy***	219 (40.58)	119 (21.69)
Colorectal cancer screening***	264 (48.91)	178 (32.54)
Child immunization***	182 (33.7)	92 (16.81)
Child weight assessment***	225 (41.67)	146 (26.68)
Diabetes control (HBA1c<7)***	355 (65.94)	230 (41.97)
Hypertension control***	361 (67.03)	244 (44.47)
Lipid therapy***	252 (46.74)	130 (23.75)
Pap test***	279 (51.81)	181 (32.97)
Tobacco cessation intervention***	293 (54.35)	195 (35.57)
Tobacco assessment***	352 (65.22)	232 (42.3)

*$p < .05$, **$p < .01$, ***$p < .001$, based on paired *t*-test and chi-squared test.
[†]The percentage of funding did not add to 100% as health centers can have more than one type of funding.
[‡]Due to different electronic health record (EHR) products being used in different health centers and that the features of EHR are different, health centers can decide whether to use EHR to report all or some clinical measures.
CHC, community health center; FTE, full-time equivalent HCH, health care for the homeless; MHC, migrant health center; PHPC, public housing primary care; PCMH, patient-centered medical home.

total of 1,087 HCs were included in the analysis, with a total of 539 HCs (46 percent) having achieved PCMH recognition.

Reflective of the aim of HCs to provide medically underserved populations with health services, a large proportion of patients served by both HCs with and without PCMH recognition were comprised of racial/ethnic

minority and uninsured patients. The results indicate that HCs without PCMH recognition served a significantly greater percentage of uninsured (40.0 percent vs. 34.6 percent, $p < .001$) patients compared to those with PCMH recognition. There was a significant difference in net revenue between HCs with and without PCMH recognition. HCs with PCMH recognition had nearly twice the annual revenue than those without ($8,737,400 vs. $4,442,700, $p < .001$). A significant proportion of HCs received grant funding (i.e., CHC, MHC, HCH, and PHPC) for providing services to underserved communities and vulnerable populations. A greater percentage of HCs with PCMH recognition received CHC and HCH funding compared to those without recognition (95.3 percent vs. 91.7 percent, $p < .05$; and 25.4 percent vs. 18.7 percent, $p < .05$, respectively). The proportion of rural patients being served was 41–50 percent. In reporting clinical performance measures, HCs achieving PCMH recognition were more likely to use EHR for their entire patients, whereas HCs not achieving PCMH recognition were more likely to use chart review for a sample of their patients, with percentage point differences ranging from approximately 14 percent for adult receiving weight screening to 25 percent for aspirin therapy ($p < .05$ to $p < .001$).

Clinical Performance Measures

As illustrated in Table 2, HCs with PCMH recognition performed better on 13 of the 16 UDS clinical performance measures in 2012. The greatest differences between HCs with and without PCMH recognition were found for tobacco cessation intervention (59.9 percent vs. 55.5 percent, $p < .05$), Pap tests (54.6 percent vs. 50.5 percent, $p < .001$), prenatal care (72.6 percent vs. 68.7 percent, $p < .001$), tobacco assessment (87.6 percent vs. 83.9 percent, $p < .001$), and adult receiving weight screening (47.8 percent vs. 44.1 percent, $p < .01$). Overall, the highest performance rate was for tobacco assessment, with 87.6 percent of HCs with PCMH recognition and 83.9 percent of HCs without ($p < .001$), while the lowest performance was for colorectal cancer screening with both achieving approximately 27–28 percent of patients (Table 3).

Clinical Performance Measures and Health Center Characteristics

After adjusting for patient, provider, financial, and practice characteristics, PCMH recognition was found to be associated with higher performance on all clinical performance measures, compared to having no PCMH

Table 2: Patient-Centered Medical Home (PCMH) Recognition and Clinical Performance

	PCMH Recognition	
	Yes (N = 539)	*No (N = 548)*
Clinical performance measures	2012	2012
% Adult receiving weight screening**	47.77 (0.89)	44.05 (0.98)
% Aspirin therapy	70.13 (0.87)	70.79 (0.91)
% Asthma patients receiving pharmacologic therapy*	75.66 (0.91)	72.61 (1.09)
% Colorectal cancer screening	27.99 (0.8)	27.18 (0.86)
% Child immunization	38.72 (1.11)	39.32 (1.32)
% Child weight assessment*	42.78 (1.1)	39.45 (1.14)
% Diabetes control (HBA1c<7)**	41.19 (0.38)	39.24 (0.49)
% Diabetes control (HBA1c<8)***	59.68 (0.46)	57.13 (0.58)
% Diabetes control (HBA1c<9)***	71.17 (0.47)	68.43 (0.6)
% Hypertension control*	63.93 (0.44)	62.49 (0.48)
% LBW	7.18 (0.2)	7.12 (0.23)
% Lipid therapy	75.59 (0.77)	73.95 (0.85)
% Pap test***	54.59 (0.73)	50.51 (0.83)
% Prenatal care***	72.58 (0.7)	68.67 (0.89)
% Tobacco assessment***	87.64 (0.69)	83.85 (0.81)
% Tobacco cessation intervention**	59.9 (1.05)	55.51 (1.14)

*$p < .05$, **$p < .01$, ***$p < .001$, based on paired *t*-test for PCMH vs. non-PCMH centers within the same year.

recognition, with statistically significant higher performance for (1) adult patients receiving weight screening and follow-up; (2) asthma patients receiving pharmacologic therapy; (4–6) all levels of diabetes control; (7) patients receiving a current Pap test; (8) patients receiving prenatal care; (9) tobacco use assessment; and (10) tobacco cessation. The largest clinical performance improvement was seen in the percent of adults receiving weight screening. HCs with PCMH recognition had a 4.2 percent higher rate of weight screening (SE = 1.522, $p < .01$).

Health centers that served racial/ethnic minority, homeless, or migrant/seasonal farmworker patients showed positive associations with some of the clinical performance measures. There was also an inverse relationship that the percentage of uninsured patients being served was associated with negative associations with most clinical performance measures. Use of EHR reporting was negatively associated with all of the performance measure rates, and the difference was statistically significant for 13 of the measures. Among them, the use of EHR showed negative association with adults weight screening rate, which showed the greatest magnitude with the regression coefficient as 13.423

Table 3: Multiple Regression: Clinical Performance Measures and Health Center Characteristics

	Estimates (SE)					
	% Adult Receiving Weight Screening (N = 1,193)	*% Aspirin Therapy (N = 1,020)*	*% Asthma Patients Receiving Pharmacologic Therapy (N = 1,002)*	*% Colorectal Cancer Screening (N = 1,186)*	*% Child Immunization (N = 914)*	*% Child Weight Assessment (N = 1,156)*
PCMH recognition (1 vs. 0)	4.2333 (1.522)**	0.5034 (1.417)	3.5164 (1.666)*	1.8893 (1.3042)	0.0102 (1.8831)	2.4395 (1.7591)
% minority patients	0.1047 (0.0238)***	−0.0067 (0.023)	0.0548 (0.0262)*	0.0601 (0.0204)**	0.2149 (0.0316)***	0.1688 (0.0277)***
% uninsured patients	−0.0118 (0.0361)	−0.0952 (0.0371)*	−0.0989 (0.0408)*	−0.199 (0.031)***	0.0057 (0.0512)	−0.1698 (0.0435)***
% homeless patients	0.1263 (0.0563)*	−0.0321 (0.0613)	−0.011 (0.0641)	−0.0187 (0.0482)	−0.0471 (0.0814)	−0.0631 (0.0689)
% migrant/seasonal patients	−0.1385 (0.0651)*	−0.1075 (0.0785)	0.0161 (0.0812)	−0.0002 (0.0562)	0.0651 (0.0885)	0.0553 (0.076)
EHR (1 vs. 0)	−13.4231 (1.3127)***	−8.3598 (1.2524)***	−5.6741 (1.508)***	−9.0156 (1.1252)***	−0.7828 (1.83)	−11.2953 (1.5721)***
Type of funding						
MHC (1 vs. 0)	0.377 (2.1996)	2.1466 (2.1035)	1.4128 (2.4259)	−2.2811 (1.8804)	1.7272 (2.6404)	3.4104 (2.5096)
CHC (1 vs. 0)	5.0957 (4.2458)	−3.9012 (4.6283)	5.4675 (4.8282)	1.5091 (3.6397)	8.6803 (6.0777)	6.7549 (5.101)
HCH (1 vs. 0)	−3.057 (1.9991)	1.6192 (1.8447)	1.4822 (2.1061)	−1.2164 (1.7061)	1.1091 (2.3858)	0.6164 (2.3107)
PHPC (1 vs. 0)	1.4145 (2.783)	1.6826 (2.635)	−1.5187 (2.9759)	−0.9888 (2.374)	1.7082 (3.3812)	5.3531 (3.1819)
Net revenue (in $10,000)	0.0003 (0.0006)	0.0006 (0.0005)	−0.0004 (0.0006)	0.0016 (0.0005)***	0.0002 (0.0007)	0.0002 (0.0006)
Physician team FTE per 10,000 medical patients	0.0636 (0.2301)	0.9348 (0.2476)***	−0.0336 (0.2766)	0.6294 (0.2001)**	−0.0016 (0.3501)	−0.0365 (0.2837)
Enabling service provider FTE per 10,000 medical patients	−0.0622 (0.0334)	0.0127 (0.0594)	0.0075 (0.0523)	0.003 (0.0385)	0.034 (0.1082)	−0.0792 (0.0679)
Urban vs. rural (1 vs. 0)	−1.8297 (1.5915)	0.4786 (1.529)	1.5942 (1.7432)	−2.0511 (1.3631)	3.7263 (2.0313)	6.1121 (1.829)***

Continued

Table 3. *Continued*

	Estimates (SE)					
	% Diabetes Control (HBA1c< 7) (N = 1,176)	*% Diabetes Control (HBA1c< 8) (N = 1,176)*	*% Diabetes Control (HBA1c< 9) (N = 1,176)*	*% Hypertension Control (N = 1,179)*	*% LBW (N = 650)*	*% Lipid Therapy (N = 966)*
PCMH recognition (1 vs. 0)	2.069 (0.7314)**	1.9088 (0.8684)*	2.0335 (0.9071)*	1.3804 (0.7519)	0.3298 (0.3399)	2.538 (1.3649)
% minority patients	−0.0767 (0.0114)***	−0.0909 (0.0135)***	−0.0798 (0.0141)***	−0.0206 (0.0117)	0.0208 (0.006)***	0.0048 (0.0225)
% uninsured patients	−0.0888 (0.0173)***	−0.0695 (0.0205)***	−0.0464 (0.0214)*	−0.0708 (0.0178)***	−0.0254 (0.0094)**	−0.0102 (0.036)
% homeless patients	−0.0449 (0.0274)	−0.0525 (0.0325)	−0.0742 (0.0339)*	−0.0547 (0.0279)	0.0392 (0.0187)*	−0.0696 (0.0589)
% migrant/seasonal patients	0.0038 (0.0318)	−0.0042 (0.0377)	−0.0017 (0.0394)	−0.0016 (0.0326)	−0.0202 (0.015)	−0.1201 (0.0773)
EHR (1 vs. 0)	−2.6855 (0.6098)***	−3.4917 (0.7241)***	−4.3224 (0.7562)***	−4.6053 (0.6259)***	N/A	−3.0803 (1.225)*
Type of funding						
MHC (1 vs. 0)	−0.1768 (1.0532)	−1.2089 (1.2506)	−1.4227 (1.3062)	−0.8326 (1.0783)	−0.5364 (0.4573)	2.1591 (1.9813)
CHC (1 vs. 0)	0.3468 (2.0892)	3.6509 (2.4809)	3.0109 (2.5912)	−1.8528 (2.1112)	0.6898 (1.2326)	2.4576 (4.4865)
HCH (1 vs. 0)	0.3434 (0.9551)	−1.039 (1.1342)	−0.7444 (1.1846)	−1.1236 (0.9825)	0.0007 (0.4235)	2.2338 (1.7464)
PHPC (1 vs. 0)	−0.1911 (1.332)	0.6317 (1.5817)	−0.0244 (1.652)	1.9541 (1.3725)	1.0466 (0.601)	−2.3886 (2.5324)
Net revenue (in $10,000)	0.0001 (0.0003)	0.0003 (0.0003)	0.0003 (0.0003)	0.0005 (0.0003)	0.00001 (0.0001)	0.0002 (0.0005)
Physician team FTE per 10,000 medical patients	0.0822 (0.1119)	0.1193 (0.1329)	0.2263 (0.1388)	−0.0081 (0.1152)	−0.0482 (0.0643)	−0.0869 (0.2334)
Enabling service provider FTE per 10,000 medical patients	0.0116 (0.0215)	0.013 (0.0255)	−0.001 (0.0266)	0.0708 (0.0221)**	−0.0364 (0.0198)	0.0614 (0.0644)
Urban vs. rural (1 vs. 0)	0.7659 (0.7628)	1.4046 (0.9058)	1.3689 (0.9461)	−0.3411 (0.7816)	−0.3792 (0.3689)	2.4822 (1.4779)

Continued

Table 3. *Continued*

	Estimates (SE)			
	% Pap Test (N = 1,188)	*% Prenatal Care (N = 708)*	*% Tobacco Cessation Intervention (N = 1,175)*	*% Tobacco Assessment (N = 1,193)*
PCMH recognition (1 vs. 0)	4.1201 (1.2415)***	3.9713 (1.1564)***	3.7993 (1.7852)*	3.0079 (1.3256)*
% minority patients	0.1119 (0.0194)***	−0.1074 (0.0202)***	−0.0306 (0.028)	−0.0363 (0.0205)
% uninsured patients	−0.0918 (0.0294)**	−0.1427 (0.0319)***	−0.0364 (0.0427)	−0.0516 (0.0311)
% homeless patients	−0.0677 (0.0459)	−0.0224 (0.0582)	0.0915 (0.0672)	0.0772 (0.0485)
% migrant/seasonal patients	0.0682 (0.0533)	0.1952 (0.0511)***	−0.1127 (0.0817)	−0.0749 (0.056)
EHR (1 vs. 0)	−6.6603 (1.0595)***	N/A	−11.9137 (1.5127)***	−3.7222 (1.1)***
Type of funding				
MHC (1 vs. 0)	1.556 (1.785)	−1.4539 (1.5816)	0.5128 (2.5801)	0.9836 (1.8984)
CHC (1 vs. 0)	5.5389 (3.461)	−1.1501 (3.8953)	−5.4219 (5.1166)	6.2299 (3.6593)
HCH (1 vs. 0)	−0.0684 (1.6229)	−0.7383 (1.463)	−2.4721 (2.3307)	0.926 (1.7235)
PHPC (1 vs. 0)	−4.168 (2.2586)	−0.3185 (2.067)	1.602 (3.2433)	−1.4507 (2.3996)
Net revenue (in $10,000)	0.0018 (0.0005)***	−0.0001 (0.0004)	0.0007 (0.0007)	0.0004 (0.0005)
Physician team FTE per 10,000 medical patients	0.5472 (0.1875)**	0.7558 (0.2139)***	0.1204 (0.2701)	−0.1474 (0.1985)
Enabling service provider FTE per 10,000 medical patients	0.0057 (0.0282)	0.0784 (0.0517)	0.0073 (0.0419)	0.0103 (0.0288)
Urban vs. rural (1 vs. 0)	3.9883 (1.2904)**	0.5407 (1.2648)	1.8787 (1.8671)	1.6372 (1.3679)

Notes. *$p < .05$, **$p < .01$, ***$p < .001$.
CHC, community health center; HCH, health care for the homeless; MHC, migrant health center;PHPC, public housing primary care.

(SE = 1.313, $p < .001$). Higher physician team FTE per 10,000 medical patients was positively associated with four performance measures (Pap tests, prenatal care, colorectal cancer screening, and aspirin therapy). Among them, the greatest magnitude with the regression coefficient was found for aspirin therapy at 0.9 percent (SE = 0.247, $p < .001$).

Discussion

Support to facilitate the implementation of the PCMH model of health care delivery continues to expand. However, large-scale evaluations of resulting improvements in quality of care are not well documented. The current study examined all HRSA-funded HCs providing services to more than 21 million patients, and it sought to determine if achieving PCMH recognition in HCs was associated with better health care quality as measured by clinical performance measures reported by HCs and PCMH recognition through NCQA, the Joint Commission, AAAHC, and select state programs.

This study showed that adoption of the PCMH model of care was associated with better clinical performance. After adjusting for patient, provider, and practice characteristics, PCMH recognition was associated with better clinical performance on 9 of the 16 clinical measures examined, including adult weight screening, asthma therapy, diabetes control (HBA1c<7), diabetes control (HBA1c<8), diabetes control (HBA1c<9), Pap test, prenatal care, tobacco cessation, and tobacco assessment. Positive differences were also observed for the remaining seven clinical measures, although they were not statistically significant. Our findings are consistent with those of a 2014 study by Jason J. Wang and coauthors that showed a positive association between PCMH and clinical performance in small physician practices (Wang et al. 2014). They were also consistent with those of a 2012 study that found PCMH provided better preventive care and disease management (DeVries et al. 2012). One of the unique contributions of our study is the comprehensiveness of the outcome measures included, further supporting that complete achievement of PCMH recognition is associated with better clinical performance. Although the absolute magnitude of the differences was small, the impact on patients is significant as our national sample of facilities provide care to over 21 million Americans.

While all clinical performance measures indicated a positive association with PCMH recognition, the varying magnitude of the differences highlight the need to examine the relationship between PCMH recognition and specific

quality of care measures. For example, we found that clinical performance measures related to chronic disease care/management (i.e., all three diabetes measures) were significantly associated with PCMH recognition, demonstrating that the PCMH model, with its focus on specific needs and challenges of high-risk populations such as the chronically ill, has the potential to promote primary care utilization and chronic disease monitoring and management (O'Toole et al. 2011). These findings were also consistent with the literature regarding the effect of the medical home model on care utilization by chronically ill patient population under Medicaid at 26 practices in Louisiana (Paustian et al. 2014). However, our findings were nationally representative, as well as included the other types of health plan beneficiaries in underserved populations. Our study also provided evidence that many preventive measures had positive associations with PCMH recognition in large magnitude, such as adult receiving weight screening, cervical cancer screening, and tobacco cessation intervention, which pointed to the possibility that PCMH practices were associated with improvements in provision of appropriate preventive, screening, and public health services. However, future research should seek to identify the underlying mechanisms that drive the varying strengths across measures.

Another notable finding was that use of EHRs to report on clinical performance (vs. sample chart reviews) was consistently associated with poorer performance, after accounting for potential confounders. This finding suggests that a potential bias is introduced for the manual chart reviews if the samples of charts are not being randomly selected. As EHRs are an integral part of achieving the PCMH model of care, it is important to understand the implications of patient data drawn from a sample versus a universe, such that observed lower clinical performance among PCMH-recognized providers may be an artifact of data collection/extraction. The other noteworthy finding was that there was only a minimal effect on clinical performance due to number of physician or number of enabling providers. One possible explanation is that all the HCs included in this study were HRSA-funded HCs, which were required to meet certain criteria on primary care workforce when they applied for federal designations, so they had comparatively abundant workforce, and the additional physician and enabling FTEs would not have notable effect on the clinical performance.

There are several limitations with the current study. First, this was a cross-sectional study and the multivariate analysis focused on one point in time. The cross-sectional nature of the multivariate analysis made it difficult to make causal inferences from the analyses, and it is possible that

high-performing HCs and those with greater resources already had PCMH features in place. These HCs may have been more likely to seek and gain PCMH recognition. We will attempt longitudinal analysis in the future to generate causal findings. Also, the study utilized 2012 data, which while recent, may not fully capture the current PCMH recognition among HCs as support for PCMH development has continued to increase dramatically in the years since. Furthermore, there is likely a lagged effect of the PCMH model as the benefits of PCMH take time to exert impact on clinical care improvement. Therefore, future analyses should consider examining the relationship on outcomes over a longer period of time, which could better capture the effect of PCMH adoption. Another limitation of the study is its failure to distinguish types of PCMH recognition. We will collect more detailed information from HCs regarding the type of PCMH recognition (e.g., Level 1 vs. Level 2 vs. Level 3) and reflect this accordingly in the analysis.

In conclusion, the current study findings support the claim that achievement of PCMH accreditation is associated with better performance on clinical quality indicators (Lebrun-Harris et al. 2013). Additionally, the present study provides robust findings based on the universe of HRSA-supported HCs in 2012, allowing for nationally representative results and with an analytical sample size large enough to provide sufficient power to detect differences; a limitation of previous research on the relationship between PCMH adoption and health care quality. In addition to the key findings presented, this study highlights the need for future research into the underlying mechanisms between PCMH and specific quality of care indicators. For example, as HCs serve a large proportion of the chronically ill with multiple and complex needs, knowing which components within the PCMH model that are most associated with improved care performance for chronic disease care and management would allow HCs to develop targeted interventions that aim at enhancing these components.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Appendix SA1: Author Matrix.