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Associations of patient-centered medical home with quality of care, patient experience, and health expenditures

A STROBE-compliant cross-sectional study

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Abstract

In efforts to improve the delivery of quality primary care, patient-centered medical home (PCMH) model has been promoted. However, evidence on its association with health outcomes has been mixed. The aim of this study was to assess the performance of PCMH model on quality of care, patient experience, health expenditures.

This was a cross-sectional study of the 2015–2016 Medical Expenditure Panel Survey-Medical Organization Survey linked data, including 5748 patient-provider pairs. We examined twenty-four quality of care measures (18 high-value and 6 low-value care services), health service utilization, patient experience (patient-provider communication, satisfaction), and health expenditure.

Of 5748 patients, representing a weighted population of 56.2 million American adults aged 18 years and older, 44.2% were cared for by PCMH certified providers. 9.3% of those with PCMHs had at least one inpatient stay in the past year, which was comparable to the 11.4% among those with non-PCMHs. Similarly, 17.4% of respondents cared for by PCMH and 18.5% cared for by non-PCMH had at least one ED visit. Overall, we found no significant differences in quality of care measures (neither high-nor low-value of care) between the two groups. The overall satisfaction, the experience of access to care, and communication with providers were also comparable. Patients who were cared for by PCMHs had less total health expenditure (difference $217) and out-of-pocket spending (difference $91) than those cared for by non-PCMHs; however, none of these differences reached the statistical significance (adjusted $P > 0.05$ for all).

This study found no meaningful difference in quality of care, patient experience, health care utilization, or health care expenditures between respondents cared for by PCMH and non-PCMH. Our findings suggest that the PCMH model is not superior in the quality of care delivered to non-PCMH providers.

Abbreviations: ED = emergency department, FPL = federal poverty level, MEPS-MOS = Medical Expenditure Panel Survey-Medical Organization Survey, PCMH = patient-centered medical home, USC = usual source of care.

Keywords: care utilization, health expenditures, patient experience, Patient-centered medical home, quality of care

1. Introduction

The US health care system has been faced with numerous challenges and inefficiency, namely excessive health care spending and poor health outcomes.[1,2] Given the growing recognition of the role of primary care in improving population health, many efforts have been directed toward bolstering the effectiveness of primary care delivery.[3] The patient-centered medical home (PCMH), which is a team-based coordinated care model, has been promoted to address the fragmented nature of care delivery and help achieve the "triple aims" of improved quality of care, patient experience, and value-based care.[4–6]

The concept of PCMH can be traced back to the medical home model in pediatrics in the 1960s and has been evolved in the past 50 years.[7] The PCMH was one of the cornerstones of the novel primary care delivery models promoted by the Affordable Care Act.[8] Although studies have demonstrated that the implementation of PCMHs was associated with modest improvement in cancer screening uptake,[9] patient and staff experience, and care process,[10,11] variations in definition and certifying process of this model across organizations have impeded its wide adoption.[9] Previous studies have examined the PCMH model using a single item as the quality of care measure, such as emergency department (ED) visits,[12–14] and hospitalization.[15]

Many of them were also conducted in unique care setting such as the Veterans Health Administration, one accreditation model, or a specific region,[16–18] limiting its generalizability. Furthermore, existing studies on PCMH implementation yielded mixed evidence on the key measurements that the PCMH model intended to achieve.[10,19]

As the PCMH model is continually evolving and receiving more attention from the public, a more comprehensive evaluation of PCMH is needed to better inform the national investment in the quality of care and population health.[20] The current evidence of PCMH relies on a single outcome assessment, which likely biases its overall effects on patient outcomes, and fails to take account of the important provider characteristics.[10] To address this gap, this population-based study aimed to assess the performance of the PCMH model on quality of care, patient experience, health care utilization, and health care expenditures using the Medical Expenditure Panel Survey-Medical Organization Survey (MEPS-MOS) linked dataset. This study would add more in-depth evidence through a holistic view of the PCMH model by examining both patient- and provider-level characteristics to understand whether the PCMH model was associated with meaningful improvement in primary patient care.

We hypothesized the patients cared for by certified PCMH providers would receive more high-value care while receiving less low-value care, had a better experience, used less inpatient care and emergency care, and had lower health expenditures than their counterparts who cared for by non-PCMH providers.

2. Methods

2.1. Data and sample

This was a cross-sectional study to compare the differences in the quality of care, patient experience, health care utilization, and expenditure between individuals cared for by certified PCMH and non-PCMH providers. We extracted data from the 2015 to 2016 MEPS-MOS, which contains a nationally representative sample of the non-institutionalized population in the United States.[21] The MEPS data contain information on patient-level sociodemographic and health-related characteristics, health care utilization, and health care expenditures. The MOS data include organizational level information of health care providers that were identified as a usual source of care (USC) in the MEPS respondents.[22,23] Thus, the MEPS-MOS linked dataset is useful since it can provide nationally representative information on patient-provider pair characteristics. To ascertain detailed medical condition diagnosis and medication use, we further linked the MEPS-MOS data with supplementary medical event files using a unique person identifier.

For this study, we included respondents aged 18 years and older with an identified USC provider. Based on each study outcome measure, we applied further inclusion and exclusion criteria (see Table S1, Supplemental Digital Content, http://links. lww.com/MD2/A185, which illustrates specific clinical quality measures) to restrict the study sample; for example, we restricted data to respondents with a diagnosis of diabetes when analyzing diabetes care quality measures. Provider's PCMH status was defined using a MOS question, "*Is the practice certified as a patient-centered medical home?*". We treated the response "yes" as a certified-PCMH provider and as a non-PCMH provider if responded otherwise.

2.2. Outcome variables

2.2.1. Quality of care. Using the quality of primary care measures from previous studies,[24–26] we employed 5 high-value (determined as appropriate and beneficial for those eligible individuals) and 2 low-value (as inappropriate or having no value) primary care composites to assess the quality of care for both PCMH and non-PCMH providers. Using this approach enables us to summarize quality of care across multiple indicators and help prioritize improvement in quality of care domains (see Table S1, Supplemental Digital Content, http://links.lww.com/ MD2/A185, which illustrates specific clinical quality measures). Briefly, each care composite is created by summing scores of selected similar health care measures (eg, measures of cholesterol, blood pressure, influenza vaccine, routine checkup, and dental checkup constitute diagnostic, and preventive testing/care composite). In total, we extracted 18 independent high-value care and 6 low-value care measures to create 7 quality of care composites. We estimated the prevalence of population receiving those health care services for each selected measure in the identified patient groups; firstly, we then constructed aggregated prevalence for each composite by dividing all instances under the same category by the number of times eligible individuals for those measures. For example, there are 3 measures for diabetic care; the number of times respondents were eligible for these 3 measures would constitute the denominator for the diabetic care composite, and the numerator would be the total number of respondents who received those 3 types of care.

2.2.2. Patient experience. Patient experience was measured with the survey instrument from the Consumer Assessment of Healthcare Providers and Systems, which included 17 items in total to measure the quality of care from the patient's perspective. Patient experience measures mainly contained three components: overall experience and satisfaction, which was ranged from 0 (worst health care possible) to 10 (best health care possible); access to care (eg, "how often got care right away?"; answers include "never," "sometimes," "usually,", and "always"); communication (eg, "how often doctors or other health providers spent enough time with a person?"; answers include "never," "sometimes," "usually," and "always"). We followed the previously validated methods to calculate the patient experience composite measures. We selected 8 items (4 items for care access and 4 items for provider-patient communication) and calculated top-box scores by dichotomizing responses. For overall satisfaction, we coded scores of 8, 9, or 10 (best experience) as positive responses; the rest of the experience items were coded as positive responses if answered with "always".[25] For example, if there are 80% of patients responded "always" to the question "how often doctors or other health providers spent enough time with a person?", the top-box score of this question is 80.

2.2.3. Health care utilization. We used hospital discharges and ED visits to measure the health care utilization for respondents cared for by PCMH and non-PCMH providers. We dichotomized these variables to indicate no visit and any visit (if the number of visits >zero).[25]

Later, in the subgroup analysis, we further specified ED visit types: urgent visits (emergency type) and nonurgent visits (including diagnosis or treatment, follow-up or postoperative visit, immunizations or shots, or other types).

2.2.4. Health care expenditures. Health care expenditures included the overall total health care expenditures and out-of-

pocket spending (expenditures paid by self or family members). For the analysis purpose, we added $1 to those who had zero values on overall total health care expenditure or out-of-pocket spending.[27] Therefore, the value of these variables was forced to be positive. We converted all the expenditures into 2016 dollars by using the consumer price indices for medical care.[28]

2.3. Patient and provider characteristics

We included both respondents' and providers' characteristics in the analyses. The respondents' characteristics include age (18–49, 50–64, and 65+ years), sex (male vs female), race/ethnicity (Non-Hispanic White, Non-Hispanic Black, Hispanic, Other), family income level (low, <200% federal poverty level [FPL]; middle, 200%–400% FPL; high, 400% FPL), education (less than high school, high school diploma, some college, and a college degree or higher education), marital status (married vs. not married), employment status (employment vs. unemployed), insurance status (any private, any public, not insured), current smoking (yes vs no), obesity (based on self-reported BMI >29.9), self-report health status (excellent/good vs fair/poor), and the number of chronic conditions (0, 1, 2, 3+). The providers' characteristics included the type of practice (independent practice, physician network, non-profit/government clinics, other types), staffing size (the number of physicians and nurse practitioners/physician assistants), having capitated contracts, and the percent of Medicaid patients.

2.4. Statistical analyses

Both patient and provider characteristics were compared by the PCMH status using the Wald χ^2 test. To examine the 3 main outcomes (quality of care, patient experience, and health care utilization), we constructed multivariate logistic regression models adjusting for patient and provider characteristics that showed statistical significance. The smallest Akaike information criterion defined the best-fitting model, and seven covariates were included in adjusted models: sex, obesity, practice type, the number of physicians, the number of nonphysicians, capitation contract, and the percentage of Medicaid patients. We examined the differences in total health care expenditure and out-of-pocket spending between PCMH and non-PCMH groups using generalized linear models with log link and gamma distribution, adjusting for all patient characteristics. Finally, we conducted a series of subgroup analyses to further test the changes of patient experience, health care utilization, and health care expenditures in 5 common chronic conditions (diabetes, cardiovascular diseases, chronic obstructive pulmonary disease, and chronic kidney disease [CKD]). We set a P value of <.05 to be statistically significant. To adjust for multiple testing, we used the Benjamini-Hochberg procedure, and adjusted P-values are reported.[29] All analyses were operated in SAS 9.4 (SAS Institute, Cary, NC). This study was approved exempt from review by the Institutional Review Board of the University of Florida.

3. Results

Table 1 shows the sociodemographic and clinical characteristics of the respondents and the characteristics of USC providers. A total of 5748 patient–provider pairs, which represent a weighted population of 56.2 million American adults aged 18 years and older, were included in the analysis. Of those, 2540 (44.2%) participants were cared for by PCMH certified providers. Except

for sex (P = .02) and obesity (P = .03), there was no significant difference in patient characteristics between the 2 groups. However, for USC characteristics, PCMH were more likely to be in physician network or nonprofit/government clinics, have more physicians and non-physician providers (nurses and physician assistants), capitated contracts, and a higher proportion of patients with Medicaid, compared to non-PCMH provider group (P for all <.001).

3.1. Performance on quality of care and patient experience

Table 2 presents the summary statistics for adjusted differences in high-value and low-value primary care between respondents cared for by PCMH certified and non-PCMH providers. There was no significant difference in the quality of care measures between PCMH and non-PCMH groups. The overall satisfaction, the experience of access to care, and communication with providers were also comparable (Table 3).

3.2. Performance on health care utilization

Figure 1 shows the adjusted difference in health care utilization between respondents cared for by PCMH and non-PCMH providers. 9.3% (95% confidence interval [CI], 7.6%–10.9%) of respondents cared for by PCMH and 11.4% (95% CI, 9.7%–13.2%) those cared for by non-PCMH had at least 1 inpatient stay. Similarly, 17.4% (95% CI, 15.2%–19.6%) of respondents cared for by PCMH and 18.5% (95% CI, 16.4%–20.6%) cared for by non-PCMH had at least 1 ED visit. We found no significant difference in inpatient stay or ED visits between the PCMH and non-PCMH groups. Nonurgent visits among those who had any ED visits were not significantly different between the 2 groups either (see Figure S1, Supplemental Digital Content, http://links.lww.com/MD2/A190, which shows adjusted difference in nonurgent emergency department visits).

3.3. Performance on health expenditure

Figure 2 depicts the adjusted differences in health care expenditures for respondents cared for by PCMH and non-PCMH providers. The annual total health care expenditures for those cared for by PCMH were $9050 (95% CI $8011–$10088), whereas the amount for those cared for by non-PCMH providers was $9266 (95% CI: $8350–$10182). Respondents cared for by PCMH and non-PCMH providers had $816 (95% CI: $654–$1018) and $892 (95% CI: $734–$1085) out-of-pocket spending, respectively. Although the predicted total health care expenditures and out-of-pocket spending were lower in the patients cared for by PCMH providers, none of the differences between the two groups were statically significant. We conducted a sensitivity analysis for health expenditures using 2-part models (part 1: logit and part 2: gamma distribution with a log link). The differences in total expenditure and out-of-pocket spending from the two-part models are similar to the results from generalized linear models (see Table S2, Supplemental Digital Content, http://links.lww.com/MD2/A186, which compares predicted total health expenditures and out-of-pocket spending between the 2 models).

3.4. Subgroup analysis

Table S3, Supplemental Digital Content, http://links.lww.com/MD2/A187, presents the adjusted differences in patient experience

Characteristics of respondents and paired certified-PCMH versus non-PCMH providers.

Characteristics	PCMH Estimates % (95% CI)[*]	Non-PCMH Estimates % (95% CI)[*]	P
Sample, n	2540	3208	
Weighted, n	24,809,532	31,405,634	
Age, y			.56
18–49	37.7 (34.0–41.3)	37.3 (34.0–40.6)	
50–64	32.1 (28.6–35.6)	30.3 (27.2–33.3)	
65+	30.2 (26.4–34.0)	32.4 (29.3–35.6)	
Sex			.02
Female	40.0 (37.3–42.6)	44.3 (42.2–46.5)	
Race/ethnicity			.91
Non-Hispanic White	71.9 (68.3–75.5)	70.4 (67.2–73.6)	
Non-Hispanic Black	8.9 (7.0–10.7)	9.3 (7.5–11.2)	
Hispanic	11.8 (8.9–14.7)	12.3 (10.2–14.4)	
Other	7.4 (5.5–9.3)	8.0 (6.3–9.6)	
Family income level			.90
Low income (<200% FPL)	27.5 (24.0–31.1)	26.6 (23.1–30.1)	
Middle income (200%–400% FPL)	26.4 (23.6–29.2)	27.1 (24.2–29.9)	
High income (>400% FPL)	46.1 (41.8–50.3)	46.3 (42.5–50.2)	
Education			.92
Less than high school	4.7 (3.5–6.0)	4.9 (4.0–5.8)	
High school diploma or GED	37.1 (33.8–40.5)	36.7 (33.6–39.8)	
Some college education	20.5 (17.8–23.3)	19.5 (17.0–21.9)	
College and above	37.6 (34.1–41.1)	38.9 (35.5–42.4)	
Marital status			.88
Married	56.6 (52.8–60.5)	56.2 (53.0–59.5)	
Employment			.51
Employed	57.8 (54.1–61.5)	56.3 (53.3–59.4)	
Insurance status			.12
Any private	69.7 (66.5–72.8)	70.6 (67.6–73.7)	
Any public	25.8 (22.8–28.7)	26.2 (23.2–29.2)	
Not insured	4.6 (3.5–5.7)	3.1 (2.3–4.0)	
Current smoking			.57
Yes	13.8 (12.0–15.5)	13.1 (11.4–14.8)	
Obese (BMI ≥30)			.03
Yes	33.2 (30.2–36.3)	37.5 (34.7–40.3)	
Self-reported health status			.92
Fair/poor	18.2 (15.5–20.8)	18.0 (15.9–20.0)	
No. of Comorbidity			.21
0	32.9 (29.8–36.0)	32.7 (29.7–35.7)	
1	28.4 (25.6–31.3)	25.2 (23.1–27.3)	
2	20.4 (18.0–22.7)	23.2 (20.8–25.5)	
3+	18.3 (15.4–21.1)	18.9 (16.8–21.1)	
Type of practice			<.001
Independent practice	47.5 (43.3–51.6)	64.9 (60.5–69.3)	
Physician network	23.4 (19.5–27.3)	18.1 (13.8–22.4)	
Nonprofit and government clinics	17.6 (14.3–20.9)	7.8 (6.0–9.6)	
Others	11.6 (8.4–14.7)	9.2 (7.1–11.4)	
No. of primary physicians			<.001
≤1	19.2 (15.9–22.4)	40.7 (35.8–45.7)	
2–5	41.8 (37.1–46.5)	36.7 (32.3–41.2)	
6–10	16.5 (13.3–19.7)	11.2 (7.6–14.8)	
≥11	22.5 (18.7–26.3)	11.4 (8.2–14.5)	
No. of nurse practitioners/physician assistants			<.001
0	22.1 (18.8–25.4)	30.0 (25.9–34.1)	
1	19.1 (15.1–23.1)	25.5 (21.2–29.8)	
2–3	27.4 (24.0–30.7)	22.0 (18.8–25.2)	
≥4	31.5 (27.0–35.9)	22.5 (18.0–27.0)	
Having capitated contracts			<.001
Yes	56.8 (52.1–61.5)	36.3 (32.7–39.9)	
Percentage of Medicaid patients			<.001
<10%	32.8 (28.4–37.2)	48.6 (44.2–52.9)	
10%–50%	48.6 (44.0–53.3)	38.1 (33.3–43.0)	
>50%	18.6 (15.8–21.4)	13.3 (10.3–16.2)	

PCMH = patient-centered medical home, FPL = federal poverty level, GED = general educational development, BMI = body mass index.

[*] Percentages are weighted to be nationally representative using recommended stratification, clustering and weighting by Agency for Healthcare Research and Quality.

Table 2

Adjusted Differences in high-value and low-value primary care for respondents aged 18 years and older cared for by certified PCMH and non-PCMH providers.

Type of primary care*	PCMH		Non-PCMH		Difference, % (95% CI)†	P‡	Adjusted§ P
	No.	Estimates % (95% CI)	No.	Estimates % (95% CI)			
High-value care							
Diabetes care composite	440	81.4 (75.1–87.7)	627	83.2 (78.6–87.7)	−1.8 (−10.0 to 6.5)	.67	.90
HbA1c	440	55.5 (47.8–63.1)	627	54.7 (48.5–61.0)	0.7 (−10.0 to 11.4)	.90	.90
Foot examination	440	68.6 (61.7–75.4)	627	65.5 (59.2–71.8)	3.1 (−7.2 to 13.3)	.56	.90
Eye examination	440	62.3 (56.3–68.4)	627	61.5 (55.6–67.4)	0.8 (−8.1 to 9.8)	.86	.90
Cancer screening composite	1795	77.5 (73.7–81.4)	2195	76.9 (74.1–79.6)	0.6 (−4.0 to 5.3)	.79	.90
Cervical cancer Screening	932	86.4 (82.3–90.4)	1042	86.9 (83.5–90.2)	−0.5 (−5.8 to 4.8)	.85	.90
Breast cancer Screening	668	81.6 (76.3–86.9)	820	81.1 (77.1–85.2)	0.5 (−6.6 to 7.5)	.90	.90
Colorectal cancer Screening	1200	73.9 (69.1–78.7)	1531	72.6 (69.1–76.1)	1.3 (−4.5 to 7.0)	.67	.90
Diagnostic and preventive testing/care composite	2540	98.2 (97.6–98.8)	3208	97.0 (96.2–97.9)	1.1 (0.1 to 2.2)	.03	.46
Cholesterol measurement	2061	98.2 (97.6–98.8)	2656	96.7 (95.7–97.7)	1.5 (0.3 to 2.6)	.01	.40
Blood pressure measurement	2540	99.3 (98.8–99.7)	3208	98.8 (98.4–99.2)	0.5 (−0.1 to 1.0)	.14	.72
Influenza vaccine	2540	57.0 (53.6–60.4)	3208	54.8 (51.7–57.9)	2.2 (−2.2 to 6.7)	.33	.85
Routine checkup	2540	87.7 (85.5–90.0)	3208	87.2 (85.4–89.0)	0.5 (−2.2 to 3.2)	.71	.90
Dental checkup	2340	47.6 (43.7–51.6)	2929	46.8 (43.2–50.5)	0.8 (−4.5 to 6.0)	.78	.90
Counseling composite	1918	67.2 (64.2–70.1)	2440	65.0 (62.2–67.8)	2.2 (−1.9 to 6.4)	.30	.84
Exercise counseling	1788	65.4 (62.0–68.7)	2306	63.7 (60.9–66.5)	1.7 (−2.7 to 6.1)	.46	.90
Smoking cessation counseling	358	75.9 (67.7–84.1)	442	74.0 (67.9–80.1)	2.0 (−8.2 to 12.1)	.71	.90
Medical treatment composite	985	32.2 (27.2–37.2)	1369	36.7 (31.0–42.3)	−4.4 (−12.2 to 3.3)	.26	.84
Anticoagulation for atrial fibrillation	116	49.5 (38.8–60.1)	150	60.8 (51.3–70.4)	−11.4 (−25.1 to 2.3)	.10	.80
Salicylates and/or platelet aggregation inhibitors for CAD/MI	452	14.6 (8.9–20.2)	637	13.4 (7.7–19.2)	1.1 (−7.0 to 9.2)	.79	.90
Beta blocker for CAD/MI	452	59.3 (51.6–67.0)	637	67.7 (60.5–74.9)	−8.4 (−19.3 to 2.4)	.13	.79
ACEi/ARB for diabetes & hypertension	489	64.3 (56.6–72.0)	721	63.2 (56.4–70.0)	1.1 (−8.9 to 11.2)	.83	.90
Antiplatelet for CVA	164	17.4 (10.0–24.8)	224	28.4 (19.8–36.9)	−11.0 (−21.6 to −0.3)	.04	.46
Low-value care							
Cancer screening composite	470	47.1 (40.1–54.2)	713	42 (36.2–47.9)	5.1 (−4.1 to 14.4)	.28	.84
Cervical cancer screening in women aged 65+	384	42.2 (34.4–50.0)	544	38.1 (32.1–44.2)	4.1 (−5.7 to 13.8)	.41	.90
Colorectal cancer screening in adults aged 75+	260	22.5 (14.3–30.6)	414	17.7 (12.4–22.9)	4.8 (−3.8 to 13.4)	.27	.84
Prostate cancer screening in men aged 75+	86	33.9 (21.6–46.2)	169	37.9 (28.6–47.2)	−4 (−20.4 to 12.4)	.63	.90
Medical treatment composite	1501	11.2 (8.8–13.5)	2048	12.4 (10.1–14.6)	−1.2 (−4.4 to 2.0)	.46	.90
Anxiolytics/sedatives/ hypnotics in adults 65+	834	7.6 (5.1–10.1)	1219	8.8 (6.6–11.1)	−1.2 (−4.8 to 2.3)	.50	.90
Benzodiazepine for depression	273	21.3 (15.2–27.3)	346	25.8 (19.4–32.1)	−4.5 (−12.8 to 3.9)	.29	.84
NSAID use for hypertension/heart failure/kidney disease	908	10.1 (6.9–13.2)	1208	10.8 (8.1–13.6)	−0.8 (−4.9 to 3.3)	.71	.90

A1c = hemoglobin A1c, ACEi = angiotensin converting enzyme inhibitor, ARB = angiotensin receptor blocker, CAD/MI = coronary artery disease / myocardial infarction, COPD = chronic obstructive pulmonary disease, CT = computed tomography, CVA = cerebral vascular accident, PCMH = patient-centered medical home.

* Detailed measure for high-value and low-vale care in appendix table 1.

† Positive difference, respondents cared for by PCMH received more high-value care; negative difference, respondents cared for by non-PCMH received more high-value care.

‡ Adjusted for sex, obesity, type of practice, staffing size, having capitated contracts, and the percent of Medicaid patients.

§ Used Benjamini-Hochberg procedure.

between respondents cared for by PCMH and those who cared for by non-PCMH providers for disease subgroups (diabetes, cardiovascular diseases, chronic obstructive pulmonary disease, and CKD). The only significant difference was observed in the communication composite for the CKD subgroup (difference, 30.1%; 95% CI, 15.2%–44.9%). Table S4, Supplemental Digital Content, http://links.lww.com/MD2/A188, shows the adjusted differences in health care utilization. Patients cared for by PCMH providers had significantly lower percentages of any ED visits (diabetes and CKD groups) compared to those who cared for by non-PCMH providers (P < .05 for all), whereas they had a significantly higher percentage of ED visits among the cancer subgroup (P = .03). Patients cared for by PCMH providers had no significant difference in total health expenditures or out-of-pocket spending compared to their counterparts (see Table S5, Supplemental Digital Content, http://links.lww.com/MD2/A189, demonstrates adjusted differences in health care expenditures for each disease subgroup).

4. Discussion

Using a nationally representative sample, our study explored the associations of having a certified-PCMH provider on quality of care, patient experience, health care utilization, and health expenditure. To the best of our knowledge, this is the first to comprehensively assess the quality of care and patient outcomes among US adults according to their providers' PCMH status. In contrast to our hypotheses, we found no significant differences in quality of care, patient experience, health care utilization, or health care expenditures between those cared for by PCMH and non-PCMH providers. These findings suggest that having a PCMH provider is not associated with the quality of care received and health expenditure; non-PCMH providers seem to perform as good as, or at least, not inferior to PCMH providers.

Primary care is an essential foundation for an effective national health care system. A well-functioning primary care delivery can lead to better health status, lower health disparities, and lower health care costs at the population level.[30,31] The Centers for

Table 3

Adjusted differences in patient experience for respondents aged 18 years and older cared for by certified PCMH and non-PCMH providers.

Patient experience	PCMH		Non-PCMH		Difference % (95% CI)*	P†	Adjusted‡ P
	No.	Estimates % (95% CI)	No.	Estimates % (95% CI)			
Overall satisfaction	2140	82.1 (79.4–84.8)	2690	81.6 (79.6–83.6)	0.5 (−3.0 to 3.9)	.80	.90
Access composite	2203	78.0 (75.4–80.6)	2813	78.4 (76.2–80.6)	−0.4 (−3.9 to 3.1)	.82	.90
Got care right away	762	66.4 (60.7–72.2)	1072	71.3 (67.7–74.9)	−4.9 (−12.1 to 2.4)	.19	.77
Got needed appointment	1983	60.7 (57.1–64.3)	2482	60.8 (57.7–64.0)	−0.2 (−4.9 to 4.6)	.95	.95
Easy to get care	1561	71.9 (68.7–75.1)	2032	69.0 (65.9–72.1)	2.9 (−1.7 to 7.5)	.21	.77
Easy to see specialist	1112	51.9 (47.3–56.4)	1437	59.2 (55.4–63.0)	−7.3 (−13.5 to −11.5)	.02	.22
Communication composite	2162	80.4 (77.5–83.2)	2719	81.6 (79.3–84.0)	−1.2 (−5.0 to 2.6)	.52	.90
Listened carefully	2141	66.8 (63.2–70.5)	2698	67.5 (64.7–70.3)	−0.6 (−5.6 to 4.3)	.80	.90
Showed respect	2154	70.1 (67.2–73.1)	2710	72.4 (69.7–75.0)	−2.2 (−6.4 to1.9)	.29	.80
Spent enough time	2156	58.4 (54.6–62.2)	2708	59.4 (56.4–62.5)	−1.0 (−5.8 to 3.7)	.67	.90
Explained easily	2156	65.5 (62.3–68.7)	2713	67.6 (64.6–70.6)	−2.1 (−6.7 to 2.5)	.38	.83

CI = confidence interval, PCMH = patient-centered medical home.

* Positive difference, respondents cared for by PCMH had better experience; negative difference, respondents cared for by non-PCMH has better experience.

† Adjusted for sex, obesity, type of practice, staffing size, having capitated contracts, and the percent of Medicaid patients.

‡ Used Benjamini-Hochberg procedure.

Medicare and Medicaid Services has started various primary care initiatives such as Primary Care First Model Options, Comprehensive Primary Care Initiative, and Comprehensive Primary Care Plus. Other private payers also have different payment reform and quality improvement initiatives that targeted primary care. All these efforts shared similar goals and measures with the PCMH model. Thus, it is possible that non-PMCH providers in this study were implementing some similar quality improvement programs or had spillover effects from existing PCMH programs. Phillips et al[32] found under the state-wide PCMH implementation in Illinois, primary care providers who did not participate had a spillover effect on Medicaid spending. Additionally, the overall quality of primary care might be improving over time. For example, Wong et al found that the quality of diabetes care
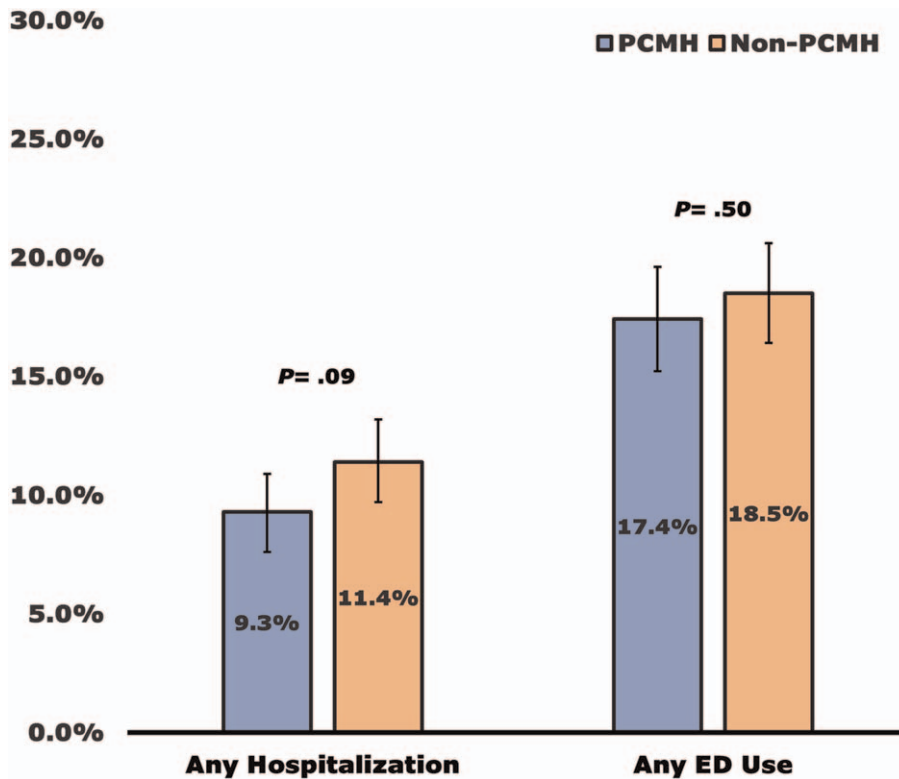

Figure 1. Adjusted health care utilization for respondents aged 18 years and older cared by certified PCMH and non-PCMH providers. Materials and methods: Multivariate logistic regression models adjusting for sex, obesity, practice type, the number of physicians, the number of non-physicians, capitation contract, and the percentage of Medicaid patients. Results: 9.3% of those with PCMHs had at least one inpatient stay in the past year, which was comparable to the 11.4% among those with non-PCMHs. Similarly, 17.4% of respondents cared for by PCMH and 18.5% cared for by non-PCMH had at least one ED visits. Definitions: Blue, respondents cared for by patient-centered medical home (PCMH); orange, respondents cared for by non-PCMH.
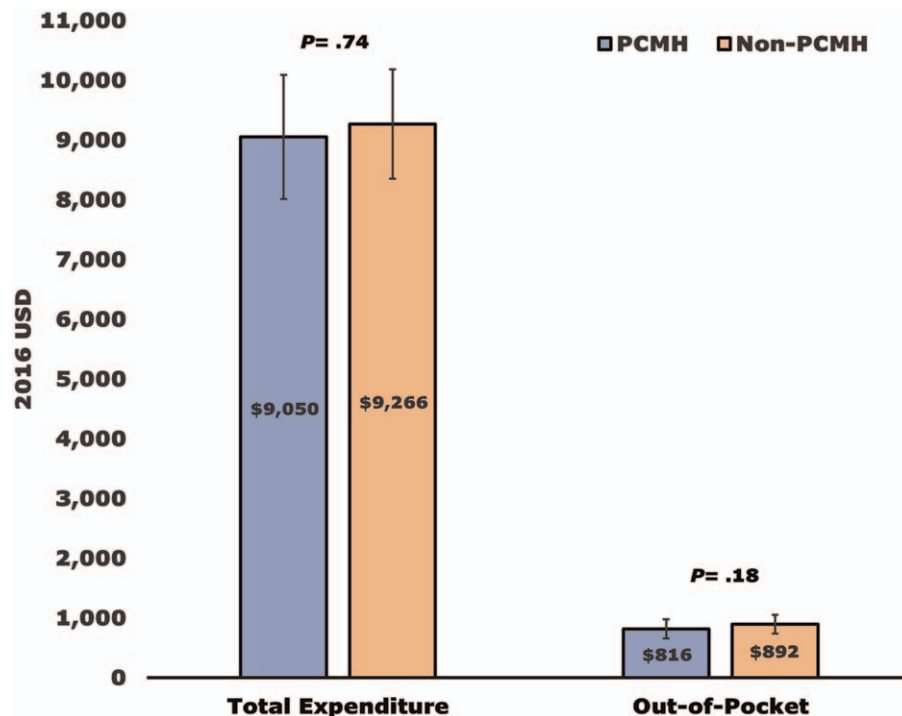
Figure 2. Adjusted differences in health care expenditures for respondents aged 18 years and older cared for by certified PCMH and non-PCMH providers. Materials and methods: Generalized linear models (GLMs) with log link and gamma distribution, adjusting for all patient characteristics. Results: The annual total health care expenditures for those cared for by PCMH were $9050, whereas the amount for those cared for by non-PCMH providers was $9266. Respondents cared for by PCMH and non-PCMH providers had $816 and $892 out-of-pocket spending, respectively. Definitions: Blue, respondents cared for by patient-centered medical home (PCMH); orange, respondents cared for by non-PCMH.

improved significantly from 2009 to 2014.[33] These external factors might ultimately moderate the difference in quality measures, health care utilization, and expenditures between PCMH and non-PCMH groups.

Patient experience is associated with health care utilization, treatment adherence, and health outcome.[34,35] The findings in this study suggest no significant difference in overall satisfaction, overall access, or overall communication between the study groups. Although the PCMH model advocates improving patient experience, a team-based approach may not be effective in improving patient experience.[36] It might rather diminish the intention of improvement of the patient experience. For example, patients see different physician or nophysician providers based on the various clinical needs under the PCMH model. This would make it more difficult to effectively build a patient–provider relationship than the conventional primary care that encourages continuity of care from a provider to whom a patient (or family) has an ongoing relationship.[15,37] In contrast, an already-established patient–provider relationship may lessen the effect of PCMH on patient experience. Studies reported that those having USC providers reported improvement in patient–provider communication and interaction quality.[35] Our study included individuals who had USC providers only, and the difference in overall satisfaction score between the PCMH and non-PCMH groups was minimal (82.1 vs 81.6); thus, it is possible that further improvement may be hard to be realized regardless of PCMH status (i.e., marginal diminishing returns).

We also found that respondents cared for by PCMH had lower patient experience in access to specialists (defined as easiness of seeing specialists). A potential explanation is that patients may

prefer to have more extensive freedom of choosing health care providers.[38,39] However, the PCMH model focuses on primary care and has a higher percentage of capitated care among practices; thus, those providers have more rules to restrict ineligible patients to be referred to specialty care. Barnett et al found having a preferred provider organization insurance plan was more likely to have annual new specialist visits than capitated health maintenance organization plans.[40] This might be one of the reasons that preferred provider organization has been more popular plan in the employer-based insurance market in recent years.[41,42] Although preventing unnecessary specialty care is a desired outcome in the primary care setting; it might negatively affect patient expectations and overall experience in the short run. It was suggested integrating PCMH with accountable care organization models would help to mitigate the pitfalls of access to specialized care under PCMH models.[43]

Overall, patients cared for by certified PCMH providers were less likely to use inpatient care and emergency care compared to those who were cared for by non-PCMH providers. However, all the differences were not statistically significant. According to a systematic review, no previous evidence showed PCMH model decreased hospitalization, whereas the effects on reducing ED visits were mixed.[10] Our subgroup analyses show the hospitalization and ED visits vary in different subpopulations; this suggests PCMH models may work better for certain groups which is consistent with previous studies.[10] Similarly, we did not find any significant differences in total health expenditures or out-of-pocket spending between PCMH and non-PCMH groups using generalized linear models. Existing studies showed total health expenditures were not consistently lower in PCMH

model.[10] However, decreased total costs may occur when a longer exposure to the PCMH model.[44] This may reflect the complex PCMH accreditation process and suggests that the providers need time to adjust their practice to achieve the benefits of PCMH model. Since we could not ascertain when the providers started the PCMH system in our study, the mixed length of exposure to PCMH leads to null findings. Additionally, not all PCMH models include reducing health costs as a major measure.[45] Thus, the overall economic effect of PCMH is attenuated.

5. Study limitation

Our study has several limitations. First, the PCMH model is not a well-defined manualized protocol; it lacks standard components at the national level. By contrast, various definitions of the PCMH model and several PCMH accreditation organizations existed in the country.[46,47] Some practices that are intended to participate in any PCMH incentive program are mandatory to complete a PCMH recognition program, whereas PCMH recognition is voluntary for many practices which might be different from their counterparts in the motivation of participation and the level of compliance to the rules. The current data lack detailed information to further capture the differences at the practice level among those certified-PCMH providers as well as between PCMH and non-PCMH providers. Second, the short observational window might not reflect the entire picture of the efforts of the PCMH model, especially the progress of the PCMH model in recent years. For example, as the most widely accepted PCMH model in the country, the National Committee for Quality Assurance's PCMH recognition program changed a previous three-year recognition cycle to annual check-in (in 2017).[45] This yearly evaluation mechanism can have affected the performance of certified-PCMH practices through intensive monitoring, evaluation, and continuous support. Further studies with updated data are warranted to confirm the associations observed in this study. Third, the nature of the cross-sectional study design and the constraints of the dataset restricted us from eliminating some potential confounding factors such as other quality improvement interventions in the control group, and the study design precludes the examination of the impacts of PCMH model overtime. However, we included both individual-level and paired provider-level characteristics in our analyses to minimize these potential effects compared to those studies that only controlled the individual-level factors.

6. Conclusions

In conclusion, no meaningful difference in quality of care, patient experience, health care utilization, or health care expenditures between respondents cared for by PCMH and non-PCMH has been found. Our findings suggest that the PCMH model is not superior in the quality of care delivered to non-PCMH providers. Regardless of PCMH certification, primary care providers seem to perform equally. Adopting and optimizing practical performance measures by varying degrees of risk adjustment in patient populations may be needed to better reflect the quality of care in PCMH models. Studies focusing on examining variations in the PCMH performance using longitudinal data that includes detailed provider characteristics are needed to inform future PCMH model and ongoing health care reform.

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