

Impact of Medical Homes on Quality, Healthcare Utilization, and Costs

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Objectives: To assess baseline quality metrics, healthcare utilization, and costs of commercially insured patients treated at practices participating in a patient-centered medical home (PCMH) pilot.

Study Design: Observational cohort study utilizing claims data for patients treated at PCMH and non-PCMH practices.

Methods: Data from Empire Blue Cross and Blue Shield, 1 of 14 plans in the HealthCore Integrated Research Database, were queried for patients identified based on visits to PCMH and non-PCMH practices during 2007-2008; outcome metrics were formulated from the baseline calendar year, 2009. Differences in healthcare utilization were determined with χ^2 and 2-sample *t* tests. Regression models were used to test differences in adjusted emergency department (ED) use, inpatient services, and costs.

Results: The study included 31,032 PCMH and 350,015 non-PCMH patients. Among PCMH-treated patients, diabetics had higher rates of glycated hemoglobin testing; cardiovascular disease patients had higher rates of testing and better low-density lipoprotein cholesterol control; imaging rates for low back pain were lower; among pediatric patients, inappropriate antibiotic use for nonspecific or viral respiratory infections was lower. PCMH-treated adults and children had 12% and 23% lower odds of hospitalization, and required 11% and 17% fewer ED services, respectively, than non-PCMH patients. Risk-adjusted total per member per month costs were 8.6% and 14.5% lower for PCMH-treated pediatric and adult patients, respectively ($P < .01$).

Conclusions: PCMH practices in this pilot were associated with better preventive health, higher levels of disease management, and lower resource utilization and costs in 2009 compared with practices not pursuing PCMH status.

(*Am J Manag Care.* 2012;18(9):534-544)

For author information and disclosures, see end of text.

Amidst dwindling economic resources and shrinking health-care budgets, patient-centered medical homes (PCMHs) are gaining traction as an innovative approach for improving healthcare quality while reducing costs.¹⁻⁴ With solid emphasis on preventive care² and primary care,⁵⁻⁷ the PCMH model seeks to improve the continuum of patient care⁸ and drive efficiency by reconfiguring the primary care system.^{2,4,9} First introduced for pediatric patients in the 1960s,¹⁰ the PCMH concept now enjoys more support because of its broader potential in chronic disease management¹¹⁻¹⁴ and for the enhancement of the vital triple outcomes: quality, cost, and the experiences of patients, their families, and providers.^{5,15}

The PCMH approach seeks to replace volume-based financial incentives for providers (eg, reimbursements tied to numbers of visits, laboratory tests, and procedures) with more coordinated care that targets better patient outcomes.¹¹ Practices typically seek recognition from accredited entities such as the National Committee for Quality Assurance (NCQA),¹⁶ which requires the satisfaction of a number of well-defined “must-pass” requirements (Table 1).^{17,18} Two prominent practice models have emerged: consultative, in which practices engage external consultants to help them navigate the transformation period; and enhanced chronic care models, which pursue PCMH recognition by enhancing their core capabilities in caring for chronic illnesses.¹⁹

In a study of 7 PCMH demonstrations, Fields et al showed annual reductions in hospitalizations (6% to 40%) and emergency department (ED) visits (7.3% to 29%), suggesting improvements in quality, and total annual savings ranging from \$71 to \$640 per patient.²⁰ The practices did not focus on chronic care exclusively, and one, the Colorado Medical Homes for Children, reported total mean annual savings of \$169 for all patients versus \$530 for patients with chronic conditions.²⁰ Transformation to PCMH status, however, could be a long and complicated process, as Nutting et al observed in a study of the first national PCMH demonstration (36 practices) that spanned from June 2006 to May 2008.²¹ Apart from payment reforms, PCMH transformation entails numerous adjustments such as learning new or redesigned service delivery models, changed perceptions about patient-provider relationships, and the need for extended periods of external guidance, among others.²¹

Increasing evidence suggests that the PCMH model offers greater advantages to stakeholders than non-

In this article
Take-Away Points / p535
www.ajmc.com
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PCMH practices in treatment delivery, especially for chronic care. To date, however, much of the available data have been derived from pre-PCMH versus post-PCMH comparisons, which provide a limited picture of changes from baseline to full-fledged PCMH status.^{14,21-25} Only a few more than a third of the demonstration projects nationwide used non-PCMH controls in their comparisons,¹⁹ and in 7 studies evaluated by Fields et al, only 1 study used a control.²⁰ A control population enhances the robustness and reliability of the results in comparison studies.²⁶

The main objective of this study was to compare PCMH practices during their prerecognition phase with non-PCMH practices to assess important quality differences in healthcare delivery and costs that may already be evident during the transformative baseline period. This study, the first of its kind in a large commercially insured population, compared key elements of the vital triple outcomes for PCMH practices, with particular emphasis on quality, including appropriate prevention, screening, and care of common chronic conditions; laboratory evaluations; and cost improvements.

METHODS

This study compared patients treated within primary care practices classified as PCMH and non-PCMH, and located within the same geographic region. All practices (both PCMH [10] and non-PCMH [202]) were located within the 5 boroughs of New York City and its suburbs in Nassau County, Suffolk County, and Westchester County, were part of the Empire Blue Cross and Blue Shield (BCBS) network, and received payment according to existing negotiated fee schedules. The 10 practices in the PCMH category achieved NCQA recognition in 2010. The PCMH practices employed 247 physicians at 86 different locations. The 202 non-PCMH practices operated from 898 different sites and employed a total of 4048 physicians; non-PCMH practice sizes ranged from 1 to 250 providers.

Data Source

Data on the patients treated by the practices were drawn from the HealthCore Integrated Research Database, which contains medical and pharmacy claims from 14 commercial healthcare plans in the northeastern, southeastern, mid-Atlantic, Midwestern, and western regions of the United States. Data for 2007 through 2009 were selected for 1 northeastern managed care plan, Empire BCBS, relative to its PCMH initiative that started in August 2010. Data handling in this

Take-Away Points

Baseline quality metrics, healthcare utilization, and costs for commercially insured patients treated at practices participating in a patient-centered medical home (PCMH) pilot were assessed.

- Compared with patients treated in practices not pursuing PCMH status, patients treated within PCMH practices had equal or better care management; lower rates of high-cost diagnostic imaging procedures, emergency department visits, and hospitalizations; and lower resource utilization and costs.
- Providers using the PCMH model may have an opportunity to offer enhanced patient care even during early transformation.

observational retrospective study complied with the Health Insurance Portability and Accountability Act of 1996.

Study Design

This study included administrative claims data from 2 periods: (1) the identification period of 2007 to 2008 and (2) the measurement period of calendar year 2009. Administrative claims for calendar years 2007 and 2008 were used for patient-provider attribution; a patient was attributed to the single provider with whom the patient had the highest number of office visits based on the patient's medical records in 2007 and 2008. Patients attributable to multiple providers were assigned to the provider visited most recently. Patients were then classified as PCMH or non-PCMH according to the PCMH recognition status as of 2010 for the provider to whom they were attributed. Members who had at least 2 visits to a practice that had not achieved PCMH recognition in 2010 were assigned to the non-PCMH control group. Data in the second period, calendar year 2009, were used to examine patients' outcome metrics.

Inclusion/Exclusion Criteria

The study's inclusion criteria required that the patients be treated at primary care practices located within specific zip codes and that the practices participate in the BCBS network. There were no age restrictions on patients, but members who were older than 65 years at baseline (January 1, 2009) were excluded from the analysis to avoid any service complications or potential missing expenditures associated with Medicare eligibility. Members without continuous eligibility during calendar year 2009 were also excluded from the analysis to avoid any incompleteness in the data set.

Outcome Measures

The processes and clinical metrics in this analysis focused on appropriate prevention of and care for chronic conditions, derived from a selection of measures in the Healthcare Effectiveness Data and Information Set (HEDIS).²⁷⁻²⁹ We measured appropriate markers for disease control, where applicable (eg, laboratory tests for glycated hemoglobin [A1C] and low-den-

■ **Table 1.** NCQA’s “Must-Pass” Elements for PCMH Recognition^a

Must-Pass Elements ^b
Written standards for patient access/communication
Use of data to demonstrate that standards for patient access and communication are met
Use of paper or electronic charting tools to organize clinical information
Use of data to identify important diagnoses and conditions in practice
Adoption and implementation of evidence-based guidelines for 3 chronic or important conditions
Active support of patient self-management
Systematic tracking of tests and follow-up on test results
Systematic tracking of critical referrals
Measurement of clinical and/or service performance
Performance reporting by physician or across the practice

NCQA indicates National Committee for Quality Assurance; PCMH, patient-centered medical home.
^aData were derived from references 17 and 18.
^bLevel 1 recognition requires practices to comply with at least 5 of the must-pass elements. Level 2 or 3 recognition is based on attaining required scores and complying with the 10 must-pass elements.

sity lipoprotein cholesterol [LDL-C]), which were adapted from the HEDIS measures (Table 2). Also compared were rates of eye examinations (retinal) and medical attention for nephropathy for diabetic patients, imaging procedures for low back pain that were not supported by appropriate diagnoses, and appropriate testing of children with pharyngitis. Appropriate medication usage was assessed, including antibiotic use among children with nonspecific or viral upper respiratory tract infections and among adults with acute bronchitis, as well as the use of long-term controller medications among patients with persistent asthma. This study also evaluated the rates of inpatient hospitalization and use of ED services, and costs for PCMH and non-PCMH patients.

This analysis assessed 2 types of costs: medical costs only and total costs on a per member per month (PMPM) basis. Allowed medical costs included plan-paid and patient out-of-pocket costs (deductibles, copayments, and coinsurance) associated with medical claims only, which allowed for the inclusion of members who did not receive their pharmacy benefits through BCBS. Total costs represented the aggregate of allowed costs associated with both medical and pharmacy claims, and applied to members who received both their medical and pharmacy benefits from BCBS only. Members with zero PMPM costs were excluded from the cost analyses as these cases could potentially distort the analysis.

Statistical Analysis

Chi-square and 2-sample *t* tests were used to assess the statistical significance of any differences in preventive services and care management between the PCMH and non-PCMH cohorts. Statistical models were fitted individually to the pediatric and adult groups. Logistic regression models were used to test differences in adjusted rates of inpatient hospitaliza-

tion and use of ED services, with covariates including age, sex, health plan type, and Deyo-Charlson comorbidity index (DCI) scores that were calculated from claims between July 1, 2008, and December 31, 2008, depending on their clinical merit and potential importance.³⁰ Differences in costs were analyzed with multivariate generalized linear regression modeling, using gamma distribution and log link function because of its applicability to continuous variables with highly skewed distribution. To risk-adjust costs, multivariate generalized linear regression models were fitted for costs based on non-PCMH cohorts’ data. The cost models included age, sex, health plan type, and DCI score as covariates because of their clinical importance to healthcare utilization.³¹ Female patients, older patients, and patients with greater comorbidity burdens were likelier to utilize healthcare services. We also adjusted for health plan types (health maintenance organizations, preferred provider organizations, point-of-service plans) to account for potential differences due to benefit design or variations in insurance products. Cost models were used to predict the costs for each patient in the PCMH cohort given an individual’s age, sex, health plan type, and DCI score, and predicted costs were presented as risk-adjusted costs.³² To address outlier issues in the costs data, PMPM caps were applied in accordance with actuarial standards (\$8333.33 for pediatrics and \$20,833.33 for adults). Statistical analyses were conducted with SAS 9.1 software (SAS Institute Inc, Cary, North Carolina). The alpha level was set at .05 for each test.

RESULTS

Patients’ Clinical and Demographic Characteristics at Baseline

This study included 31,032 patients in the PCMH co-

■ **Table 2.** Definition of Appropriate Care^a

Condition	Eligible Cohort	Measures of Appropriate Care
Diabetes	Age range: 18 to 75 y <i>Diagnoses criteria:</i> (1) diagnosed with diabetes twice in outpatient or nonacute inpatient setting or (2) diagnosed with diabetes once in acute inpatient/ED setting	Having each of the following in 2009: • A1C testing • Eye exam (retinal) • LDL-C screening • Medical attention for nephropathy
Cardiovascular disease	Age range: 18 to 75 y <i>Diagnoses criteria:</i> (1) discharged alive from inpatient setting after acute myocardial infarction or coronary artery bypass graft or (2) discharged alive after percutaneous transluminal coronary angioplasty or (3) diagnosed with ischemic vascular disease twice: once in any outpatient setting and once in an acute inpatient setting	Having 1 LDL-C test in 2009
Low back pain	Age range: 18 to 50 y <i>Diagnoses criteria:</i> diagnosed with low back pain in principal diagnosis field in an outpatient or ED setting	Avoidance of having imaging test in 2009
Respiratory condition: pharyngitis	Age range: 2 to 18 y <i>Diagnoses criteria:</i> diagnosed with pharyngitis in an outpatient or ED setting and dispensed an antibiotic for that episode of care	Having a group A streptococcus test
Respiratory condition: nonspecific or viral upper respiratory infection	Age range: 3 mo to 18 y <i>Diagnoses criteria:</i> diagnosed with upper respiratory infection without other conditions in an outpatient or ED setting	Avoidance of antibiotic prescription in 2009
Respiratory condition: acute bronchitis	Age criteria: 18 to 64 y <i>Diagnoses criteria:</i> diagnosed with acute bronchitis in an outpatient or ED setting	Avoidance of antibiotic prescription in 2009
Respiratory condition: persistent asthma	Age range: 5 to 50 y <i>Diagnoses criteria:</i> (1) diagnosed with asthma in principal diagnosis field in either acute inpatient or ED setting or (2) diagnosed with asthma 4 times in outpatient settings and dispensed asthma medication twice or (3) dispensed asthma medication 4 times	Prescription of long-term asthma controller

A1C indicates glycated hemoglobin; ED, emergency department; LDL-C, low-density lipoprotein cholesterol.

^aData were derived from references 27-29.

hort and 350,015 patients in the non-PCMH cohort, each of which had a greater proportion of females ($P < .01$).

Pediatric Population

The pediatric population (<18 years old) had 14,434 members in the PCMH cohort and 77,810 in the non-PCMH group; mean (\pm SD) age and sex distributions were similar (**Table 3A**). A greater proportion of the PCMH-treated pediatric patients (51.0%) had pharmacy benefits through BCBS versus 43.5% in the non-PCMH group ($P < .001$). Asthma (7.3% and 8.0%), bronchitis (5.7% and 6.0%), and strep throat (10.3% and 7.4%) were among the most common ailments in the PCMH and non-PCMH groups, respectively. In the PCMH cohort, 7.2% had a DCI score of 1 to 2 compared with 6.2% in the non-PCMH cohort; higher DCI scores indicate greater comorbidity burden.³⁰

Adult Population

There were 16,598 and 272,205 adults aged 18 to 64 years in the PCMH and non-PCMH cohorts, with a mean (\pm SD) age of 41.1 (\pm 13.3) and 42.4 (\pm 12.5) years, respectively (**Table 3B**). HMOs and preferred provider organizations were the dominant payers, and more PCMH members had pharmacy benefits compared with the non-PCMH members ($P < .001$). The most prevalent conditions were hypertension (17.8% and 22.3%), hypercholesterolemia (19.1% and 23.0%), and diabetes (7.9% and 8.3%) in the PCMH and non-PCMH groups, respectively. A DCI severity score of 1 to 2 was reported for 11.9% of the PCMH and 13.1% of the non-PCMH groups ($P < .001$).

Appropriate Care Metrics

There were 1101 diabetic patients in the PCMH cohort and 14,401 in the non-PCMH cohort. A significantly larger

■ **Table 3A.** Baseline Characteristics of PCMH and Non-PCMH Members Aged <18 Years

Characteristics	All		PCMH Members		Non-PCMH Members		P
	No.	%	No.	%	No.	%	
No. of patients	92,244		14,434		77,810		
Age as of index date, mean ± SD, y	8.41 ± 5.27		8.35 ± 5.15		8.43 ± 5.29		.134
Age category, y							
0-5	32,041	34.74	4954	34.32	27,087	34.81	<.004
6-12	34,430	37.32	5647	39.12	28,783	36.99	
13-17	25,773	27.94	3833	26.56	21,940	28.20	
Sex							
Female	45,024	48.81	7117	49.31	37,907	48.72	.193
Male	47,220	51.19	7317	50.69	39,903	51.28	
Type of health plan							
HMO	34,020	36.88	6090	42.19	27,930	35.90	<.001
Preferred provider organization	44,665	48.42	6445	44.65	38,220	49.12	
Point of service	884	0.96	115	0.80	769	0.99	
Other	12,125	13.14	1718	11.90	10,407	13.37	
Unknown	550	0.60	66	0.46	484	0.62	
Condition							
Asthma	7252	7.86	1049	7.27	6203	7.97	.004
Bronchitis	5445	5.90	817	5.66	4628	5.95	.178
Diabetes	392	0.42	61	0.42	331	0.43	.962
Hypertension	615	0.67	98	0.68	517	0.66	.844
Hypercholesterolemia	1018	1.10	122	0.85	896	1.15	.001
Obesity ^a	819	0.89	111	0.77	708	0.91	.098
Strep throat	7215	7.82	1481	10.26	5734	7.37	<.001
Have pharmacy benefit	41,164	44.63	7357	50.97	33,807	43.45	<.001
DCI score							
Mean	0.07	0.31	0.08	0.32	0.07	0.31	.002
0	86,323	93.58	13,392	92.78	72,931	93.73	<.001
1-2	5839	6.33	1033	7.16	4806	6.18	
3	82	0.09	9	0.06	73	0.09	

DCI indicates Deyo-Charlson Comorbidity Index; HMO, health maintenance organization; PCMH, patient-centered medical home; SD, standard deviation.
^aObesity is under-reported in claims data.

proportion of the diabetic patients in the PCMH group received A1C testing compared with the non-PCMH group (82.1% vs 77.7%; $P < .001$). Although the prevalences of LDL-C screening and eye examinations were roughly similar between 2 cohorts, a greater proportion of non-PCMH diabetic patients received medical attention for nephropathy ($P = .01$) (Table 4A). There were 1367 and 32,193 patients with cardiovascular disease in the PCMH and non-PCMH cohorts, respectively, and a larger proportion in the PCMH cohort received LDL-C screening compared with the non-PCMH cohort (75.9% vs 73.5%, $P = .05$). Among patients

presenting with lower back pain, a smaller proportion of the PCMH group received diagnostic imaging procedures compared with non-PCMH patients ($P = .001$). A significantly larger percentage of children with pharyngitis in the PCMH group received appropriate testing (97.4% vs 90.9%, $P = .001$), and antibiotic use among children was proportionately lower for the PCMH cohort compared with the non-PCMH cohort (27.5% vs 35.4%; $P = .001$). PCMH-treated asthma patients had greater use of long-term controller medication compared with non-PCMH-treated asthma patients (99.4% vs 97.9%, $P = .05$).

Impact of Medical Homes on Patient Services

■ Table 3B. Baseline Characteristics of PCMH and Non-PCMH Members Aged 18 to 64 Years

Characteristics	All		PCMH Members		Non-PCMH Members		P
	No.	%	No.	%	No.	%	
No. of patients	288,803		16,598		272,205		
Age as of index date, mean ± SD	42.29 ± 12.53		41.05 ± 13.28		42.36 ± 12.48		<.001
Age category, y							
18-24	27,786	9.62	2304	13.88	25,482	9.36	<.001
25-34	59,872	20.73	3388	20.41	56,484	20.75	
35-44	68,451	23.70	3849	23.19	64,602	23.73	
45-54	73,454	25.43	3744	22.56	69,710	25.61	
55-64	59,240	20.51	3313	19.96	55,927	20.55	
Sex							
Female	162,358	56.22	9265	55.82	153,093	56.24	.288
Male	126,445	43.78	7333	44.18	119,112	43.76	
Type of health plan							
HMO	103,887	35.97	5766	34.74	98,121	36.05	<.001
Preferred provider organization	129,294	44.77	7692	46.34	121,602	44.67	
Point of service	2079	0.72	79	0.48	2000	0.73	
Other	51,933	17.98	2952	17.79	48,981	17.99	
Unknown	1610	0.56	109	0.66	1501	0.55	
Condition							
Asthma	14,177	4.91	634	3.82	13,543	4.98	<.001
Bronchitis	22,208	7.69	886	5.34	21,322	7.83	<.001
Diabetes	23,796	8.24	1314	7.92	22,482	8.26	.120
Hypertension	63,527	22.00	2949	17.77	60,578	22.25	<.001
Hypercholesterolemia	65,878	22.81	3166	19.07	62,712	23.04	<.001
Obesity ^a	4058	1.41	238	1.43	3820	1.40	.745
Strep throat	2378	0.82	175	1.05	2203	0.81	.001
Have pharmacy benefit	143,059	49.54	9333	56.23	133,726	49.13	<.001
DCI score							
Mean	0.26	0.84	0.22	0.77	0.27	0.85	<.001
0	244,909	84.80	14,339	86.39	230,570	84.70	<.001
1-2	37,757	13.07	1981	11.94	35,776	13.14	
3	6137	2.12	278	1.67	5859	2.15	

DCI indicates Deyo-Charlson Comorbidity Index; HMO, health maintenance organization; PCMH, patient-centered medical home; SD, standard deviation.

^aObesity is under-reported in claims data.

Clinical Outcome Metrics

More than half of the diabetic patients who had recorded test results achieved A1C control (<7%) and LDL-C control at <100 mg/dL level, but the difference between the PCMH and non-PCMH groups was not significant ($P = .70$ for A1C control; $P = .40$ for LDL-C control). Among patients with cardiovascular disease, however, 48.7% and 51.0% in the PCMH and non-PCMH cohorts had recorded LDL-C values, and 64.7% and 57.3% achieved LDL-C control (<100 mg/dL) ($P < .001$), respectively (Table 4B).

Hospitalization and Emergency Department Utilization

Table 5A provides unadjusted hospitalization and ED utilization rates for patients in the 2 cohorts stratified by age (<18, 18-44, 45-64 years). In the PCMH cohort, both pediatric patients and patients aged 18-44 years had significantly fewer hospitalizations and ED visits compared with non-PCMH patients within the same age category ($P < .001$). However, among patients aged 45 to 64 years, hospitalizations were reported for 8.1% of the eligible patients in the PCMH cohort

■ **Table 4A.** Appropriate Care Metrics for PCMH and Non-PCMH Patients

Metrics	PCMH Members			Non-PCMH Members			P
	No. Eligible	No. Who Met Criteria	%	No. Eligible	No. Who Met Criteria	%	
Diabetes mellitus population							
A1C testing performed ^a	1101	904	82.11	14,401	11,195	77.74	<.001
LDL-C screening performed ^a	1101	899	81.65	14,401	11,464	79.61	.103
Eye exam (retinal) performed	1101	497	45.14	14,401	6109	42.42	.079
Medical attention for nephropathy	1101	855	77.66	14,401	11,637	80.81	.011
Cardiovascular disease population							
LDL-C screening performed ^a	1367	1038	75.93	32,193	23,666	73.51	.047
Low back pain population							
Use of imaging for low back pain (lower rates are better)	868	413	47.58	17,308	9216	53.25	.001
Respiratory conditions population							
Appropriate testing of children with pharyngitis	1028	1001	97.37	4539	4127	90.92	<.001
Antibiotic use among children with nonspecific or viral upper respiratory diagnosis ^b (lower rates are better)	426	117	27.46	2865	1014	35.39	.001
Antibiotic use among adults with acute bronchitis ^b (lower rates are better)	278	239	85.97	6706	5699	84.98	.651
Use of long-term controller medications among members with persistent asthma ^b	352	350	99.43	3209	3141	97.88	.046

A1C indicates glycated hemoglobin; LDL-C, low-density lipoprotein cholesterol; PCMH, patient-centered medical home.

^aIdentified based on Current Procedural Terminology codes on medical claims or results from laboratory data.

^bRequire pharmacy benefit.

■ **Table 4B.** Quality Outcomes for PCMH and Non-PCMH Patients

Metrics	PCMH Members		Non-PCMH Members		P
	No.	%	No.	%	
Diabetes mellitus population					
	1101	100.00	14,401	100.00	NA
A1C testing performed ^a	904	82.11	11,195	77.74	.001
A1C lab results recorded	258	23.43	7785	54.06	<.001
A1C control (<7.0%) among people with recorded lab results	144	55.81	4453	57.20	.658
LDL-C screening performed ^a	899	81.65	11,464	79.61	.103
LDL-C value recorded	590	53.59	8477	58.86	.001
LDL-C control (<100 mg/dL) among people with recorded test	368	62.37	5148	60.73	.429
Cardiovascular disease population					
	1367	100.00	32,193	100.00	—
LDL-C screening performed ^a	1038	75.93	23,666	73.51	.047
LDL-C value recorded	666	48.72	16,430	51.04	.093
LDL-C control (<100 mg/dL) among people with recorded test	431	64.71	9419	57.33	<.001

A1C indicates glycated hemoglobin; LDL-C, low-density lipoprotein cholesterol; PCMH, patient-centered medical home.

^aIdentified based on Current Procedural Terminology codes on medical claims or results from laboratory data.

Table 5A. Unadjusted Hospitalization and Emergency Department Utilization for PCMH and Non-PCMH Patients

Utilization	PCMH Members				Non-PCMH Members				P
	No. Eligible	No. Who Met Criteria	%	Rates per 1000	No. Eligible	No. Who Met Criteria	%	Rates per 1000	
Age <18 y	13,645		15.7		73,432		84.3		
Inpatient hospitalization	13,645	311	2.3	23	73,432	2152	2.9	29	<.001
ED visits	13,645	1871	13.7	137	73,432	11,698	15.9	159	<.001
Age 18-44 y									
Inpatient hospitalization	9541	642	6.7	67	146,568	11,057	7.5	75	.003
ED visits	9541	1222	12.8	128	146,568	21,258	14.5	145	<.001
Age 45-64 y									
Inpatient hospitalization	7057	571	8.1	81	125,637	11,816	9.4	94	<.001
ED visits	7057	782	11.1	111	125,637	14,858	11.8	118	.059

ED indicates emergency department; PCMH, patient-centered medical home.

Table 5B. Adjusted Hospitalization and Emergency Department Utilization for PCMH and Non-PCMH Patients

Utilization	Point Estimate Odds Ratio	95% Wald Confidence Limits
Pediatric		
Inpatient hospitalization	0.765	0.682, 0.858
ED visits	0.831	0.790, 0.874
Adult		
Inpatient hospitalization	0.878	0.827, 0.933
ED visits	0.886	0.844, 0.930

ED indicates emergency department; PCMH, patient-centered medical home.

versus 9.4% in the non-PCMH cohort ($P < .001$), whereas ED use in the cohorts was not significantly different ($P = .06$). After risk adjustment, the PCMH cohort had significantly lower rates of hospitalization and ED use compared with the non-PCMH cohort in both the adult and the pediatric populations (Table 5B).

Healthcare Costs

Medical Costs. Among the pediatric patients, the mean (\pm SD) unadjusted PMPM medical costs for PCMH-treated patients were lower than those of non-PCMH patients: \$141 (\pm \$391) compared with \$155 (\pm \$476) ($P = .01$). PCMH-treated adults also had lower average PMPM medical costs than non-PCMH adults ($P = .01$). After adjusting for risks, medical costs were 6.8% and 12.7% lower in the PCMH cohort versus the non-PCMH cohort for the pediatric and adult populations, respectively (Table 6A).

Total Costs. Table 6B shows unadjusted total costs for patients with both medical and pharmacy benefits by pediatric and adult categories. PCMH-treated pediatric patients had lower total costs PMPM on average ($P = .02$) but similar median costs compared with non-PCMH pediatric pa-

tients. In the adult population, the mean (\pm SD) PMPM total costs were \$481 (\pm \$1184) in the PCMH cohort versus \$584 (\pm \$1476) in the non-PCMH cohort ($P = .01$). Risk-adjusted total costs were 8.6% and 14.5% lower for the PCMH cohort than the non-PCMH cohort in pediatric and adult populations, respectively.

DISCUSSION

The PCMH practices in this study had performances that were consistent with those reported in prior studies that evaluated PCMH-related improvements in hospitalization rates, ED utilization, and costs in pilot and demonstration projects.^{19,20,33,34} This study is unique in the comprehensiveness of the outcome measures and the use of a control population from the same geographic area. In this study, the practices in the PCMH cohort were selected because of their ability to adopt the NCQA criteria during the baseline period; they were progressive both in their organizational culture and in their care-delivery infrastructure. Our findings add further support to the contention that practices operating in a style consistent with the PCMH model have a propensity toward

■ **Table 6A.** Medical Costs for PCMH and Non-PCMH Patients With Medical Benefit

Age Group	PCMH ^a	Non-PCMH ^b	Difference
Pediatric			
Unadjusted PMPM	\$141.45	\$155.34	-8.94%
Risk-adjusted PMPM	\$161.10	\$172.78	-6.76%
Adult			
Unadjusted PMPM	\$408.84	\$484.16	-15.56%
Risk-adjusted PMPM	\$449.99	\$515.13	-12.65%

PCMH indicates patient-centered medical home; PMPM, per member per month; SD, standard deviation.
^aFor PCMH pediatric patients, mean ± SD (median) values were \$141.45 ± \$391.05 (\$61.27). For PCMH adult patients, mean ± SD (median) values were \$408.84 ± \$1091.99 (\$135.55).
^bFor non-PCMH pediatric patients, mean ± SD (median) values were \$155.34 ± \$475.97 (\$59.74). For non-PCMH adult patients, mean ± SD (median) values were \$484.16 ± \$1345.76 (\$145.07).

■ **Table 6B.** Total Costs for PCMH and Non-PCMH Patients With Both Medical and Pharmacy Benefits

Age Group	PCMH ^a	Non-PCMH ^b	Difference
Pediatric			
Unadjusted PMPM	\$169.68	\$187.79	-9.64%
Risk-adjusted PMPM	\$210.06	\$229.86	-8.62%
Adult			
Unadjusted PMPM	\$481.02	\$583.89	-17.62%
Risk-adjusted PMPM	\$546.26	\$638.87	-14.50%

PCMH indicates patient-centered medical home; PMPM, per member per month; SD, standard deviation.
^aFor PCMH pediatric patients, mean ± SD (median) values were \$169.68 ± \$479.72 (\$71.41). For PCMH adult patients, mean ± SD (median) values were \$481.02 ± \$1183.72 (\$185.40).
^bFor non-PCMH pediatric patients, mean ± SD (median) values were \$187.79 ± \$547.55 (\$70.39). For non-PCMH adult patients, mean ± SD (median) values were \$583.89 ± \$1476.22 (\$199.95).

favorable patient outcomes even in the early transformative stages.^{2,4,5}

Most prior comparisons relied on pre-post performance and outcomes or changes from baseline within the same patient population.^{14,21-25} This has important implications for researchers and policy makers engaged in evaluating PCMH practices. Given that all the practices in this study had differences (size, installed technology, practice models, payer affiliations, and patient relationships) at baseline, it is likely that a simple pre-post measurement of PCMH programs without a control group may not fully account for the benefits of a patient-centered practice style. Also, a post-implementation comparison of PCMH and non-PCMH practices may overestimate the impact of the measures themselves, given the likelihood that organizational factors beyond the specific metrics under investigation could contribute to a positive patient experience.

PCMH-treated pediatric and adult groups had lower rates of both ED visits and hospitalizations compared with the non-PCMH cohort, suggesting that potential benefits of the PCMH model may be applicable across several age groups. Prior demonstration studies have shown reductions in ED

visits ranging from 7.5% to 29% and in patient hospitalizations ranging from 4.8% to 40% in PCMH pilot projects.²⁰ Our risk-adjusted findings for adults, an 11% reduction in use of ED services and 12% fewer hospitalizations in the PCMH cohort, are consistent with the results reported in the Fields et al demonstration study.²⁰

Both adjusted and unadjusted medical and total costs were lower for both pediatric and adult patients in the PCMH cohort. Annual costs reductions linked to PCMH pilot practices in the study by Fields et al ranged from \$71 to \$640 per patient, supporting the overall trend that PCMH practices are capable of delivering services at lower costs to patients.²⁰ Our results are consistent with the overall conclusions of the Fields et al study²⁰: that over time PCMH practices that emphasize preventive care, optimal focus on chronic care, reconfigured primary care, and more comprehensive care management are capable of reducing costs.² In the adult population in this study, the mean adjusted costs on a PMPM basis were \$409 in the PCMH cohort versus \$484 in the non-PCMH cohort, a substantial annual savings per patient.

These are instructive findings in the baseline period, when practices likely needed to make additional investments in

new equipment and procedures. Such savings suggest that despite additional transformation-associated expenditures, the PCMH model offers the potential for reduced overall costs. It is difficult to make connections between specific attributes and cost savings because each practice in this study selected combinations of transformative measures that were appropriate for its operations. Cost reductions could well have resulted from synergies generated by particular combinations of interventions. Studies of individual practices are providing insights into this question.²

From the differences we observed in quality, outcomes, resource utilization, and costs, it would appear that a number of the practices that acquired NCQA recognition were progressive and had already implemented elements and principles consistent with the PCMH model before their official recognition date in 2010. This has 2 potential implications. First, that there were many favorable findings for the PCMH cohort is an indicator that the standards for PCMH recognition by NCQA are consistent with and help to promote high-quality, cost-effective care. The second, more complex implication is that the providers who engage in the transformational process leading up to PCMH recognition do so over a period of time, and potential benefits associated with the changes also accrue over time. The assignment of PCMH status based on a specific time, such as the date of NCQA recognition, may create an artificial distinction of “pre” and “post,” given that practice patterns and their effects evolve and do not typically lend themselves well to simple before and after measurements. Moreover, the improvements noted early in the transformation suggest that even initial changes in practices (eg, electronic medical records, expanded access) could have a meaningful positive impact on costs and quality.

Limitations

The use of claims data from a managed care population introduces data-related limitations such as miscoding, incompleteness, and the limits on the generalizability of the findings. Although we included only patients from the same geographic area, we did not test for any potential sociodemographic differences. Another limitation was that non-PCMH practices may have been engaging in ad hoc quality improvements, although to the best of our knowledge they were neither systematic nor targeted at NCQA recognition.

CONCLUSION

The population treated within PCMH practices had equal or better rates of care management, lower rates of high-cost diagnostic imaging procedures, and lower rates of ED visits

and hospitalizations. This means that providers using the PCMH model might have an opportunity to offer enhanced patient care even during early transformation. Further research is needed to determine whether practices continue to improve post-recognition, to assess the impact of enhanced payments from health plans, to test the generalizability of these findings, and to evaluate the impact of transformational processes on practices.

Acknowledgments

Bernard B. Tuli, MSc, provided writing and other editorial support for this study.

Author Affiliations: From HealthCore, Inc (AD, C-HWL, GS, JJB), Wilmington, DE; WellPoint, Inc (JRH, SB), New York, NY.

Funding Source: None.

Author Disclosures: The authors (AD, C-HWL, GS, JRH, SB, JJB) report no relationship or financial interest with any entity that would pose a conflict of interest with the subject matter of this article.

Authorship Information: Concept and design (AD, GS, JRH, SB, JJB); acquisition of data (AD, GS); analysis and interpretation of data (AD, C-HWL, GS, JJB); drafting of the manuscript (AD, C-HWL, JRH); critical revision of the manuscript for important intellectual content (AD, JRH, JJB); statistical analysis (AD, C-HWL, GS); provision of study materials or patients (JRH); obtaining funding (AD, JJB); administrative, technical, or logistic support (GS, SB); and supervision (AD, SB, JJB).

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REFERENCES

- Dentzer S.** Reinventing primary care: a task that is far ‘too important to fail’ [published correction appears in *Health Aff (Millwood)*. 2010;29(6):1275]. *Health Aff (Millwood)*. 2010;29(5):757.
- Maeng DD, Graf TR, Davis DE, Tomcavage J, Bloom FJ Jr.** Can a patient-centered medical home lead to better patient outcomes? the quality implications of Geisinger’s ProvenHealth Navigator. *Am J Med Qual*. 2012;27(3):210-216.
- Maeng DD, Graham J, Graf TR, et al.** Reducing long-term cost by transforming primary care: evidence from Geisinger’s medical home model. *Am J Manag Care*. 2012;18(3):149-155.
- Peikes D, Zutshi A, Genevro JL, Parchman ML, Meyers DS.** Early evaluations of the medical home: building on a promising start. *Am J Manag Care*. 2012;18(2):105-116.
- Berwick DM, Nolan TW, Whittington J.** The triple aim: care, health, and cost. *Health Aff (Millwood)*. 2008;27(3):759-769.
- Chang CH, Stukel TA, Flood AB, Goodman DC.** Primary care physician workforce and Medicare beneficiaries’ health outcomes. *JAMA*. 2011;305(20):2096-2104.
- Friedberg MW, Hussey PS, Schneider EC.** Primary care: a critical review of the evidence on quality and costs of health care. *Health Aff (Millwood)*. 2010;29(5):766-772.
- Bodenheimer T, Pham HH.** Primary care: current problems and proposed solutions. *Health Aff (Millwood)*. 2010;29(5):799-805.
- Berenson RA, Rich EC.** US approaches to physician payment: the deconstruction of primary care. *J Gen Intern Med*. 2010;25(6):613-618.
- Dinan MA, Simmons LA, Snyderman R.** Commentary: personalized health planning and the Patient Protection and Affordable Care Act: an opportunity for academic medicine to lead health care reform. *Acad Med*. 2010;85(11):1665-1668.
- American Academy of Family Physicians (AAFP), American Academy of Pediatrics (AAP), American College of Physicians (ACP), American Osteopathic Association (AOA).** *Joint Principles of the Patient-centered Medical Home*. http://www.acponline.org/advocacy/where_we_stand/medical_home/approve_jp.pdf. Published March 2007. Accessed August 1, 2011.

- 12. Landon BE, Gill JM, Antonelli RC, Rich EC.** Prospects for rebuilding primary care using the patient-centered medical home. *Health Aff (Millwood)*. 2010;29(5):827-834.
- 13. Rosenthal TC.** The medical home: growing evidence to support a new approach to primary care. *J Am Board Fam Med*. 2008;21(5):427-440.
- 14. Scholle SH, Saunders RC, Tirodkar MA, Torda P, Pawlson LG.** Patient-centered medical homes in the United States. *J Ambul Care Manage*. 2011;34(1):20-32.
- 15. Berwick DM.** Launching accountable care organizations—the proposed rule for the Medicare Shared Savings Program. *N Engl J Med*. 2011;364(16):e32.
- 16. National Committee for Quality Assurance.** *Standards and Guidelines for Physician Practice Connections®—Patient-Centered Medical Home (PPC-PCMH™)*. Washington, DC: NCQA; 2008.
- 17. National Committee for Quality Assurance.** *PPC-PCMH Content and Scoring*. http://mhcc.maryland.gov/pcmh/documents/PPC_PCMH_Summary.pdf. Published July 2011. Accessed August 12, 2011.
- 18. Fisher ES.** Building a medical neighborhood for the medical home. *N Engl J Med*. 2008;359(12):1202-1205.
- 19. Bitton A, Martin C, Landon BE.** A nationwide survey of patient centered medical home demonstration projects. *J Gen Intern Med*. 2010;25(6):584-592.
- 20. Fields D, Leshen E, Patel K.** Analysis & commentary. Driving quality gains and cost savings through adoption of medical homes. *Health Aff (Millwood)*. 2010;29(5):819-826.
- 21. Nutting PA, Crabtree BF, Miller WL, Stange KC, Stewart E, Jaén C.** Transforming physician practices to patient-centered medical homes: lessons from the national demonstration project. *Health Aff (Millwood)*. 2011;30(3):439-445.
- 22. Cooley WC, McAllister JW, Sherrieb K, Kuhlthau K.** Improved outcomes associated with medical home implementation in pediatric primary care. *Pediatrics*. 2009;124(1):358-364.
- 23. Gilfillan RJ, Tomcavage J, Rosenthal MB, et al.** Value and the medical home: effects of transformed primary care. *Am J Manag Care*. 2010;16(8):607-614.
- 24. Jaén CR, Ferrer RL, Miller WL, et al.** Patient outcomes at 26 months in the patient-centered medical home National Demonstration Project [published correction appears in *Ann Fam Med*. 2010;8(4):369]. *Ann Fam Med*. 2010;8(suppl 1):S57-S67; S92.
- 25. Roby DH, Pourat N, Pirritano MJ, et al.** Impact of patient-centered medical home assignment on emergency room visits among uninsured patients in a county health system. *Med Care Res Rev*. 2010;67(4):412-430.
- 26. Mann CJ.** Observational research methods: research design II: cohort, cross sectional, and case-control studies. *Emerg Med J*. 2003;20(1):54-60.
- 27. Healthcare Effectiveness Data and Information Set (HEDIS).** *HEDIS 2010 Summary Table of Measures, Product Lines and Changes*. http://www.ncqa.org/Portals/0/HEDISQM/HEDIS2010/2010_Measures.pdf. Published 2010. Accessed March 20, 2012.
- 28. Levine RS, Briggs NC, Husaini BA, et al.** HEDIS prevention performance indicators, prevention quality assessment and Healthy People 2010. *J Health Care Poor Underserved*. 2005;16(4)(suppl A):64-82.
- 29. Sennett C.** An introduction to HEDIS. *Hosp Pract (Minneapolis)*. 1996;31(6):147-148.
- 30. Deyo RA, Cherkin DC, Ciol MA.** Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. *J Clin Epidemiol*. 1992;45(6):613-619.
- 31. Wang PS, Avorn J, Brookhart MA, et al.** Effects of noncardiovascular comorbidities on antihypertensive use in elderly hypertensives. *Hypertension*. 2005;46(2):273-279.
- 32. Van de Ven WERP.** Risk adjustment in competitive health plan markets. In: Culyer AJ, Newhouse JP, eds. *Handbook of Health Economics*. 1st ed. Vol 1A. Amsterdam: North-Holland. 2000.
- 33. Nutting PA, Crabtree BF, Miller WL, Stewart EE, Stange KC, Jaén CR.** Journey to the patient-centered medical home: a qualitative analysis of the experiences of practices in the National Demonstration Project [published correction appears in *Ann Fam Med*. 2010;8(4):369]. *Ann Fam Med*. 2010;8(suppl 1):S45-S56; S92.
- 34. Nutting PA, Crabtree BF, Stewart EE, et al.** Effect of facilitation on practice outcomes in the National Demonstration Project model of the patient-centered medical home [published correction appears in *Ann Fam Med*. 2010;8(4):369]. *Ann Fam Med*. 2010;8(suppl 1):S33-S44; S92. ■