Medical Homes and Cost and Utilization Among High-Risk Patients

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Objectives: Evaluate the effects of the patient-centered medical home (PCMH) model on medical costs and utilization in the nonpediatric population, particularly among high-risk patients.

Study Design: Longitudinal case-control design, comparing per member per month (PMPM) cost and utilization per 1000 patients for members enrolled in PCMH and non-PCMH practices from 2009 to 2011.

Methods: Commercial health maintenance organization members in nonpediatric practices that adopted the PCMH model in 2009 were matched to patients in nonpediatric practices that did not adopt the model until 2011 or later. Propensity score matching was used to identify a pool of similar controls, and difference-in-differences regression analysis was used to compare PCMH and non-PCMH patients relative to baseline. Analysis was conducted using the complete pool of matched patients (N = 6940 cases and 6940 controls), then using the 10% of patients with the highest DxCG risk scores (N = 654 cases and 734 controls).

Results: There were no significant cost or utilization differences for the overall population. Total cost decreased significantly more for the PCMH group than for controls in the high-risk group in years 1 and 2 (reductions of $107 and $75 PMPM), driven by lower inpatient costs. The PCMH group experienced a significantly greater reduction in inpatient admissions in all 3 years (61, 48, and 94 hospitalizations per 1000).

Conclusions: PCMH practices had significantly reduced costs and utilization for the highest risk patients, particularly with respect to inpatient care. As high-risk members represent a high-cost group, the most benefit can be gained by targeting these members.

Am J Manag Care. 2014;20(3):e61-e71

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The patient-centered medical home (PCMH) has been advanced as a promising framework for transforming primary care. In 2007, the American Academy of Family Physicians, American Academy of Pediatrics, American College of Physicians, and American Osteopathic Association issued the "Joint Principles of the Patient-Centered Medical Home," which outlined the PCMH model. The medical home model emphasizes a team-based approach to primary care, in which a physician-leader coordinates care by other providers across multiple sites and specialties. It encourages increased access, both in terms of expanding practice hours and opening new channels of communication with patients. Organizations such as the Patient-Centered Primary Care Collaborative have initiated numerous pilot programs aimed at studying the impact of PCMH adoption,[1] and the PCMH model was written into the Patient Protection and Affordable Care Act of 2010 as an area for study.[2]

A number of previous studies have shown early promise for the PCMH model as a vehicle for controlling costs and improving the quality of healthcare delivered by primary care practices,[3-6] including for targeting subpopulations such as children with special health needs.[7] However, reviews often point to the incomplete nature of this work, citing methodological concerns,[5,7,8] insufficient time for practices to implement reforms, and inadequate policy support beyond the level of individual practices.[4] This study aims to contribute to this literature by comparing the effects of adopting the PCMH model on the healthcare cost and utilization in the nonpediatric population, using propensity score matching in order to reduce variability in the PCMH and non-PCMH groups studied. Additionally, the analysis employs difference-in-differences regression analysis in order to further control for remaining differences in patients' characteristics as well as cost and utilization at baseline.

This study aims to assess the impact of PCMH adoption on the patients identified as having the greatest health risks. While the Joint Principles envision the PCMH model as being applicable to all patients, other pilots have targeted only high-risk patients with complex needs.[9] The high cost of care associated with relatively few individuals makes such targeting a potentially powerful mechanism: one study noted that virtually all

In this article
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Published as a Web exclusive
www.ajmc.com

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High-risk patients enrolled in nonpediatric primary care practices which adopted the patient-centered medical home (PCMH) model had significantly lower per member per month medical costs and utilization per 1000 members compared with non-PCMH practices after adjusting for baseline characteristics.

- Costs and utilization did not significantly differ between PCMH and non-PCMH groups among all patients, suggesting that the benefits of the PCMH model are concentrated among high-risk, high-cost patients.
- PMCH cost reductions appear to have been driven by lower rates of hospitalization, and total costs fell even though utilization of specialist care saw significant increases in the first 2 years.

of the growth in expenditures for Medicare over the period from 1987 to 2002 occurred among beneficiaries with 5 or more chronic illnesses[10]; another paper noted that only 10% of Medicare beneficiaries accounted for 70% of healthcare costs.[11] In order to evaluate whether the benefits of medical homes are limited to such high-risk, high-cost subpopulations, this study reports cost and utilization comparisons 2 ways: first, for all matched patients; and subsequently, limited to the patients with risk scores in the 90th percentile or above for the study population.

METHODS

Program Description

The majority of the PCMH practices (15/17) included in this study were part of Pennsylvania's Chronic Care Initiative, a multi-stakeholder effort to improve primary care, which launched a 3-year pilot project that started in May 2008 in the Philadelphia area. The largest commercial health plans—led by Independence Blue Cross, all 3 Medicaid managed care plans, and 32 practices caring for 250,000 members—were convened by the governor to establish the first of several regional PCMH programs. Practices received significant additional payments to participate in a learning collaborative which supported practice transformation and provided the care management and coordination services required by patients with chronic conditions. The learning collaborative was based on Wagner's Chronic Care Model[12] and led by the MacColl Institute, with Edward H. Wagner, MD, MPH, facilitating the first session.

Practices were required to send a physician and a practice support leader to 7 days of sessions. Practice coaches provided ongoing support and education on installing and using a registry to track and monitor patients and implementing a team-based approach involving care managers, health educators, and other nonphysician healthcare personnel to promote self-management skills and patient engagement.[13] Additionally, clinical guidelines were used to create evidence-based standing orders to optimize patient care. Practices used their electronic systems to identify and stratify patients in need of care management, self-management support, and goal monitoring. Patient engagement was promoted through the use of report cards, on which concrete data from each visit are logged for patients so they can monitor their progress.

To provide a definition of the PCMH model, the authors employed the recognition standards published by the National Committee for Quality Assurance (NCQA). These standards list 9 categories encompassing 30 possible practice improvements (including 10 "must pass" items), each of which has a point value. Three levels of certification are possible, with each defined by a minimum number of "must pass" items achieved and specified point totals. The full list of recognition criteria appears in **Table 1**.[14] Practices qualified for PCMH status by achieving NCQA Level 1 recognition or higher during 2009, and the control group was limited to practices which did not receive recognition until 2011 or later.

Study Population and Design

This study employs a longitudinal, case-control design to compare members of commercial health maintenance organizations (HMOs) enrolled in nonpediatric PCMH and non-PCMH practices with respect to healthcare costs and utilization during the period from 2009 to 2011. All figures are reported first for the full matched cohort of cases and controls (N = 6940 cases and 6940 controls), and then using the 10% of patients with highest risk scores, drawn from the pooled population of cases and controls (N = 654 cases and 734 controls).

DxCG risk score refers to the concurrent medical risk score calculated using the commercial risk adjustment model developed by Verisk Health DxCG Risk Solutions, version 3.1 (Verisk Health, Cary, North Carolina).[15] The DxCG models use linear, additive formulas obtained from ordinary least squares (OLS) regressions to combine expenses associated with clinical groupings (Condition Categories and Rx-Groups) and demographic factors (age, gender) to generate predictions. Hierarchies are imposed on Condition Categories before regression models are run to decrease their sensitivity to variations in coding and to strengthen the predictive power of the models across a wide range of benefit designs and pricing arrangements.[15] The concurrent risk score in this analysis used each individual's age, gender, and claims information from all medical encounters and enrollment data as inputs to predict annual total medical resource use for the patient.

Patients evaluated were enrolled in 17 PCMH practices, 15

of which were participating in the Pennsylvania Chronic Care Initiative pilot (cases), or 1 of 103 non-PCMH comparison practices in PA (controls). The high-risk patients were slightly more concentrated, appearing in only 14 PCMH practices (12 of which were part of the pilot) and 69 non-PCMH practices. Costs were assessed as per member per month (PMPM) costs and utilization was measured as encounters per 1000 patients per year.

Inclusion/Exclusion Criteria

In order to qualify for inclusion, each member must have been enrolled with the same primary care physician for at least 3 months and have been associated consistently with a PCMH or non-PCMH practice for 6 months or more during each year of the study period, including baseline (2008). Only nonpediatric practices located in Pennsylvania were included in the analysis. Pediatric practices were excluded to reduce the variability in the age of members in the study and minimize the impact of any potential unobserved differences between pediatric practices and nonpediatric practices. Patients with end-stage renal disease or extremely high medical costs (≥$100,000 per year) were excluded to limit the impact of extreme outliers on the cost analysis.

The pool of eligible controls was limited to later adopters of the PCMH model in order to reduce potential practice self-selection issues. Patients enrolled in control practices that received NCQA recognition in 2011 were included in analyses for the first 2 program years, but were removed from the final year's analysis to avoid contaminating the non-PCMH group with late adopters, along with their matched cases. This reduced the numbers included in program year 3 to 1141 cases and 1141 controls in the overall analysis, and 109 cases and 131 controls in the high-risk subgroup. While the guidelines remained largely similar from 2008 to 2011, some changes were made to the NCQA requirements, and a crosswalk table detailing

Table 1. NCQA Recognition Guidelines (2008)

PPC-PCMH 2008	Points
PPC 1: Access and Communication	**9**
PPC 1A: Access and Communication Processes—MUST PASS	4
PPC 1B: Access and Communication Results—MUST PASS	5
PPC 2: Patient Tracking and Registry	**21**
PPC 2A: Basic System for Managing Patient Data	2
PPC 2B: Electronic System for Clinical Data	3
PPC 2C: Use of Electronic Clinical Data	3
PPC 2D: Organizing Clinical Data—MUST PASS	6
PPC 2E: Identifying Important Conditions—MUST PASS	4
PPC 2F: Use of System for Population Management	3
PPC 3: Care Management	**20**
PPC 3A: Guidelines for Important Conditions—MUST PASS	3
PPC 3B: Preventive Service Clinician Reminders	4
PPC 3C: Practice Organization	3
PPC 3D: Care Management of Important Conditions	5
PPC 3E: Continuity of Care	5
PPC4: Patient Self-Management	**6**
PPC4A: Documenting Communication Needs	2
PPC4B: Self-Management Support—MUST PASS	4
PPC 5: Electronic Prescribing	**8**
PPC 5A: Electronic Prescription Writing	3
PPC 5B: Prescribing Decision Support—Safety	3
PPC 5C: Prescribing Decision Support—Efficiency	2
PPC 6: Test Tracking	**13**
PPC 6A: Test Tracking and Follow-Up—MUST PASS	7
PPC 6B: Electronic System for Managing Tests	6
PPC 7: Referral Tracking	**4**
PPC 7A: Referral Tracking and Coordination—MUST PASS	4
PPC 8: Performance Reporting and Improvement	**15**
PPC 8A: Measures of Performance—MUST PASS	3
PPC 8B: Patient Experience Data	3
PPC 8C: Reporting to Physicians—MUST PASS	3
PPC 8D: Setting Goals and Taking Action	3
PPC 8E: Reporting Standardized Measures	2
PPC 8F: Electronic Reporting—External Entities	1
PPC 9: Advanced Electronic Communication	**4**
PPC 9A: Availability of Interactive Web	1
PPC 9B: Electronic Patient Identification	2
PPC 9C: Electronic Care Management Support	1

Source: NCQA PCMH Standards and Guidelines.[14]
The National Committee for Quality Assurance (NCQA) has created a list of standards for the Physician Practice Connections–Patient-Centered Medical Home (PPC-PCMH). To be certified as a Level 1 PCMH, a practice has to meet 5 of the 10 must-pass elements and have at least 25 total points. Level 2 practices have passed all 10 elements and have 50 or more points. Level 3 practices have all 10 elements and score at least 75 points.

the differences is available from the NCQA.[16] An attrition diagram detailing all exclusion steps appears in **Appendix A**.

Matching Technique

Propensity score matching was used to select a sample of controls which were similar to the PCMH cases with respect to both practice- and patient-level demographics and characteristics. The propensity score included practice size, practice location, age, gender, DxCG risk score, chronic conditions (including asthma, diabetes, congestive heart failure, chronic obstructive pulmonary disease, and coronary artery disease), and median income for member's zip code of residence. Matching successfully controlled for the significant differences at baseline between the group of cases and pool of potential controls, both for the overall comparison and among the cohort of highest risk patients (**Table 2A** and **2B**).

Statistical Analysis

Differences in PMPM cost and utilization per 1000 patients between PCMH and non-PCMH practices for the 3 follow-up years were compared using regression analysis. This method provides an estimate of the differences between treatment and control groups before and after treatment. Since the members included in this study are the same in each time period (ie, panel data), the difference-in-differences model can be simplified and is more statistically powerful. The difference between baseline and each time period can be modeled as follows (separate model for each time period difference):

$$Y_{i,1} - Y_{i,0} = \delta + \beta X_{i,1} + \varepsilon_I$$

where $Y_{i,1} - Y_{i,0}$ is the difference between the repeated outcome measure for each observation, δ is the effect of time on all units, $X_{i,1}$ is the treatment indicator, and β is the treatment effect.[17] Cost and utilization regressions controlled for concurrent risk in the comparison year and having a chronic condition in the baseline year, factors that could influence both cost and utilization in the comparison year. For example, when comparing 2010 with baseline, the 2010 risk score was added to the model to adjust for any new diagnoses a member might have acquired in 2010. Presence of a chronic condition at baseline was used as a covariate because chronic members often continue to incur costs, or incur even higher costs, over time. In order to test for the treatment effect for just the high-risk members, a high-risk indicator was introduced as covariate (ie, as a main effect and interaction term with the treatment indicator) into the model using the whole population. Additionally, a random intercept term was used in the model to account for any practice-level effects.

RESULTS

When comparing utilization and PMPM cost for all matched cases and controls during the 3 follow-up years with respect to baseline characteristics, no difference-in-differences comparison reached significance at $\alpha = .1$ (**Appendices B, C**). The regression results limited to the 10% of pooled cases and controls with the highest DxCG risk scores resulted in clear differences between PCMH and non-PCMH. PCMH practices achieved statistically significant decreases in utilization of inpatient medical services in all 3 program years, amounting to reductions of 61, 48, and 94 hospitalizations per 1000 patients. In the first 2 program years, these reductions were accompanied by statistically significant adjusted savings in inpatient costs ($115 PMPM in 2009 and $62 PMPM in 2010). The decline in utilization of inpatient hospital services contributed to lower total medical costs for patients enrolled in PCMH practices during the first 2 study years as well. Cases had an adjusted total savings of $107 PMPM in 2009, representing an 11.2% reduction from baseline. For 2010, the difference was $75 PMPM, corresponding to a 7.9% reduction.

While total medical costs decreased, there were areas in which high-risk patients in PCMH practices experienced increases in costs and utilization. This cohort saw a statistically significant increase in specialist visits in 2009, and corresponding increases in PMPM spending for specialist care in 2009 and 2010 (**Tables 3** and **4**).

DISCUSSION

This study offers particular methodological contributions to the PCMH literature. The approach of combining propensity score matching to create comparable case and control pools with difference-in-differences regression analysis to adjust for practice- and patient-level variation and baseline cost and utilization characteristics allows improved control for factors which might otherwise confound efforts to study the effects of PCMH adoption. Inclusion of a non-PCMH control group and assessing differences over time allows the analyses to control for trends which may have affected all practices, regardless of PCMH status. Along with controlling for practice size, excluding practices which transitioned to the PCMH model in 2010 helped to limit the impact of self-selection on results. Because adoption of the PCMH reforms does not occur instantaneously, some non-PCMH practices may have incorporated aspects of the medical home without having yet risen to the level of eligibility for NCQA recognition. Confining the control group to later adopters diminishes this issue.

The findings of this study add new texture to the existing PCMH literature. After controlling for baseline differenc-

Table 2A. Matching Results (Overall)

	Cases (N = 6940)	Matched Controls (N = 6940)	Potential Controls (N = 33,031)	*P* (before match)	*P* (after match)
% belonging to practices in Philadelphia	78.1%	78.3%	20.8%	<.0001	.774
% belonging to a "large" practice (panel size >1000)	92.2%	91.9%	75.5%	<.0001	.491
Mean census (2000) income	$43,066	$43,682	$56,010	<.0001	.078
% living in Philadelphia	67.6%	67.1%	21.5%	<.0001	.563
% male	38.7%	40.1%	45.1%	<.0001	.089
Mean age	42	42	43	<.0001	.815
DxCG concurrent risk score	1.36	1.38	1.40	.237	.723
% CHF	0.5%	0.7%	0.5%	.488	.142
% COPD	0.9%	1.1%	1.3%	.008	.275
% CAD	2.5%	2.6%	3.2%	.003	.914
% diabetes	6.7%	7.3%	7.3%	.106	.153
% asthma	8.3%	8.0%	7.8%	.566	.925
% hypertension	21.3%	21.6%	21.8%	.348	.852
% chronic (defined as having CHF, COPD, CAD, diabetes, asthma, and/or hypertension)	29.6%	30.2%	30.4%	.167	.415
% having diabetes and CHF and/or CAD	0.9%	0.8%	1.0%	.178	.707
% with Rx benefit	47.3%	47.9%	67.2%	<.0001	.465
% self-funded	31.8%	31.7%	17.2%	<.0001	.884

CAD indicates coronary artery disease; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease.

Table 2B. Descriptive Statistics for 10% Highest Risk[a] Subgroup

	Case (N = 654)	Control (N = 734)	*P*
% belonging to practices in Philadelphia	72.8%	80.3%	.001
% belonging to a "large" practice (panel size >1000)	93.3%	88.8%	.004
Mean census (2000) income	$43,929	$43,868	.955
% living in Philadelphia	63.9%	65.3%	.601
% male	29.1%	30.4%	.589
Mean age	47	46	.394
DxCG concurrent risk score	6.68	6.48	.517
% CHF	3.5%	3.5%	.980
% COPD	2.9%	3.7%	.422
% CAD	9.5%	11.6%	.204
% diabetes	12.8%	17.3%	.021
% asthma	13.5%	13.1%	.836
% hypertension	38.7%	40.9%	.406
% chronic (defined as having CHF, COPD, CAD, diabetes, asthma, and/or hypertension)	50.3%	53.8%	.191
% having diabetes and CHF and/or CAD	3.7%	4.0%	.785
% with Rx benefit	49.2%	46.3%	.278
% self-funded	31.5%	32.8%	.595

CAD indicates coronary artery disease; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease.
[a]Cases and controls with DxCG Risk Score ≥3.3155.

Table 3. Adjusted Utilization per 1000 Patients, High-Risk 10% Sample

	High-Risk Cases	High-Risk Controls	High-Risk Cases	High-Risk Controls	Savings (adjusted DID)	*P*	% Reduction From Baseline
	Actual		Adjusted[a]				
Baseline	**N = 654**	**N = 734**	**N = 654**	**N = 734**			
Inpatient	566	540					
Emergency department	530	572					
Specialist	5644	6258					
2009 Difference From Baseline	**N = 654**	**N = 734**	**N = 654**	**N = 734**			
Inpatient	–363	–300	–366	–304	61	.0209[d]	10.8%
Emergency department	–119	–99	–117	–99	18	.7225	3.4%
Specialist	–1243	–1662	–1198	–1642	–448	.0716[c]	–7.9%
2010 Difference From Baseline	**N = 654**	**N = 734**	**N = 654**	**N = 734**			
Inpatient	–400	–346	–401	–351	48	.0255[d]	8.6%
Emergency department	–174	–164	–171	–166	5	.7656	1.0%
Specialist	–1686	–1927	–1644	–1918	–277	.1196	–4.9%
2011[b] Difference From Baseline	**N = 109**	**N = 131**	**N = 109**	**N = 131**			
Inpatient	–352	–376	–365	–270	94	.0765[c]	16.6%
Emergency department	–157	–298	–95	–194	–98	.1735	–18.4%
Specialist	–892	–854	–2291	–3181	–858	.1225	–15.2%

DID indicates difference-in-differences.
[a]Adjusted for risk in comparison year and having a chronic condition at baseline.
[b]Removing the controls that were Year 3 adopters and their matched cases.
[c]Indicates significance at $\alpha = .1$.
[d]Indicates significance at $\alpha = .05$.

es, no statistically significant differences between patients enrolled in PCMH and non-PCMH practices were observed. However, when looking at the patients with highest risk scores in the pool of matched patients and practices, PCMH model adoption was shown to lead to a significant relative reduction in total costs in years 1 and 2, and significantly lower numbers of inpatient admissions in all 3 years. This suggests that the average patient may not be the relevant unit of observation for evaluating the impact of PCMH adoption. Rather, high risk patients with multiple comorbidities are the most logical targets for interventions aimed at supporting self-management, conveying test results in a timely and clear fashion, and coordinating follow-up and specialist care. Researchers may miss cost and utilization improvements if they confine their analyses to the typical patient, since healthcare costs are primarily driven by relatively rare events concentrated in few individuals. For example, during the baseline year, all cases and controls had 73 and 78 admissions per 1000 patients, respectively; but among the high-risk pool, these numbers increased to 566 and 540.

The observation that relative cost reductions are driven by decrease in inpatient admissions among high-risk patients suggests that the PCMH model is having its intended effect—improvements to information technology permit physicians to better assess patient needs, and better coordination of care means that ongoing issues can be managed at lower levels of care intensity (self-management, primary care) rather than after manifesting as crises requiring hospitalization. Even the observation of increased spending for specialist care can be interpreted as being consistent with this conceptualization: as providers gain access to better quality information about patient needs through improved medical record-keeping and care is coordinated across multiple sites, the patients with the highest medical risk may be appropriately directed to more frequent contact with specialists. This could drive up the cost of 1 component of care, while the use of appropriate early interventions helps control costs overall.

Study Limitations

Despite extensive controls through matching, regression analysis, and study design, some self-selection issues may persist. A number of the initial pool of control practices received NCQA recognition in 2011, meaning that there may have been some "wind up" time in the prior year for practices identified as controls. However, this should have had the effect of reducing the apparent difference between PCMH and non-PCMH practices for the 2010 analyses.

Table 4. Adjusted PMPM Cost, High-Risk 10% Sample

	High-Risk Cases	High-Risk Controls	High-Risk Cases	High-Risk Controls	Savings (adjusted DID)	*P*	% Reduction From Baseline
	Actual		Adjusted[a]				
Baseline	**N = 654**	**N = 734**					
Total	$953	$965					
Inpatient	$458	$407					
Emergency department	$20	$21					
Specialist	$89	$107					
2009 Difference From Baseline	**N = 654**	**N = 734**	**N = 654**	**N = 734**			
Total	–$467	–$360	–$467	–$358	$107	.004[e]	11.2%
Inpatient	–$284	–$173	–$294	–$178	$115	<.0001[e]	25.1%
Emergency department	–$3	–$2	–$3	–$2	$1	.5759	3.9%
Specialist	–$21	–$36	–$20	–$36	–$16	.0062[e]	–17.9%
2010 Difference From Baseline	**N = 654**	**N = 734**	**N = 654**	**N = 734**			
Total	–$520	–$447	–$524	–$446	$75	.0579[c]	7.9%
Inpatient	–$298	–$241	–$303	–$240	$62	.0122[d]	13.5%
Emergency department	–$4	–$2	–$4	–$2	$1	.5938	6.8%
Specialist	–$26	–$36	–$26	–$36	–$10	.0579[c]	–11.4%
2011[b] Difference From Baseline	**N = 109**	**N = 131**	**N = 109**	**N = 131**			
Total	–$303	–$455	–$420	–$393	$27	.9108	2.9%
Inpatient	–$199	–$234	–$215	–$136	$79	.2742	17.3%
Emergency department	–$4	–$8	$2	–$2	–$4	.4132	–17.6%
Specialist	–$23	$3	–$56	–$37	$19	.6811	21.5%

DID indicates difference-in-differences.
[a]Adjusted for risk in comparison year and having a chronic condition at baseline.
[b]Removing the controls that were Year 3 adopters and their matched cases.
[c]Indicates significance at $\alpha = .1$.
[d]Indicates significance at $\alpha = .05$.
[e]Indicates significance at $\alpha = .01$.

Additionally, other studies of the medical home model have focused on patient satisfaction and quality improvement measures, which are essential aspects of the PCMH model and central to providing exceptional primary care, but these attributes are not the focus of this study. Over a sufficient time frame, improved integration of care may lead to better outcomes for patients with lower levels of health risk as well, so ongoing assessments of PCMH adoption should be conducted with these considerations in mind.

CONCLUSION

While no differences were observed when assessing patients from the full distribution of risk scores, this study demonstrated that adoption of the PCMH model was associated with significantly reduced costs and utilization for those members at highest risk, particularly with respect to inpatient care. High-risk members are the most costly to health plans, so it logically follows that the most benefit can be gained by targeting these members with programs such as the medical home. When evaluating PCMH programs, it is important to focus both interventions and evaluations on relevant populations.

Acknowledgments

The authors thank Cindy Wang, Jason Neal, Manu Tyagi, Sara Fritz, and Pam Eckardt of Independence Blue Cross (IBC), Philadelphia, for their assistance in data collection, analysis, and review. The authors acknowledge the assistance of S^2 Statistical Solutions, Inc, Cincinnati, OH, a paid consultant to IBC, for their technical support and editing during the manuscript preparation.

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Source of Funding: This study was funded by Independence Blue Cross, which is an independent licensee of the Blue Cross and Blue Shield Association. All of the authors were employed by the Independence Blue Cross during the course of the study.

Author Disclosures: The authors (SH, RC, CC, RS, SN) all report employment with Independence Blue Cross, which funded this study.

Authorship Information: Concept and design (SH, RC, RS, SN); acquisition of data (SH); analysis and interpretation of data (SH, RC, CC, RS, SN); drafting of the manuscript (SH, RS); critical revision of the manuscript for important intellectual content (SH, CC, RS, SN); statistical analysis (SH); administrative, technical, or logistic support (RC, RS); supervision (RC, CC, SN).

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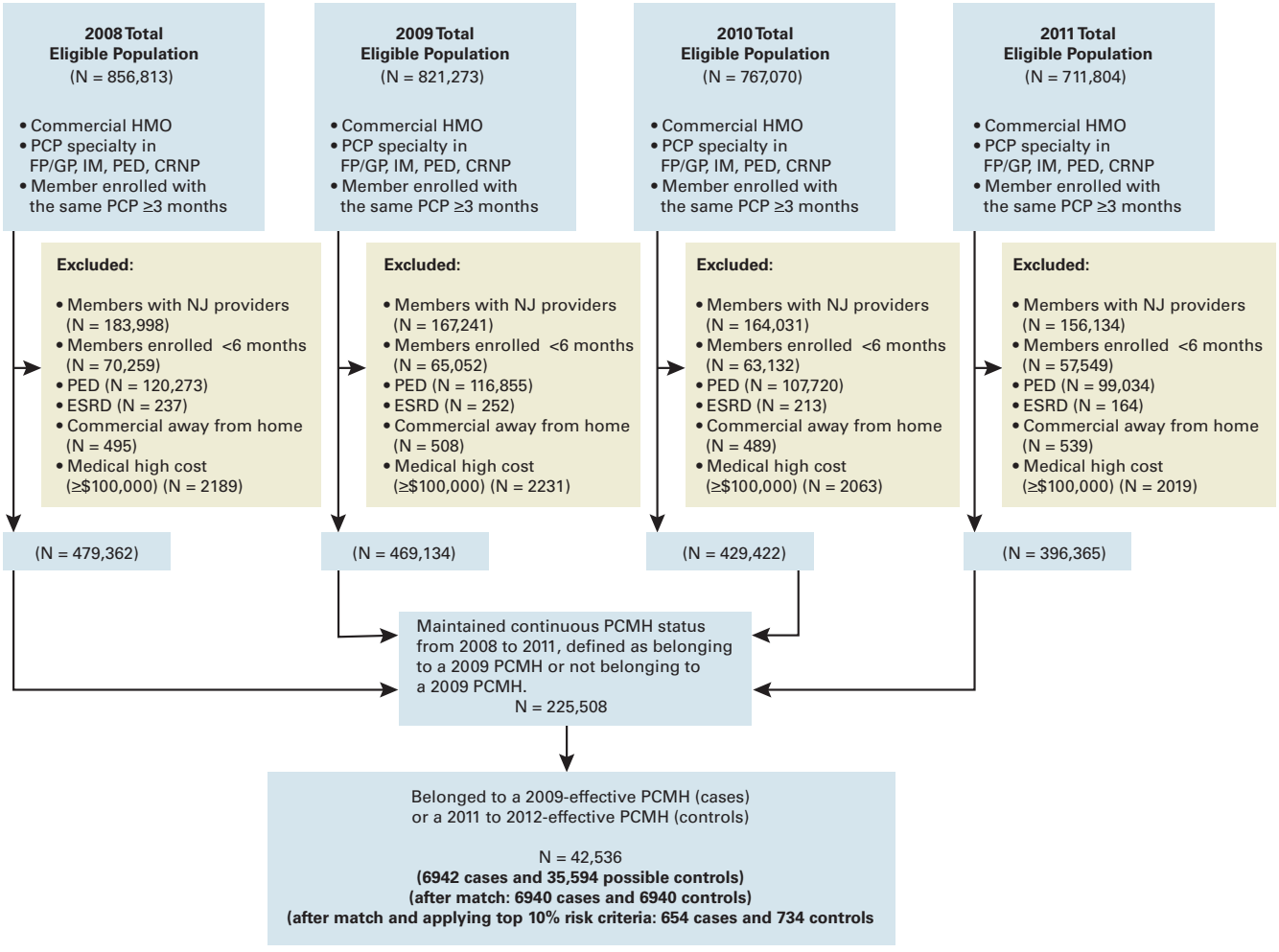
Appendix A. Attrition Diagram



CRNP indicates certified registered nurse practitioner; ESRD, end-stage renal disease; FP/GP, family practice/general practice; HMO, health maintenance organization; IM, internal medicine; PCMH, patient-centered medical home; PCP, primary care practitioner; PED, pediatrics.

Appendix B. Adjusted Utilization per 1000 Patients, Complete Matched Sample

	Cases	Controls	Cases	Controls	Savings[a] (adjusted DID)	*P*	% Reduction From Baseline
Baseline	**N = 6940**	**N = 6940**					
Inpatient	73	78					
Emergency department	229	214					
Specialist	1757	1800					
	Actual		**Adjusted[b]**				
Year 1 Difference From Baseline	**N = 6940**	**N = 6940**	**N = 6940**	**N = 6940**			
Inpatient	3	5	1	6	6	.4843	8.0%
Emergency department	16	16	15	15	2	.8692	0.9%
Specialist	10	–95	27	–85	–105	.2854	–6.0%
Year 2 Difference From Baseline	**N = 6940**	**N = 6940**	**N = 6940**	**N = 6940**			
Inpatient	2	–6	–1	–8	–3	.7260	–4.5%
Emergency department	–9	–1	–10	–1	13	.3054	5.8%
Specialist	22	54	3	36	61	.6415	3.5%
Year 3[c] Difference From Baseline	**N = 1141**	**N = 1141**	**N = 1141**	**N = 1141**			
Inpatient	0	–13	–3	–3	1	.9499	1.6%
Emergency department	–32	–13	16	22	8	.7831	3.4%
Specialist	338	942	–14	177	213	.4100	12.1%

DID indicates difference-in-differences.
[a]Signs are reversed so that a negative DID is shown as a positive savings.
[b]Adjusted for risk in comparison year and having a chronic condition at baseline.
[c]Removing the controls that were Year 3 adopters and their matched cases.

Appendix C. Adjusted Per Member Per Month Cost, Complete Matched Sample

	Cases	Controls	Cases	Controls	Savings[a] (adjusted DID)	*P*	% Reduction From Baseline
Baseline	**N = 6940**	**N = 6940**					
Total	$180	$193					
Inpatient	$52	$54					
Emergency department	$8	$8					
Specialist	$25	$28					
	Actual		**Adjusted[b]**				
Year 1 Difference From Baseline	**N = 6940**	**N = 6940**	**N = 6940**	**N = 6940**			
Total	$22	$26	$20	$28	$10	.4601	5.3%
Inpatient	$8	$17	$5	$19	$15	.1024	29.0%
Emergency department	$2	$1	$2	$1	$0	.7832	–2.5%
Specialist	$2	$1	$2	$1	–$1	.6983	–4.7%
Year 2 Difference From Baseline	**N = 6940**	**N = 6940**	**N = 6940**	**N = 6940**			
Total	$31	$21	$25	$21	$4	.8290	2.1%
Inpatient	$13	$8	$9	$8	$3	.7862	5.7%
Emergency department	$2	$2	$2	$2	$0	.7548	2.7%
Specialist	$3	$3	$3	$3	$0	.8328	1.7%
Year 3[c] Difference From Baseline	**N = 1141**	**N = 1141**	**N = 1141**	**N = 1141**			
Total	$71	$58	$51	$53	$5	.8794	2.7%
Inpatient	$27	$13	$17	$25	$10	.7068	18.3%
Emergency department	$1	$1	$3	$3	$0	.9304	–2.1%
Specialist	$12	$27	$7	$14	$8	.4010	30.4%

DID indicates difference-in-differences.
[a]Signs are reversed so that a negative DID is shown as a positive savings.
[b]Adjusted for risk in comparison year and having a chronic condition at baseline.
[c]Removing the controls that were Year 3 adopters and their matched cases.