

Medical Homes: Cost Effects of Utilization by Chronically Ill Patients

Jason Neal, MA; Ravi Chawla, MBA; Christine M. Colombo, MBA; Richard L. Snyder, MD; and Somesh Nigam, PhD

Despite extensive evidence that quality primary care has the effect of improving health and controlling costs,^{1,2} the field is described as facing a crisis. One oft-cited source of the problem is the current fee-for-service reimbursement system, which does not adequately compensate the “cognitive” services that lie at the core of primary care.³ The American College of Physicians (ACP) position paper distinguishes “cognitive” from procedural-driven services, and refers to the evaluation and management of patients by primary care physicians.³ The fee-for-service reimbursement model is credited in part with driving medical school graduates to enter better compensated specialty fields, creating the potential for a shortage in primary care practitioners.^{4,5}

Other concerned voices note that beyond the debate about an adequate supply of doctors, there is a need for primary care practitioners to take a more proactive role in the coordination of care across multiple sites and providers.⁶ Poor coordination of care, as can occur when a patient lacks a usual source of care, has been shown to lead to increased costs, diminished care quality, reduction of access to preventive services, and increased usage of high-intensity care.^{1,7}

This relationship is of particular concern for the treatment of chronically ill patients. Primary care doctors are encountering increasingly complex patients, with the average family practice office encounter addressing 2.7 medical problems.⁸ This complexity has very real implications for costs in the healthcare system: one study found that nearly all of the cost growth from 1987 to 2002 occurred among patients being treated for 5 or more conditions.⁹ Another noted that among Medicare beneficiaries, 10% of patients—typically those with multiple chronic illnesses that require numerous prescription medications, and who experience frequent hospitalization—account for 70% of healthcare costs.⁵ The presence of chronic illness makes accurate, readily accessible medical records essential to providing quality care, and effective management may

ABSTRACT

Objectives

The impact of primary care practices adopting the patient-centered medical home (PCMH) model is analyzed by comparing per member per month (PMPM) costs and utilization among commercial HMO members with chronic illnesses in PCMH and non-PCMH practices in the Philadelphia area. Transforming primary care practices to conform to the PCMH model has shown early promise in reducing costs and improving outcomes, and chronically ill patients’ frequent contact with the healthcare system and costly care make them ideal targets for such health system reforms.

Study Design and Methods

The impact of the PCMH model on PMPM costs was analyzed using a generalized linear regression model to adjust for age, gender, and baseline cost. The impact of the PCMH model on utilization per 1000 rates was analyzed with the Poisson regression model, adjusting for baseline differences in age, gender, and risk score.

Results

After accounting for differences at baseline, PCMH practices achieved lower total, inpatient, and specialist PMPM costs, as well as lower relative utilization of hospital admissions and specialist visits.

Conclusions

These findings suggest that policy makers should maintain or expand incentives to adopt PCMH reforms and that targeting chronically ill patients may be the most effective way to leverage the benefits of PCMH adoption.

Am J Manag Care. 2015;21(1):e51-e61

require ongoing patient contact, even outside of the doctor's office.

The patient-centered medical home (PCMH) model offers a promising alternative to the current paradigm in primary care. The concept of the "medical home" originated in 1967 with the American Academy of Pediatrics (AAP), was initially presented as a model for addressing special healthcare needs among children. The medical home focuses on a team-based approach to primary care whereby a physician-leader coordinates care received from other providers across multiple sites and specialties. This methodology encourages increased access in terms of expanded practice hours and enabling new ways to engage with patients.¹⁰ Information technology, such as electronic health records, is part of this approach, which can facilitate better identification of patient needs, more effective care management, and more efficient tracking of health outcomes. Incentive-based payment structures to better reward evaluation and management are also included. This concept gained wider attention following the 2007 statement of Joint Principles by the American Academy of Family Physicians, AAP, ACP, and American Osteopathic Association, which offered a unified vision of the central components of the PCMH model.^{11,12}

Some preliminary research has shown promising, though mixed, early results for practices adopting the PCMH model in terms of patient experience^{13,14} and in reducing utilization of high-cost medical interventions, such as emergency department (ED) visits and hospitalizations.¹⁴⁻¹⁷ This was corroborated by a recent review of studies of the PCMH model which showed that while individual programs have yielded successes, the overall evidence is more mixed. Adoption of the PCMH model appears to have positive effects on patient experience and provision of preventive services to patients, but its effect on ED utilization, an important driver of healthcare costs, was limited to older patients. Moreover, this review found no consistent reduction in hospital admissions or overall expenditures for patients in practices that adopted the PCMH model.¹⁸ Given inconsistent definitions of the "medical home,"^{18,19} this review and others point to the difficulty in assessing the impact of the PCMH model. As much of the work to date has been inconclusive, this analysis will focus on the relevant subpopulation of chronically ill patients for whom the PCMH model would be most likely to yield benefits.

This paper aims to contribute to the growing body of literature and evidence on the PCMH model. Previous work, such as the 2010 Group Health Cooperative

(GHC) study by Reid et al¹⁴ and Friedberg et al's,²⁰ study on the Pennsylvania Chronic Care Initiative (PACCI) have evaluated the effects of the medical home on costs and utilization for all patients. This study focuses on the PCMH effect on patients with chronic illness(es). This subpopulation requires complex care and frequent contact with the healthcare system, which makes them more likely to benefit from improved coordination of care and enhanced access and communication.^{21,22} We hypothesize that implementing PCMH practices will result in lower total, inpatient, and specialist per member per month (PMPM) costs, and will lower relative utilization of hospital admissions and specialist visits over the 3-year study period.

METHODS

Program Description

This study evaluates early implementation of the PCMH model using data collected from the PACCI. This initiative was convened as a collaborative effort by the state's largest commercial health plans (led by Independence Blue Cross), all 3 Medicaid managed care plans, and 32 medical practices, and was organized by the Governor's Office of Health Care Reform to promote the adoption of the PCMH model and improve the quality of primary care for patients with chronic illnesses. Engagement by multiple stakeholders allowed for the appropriate resources, scale, and support to be provided, creating a framework for education, training, and data submission, as well as allowing for consistency in monitoring outcomes across the program.

To facilitate transition to the PCMH model, practices received supplemental financial incentives and were required to participate in a Learning Collaborative based on Wagner's Chronic Care Model,²³ working toward recognition from the National Committee for Quality Assurance (NCQA) as a PCMH by the end of the first year of participation. Each practice enrolled in the initiative was required to a) have at least 1 physician, plus a practice support leader, in attendance at each of 7 full-day sessions and to b) participate in weekly meetings. Furthermore, practices were paired with practice coaches responsible for providing additional support and training.

Data from practices in the PACCI pilot were used to determine the program's effect on patients with chronic illness(es), a subpopulation requiring complex care. This was a longitudinal observational study conducted to assess the impact of adopting the PCMH as a model for

improving primary care, focusing on PMPM healthcare costs and utilization per 1000 patients over 3 years of follow-up data.

Study Population

A cohort of chronically ill members—defined as patients having asthma, coronary artery disease, congestive heart failure, chronic obstructive pulmonary disease, diabetes, and/or hypertension—was created from administrative medical claims in the baseline year, 2008. Chronic illness was identified using *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* codes from medical claims data. Additionally, all patients must have been continuously enrolled in the same practice from 2008 through 2011. We also limited our analysis to practices located within Philadelphia city limits in order to limit the effect of urban-suburban disparities on our findings^{24,25} and because the majority of initial PCMH practices were located within the city.

Defining the Patient-Centered Medical Home

To provide an operational definition of a “medical home,” the PACCI relied on the definition provided by the NCQA as of 2008.²⁶ Practices were assigned PCMH status if they received at least Level 1 NCQA recognition in 2009 and maintained recognition through at least 2011. Level 1 recognition required that practices meet 5 of 10 possible “must pass” criteria and accumulate 25 total “points.” The complete list of potential PCMH improvements recognized by the NCQA appears in **Table 1**. Practices designated “non-PCMH” did not join the PCMH program at any point during years 2008 to 2011 and were used as controls. The resulting study population consisted of 2674 patients enrolled in 11 PCMH practices and 19,546 patients in 393 non-PCMH practices, all of which were located within Philadelphia city limits.

Analytical Framework

This study was conducted as a longitudinal observational study to best assess the impact of adopting the PCMH model as a vehicle for improving primary care of chronically ill members. The outcomes of interest were PMPM healthcare utilization and costs. Costs were reported separately as inpatient, ED, specialist, and outpatient care costs, as well total PMPM costs. Utilization was reported in terms of inpatient admissions, ED visits, specialist visits, and outpatient visits per 1000 patients over 3 years of follow-up. Data on costs and utilization were extracted from medical

claims; patient-level covariates of age and gender were recorded from enrollment data. To control for differences between the PCMH and non-PCMH groups at baseline, patient-level covariates (age, gender, and costs at baseline) were included in regression models.

At baseline, a number of differences were observed between case and control practices in terms of patient age and risk profile, socioeconomic characteristics, and comorbid conditions, which translated into significant differences in terms of costs and utilization even before the introduction of PCMH changes in the cases. The **Figure** presents some of these baseline comparisons. Patients in practices adopting PCMH reforms were generally younger (aged 39.2 years vs 45.4 years; $P < .0001$), but had lower estimated risk scores (1.61 vs 1.81; $P < .05$) and significantly different case mix in terms of illness profiles.

To control for variation at baseline, statistical models were employed to generate adjusted figures for the program effects on costs and utilization for each of the follow-up years. PMPM costs were adjusted using a generalized regression model, which controlled for age, gender, and costs at baseline. For utilization per 1000 patients, Poisson regression models were used to estimate utilization counts after adjustment for baseline differences in age, gender, and risk score. These methods parallel those used in the GHC study. Risk scores were calculated using Verisk Health DxCG Risk Solutions version 3.1,²⁷ a commercial population risk adjustment package. The risk score used patient age, gender, and claims information from all medical encounter and enrollment data to estimate annual total medical resource use. Once adjusted cost and utilization figures were imputed for each of the program years, differences between PCMH practices and controls were compared using the *t* test for dependent means, using Satterthwaite or unequal variances. The results appear in **Tables 2** and **3**.

RESULTS

Differences in Utilization

Controlling for baseline differences, PCMH practices maintained significantly lower utilization for hospital admissions ($P < .0001$) and specialist visits ($P < .01$) for each year in the follow-up period. PCMH practices also saw 0.3 fewer admissions per patient in 2009, and 0.2 fewer admissions per patient in both 2010 and 2011. Specialist visits were reduced by 12.3 visits per 1000 patients in 2009, and by more than 10 visits per 1000 patients in 2010 and 2011. However, PCMH practices observed significantly higher utilization in ED and outpatient visits, though the

adjusted difference in ED visits shrank over the period from 2009 to 2011 (Table 2).

Differences in Cost

Predictably, the observed differences in utilization translated into lower adjusted total PMPM costs. Total costs were significantly lower in PCMH practices during all 3 follow-up years ($P < .05$). Relative to baseline, overall PMPM costs were \$16.50 lower in 2009, a difference of 5.5%. Total PMPM costs were \$13.00, and \$13.70 lower in subsequent years as well. This reduction was driven by significantly lower inpatient ($P < .01$) and specialist ($P < .0001$) costs among PCMH practices over all 3 program years. The relative reduction in specialist costs was particularly pronounced: in 2009, adjusted costs for PCMH were 17.5% lower than those in non-PCMH practices. While significant relative increases in ED PMPM costs ($P < .0001$) partially offset these reductions, PCMH practices did not experience a significant increase in outpatient costs despite the observed increase in outpatient utilization (Table 3).

DISCUSSION

This study adds to the growing body of literature, including prior work by the GHC team, which indicates that the initial investments required for primary care practices to adopt PCMH reforms can yield successes in controlling growth in cost and utilization of high-cost, high-intensity medical services.¹⁴ GHC is a nonprofit health insurance and care delivery system based in Seattle. That study looked at cost and utilization results between 12 and 21 months after implementation in an attempt to track progress in quality improvement, in creating a sustainable work environment, and in lowering costs. The data source on utilization and costs was the GHC's costing system, which allocates use and costs for all services provided at GHC facilities and from external claims. Utilization and costs from 7018 continuously enrolled adults at the prototype clinic were compared with those of 200,970 adults enrolled at other clinics in the Puget Sound area.

Three particularly important differences exist between the work by the GHC and this study: this study explores only cost and utilization, without commenting on patient or provider satisfaction; the end points do not match exactly (the GHC study measured cost and utilization after 12, 18, and 21 months, whereas the Pennsylvania study measured results annually over 3 years). Most importantly, this study focuses on chronically ill patients, whereas GHC analyzed all patients. Data comparing the GHC

study results with this study's results appear in **Table 4**. Variables discussed include differences in inpatient admissions, ambulatory care utilization, and ED and specialty care costs and utilization. For this study, there is also discussion on possible reasons for gaps in cost and utilization between PCMH and non-PCMH practices.

Regarding inpatient admissions, the GHC study showed that differences in all-cause inpatient admissions did not reach significance until the 21-month follow-up, whereas the differences in inpatient admissions per 1000 patients were significant in all 3 program years of the Pennsylvania study. This gap between the 2 studies, in terms of utilization, was also reflected in PMPM costs: the GHC study found a consistent relative reduction of more than \$10 PMPM in total costs, but this did not meet statistical significance at $\alpha = .05$. By comparison, we found statistically significant relative reductions amounting to \$16.50 PMPM in the first program year and \$13.00 and \$13.70 PMPM in subsequent years.

In the case of ambulatory care-sensitive treatment, the medical home practices in the GHC study were able to achieve significant relative reductions in admissions when the analysis was limited to inpatient admissions for ambulatory care-sensitive conditions ($P < .001$). By controlling for the presence of chronic illness—either by limiting the population to such patients, as in the case of the Pennsylvania study, or by framing the outcomes to focus only on treatment for chronic illness—significant differences become apparent in the outcomes achieved by PCMH and non-PCMH practices. This suggests that, with respect to costs and utilization, the PCMH may lead to meaningful improvements only when applied to relevant subpopulations, such as chronically ill patients.

In the Pennsylvania study, the increased utilization of outpatient care is actually suggestive of further success for the PCMH model. By improving coordination of care, doctors may have been appropriately directing their patients to lower-cost, lower-intensity services, which acted as substitutes for costlier hospital admissions and other services. This finding is especially promising, given that the increased utilization in terms of visits per 1000 patients did not lead to a significant increase in PMPM costs. Similar findings of increased primary care intensity leading to lower costs via substitution have been reported elsewhere.²⁸ Also, Wang et al report using a case-control matched longitudinal cohort study in patients with type 1 and type 2 diabetes mellitus, and found that adoption of the PCMH reduced overall medical cost for diabetic members by 21% in the first year.²⁹ This result largely reflects a drop in inpatient costs, which fell by 44%.

The 2 studies also report disparate findings concerning costs and utilization of specialty care. Patients enrolled in the GHC study's PCMH practices exhibited fewer ED visits and more specialty care visits, whereas the opposite was true of the Pennsylvania PCMH patients. This difference may be attributable in part to the Pennsylvania study's focus on chronically ill patients. For example, increasing focus on patient needs and satisfaction may identify unmet healthcare needs across all patients, whereas among patients with chronic illness who are likely to have frequent and ongoing contact with the healthcare system, improved disease management may reduce the need for specialized care. Alternatively, physicians in the Pennsylvania managed care practices may be under-referring patients to specialist services, but these differences in specialty care may simply reflect regional variation in practice.

Finally, with respect to the Pennsylvania study, it is worth noting that in most cases, the gap in cost and utilization between PCMH and non-PCMH practices was seen to decrease over the 3 follow-up years. Although the control practices were required to have completed all 3 program years without formally receiving NCQA recognition, it is possible that some of the innovations adopted as a package by PCMH practices were embraced piecemeal by non-PCMH practices during follow-up years, leading to a gradual flattening of the results across practice type. One possible explanation stems from the fact that non-PCMH practices tended to be in the medium- / average-practice size category, whereas PCMH practices were typically larger group practices. The scale advantages of larger practices might have made information technology or staffing improvements more affordable, with average-size practices lagging behind on the trend. Previous research has indicated that larger practice size is positively correlated with the presence of elements of the PCMH infrastructure.³⁰ Additionally, because the PCMH practices began adopting elements of the NCQA guidelines before obtaining formal recognition, the process of improving outcomes may have started ahead of the medical home pilot program. This self-selection bias may have reduced the apparent impact of PCMH adoption.

The PCMH impact may extend to smaller practices as well. A recent PCMH study that focused on small, independent primary care practices in Rhode Island found that 5 pilot practices increased their NCQA recognition score from 42 to 90 points over a 2-year study period.³¹ There was a significantly lower rate of ambulatory care–

sensitive ED visits in the pilot practices compared with 34 nonpilot practices.

Policy Relevance

Both the GHC experience and the results of the PACCI study suggest that the introduction of medical home innovations into primary care practices may help to curb utilization of high-intensity medical services as well as overall cost growth, despite initial investments in staffing changes and technology infrastructure. The differences in results observed when analyzing the primary care population as a whole, as opposed to the chronically ill cohort tracked in the Pennsylvania study, stresses the importance of quality risk stratification of patients, not only for research purposes, but also for making fair assessments of practice quality and for targeting of resources by medical practices.

A study by the Commonwealth Fund has suggested that with the exception of information technology infrastructure, incremental costs do not rise with increasing “medical homeness” of primary care practices.³² However, both the GHC medical home practices and those in the Pennsylvania pilot made staffing changes as part of their transition, adding physicians and nurse practitioners to allow enhanced patient contact.¹⁴ With this in mind, financial incentives to defray the costs of introducing care managers, electronic medical records, registries, and related improvements may be particularly crucial to promoting adoption of the medical home as a model. Cost savings may eventually make the PCMH self-sustaining, with cost savings redirected to improving compensation for primary care doctors⁵ and to other practice improvements.

Implications for Future Research and Limitations

Although we employed the same rigorous adjustments used by the GHC study, some differences at baseline were not specifically accounted for in the regression adjustments used. For example, while all patients in the Pennsylvania study satisfied the criterion of displaying some chronic illness or illnesses, PCMH and non-PCMH practices may have had a different case mix. Though patient-level variation was accounted for, at least in part, by use of the DxCG risk score in the regression adjustments, future research might consider identifying the most useful practice changes for specified conditions or assessing whether practice case mix drives the decision to adopt PCMH innovations.

Furthermore, observed differences may be driven in part by self-selection on the part of primary care prac-

tices; practices with a trajectory toward electronic health records, enhanced case management, and so forth may have been more likely to seek NCQA certification early in the process. Future work based on finer practice-level variation could account for these baseline differences and could also assess the relative impact of higher levels of NCQA certification and within-level variation in order to distinguish the contributions of various components of the PCMH model to improving care and controlling costs and utilization. One promising method for follow-up studies would be to pair difference-in-difference regression analysis with case-control matching in order to get equal samples from PCMH and non-PCMH practices, and to achieve improved control of practice-level differences such as size and affiliation.

CONCLUSION

This study joins a growing body of research which suggests that the PCMH model offers a promising mechanism for addressing primary care's pressing concerns with respect to delivering quality care and facing potentially unsustainable cost growth. By supporting patient self-management and improving coordination of care, practices adopting the PCMH model were able to achieve relative decreases in cost and utilization at the highest levels of care intensity (inpatient admissions) by chronically ill patients. In light of these findings, policy makers and healthcare thought leaders should continue to emphasize the PCMH as a vehicle for improving primary care, particularly for patients with complex, chronic conditions.

Acknowledgments

The authors thank Susannah Higgins, Manu Tyagi, Sara Fritz, Qiuyan Cindy Wang, Aaron Smith-McLallen, and Pam Eckardt of Independence Blue Cross, Philadelphia, for their assistance in data collection, analysis, and review. The authors acknowledge the assistance of CTI Clinical Trial & Consulting Services, Inc, Cincinnati, a paid consultant to Independence Blue Cross, for their technical support and editing during the manuscript preparation.

Author Affiliations: Independence Blue Cross (JN, RC, CMC, RLS, SN), Philadelphia, PA.

Source of Funding: This study was funded by Independence Blue Cross, an independent licensee of the Blue Cross and Blue Shield Association.

Author Disclosures: During the course of the study, all of the authors were employed by Independence Blue Cross. Physicians subject to the study are contracted as in-network by Independence Blue Cross for agreed-upon reimbursement of covered services.

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

Address correspondence to: Jason Neal, MA, Independence Blue Cross, 1901 Market St, 22nd Fl, Philadelphia, PA 19103. E-mail: Jason.Neal@ibx.com.

REFERENCES

- Starfield B, Shi L, Macinko J. Contribution of primary care to health systems and health. *Milbank Q*. 2005;83(3):457-502. Review.
- Baicker K, Chandra A. Medicare spending, the physician workforce, and beneficiaries' quality of care. *Health Aff (Millwood)*. 2004;Suppl Web Exclusives:W4-184-197.
- American College of Physicians. Reform of the dysfunctional healthcare payment and delivery system: a position paper. http://www.acponline.org/advocacy/current_policy_papers/assets/dysfunctional_payment.pdf. Published April 2006. Accessed November 2012.
- Moore G, Showstack J. Primary care medicine in crisis: toward reconstruction and renewal. *Ann Intern Med*. 2003;138(3):244-247.
- Bodenheimer T, Berry-Millett R. Follow the money—controlling expenditures by improving care for patients needing costly services. *N Engl J Med*. 2009;361(16):1521-1523.
- Margolius D, Bodenheimer T. Transforming primary care: from past practice to the practice of the future. *Health Aff (Millwood)*. 2010;29(5):779-784.
- Weiss LJ, Blustein J. Faithful patients: the effect of long-term physician-patient relationships on the costs and use of health care by older Americans. *Am J Public Health*. 1996;86(12):1742-1747.
- Flocke SA, Frank SH, Wenger DA. Addressing multiple problems in the family practice office visit. *J Fam Pract*. 2001;50(3):211-216.
- Thorpe KE, Howard DH. The rise in spending among Medicare beneficiaries: the role of chronic disease prevalence and changes in treatment intensity. *Health Aff (Millwood)*. 2006;25(5):w378-w388.
- Higgins S, Chawla R, Colombo CM, Snyder RL, Nigam S. Medical homes and cost and utilization among high-risk patients. *Am J Manag Care*. In press.
- American Academy of Family Physicians, American Academy of Pediatrics, American College of Physicians, American Osteopathic Association. Joint principles of the patient-centered medical home. http://www.aafp.org/dam/AAFP/documents/practice_management/pcmh/initiatives/PCMHJoint.pdf. Published February 2007. Accessed November 2012.
- Berenson RA, Hammons T, Gans DN, et al. A house is not a home: keeping patients at the center of practice redesign. *Health Aff (Millwood)*. 2008;27(5):1219-1230.
- 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.
- Reid RJ, Coleman K, Johnson EA, et al. The group health medical home at year two: cost savings, higher patient satisfaction, and less burnout for providers. *Health Aff (Millwood)*. 2010;29(5):835-843.
- Harbrecht MG, Latts LM. Colorado's patient-centered medical home pilot met numerous obstacles, yet saw results such as reduced hospital admissions. *Health Aff (Millwood)*. 2012;31(9):2010-2017.
- DeVries A, Li CH, Sridhar G, Hummel JR, Breidbart S, Barron JJ. Impact of medical homes on quality, healthcare utilization, and costs. *Am J Manag Care*. 2012;18(9):534-544.
- Flottemesch TJ, Scholle SH, O'Connor PJ, Solberg LI, Asche S, Pawlson LG. Are characteristics of the medical home associated with diabetes care costs? *Med Care*. 2012;50(8):676-684.
- Jackson GL, Powers BJ, Chatterjee R, et al. Improving patient care. The patient centered medical home: a systematic review. *Ann Intern Med*. 2013;158(3):169-178.
- Hoff T, Weller W, DePuccio M. The patient-centered medical home: a review of recent research. *Med Care Res Rev*. 2012;69(6):619-644.
- Friedberg MW, Schneider EC, Rosenthal MB, Volpp KG, Werner RM. Association between participation in a multipayer medical home intervention and changes in quality, utilization, and costs of care. *JAMA*. 2014;311(8):815-825.
- Bodenheimer T, Wagner EH, Grumbach K. Improving primary care for patients with chronic illness. *JAMA*. 2002;288(14):1775-1779.
- Wagner EH, Austin BT, Davis C, Hindmarsh M, Schaefer J, Bonomi A. Improving chronic illness care: translating evidence into action. *Health Aff (Millwood)*. 2001;20(6):64-78.

23. Wagner EH, Austin BT, Von Korff M. Organizing care for patients with chronic illness. *Milbank Q.* 1996;74(4):511-544.
24. Fiscella K, Williams DR. Health disparities based on socioeconomic inequities: implications for urban health care. *Acad Med.* 2004;79(12):1139-1147. Review.
25. Eberhardt MS, Pamuk ER. The importance of place of residence: examining health in rural and nonrural areas. *Am J Public Health.* 2004;94(10):1682-1686.
26. National Committee for Quality Assurance. Standards and Guidelines for Physician Practice Connections—Patient-Centered Medical Home (PPC-PCMH). Washington, DC: National Committee for Quality Assurance; 2008.
27. Verisk Health Inc. *Sightlines DxCG Risk Solutions: Concepts and Methodologies Guide for UNIX.* Waltham, MA: Verisk Health, 2010.
28. Fortney JC, Steffick DE, Burgess JF Jr, Maciejewski ML, Petersen LA. Are primary care services a substitute or complement for specialty and inpatient services? *Health Serv Res.* 2005;40(5 Pt 1):1422-1442.
29. Wang QC, Chawla R, Colombo CM, Snyder RL, Nigam S. Patient-centered medical home impact on health plan members with diabetes. *J Public Health Manag Pract.* 2014;20(5):E12-E20.
30. Rittenhouse DR, Casalino LP, Gillies RR, Shortell SM, Lau B. Measuring the medical home infrastructure in large medical groups. *Health Aff (Millwood).* 2008;27(5):1246-1258.
31. Rosenthal MB, Friedberg MW, Singer SJ, Eastman D, Li Z, Schneider EC. Effect of a multipayer patient-centered medical home on health care utilization and quality: the Rhode Island Chronic Care Sustainability Initiative pilot program. *JAMA Intern Med.* 2013;173(20):1907-1913.
32. Zuckerman S, Merrell K, Berenson R, et al. *Incremental Cost Estimates for the Patient-Centered Medical Home.* New York: The Commonwealth Fund; 2009. ■

Take-Away Points

Chronically ill patients enrolled in nonpediatric primary care practices that adopted the patient-centered medical home (PCMH) model had lower total, inpatient, and specialist per member per month costs compared with non-PCMH practices after adjusting for baseline characteristics.

- PCMH cost reductions appear to have been driven by lower utilization rates of hospital admissions and specialist visits.
- Inpatient admissions per 1000 patients were significantly lower for chronically ill patients in PCMH practices in each of the 3 program years analyzed.

■ **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
PPC 4: Patient Self Management	6
PPC 4A: Documenting Communication Needs	2
PPC 4B: 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

NCQA indicates National Committee for Quality Assurance; PPC-PCMH, Physician Practice Connections—Patient-Centered Medical Home.

The NCQA has created a list of standards for the PPC-PCMH. To be certified as a Level 1 PCMH, a practice has to have met 5 of the 10 must-pass elements and scored at least 25 total points. Level 2 practices have met all 10 must-pass elements and scored 50 or more points. Level 3 practices have met all 10 must-pass elements and scored at least 75 points.

Source: NCQA PCMH Standards and Guidelines.²³

Table 2. Program Effects of Utilization

	PCMH (n = 2674 patients)	Non-PCMH (n = 19,546 patients)	Difference (%)	P
Inpatient admits per 1000				
2009	8.0	8.3	-0.3 (-3.6%)	<.0001
2010	7.2	7.4	-0.2 (-2.7%)	<.0001
2011	7.7	7.9	-0.2 (-2.5%)	<.0001
ED visits per 1000				
2009	26.9	24.1	2.8 (11.6%)	<.05
2010	25.2	22.8	2.5 (11%)	<.01
2011	26.0	23.7	2.3 (9.7%)	<.01
Specialist visits per 1000				
2009	170.3	182.6	-12.3 (-6.7%)	<.01
2010	182.8	193.4	-10.6 (-5.5%)	<.01
2011	188.9	199.2	-10.3 (-5.2%)	<.01
Outpatient visits per 1000				
2009	112.5	108.9	3.6 (3.3%)	<.01
2010	106.3	102.6	3.7 (3.6%)	<.0001
2011	112.3	108.3	4.0 (4%)	<.0001

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

Poisson regression models were used to estimate utilization counts after adjustment for baseline differences in age, gender, and risk score. Risk scores were calculated using Verisk Health DxCG Risk Solutions version 3.1, a commercial population risk adjustment package. Differences between PCMH and non-PCMH practices were compared using the *t* test for dependent means, using Satterthwaite or unequal variances. To compute the percentage difference, the non-PCMH figure is the denominator.

Table 3. Program Effects on Cost

	PCMH (n = 2674 patients)	Non-PCMH (n = 19,546 patients)	Difference (%)	P
Total				
2009	\$284.60	\$301.10	-\$16.50 (-5.5%)	<.05
2010	\$288.20	\$301.20	-\$13.00 (-4.3%)	<.05
2011	\$319.20	\$332.90	-\$13.70 (-4.1%)	<.05
Inpatient				
2009	\$139.90	\$145.20	-\$5.30 (-3.6%)	<.01
2010	\$137.80	\$142.20	-\$4.40 (-3.1%)	<.01
2011	\$159.50	\$163.40	-\$3.90 (-2.4%)	<.01
ED				
2009	\$12.31	\$11.22	\$1.09 (9.7%)	<.0001
2010	\$12.52	\$11.42	\$1.10 (9.6%)	<.0001
2011	\$13.42	\$12.27	\$1.15 (9.4%)	<.0001
Specialist				
2009	\$37.69	\$45.69	-\$8.00 (-17.5%)	<.0001
2010	\$41.34	\$48.22	-\$6.88 (-14.3%)	<.0001
2011	\$44.80	\$51.76	-\$6.96 (-13.4%)	<.0001
Outpatient				
2009	\$63.51	\$62.85	\$0.66 (1.1%)	Nonsignificant
2010	\$73.87	\$73.26	\$0.61 (1%)	Nonsignificant
2011	\$82.28	\$81.63	\$0.65 (1%)	Nonsignificant

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

Per member per month costs were adjusted using a generalized regression model, which controlled for age, gender, and costs at baseline. Differences between PCMH and non-PCMH practices were compared using the *t* test for dependent means, using Satterthwaite or unequal variances. To compute the percentage difference, the non-PCMH figure is the denominator.

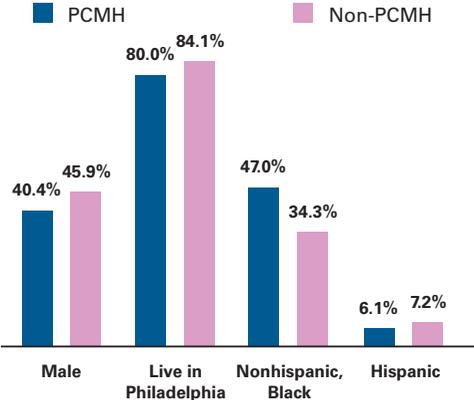
■ **Table 4.** Comparison of Cost and Utilization Results With Those From Group Health Study

Pennsylvania Study	Program Effects on Total Cost (dollars per member per months)				Adjustment Costs (dollars per member per month)				
	PCMH (n = 2674)	Non-PCMH (n = 19,546)	Difference	P	Group Health Study	Prototype Clinic (n = 7018)	Other Clinics (n = 200,970)	Cost Difference	P
2009	\$284.60	\$301.10	-\$16.50 (-5.5%)	P < .05	12 months	\$466	\$477	-10.20	P = .114
2010	\$288.20	\$310.20	-\$13.00 (-4.3%)	P < .05	18 months	\$480	\$490	-10.40	P = .059
2010	\$319.20	\$332.20	-\$13.70 (-4.1%)	P < .05	21 months	\$488	\$498	-10.31	P = .076

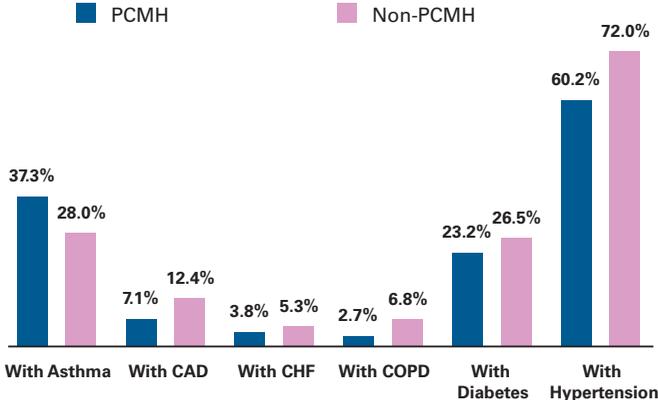
Pennsylvania Study	Program Effects of Utilization (inpatient admits per 1000)				Comparison of Adjusted Utilization—Inpatient Admissions (ambulatory care-sensitive conditions only) (per 1000 patients per month)				
	PCMH (n = 2674)	Non-PCMH (n = 19,546)	Difference	P	Group Health Study	Prototype Clinic (n = 7018)	Other Clinics (n = 200,970)	Cost Difference	P
2009	8.0	8.3	-\$0.3 (-3.6%)	P < .0001	12 months	0.22	0.26	84	P < .001
2010	7.2	7.4	-0.2 (-2.7%)	P < .0001	18 months	0.25	0.28	88	P < .001
2011	7.7	7.9	-0.270 (-2.5%)	P < .0001	21 months	0.24	0.28	87	P < .001

Figure. Baseline Practice Cost and Utilization Characteristics

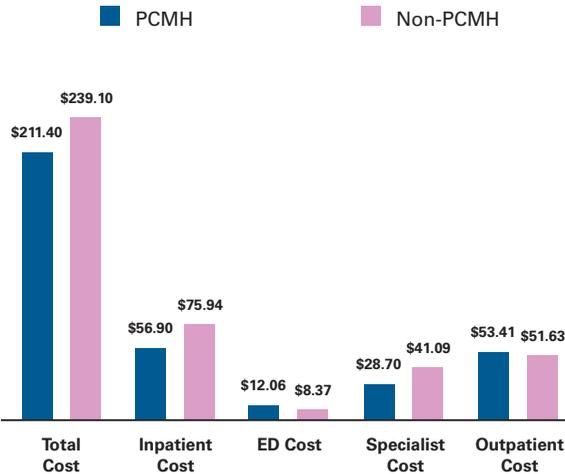
a. Baseline Population Demographics



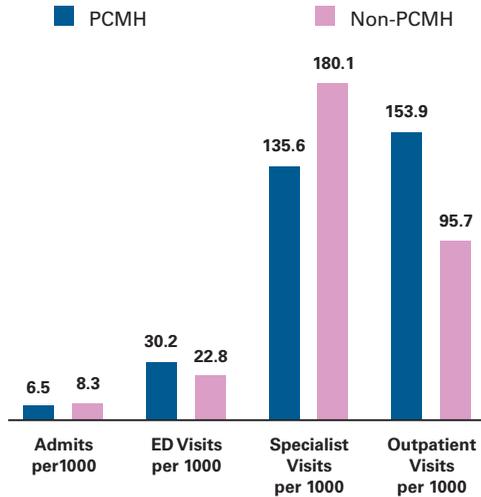
b. Baseline Population Comorbid Illness Rates



c. Baseline PMPM Costs

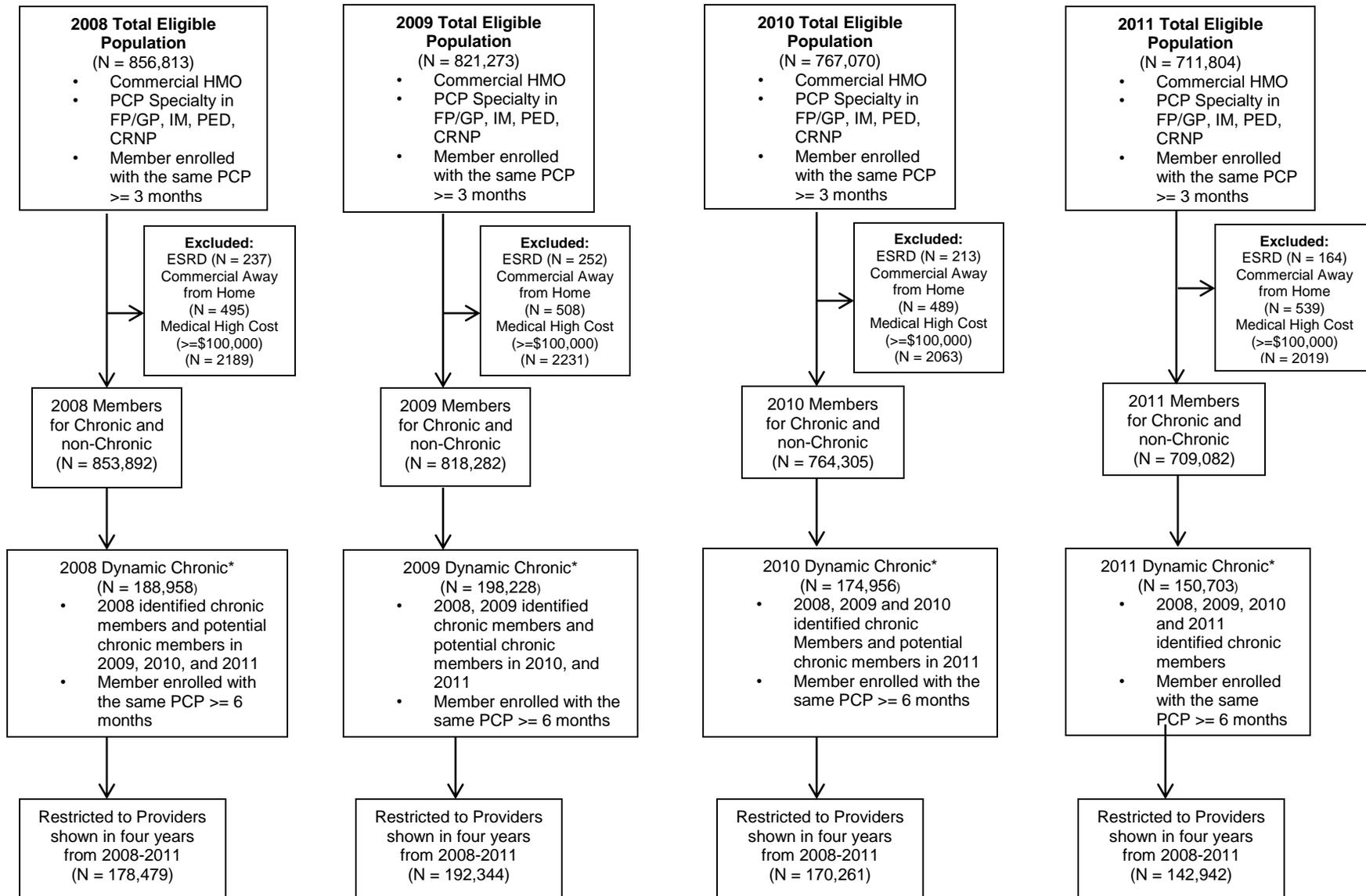


d. Baseline Utilization per 1000 Patients



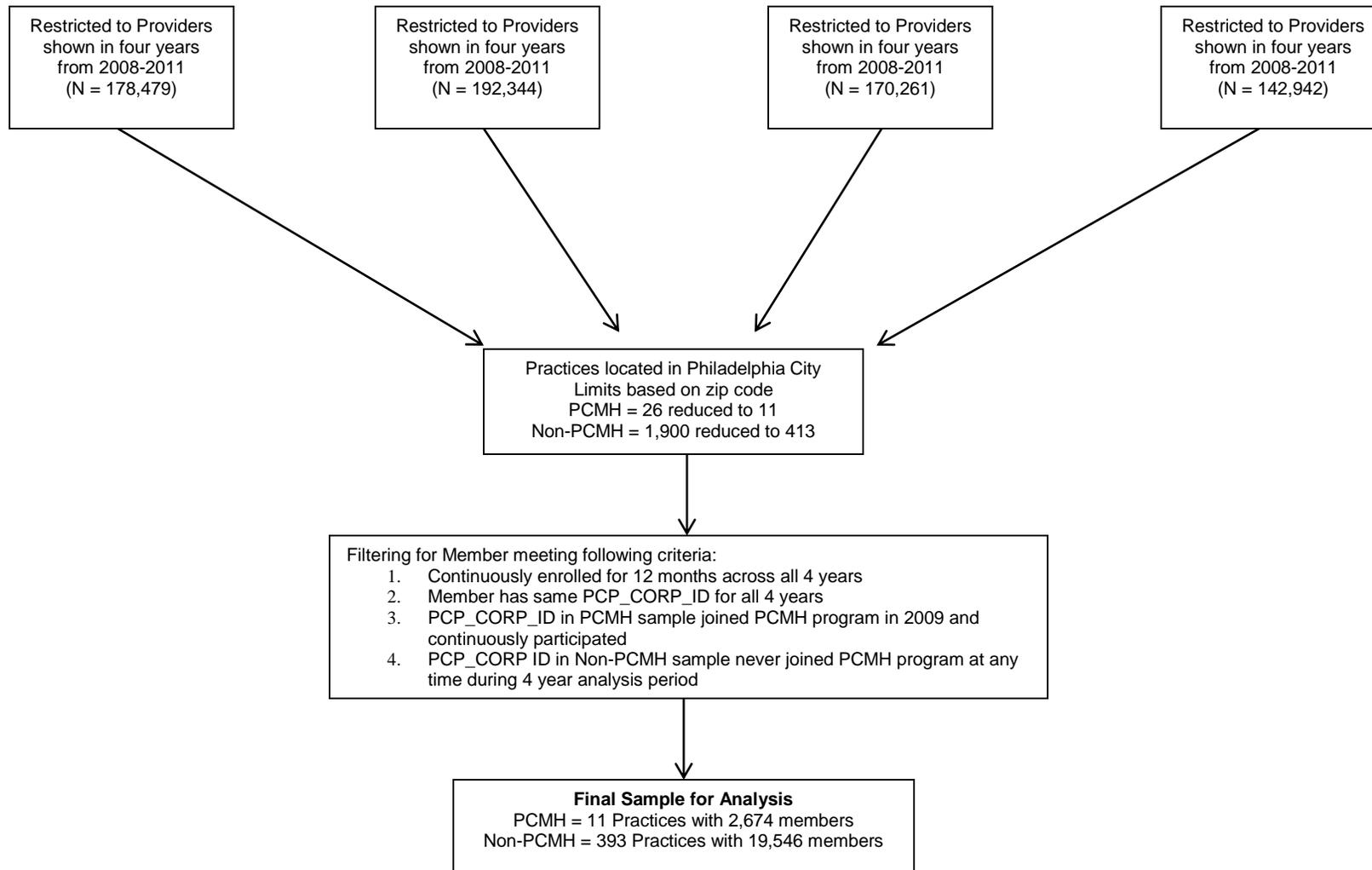
CAD indicates coronary artery disease; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; ED, emergency department; PCMH, patient-centered medical home; PMPM, per member per month.

Attrition Diagram for PCMH Chronic



*Dynamic Chronic members refer to chronic members who were identified based on claims incurred for each year at 2008, 2009, 2010 and 2011.

Attrition Diagram for PCMH Chronic (continued)



*Dynamic Chronic members refer to chronic members who were identified based on claims incurred for each year at 2008, 2009, 2010, and 2011.