

Patient-Centered Medical Home Features and Expenditures by Medicare Beneficiaries

Erica L. Stockbridge, MA; Lindsey M. Philpot, PhD, MPH; and José A. Pagán, PhD

Patient-centered medical homes (PCMHs) are showing promise as a novel way to improve healthcare quality while keeping healthcare cost growth under control.¹ Through coordinated, team-based approaches to healthcare delivery that are tailored to address the needs of individual patients via enhanced communication, PCMHs shift the focus of healthcare delivery from the system level to the patient level.¹ PCMH models have been implemented in single healthcare systems, and studies of these interventions and demonstrations have focused on implementation costs, patient experiences, evidence-based care processes, specific health outcomes, and healthcare utilization and costs. Published studies indicate that PCMHs are associated with small improvements in overall patient satisfaction with care and reported satisfaction with care coordination and communication,^{1,4} as well as moderate enhancements to clinical care delivery and processes, primarily for preventive services.^{1,4} There is also some evidence of potential associations of PCMHs with improved glycated hemoglobin and low-density lipoprotein values,⁵ as well as decreased short-term mortality rates among older adults.⁶

Studies to date indicate small improvements in inpatient and emergency department utilization among patients engaged with PCMHs,^{7,9} but none show significant cost savings associated with PCMHs.¹ However, from health policy or managed care perspectives (eg, a third-party payer or an accountable care organization), it is unclear how PCMHs impact healthcare expenditures across different levels of care (eg, outpatient care, emergency department [ED] or inpatient care).

All PCMHs deliver care by combining a set of different features, components, or services that complement each other, with the goals of enhancing care delivery and communication. For example, the National Committee for Quality Assurance's (NCQA's) Physician Practice Connections–Patient-Centered Medical Homes recognition program includes 9 standards addressing areas such as access and communica-

Objectives

To determine the impact of individual features of the patient-centered medical home (PCMH) care model on next-year healthcare expenditures including outpatient, inpatient, emergency department, pharmacy, and total healthcare expenditures among Medicare beneficiaries 65 years and older.

Study Design

Analysis of retrospective longitudinal survey data.

Methods

Longitudinal files from the Medical Expenditure Panel Survey were analyzed. Differences in expenditures for individuals whose usual sources of care did or did not have different PCMH features were estimated using recycled predictions from generalized linear regression models.

Results

Having little to no difficulty contacting the regular source of care over the telephone during regular business hours was associated with significantly lower total and inpatient expenditures over the next year (differences of \$2867 and \$3736, respectively). Having a regular source of care with office hours at night or on weekends was associated with significantly lower outpatient, emergency department, and other expenditures (differences of \$535, \$103, and \$328, respectively). Pharmacy expenditures were significantly higher for individuals whose usual source of care inquired about medications and treatments prescribed by other doctors (difference of \$362).

Conclusions

This study points out the need to identify how individual PCMH features impact healthcare expenditures across different policy-relevant categories. Practices that have not fully adopted a PCMH model can still make progress in improving quality and controlling costs by adopting even some modest features of the PCMH model.

Am J Manag Care. 2014;20(5):379-385

Take-Away Points

Features of the patient-centered medical home (PCMH) care model individually influence future healthcare expenditures among Medicare beneficiaries.

- Total, inpatient, outpatient, emergency department, pharmacy, and other expenditures were differentially affected by 1 or more individual features of PCMH care.
- This study points out the need to identify how individual PCMH features impact healthcare expenditures across different policy-relevant categories.
- Results revealed that practices that have not fully adopted a PCMH model can still make progress in improving healthcare quality while reducing or controlling costs by adopting even some modest features of the PCMH model.

tion, referral tracking, and performance reporting and improvement.^{10,11} Another example is the Comprehensive Primary Care (CPC) initiative by the Centers for Medicare & Medicaid Services (CMS).¹² Under the CPC initiative, the PCMH model is augmented by multipayer payment reform (eg, by offering bonus payments to doctors who improve care coordination), total cost accountability in the form of shared savings, and the requirement that the 500 participating primary care practices (serving 313,000 Medicare beneficiaries) use electronic health records (EHRs) to better coordinate care.¹³

Little is known about the role of different *individual* components that define a PCMH on explaining variation in *future* healthcare expenditures. This is important because the costs of implementing a PCMH model in a medical practice are nontrivial and, as a result, medical practices have to decide which elements should be implemented first. In the context of managed care, it is also important to know which PCMH features disrupt all the different categories of healthcare expenditures—which will impact profits, particularly under shared savings arrangements. Although CMS is in the process of testing Medicare PCMH models,¹⁴ there is currently a lack of PCMH research on the Medicare population. In this study, we use data from the Medical Expenditure Panel Survey (MEPS) to determine the impact of individual features of the PCMH model on different levels of future healthcare expenditures, including outpatient, inpatient, ED, pharmacy, and total healthcare costs among Medicare beneficiaries 65 years and older.

METHODS

Data Source and Study Sample

The Household Component of the MEPS was the data source for this study. The Agency for Healthcare Research and Quality administers the MEPS, collecting in-depth information about annual healthcare utilization, medical expenditures and health conditions from a

sample of households in the United States. MEPS employs an overlapping panel design; a new panel of sample households is selected each year and then tracked over the 2-year period. The 3 most recent MEPS Longitudinal Data Files were utilized, which included Panels 12, 13, and 14, interviewed over the years 2007 to 2010.

The study sample included adults who were 65 years of age or older, indicated that they were enrolled in Medicare, and reported that they had a usual source of care other than the ED. Analyses were limited to adults who were not missing data on variables of interest. As a result, 2387 individuals qualified for all analyses (54.8% of the study sample). The most common questions with missing data were those addressing PCMH features (eg, 1920 of the 1970 respondents with missing data did not include information on 1 or more of the questions used to identify PCMH features). The sample size was sufficient for determining statistical significance.

Outcome Variables

Expenditure variables describing the total of payments for care during the second year of each 2-year panel in total, and by health service category, were the outcome variables of interest. These expenditure variables were based on the sum of expenditures during the year from all payment sources, including out-of-pocket payments and payments by third-party payers. The health services expenditure categories included in the current analysis were outpatient (including office-based and hospital outpatient visits), inpatient, ED, prescription medication, and other (including dental care, home healthcare, vision aids, and other medical supplies and equipment).

Primary Independent Variables

Five variables from second-round interviews describing the features of a PCMH as described by Beal and colleagues¹⁵ were the primary independent variables for this study. These questions were worded as follows: (1) “How difficult is it to contact (a medical person at) (PROVIDER) during regular business hours over the telephone about a health problem?”; (2) “Does (PROVIDER) have office hours at night or on weekends?”; (3) “How difficult is it to contact (a medical person at) (PROVIDER) after their regular hours in case of urgent medical needs?”; (4) “Does (someone at) (PROVIDER) usually ask about prescription medications and treatments other doctors may

give them?"; and (5) "If there were a choice between treatments, how often would (a medical person at) (PROVIDER) ask (you/ name) to help make the decision?"

Responses of "yes," "no," "refused," and "don't know" were analyzed such that "yes" was coded as a positive response (1), "no" was coded as negative (0), and "refused" and "don't know" were coded as missing. Questions asking about difficulties were dichotomized, with "not too difficult" and "not at all difficult" coded as positive (1), "refused" and "don't know" coded as missing, and the remaining responses coded as negative response (0). The frequency question was also dichotomized, with "usually" and "always" coded as positive (1), "refused" and "don't know" coded as missing, and the remaining responses coded as negative (0).

The Beal study, which defined the elements of a PCMH for the current study, also included 3 other variables that help define PCMHs.¹⁵ These 3 variables looked at whether individuals visited their regular source of care for new problems, preventive care, and ongoing health problems. They were not included in the current study because most of the responses for these 3 variables were positive (98.8%, 98.7%, and 98.0%, respectively).

Other Measures

Additional variables were incorporated to describe the population and adjust for potential confounders of the relationship between PCMH features and healthcare expenditures. With the exception of race/ethnicity (which is assessed during the initial round) and household income (which is based on income for the first year of the panel), these additional variables were based on the responses to questions asked during second-round interviews. These variables included age, race/ethnicity, region, marital status, poverty status, health insurance coverage, activities of daily living (ADLs) and instrumental activities of daily living (IADLs) limitations, chronic health conditions, and perceived health status). Categorizations for these variables are described in [eAppendix A](#).

Statistical Analyses

We first explored the characteristics of the population and investigated how the potential confounding variables differed across the different features of a PCMH. χ^2 tests were used to assess the significance of unadjusted differences between the categories in each of the PCMH features. Next, we conducted analyses of second-year expenditures associated with each of the PCMH features. As the second-year expenditures for Panels 12, 13, and 14 represented expenditures in 2008, 2009, and 2010, respec-

tively, the expenditures for Panels 12 and 13 were adjusted for inflation to 2010 levels of expenditures using the Consumer Price Index for Medical Care Services.¹⁶ Then, for each of the expenditure categories, we calculated the unadjusted and adjusted predicted expenditures associated with each of the PCMH features using generalized linear regression models with a gamma distribution and a log-link function. This statistical approach accounted for the skewed nature of cost data.¹⁶ Unadjusted models included only a single PCMH feature as a predictor, while adjusted models included all PCMH features and all potential confounders described previously.

The average differences in costs for individuals who had usual sources of care with and without each of the PCMH features were determined by predicting healthcare expenditures using the estimated coefficients from the generalized linear regression equations. This yielded predictions for each individual based on the typical expenditures for individuals with similar characteristics, which were estimated using the method of recycled predictions.¹⁶ We then calculated the differences in these average expenditures. All statistical analyses took into account the complex survey design of MEPS and were conducted in Stata MP version 12.1 (StataCorp LP, College Station, Texas).¹⁷

RESULTS

Table 1 describes the percentage of the study population (N = 2387) by the reported PCMH features. The most common PCMH feature was always or usually asking patients to help decide between treatments, with 85.4% of respondents reporting this feature (95% confidence interval [CI], 83.1-87.6). The least common PCMH feature was having office hours on nights or weekends, with 29.6% of respondents reporting this feature (95% CI, 26.4-32.7). The reported frequency of the other features are provided in Table 1, and information about how the PCMH features vary by sociodemographic and health status variables is provided in [eAppendix A](#).

Table 2 reports the unadjusted and adjusted average expenditures associated with each of the PCMH features (see [eAppendix B](#) for CIs). Having little to no difficulty contacting the regular source of care over the telephone during regular business hours was associated with significantly lower total expenditures and inpatient expenditures. The adjusted average inpatient expenditures for individuals who had little to no difficulty contacting their regular source of care by telephone during business hours was \$3230, while the adjusted average inpatient expenditures for individuals who reported difficulty was \$6966,

Table 1. Percentage of Medicare Beneficiaries 65 Years and Older With a Usual Source of Care (USC) Reporting That Their USC Has Specific Patient-Centered Medical Home Features (N = 2387)

| Feature | % Responding Affirmatively | 95% Confidence Interval |
|--|----------------------------|-------------------------|
| Always or usually asks patient to help decide between treatments | 85.4% | (83.1-87.6) |
| Has no difficulty contacting regular source of care over the telephone during regular business hours | 82.9% | (80.7-85.1) |
| Usually asks about medications and treatments prescribed by other doctors | 81.9% | (79.5-84.4) |
| No difficulty contacting regular provider after regular hours | 68.7% | (65.7-71.7) |
| Regular source of care has office hours on nights or on weekends | 29.6% | (26.4-32.7) |

a difference of \$3736 ($P = .0177$). Total adjusted average healthcare expenditures were also significantly lower for individuals who had no difficulty contacting their regular source of care by telephone during business hours. The adjusted average total healthcare expenditures for individuals who had little difficulty contacting their regular source of care during business hours was \$10,117, while the adjusted average total expenditures for individuals who had difficulty was \$12,984, a difference of \$2867 ($P = .031$).

On the other hand, there were no significant differences in the adjusted average annual medical expenditures for outpatient services (difference of $-\$888$, $P = .0852$), ED services (difference of $-\$59$, $P = .4443$), pharmacy services (difference of $\$94$, $P = .6782$), or other health services (difference of $\$195$, $P = .3122$) depending on whether or not the patient had difficulty contacting his or her usual source of care by telephone during business hours.

Having a regular source of care with office hours at night or on the weekend was associated with significantly lower outpatient, ED, and other healthcare expenditures. The adjusted average outpatient expenditures for individuals who had a usual source of care with office hours at night or on the weekend was \$2531, while the adjusted average outpatient expenditures for individuals without a usual source of care with this feature was \$3066, a difference of \$535 ($P = .0201$). The adjusted average ED expenditures for individuals who had a usual source of care with office hours at night or on the weekend was \$195, while the adjusted average ED expenditures for individuals without a usual source of care with this feature was \$298, a difference of \$103 ($P = .0234$). The adjusted average for other health expenditures for individuals who had a usual source of care with office hours at night or on the weekend was \$1057, while the adjusted average for other health expenditures for individuals without a usual source of care with this feature was \$1386, a difference of \$328 (P

$= .0181$). However, there were no significant differences in the adjusted average annual medical expenditures in total (difference of $-\$1485$, $P = .065$) or for inpatient services (difference of $-\$879$, $P = .2028$) or pharmacy services (difference of $\$34$, $P = .8693$) depending on whether or not the usual source of care had office hours at night or on the weekend.

Having no difficulty contacting the usual source-of-care provider after regular hours was not associated with significant differences in total or in any individual health service category. There were no significant differences in the adjusted average annual medical expenditures for total health services (difference of $\$967$, $P = .2334$), outpatient services (difference of $-\$84$, $P = .7905$), inpatient services (difference of $\$1380$, $P = .0665$), ED services (difference of $-\$15$, $P = .8012$), pharmacy services (difference of $\$169$, $P = .3908$), or other health services (difference of $-\$122$, $P = .5349$) depending on whether or not the patient had difficulty contacting his or her usual source-of-care provider after regular hours.

There were no statistically significant differences in the adjusted average annual medical expenditures for total health services (difference of $-\$279$, $P = .7729$), outpatient services (difference of $\$23$, $P = .9311$), inpatient services (difference of $-\$360$, $P = .7068$), ED services (difference of $-\$41$, $P = .5252$), or other health services (difference of $\$141$, $P = .423$) depending on whether or not the usual source of care asked about medications and treatments prescribed by other doctors. However, the average pharmacy expenditures differed significantly depending on whether or not the usual source of care asked about medications and treatments prescribed by other doctors. The adjusted average pharmacy expenditures for individuals whose usual source of care asked about medications and treatments prescribed by other doctors was \$2735, while the adjusted average pharmacy expenditures for individuals whose usual source of care did not ask about medi-

Table 2. Unadjusted and Adjusted Average Healthcare Expenditures Associated with Specific Patient-Centered Medical Home Features, In Total and By Service Category (N = 2387)

| | Total Expenses | Outpatient Expenses | Inpatient Expenses | ED Expenses | Prescription Expenses | Other |
|--|----------------|---------------------|--------------------|-------------|-----------------------|--------|
| Usually asks about medications and treatments prescribed by other doctors | | | | | | |
| Unadjusted | | | | | | |
| No | \$10,268 | \$2910 | \$3544 | \$249 | \$2178 | \$1387 |
| Yes | \$10,480 | \$2912 | \$3353 | \$243 | \$2701 | \$1271 |
| Difference | \$212 | \$2 | -\$191 | -\$7 | \$523 | -\$115 |
| P | .8176 | .9964 | .8015 | .9084 | .0019 | .6333 |
| Adjusted | | | | | | |
| No | \$10,861 | \$2890 | \$4147 | \$302 | \$2372 | \$1173 |
| Yes | \$10,582 | \$2913 | \$3787 | \$261 | \$2735 | \$1314 |
| Difference | -\$279 | \$23 | -\$360 | -\$41 | \$362 | \$141 |
| P | .7729 | .9311 | .7068 | .5252 | .0386 | .4230 |
| Asks patient to help decide between treatments | | | | | | |
| Unadjusted | | | | | | |
| Sometimes/never | \$11,619 | \$3067 | \$3568 | \$187 | \$3042 | \$1755 |
| Usually/always | \$10,240 | \$2885 | \$3357 | \$254 | \$2532 | \$1213 |
| Difference | -\$1379 | -\$182 | -\$212 | \$66 | -\$510 | -\$542 |
| P | .1732 | .6150 | .7641 | .2818 | .1267 | .0709 |
| Adjusted | | | | | | |
| Sometimes/never | \$10,630 | \$2916 | \$3732 | \$214 | \$2958 | \$1387 |
| Usually/always | \$1632 | \$2908 | \$3883 | \$278 | \$2621 | \$1271 |
| Difference | \$3 | -\$8 | \$151 | \$64 | -\$337 | -\$116 |
| P | .9974 | .9780 | .8436 | .3239 | .2284 | .6173 |
| Difficulty contacting regular source of care over the telephone during regular business hours | | | | | | |
| Unadjusted | | | | | | |
| Somewhat/very | \$13,149 | \$3971 | \$4759 | \$250 | \$2703 | \$1466 |
| Not too/not at all | \$9885 | \$2694 | \$3105 | \$242 | \$2587 | \$1257 |
| Difference | -\$3264 | -\$1278 | -\$1653 | -\$8 | -\$116 | -\$209 |
| P | .0087 | .0617 | .0475 | .9006 | .6396 | .3843 |
| Adjusted | | | | | | |
| Somewhat/very | \$12,984 | \$3641 | \$6966 | \$317 | \$2596 | \$1134 |
| Not too/not at all | \$10,117 | \$2753 | \$3230 | \$258 | \$2690 | \$1330 |
| Difference | -\$2867 | -\$888 | -\$3736 | -\$59 | \$94 | \$195 |
| P | .0310 | .0852 | .0177 | .4443 | .6782 | .3122 |
| Regular source of care has office hours on nights or on weekends | | | | | | |
| Unadjusted | | | | | | |
| No | \$10,769 | \$2951 | \$3562 | \$248 | \$2631 | \$1376 |
| Yes | \$9665 | \$2817 | \$2972 | \$233 | \$2549 | \$1093 |
| Difference | -\$1104 | -\$134 | -\$591 | -\$15 | -\$82 | -\$283 |
| P | .2495 | .7464 | .2937 | .8185 | .7229 | .3314 |
| Adjusted | | | | | | |
| No | \$11,074 | \$3066 | \$4126 | \$298 | \$2663 | \$1386 |
| Yes | \$9588 | \$2531 | \$3247 | \$195 | \$2697 | \$1057 |
| Difference | -\$1485 | -\$535 | -\$879 | -\$103 | \$34 | -\$328 |
| P | 0.0650 | .0201 | .2028 | .0234 | .8693 | .0181 |
| Difficulty contacting regular provider after regular hours | | | | | | |
| Unadjusted | | | | | | |
| Somewhat/very | \$11,467 | \$3320 | \$3522 | \$230 | \$2733 | \$1662 |
| Not too/not at all | \$9974 | \$2725 | \$3326 | \$250 | \$2549 | \$1124 |
| Difference | -\$1493 | -\$595 | -\$196 | \$20 | -\$185 | -\$538 |
| P | .1293 | .1524 | .7379 | .7346 | .5051 | .3041 |
| Adjusted | | | | | | |
| Somewhat/very | \$10,015 | \$2964 | \$3079 | \$278 | \$2560 | \$1368 |
| Not too/not at all | \$10,982 | \$2880 | \$4458 | \$263 | \$2729 | \$1246 |
| Difference | \$967 | -\$84 | \$1380 | -\$15 | \$169 | -\$122 |
| P | .2334 | .7905 | .0665 | .8012 | .3908 | .5349 |

ED indicates emergency department.

cations and treatment prescribed by other doctors was \$2372, a difference of \$362 ($P = .0387$).

Having a usual source of care that always or usually asks the patient to help decide between treatments was not associated with significant differences in total expenditures or in any individual health service category. There were no significant differences in the adjusted average annual medical expenditures for total health services (difference of \$3, $P = .9974$), outpatient services (difference of $-\$8$, $P = .978$), inpatient services (difference of \$151, $P = .8436$), ED services (difference of \$64, $P = .3239$), pharmacy services (difference of $-\$337$, $P = .2284$), or other health services (difference of $-\$116$, $P = .6173$) depending on whether or not the patient was asked to help decide between treatments.

DISCUSSION

Having little to no difficulty contacting a regular source of care over the telephone during regular business hours was associated with significantly lower total healthcare expenditures as well as lower inpatient expenditures, which may be related to reduced hospitalizations. However, there were no significant differences in adjusted average annual healthcare expenditures for outpatient, ED, pharmacy, and other health services. Having a regular source of care with office hours at night or on the weekend was associated with significantly lower outpatient, ED, and other healthcare expenditures—perhaps due to a reduction in ED use—but it was not associated with significant differences in the adjusted average annual healthcare expenditures for inpatient or pharmacy services.

Having no difficulty contacting the usual source-of-care provider after regular hours was not associated with significant differences in total expenditures or in any individual health service category. There were also no statistically significant differences in the adjusted average annual healthcare expenditures for outpatient, inpatient, ED, and other health services depending on whether or not the usual source of care asked about medications and treatments prescribed by other doctors.

Average pharmacy expenditures differed significantly depending on whether or not the usual source of care asked about medications and treatments prescribed by other doctors. This finding may be related to better medication management. For example, when a doctor asks about medication and treatments prescribed by other doctors, then this may be a marker for better medication management; the end result is that prescription expenditures will be higher, but all other expenditures may remain the

same. Lastly, having a usual source of care that always or usually asks the patient to help decide between treatments was not associated with significant differences in total expenditures or in any individual health service category.

This study has several limitations. Some features of PCMHs could not be included in the current study because MEPS did not ask questions related to all the relevant PCMH features (eg, adoption of EHRs, use of evidence-based clinical protocols, degree of care coordination when transitioning between different levels of care). However, this study clearly points out the need to identify how individual PCMH features or components impact healthcare expenditures across different policy-relevant categories to better manage care. More specifically, the PCMH Recognition Program by the NCQA allows medical practices to qualify for financial incentives from health insurance plans and employers. Recognition is determined by achieving a set of standards related to, for example, patient access, communication, data tracking, and performance reporting.¹⁸ CMS also has developed programs to reward practices that fully implement PCMH models (eg, the CPC Initiative).¹² Although studies have shown that PCMHs can improve care coordination and communication,¹⁴ this study reveals that practices that have not fully adopted a PCMH model can still make progress in improving healthcare quality while reducing or controlling costs if they adopted even some modest features of a PCMH model. For example, Medicare could consider incentivizing medical practices that adopt individual cost-saving features of PCMHs and, thus, facilitate the progression of these medical practices toward a fully implemented PCMH model. Although the precise identification of cost-saving PCMH features remains a challenge, given data constraints, this may be the only financially feasible path available for many medical practices that are unable to fully absorb the costs associated with PCMH implementation. Future research is needed to more precisely identify and track how PCMH features related to the use of EHRs and performance reporting are directly related to quality and cost over the long term.

Author Affiliations: University of North Texas Health Science Center, School of Public Health, Department of Health Management and Policy, Fort Worth, TX (ELS, LMP); Magellan Health Services, Analytic Services Department, Maryland Heights, MO (ELS); Baylor Scott & White Health, Office of the Chief Quality Officer, Dallas, TX (LMP); Center for Health Innovation, The New York Academy of Medicine, New York, NY (JAP); Leonard Davis Institute of Health Economics, University of Pennsylvania, Philadelphia, PA (JAP).

Source of Funding: None reported.

Author Disclosures: The authors 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 (ELS, LMP, JAP); analysis and interpretation of data (ELS, LMP, JAP); drafting of the manuscript (ELS, LMP, JAP); critical revision of the manuscript for important intellectual content (ELS, LMP, JAP); statistical analysis (ELS, LMP); administrative, technical, or logistic support (ELS).

Address correspondence to: Erica L. Stockbridge, Department of Health Management and Policy, School of Public Health, University of North Texas Health Science Center, 3500 Camp Bowie Blvd, Fort Worth, TX 76107. E-mail: els0127@live.unthsc.edu.

REFERENCES

- Jackson GL, Powers BJ, Chatterjee R, et al. The patient-centered medical home: a systematic review. *Ann Intern Med.* 2013;158(3):169-178.
- Solberg LI, Asche SE, Fontaine P, Flottemesch TJ, Anderson LH. Trends in quality during medical home transformation. *Ann Fam Med.* 2011;9(6):515-521.
- Jaen CR, Ferrer RL, Miller WL, et al. Patient outcomes at 26 months in the patient-centered medical home National Demonstration Project. *Ann Fam Med.* 2010;(8, suppl 1):S57-S67, S92.
- Reid RJ, Fishman PA, Yu O, et al. Patient-centered medical home demonstration: a prospective, quasi-experimental, before and after evaluation. *Am J Manag Care.* 2009;15(9):e71-e87.
- Wise CG, Bahl V, Mitchell R, West BT, Carli T. Population-based medical and disease management: an evaluation of cost and quality. *Dis Manag.* 2006;9(1):45-55.
- Dorr DA, Wilcox AB, Brunner CP, Burdon RE, Donnelly SM. The effect of technology-supported, multidisease care management on the mortality and hospitalization of seniors. *J Am Geriatr Soc.* 2008;56(12):2195-2202.
- 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.
- Steele GD, Haynes JA, Davis DE, et al. How Geisinger's advanced medical home model argues the case for rapid-cycle innovation. *Health Aff (Millwood).* 2010;29(11):2047-2053.
- 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.
- Standards and guidelines for Physician Practice Connections—patient-centered medical home (PPC-PCMH). National Committee of Quality Assurance website. http://www.ncqa.org/portals/0/programs/recognition/PCMH_Overview_Apr01.pdf. Published 2008.
- Zuckerman S, Merrell K, Berenson R, et al. Incremental cost of estimates for patient-centered medical home. The Commonwealth Fund website. www.commonwealthfund.org/Publications/Fund-Reports/2009/Oct/Incremental-Cost-Estimates-For-The-Patient-Centered-Medical-Home.aspx. Published October 16, 2009.
- Comprehensive Primary Care Initiative: Primary care practice solicitation. Centers for Medicare & Medicaid Services website. www.innovations.cms.gov/Files/x/CPC_PracticeSolicitation.pdf. Published 2009.
- Fact sheet: Comprehensive Primary Care Initiative. Centers for Medicare & Medicaid Services website. <http://innovation.cms.gov/Files/fact-sheet/CPCI-Fact-Sheet.pdf>. Published 2012.
- Details for demonstration project name: Medicare medical home demonstration. Centers for Medicare & Medicaid Services website. <http://www.cms.gov/Medicare/Demonstration-Projects/DemoProject-eValRpts/Medicare-Demonstrations-Items/CMS1199247.html>. Updated April 14, 2011. Accessed April 16, 2013.
- Beal A, Hernandez S, Doty M. Latino access to the patient-centered medical home. *J Gen Intern Med.* Nov 2009;24(suppl 3):514-520.
- United States Census Bureau. Consumer price indexes of medical care prices: 1980 to 2010. <http://www.census.gov/compendia/statab/2012/tables/12s0142.pdf>. Published 2012. Accessed April 10, 2013.
- Martin BI, Gerkovich MM, Deyo RA, et al. The association of complementary and alternative medicine use and healthcare expenditures for back and neck problems. *Med Care.* 2012;50(12):1029-1036.
- Glick H, Doshi J, Sonnad S, D P. *Economic Evaluation in Clinical Trials*. Oxford, England: Oxford University Press; 2007.
- Stata Release 12.1 Statistical Software. College Station, TX: Stata-Corp; 2013.
- Patient-centered medical home. National Committee for Quality Assurance website. www.ncqa.org/portals/0/PCMH%20brochure-web.pdf. Published 2012. ■

www.ajmc.com Full text and PDF
Web exclusive eAppendices A and B

■ **eAppendix A.** Covariate Distribution and Frequency by Patient-Centered Medical Home Feature (N = 2387)

| | Population Total (%) | Usually Asks About Medications and Treatments Prescribed by Other Doctors (%) | Always or Usually Asks Patient to Help Decide Between Treatments (%) | Has No Difficulty Contacting Regular Source of Care Over the Telephone During Regular Business Hours (%) | Regular Source of Care Has Office Hours on Nights or on Weekends (%) | No Difficulty Contacting Regular Provider After Regular Hours (%) |
|--------------------------|----------------------|---|--|--|--|---|
| Panel | | | | | | |
| 12 | 31.0 | 84.1 | 87.8 | 84.9 | 29.3 | 69.9 |
| 13 | 34.0 | 82.2 | 84.0 | 80.6 | 27.8 | 66.4 |
| 14 | 35.0 | 79.8 | 84.6 | 83.5 | 31.5 | 69.8 |
| <i>P</i> | | .3095 | .2388 | .3011 | .4548 | .4693 |
| Gender | | | | | | |
| Male | 43.2 | 84.1 | 85.8 | 83.9 | 29.8 | 68.8 |
| Female | 56.8 | 80.3 | 85.1 | 82.1 | 29.4 | 68.6 |
| <i>P</i> | | .0042 | .5914 | .2522 | .8626 | .9217 |
| Age (y) | | | | | | |
| 65-69 | 29.0 | 81.0 | 85.9 | 82.9 | 35.8 | 68.3 |
| 70-74 | 23.1 | 82.9 | 86.8 | 82.5 | 28.3 | 72.1 |
| 75-79 | 20.9 | 84.0 | 85.0 | 84.1 | 23.8 | 65.4 |
| 80-84 | 15.9 | 80.0 | 82.8 | 81.0 | 24.3 | 64.8 |
| 85+ | 11.1 | 81.2 | 85.6 | 82.6 | 34.5 | 74.4 |
| <i>P</i> | | .6854 | .7228 | .8858 | .0017 | .1104 |
| Race/Ethnicity | | | | | | |
| White non-Hispanic | 79.2 | 82.2 | 85.8 | 81.7 | 29.9 | 69.5 |
| Black non-Hispanic | 8.4 | 81.4 | 81.1 | 86.8 | 26.2 | 64.8 |
| Hispanic | 8.0 | 82.0 | 85.8 | 88.0 | 27.3 | 64.4 |
| Other non-Hispanic | 4.4 | 77.5 | 85.0 | 88.0 | 33.8 | 68.5 |
| <i>P</i> | | .7023 | .3932 | .0394 | .5532 | .4684 |
| Region | | | | | | |
| Northeast | 20.6 | 79.1 | 88.8 | 84.5 | 34.8 | 79.3 |
| Midwest | 19.0 | 80.6 | 82.2 | 83.2 | 32.1 | 70.0 |
| South | 39.1 | 84.5 | 85.6 | 82.5 | 22.3 | 65.8 |
| West | 21.3 | 81.3 | 84.5 | 82.0 | 35.6 | 62.6 |
| <i>P</i> | | .3417 | .2942 | .8692 | .0031 | .0016 |
| Marriage Status | | | | | | |
| Not married | 41.8 | 79.6 | 82.2 | 79.9 | 29.2 | 68.8 |
| Married | 58.2 | 83.6 | 87.7 | 85.1 | 30.0 | 70.7 |
| <i>P</i> | | .0392 | .0045 | .0231 | .7776 | .0596 |
| Poverty | | | | | | |
| <100% FPL | 10.0 | 80.8 | 85.0 | 85.4 | 25.4 | 62.5 |
| 100-199% of FPL | 23.3 | 81.6 | 84.3 | 84.0 | 25.7 | 66.8 |
| 200-399% of FPL | 31.1 | 81.2 | 84.3 | 80.7 | 28.5 | 66.8 |
| 400%+ of FPL | 35.6 | 83.2 | 87.2 | 83.5 | 34.4 | 73.3 |
| <i>P</i> | | .8430 | .5221 | .4741 | .0284 | .0371 |
| Insurance | | | | | | |
| Medicare | 49.2 | 81.8 | 87.0 | 83.1 | 30.1 | 68.0 |
| Medicare + private | 42.7 | 83.1 | 84.7 | 82.3 | 29.2 | 73.2 |
| Medicare + Medicaid dual | 8.1 | 76.7 | 79.2 | 85.3 | 28.7 | 48.9 |
| <i>P</i> | | .1655 | .0520 | .6780 | .9001 | .00 |

(Continued)

■ eAppendix A. Covariate Distribution and Frequency by Patient-Centered Medical Home Feature (N = 2387)
(Continued)

| | Population Total (%) | Usually Asks About Medications and Treatments Prescribed by Other Doctors (%) | Always or Usually Asks Patient to Help Decide Between Treatments (%) | Has No Difficulty Contacting Regular Source of Care Over the Telephone During Regular Business Hours (%) | Regular Source of Care Has Office Hours On Nights or On Weekends (%) | No Difficulty Contacting Regular Provider After Regular Hours (%) |
|------------------------------|----------------------|---|--|--|--|---|
| Stroke | | | | | | |
| No | 86.0 | 81.8 | 85.8 | 83.3 | 29.6 | 69.2 |
| Yes | 13.9 | 82.8 | 82.9 | 80.9 | 29.7 | 65.5 |
| <i>P</i> | | .6896 | .2168 | .3703 | .9834 | .2408 |
| Diabetes | | | | | | |
| No | 76.7 | 81.7 | 86.3 | 83.2 | 30.0 | 69.6 |
| Yes | 23.3 | 82.9 | 82.3 | 82.1 | 28.1 | 65.6 |
| <i>P</i> | | .5813 | .0478 | .5911 | .4404 | .1139 |
| High Blood Pressure | | | | | | |
| No | 28.7 | 82.8 | 86.7 | 82.6 | 31.7 | 68.6 |
| Yes | 71.2 | 81.6 | 84.9 | 83.1 | 28.7 | 68.7 |
| <i>P</i> | | .5779 | .3493 | .8052 | .2135 | .9693 |
| Arthritis | | | | | | |
| No | 38.6 | 82.5 | 87.1 | 84.1 | 28.8 | 72.1 |
| Yes | 61.4 | 81.6 | 84.3 | 82.2 | 30.1 | 66.6 |
| <i>P</i> | | .6503 | .1166 | .3337 | .5946 | .0090 |
| High Cholesterol | | | | | | |
| No | 35.9 | 81.6 | 87.0 | 84.2 | 29.8 | 69.2 |
| Yes | 64.1 | 82.1 | 84.5 | 82.2 | 29.5 | 68.4 |
| <i>P</i> | | .7804 | .1887 | .3259 | .8986 | .7825 |
| Respiratory Condition | | | | | | |
| No | 86.1 | 81.2 | 86.2 | 83.5 | 29.7 | 69.5 |
| Yes | 13.9 | 86.7 | 80.6 | 79.5 | 29.0 | 63.6 |
| <i>P</i> | | .0356 | .0320 | .1229 | .8465 | .0891 |
| Heart Condition | | | | | | |
| No | 60.4 | 81.3 | 86.2 | 83.7 | 30.9 | 70.6 |
| Yes | 39.6 | 82.9 | 84.2 | 81.7 | 27.6 | 65.8 |
| <i>P</i> | | .3730 | .2481 | .2699 | .1841 | .0462 |
| ADL Limitation | | | | | | |
| No | 93.3 | 81.9 | 85.7 | 83.1 | 30.0 | 69.1 |
| Yes | 6.7 | 82.8 | 81.4 | 80.4 | 24.5 | 63.2 |
| <i>P</i> | | .8239 | .2318 | .4582 | .2211 | .2729 |
| IADL Limitation | | | | | | |
| No | 88.5 | 81.8 | 85.6 | 83.8 | 29.5 | 69.6 |
| Yes | 11.5 | 83.2 | 83.4 | 76.4 | 30.5 | 61.9 |
| <i>P</i> | | .6543 | .3988 | .0090 | .7978 | .0618 |
| Self-Reported Health | | | | | | |
| Excellent | 15.3 | 80.6 | 87.8 | 82.0 | 27.4 | 74.0 |
| Very good | 27.8 | 79.8 | 85.7 | 85.2 | 32.7 | 72.9 |
| Good | 32.8 | 83.3 | 85.8 | 84.5 | 29.4 | 68.1 |
| Fair | 17.6 | 82.8 | 83.4 | 77.7 | 27.3 | 61.0 |
| Poor | 6.5 | 84.8 | 81.4 | 81.6 | 28.9 | 61.8 |
| <i>P</i> | | .5272 | .4496 | .0990 | .5616 | .0064 |

ADL indicates activities of daily living; FPL, federal poverty level; IADL, instrumental activities of daily living.

■ eAppendix B. Unadjusted and Adjusted Average Healthcare Expenditures Associated With Specific Patient-Centered Medical Home Features, in Total and by Service Category, Including Confidence Intervals (N = 2387)

| | Total Expenses | | Outpatient Expenses | | Inpatient Expenses | | ED Expenses | | Prescription Expenses | | Other | |
|--|----------------------|-----------------|----------------------|----------------|----------------------|-----------------|----------------------|---------------|-----------------------|----------------|----------------------|----------------|
| | Expenditure Estimate | 95% CI | Expenditure Estimate | 95% CI | Expenditure Estimate | 95% CI | Expenditure Estimate | 95% CI | Expenditure Estimate | 95% CI | Expenditure Estimate | 95% CI |
| Usually asks about medications and treatments prescribed by other doctors | | | | | | | | | | | | |
| Unadjusted | | | | | | | | | | | | |
| No | \$10,268 | (8534-12,002) | \$2910 | (2236-3585) | \$3544 | (2123-4965) | \$249 | (152-346) | \$2178 | (1903-2453) | \$1387 | (808-1965) |
| Yes | \$10,480 | (9638-11,322) | \$2912 | (2594-3229) | \$3353 | (2787-3919) | \$243 | (182-303) | \$2701 | (2432-2970) | \$1271 | (945-1598) |
| Difference | \$212 | (-1597 to 2021) | \$2 | (-725 to 728) | -\$191 | (-1686 to 1304) | -\$7 | (-119 to 106) | \$523 | (195-851) | -\$115 | (-591 to 360) |
| P | .8176 | | .9964 | | .8015 | | .9084 | | .0019 | | .6333 | |
| Adjusted | | | | | | | | | | | | |
| No | \$10,861 | (9055-12,667) | \$2890 | (2368-3411) | \$4147 | (2413-5881) | \$302 | (167-437) | \$2372 | (2040-2705) | \$1173 | (788-1558) |
| Yes | \$10,582 | (9685-11,479) | \$2913 | (2641-3185) | \$3787 | (3024-4550) | \$261 | (192-330) | \$2735 | (2464-3005) | \$1314 | (1016-1612) |
| Difference | -\$279 | (-2182 to 1624) | \$23 | (-503 to 549) | -\$360 | (-2243 to 1523) | -\$41 | (-170 to 87) | \$362 | (19-705) | \$141 | (-205 to 487) |
| P | .7729 | | .9311 | | .7068 | | .5252 | | .0386 | | .4230 | |
| Asks patient to help decide between treatments | | | | | | | | | | | | |
| Unadjusted | | | | | | | | | | | | |
| Sometimes/never | \$11,619 | (9751-13,490) | \$3067 | (2462-3672) | \$3568 | (2260-4877) | \$187 | (87-287) | \$3042 | (2408-3675) | \$1755 | (1061-2449) |
| Usually/always | \$10,240 | (9392-11,088) | \$2885 | (2549-3221) | \$3357 | (2777-3936) | \$254 | (192-314) | \$2532 | (2290-2774) | \$1213 | (895-1531) |
| Difference | -\$1379 | (-3368 to 610) | -\$182 | (-894 to 530) | -\$212 | (-1600 to 1176) | \$66 | (-55 to 188) | -\$510 | (-1165 to 146) | -\$542 | (-1131 to 47) |
| P | .1732 | | .6150 | | .7641 | | .2818 | | .1267 | | .0709 | |
| Adjusted | | | | | | | | | | | | |
| Sometimes/never | \$10,630 | (8939-12,320) | \$2916 | (2395-3436) | \$3732 | (2319-5145) | \$214 | (101-327) | \$2958 | (2385-3531) | \$1387 | (892-1882) |
| Usually/always | \$1632 | (9737-11,528) | \$2908 | (2615-3199) | \$3883 | (3120-4646) | \$278 | (202-354) | \$2621 | (2376-2866) | \$1271 | (981-1560) |
| Difference | \$3 | (-1756 to 1762) | -\$8 | (-597 to 580) | \$151 | (-1353 to 1655) | \$64 | (-63 to 191) | -\$337 | (-887 to 213) | -\$116 | (-575 to 342) |
| P | .9974 | | .9780 | | .8436 | | .3239 | | .2284 | | .6173 | |
| Difficulty contacting regular source of care over the telephone during regular business hours | | | | | | | | | | | | |
| Unadjusted | | | | | | | | | | | | |
| Somewhat/very | \$13,149 | (10,895-15,403) | \$3971 | (2668-5275) | \$4759 | (3224-6293) | \$250 | (137-364) | \$2703 | (2289-3116) | \$1466 | (880-2052) |
| Not too/not at all | \$9885 | (9042-10,728) | \$2694 | (2447-2940) | \$3105 | (2535-3676) | \$242 | (185-300) | \$2587 | (2318-2856) | \$1257 | (931-1581) |
| Difference | -\$3264 | (-5693 to -836) | -\$1278 | (-2619 to 61) | -\$1653 | (-3289 to -18) | -\$8 | (-130 to 114) | -\$116 | (-604 to 372) | -\$209 | (-683 to 264) |
| P | .0087 | | .0617 | | .0475 | | .9006 | | .6396 | | .3843 | |
| Adjusted | | | | | | | | | | | | |
| Somewhat/very | \$12,984 | (10,640-15,328) | \$3641 | (2699-4582) | \$6966 | (3972-9960) | \$317 | (161-482) | \$2596 | (2230-2962) | \$1134 | (740-1528) |
| Not too/not at all | \$10,117 | (9193-11,040) | \$2753 | (2484-3021) | \$3230 | (2595-3865) | \$258 | (190-325) | \$2690 | (2402-2977) | \$1330 | (1023-1636) |
| Difference | -\$2867 | (-5470 to -265) | -\$888 | (-1900 to 124) | -\$3736 | (-6818 to -654) | -\$59 | (-210 to 92) | \$94 | (-351 to 539) | \$195 | (-185 to 576) |
| P | .0310 | | .0852 | | .0177 | | .4443 | | .6782 | | .3122 | |
| Regular source of care has office hours on nights or on weekends | | | | | | | | | | | | |
| Unadjusted | | | | | | | | | | | | |
| No | \$10,769 | (9723-11,812) | \$2951 | (2659-3244) | \$3562 | (2883-4242) | \$248 | (196-300) | \$2631 | (2341-2920) | \$1376 | (909-1843) |
| Yes | \$9665 | (8229-11,100) | \$2817 | (2069-3565) | \$2972 | (2099-3844) | \$233 | (113-353) | \$2549 | (2182-2916) | \$1093 | (782-1405) |
| Difference | -\$1104 | (-2989 to 781) | -\$134 | (-950 to 682) | -\$591 | (-1698 to 516) | -\$15 | (-142 to 112) | -\$82 | (-535 to 372) | -\$283 | (-855 to 290) |
| P | .2495 | | .7464 | | .2937 | | .8185 | | .7229 | | .3314 | |
| Adjusted | | | | | | | | | | | | |
| No | \$11,074 | (10,046-12,101) | \$3066 | (2776-3355) | \$4126 | (3223-5029) | \$298 | (214-381) | \$2663 | (2385-2941) | \$1386 | (1064-1707) |
| Yes | \$9588 | (8303-10,873) | \$2531 | (2105-2957) | \$3247 | (2211-4293) | \$195 | (125-266) | \$2697 | (2319-3075) | \$1057 | (788-1327) |
| Difference | -\$1485 | (-3063 to 93) | -\$535 | (-985 to -85) | -\$879 | (-2236 to 477) | -\$103 | (-191 to -14) | \$34 | (-373 to 441) | -\$328 | (-600 to -57) |
| P | .0650 | | .0201 | | .2028 | | .0234 | | .8693 | | .0181 | |
| Difficulty contacting regular provider after regular hours | | | | | | | | | | | | |
| Unadjusted | | | | | | | | | | | | |
| Somewhat/Very | \$11,467 | (9776-13,169) | \$3320 | (2575-4065) | \$3522 | (2591-4453) | \$230 | (155-305) | \$2733 | (2246-3220) | \$1662 | (665-2658) |
| Not too/Not at all | \$9,974 | (9106-10,843) | \$2725 | (2441-3009) | \$3326 | (2654-3998) | \$250 | (175-324) | \$2549 | (2292-2805) | \$1124 | (917-1330) |
| Difference | -\$1,493 | (-3426 to 440) | -\$595 | (-1411 to 221) | -\$196 | (-1349 to 957) | \$20 | (-94 to 133) | -\$185 | (-730 to 360) | -\$538 | (-1567 to 491) |
| P | .1293 | | .1524 | | .7379 | | .7346 | | .5051 | | .3041 | |
| Adjusted | | | | | | | | | | | | |
| Somewhat/Very | \$10,015 | (8651-11,378) | \$2964 | (2443-3485) | \$3079 | (2170-3987) | \$278 | (163-392) | \$2560 | (2194-2926) | \$1368 | (938-1798) |
| Not too/Not at all | \$10,982 | (9972-11,991) | \$2880 | (2563-3191) | \$4458 | (3320-5596) | \$263 | (192-334) | \$2729 | (2451-3006) | \$1246 | (974-1519) |
| Difference | \$967 | (-628 to 2562) | -\$84 | (-711 to 542) | \$1380 | (-95 to 2854) | -\$15 | (-131 to 101) | \$169 | (-218 to 556) | -\$122 | (-509 to 265) |
| P | .2334 | | .7905 | | .0665 | | .8012 | | .3908 | | .5349 | |