


# The Patient-Centered Care and Receipt of Preventive Services Among Older Adults With Chronic Diseases: A Nationwide Cross-sectional Study

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## Abstract

This article investigates the associations between the patient-centered care (PCC) and receipt of preventive services among older adults with chronic diseases. Data were derived from the nationally representative Medical Expenditure Panel Survey. The full-year consolidated data files from 2009 to 2013 were pooled to yield a final analytic sample (N = 16 654). Study outcomes included the receipt of 7 types of preventive screenings and 2 types of health education services. Patients' PCC groups were categorized as PCC, partial PCC, and non-PCC, based on 9 questions classified under the 3 distinctive attributes of PCC—whole-person care, patient engagement, and enhanced access to care. Prevalence rates for each outcome variable were calculated. We estimated odds ratios from multiple logistic regressions, comparing the likelihood of outcome variables across 3 groups of patients. Adjusting for covariates, the PCC group was more likely than the non-PCC group to receive 8 types of preventive services. The partial PCC group had a greater likelihood than the non-PCC group of receiving 7 types of preventive services. Our study reveals significant associations between PCC and receipt of preventive services. PCC has demonstrated the potential to improve preventive care for older adults with chronic diseases.

## Keywords

patient-centered care, health services, chronic disease, cross-sectional study

## Introduction

Globally, there is a demographic shift in the distribution of population toward older age. In the United States, the population aged 65 and above is projected to reach 83.7 million in 2050, almost doubling its estimated population of 43.1 million in 2012.<sup>1</sup> The age structure will experience a shift from 13.7% of the population aged 65 and above in 2012 to 20.3% in 2030.<sup>1</sup> This demographic transition is paralleled with a global burden of disease shifting from infectious to noncommunicable diseases. As of 2012, about half of all adults—117 million people—had 1 or more chronic health conditions. At the same time, 1 in 4 adults had 2 or more chronic health conditions.<sup>2</sup>

Providing optimal care for older adults with chronic conditions and comorbidities is among the greatest challenges of the health care spectrum. There is evidence of extant heterogeneity among older adults in terms of health status, disease severity, treatment options, prognosis, and risk of adverse events.<sup>3–5</sup> Importantly, the literature suggests that the optimal management of chronic conditions depends highly on active involvement of the patients.<sup>6,7</sup> The concept of patient-centered care (PCC) has been important in the health care sector since the

1950s.<sup>8</sup> PCC, as defined by the Institute of Medicine, “entails medical care processes that ensure decisions regarding the care received with respect to each patient’s wants, needs, and preferences, and for which the patient has the education and support he or she needs to make decisions and participate in his or her own care.” It has been ascertained as an effective

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approach to deliver care that meets the specific needs, values, and beliefs of patients.<sup>5</sup> The following, synthesized 3 main attributes of PCC have been comprehensively applied in various studies: (1) whole-person care orientation, (2) patient engagement in care, and (3) enhanced access to care.<sup>9-11</sup>

For decades, the US health care system has fallen short in its effort to adapt to the changing needs of the aging population and to provide them high-value health care services.<sup>12</sup> In an ongoing effort to reform the national health care system, PCC is recognized as a promising approach that can better align the care process with the patient's needs by combining primary care's traditional strengths with innovative arrangements of care delivery.<sup>12</sup> Although PCC has broad support from multiple stakeholders, and has demonstrated outcomes from a considerable number of studies, to our knowledge there is no nationwide evidence that specifically focuses on the benefits of PCC to the older chronically ill segment of the population. Our study attempts to fill this specific knowledge gap by investigating the role of PCC on this target population through the inclusion of a broad array of measures. The objective of this study is to assess the relationship between the receipt of PCC and the receipt of preventive services among older adults with chronic conditions.

## Methods

### *Data Source and Sample*

Data for this study came from the Household Component of the Medical Expenditure Panel Survey (MEPS-HC), a nationally representative 2-year panel survey of noninstitutionalized US civilian families and individuals administered by the Agency for Healthcare Research and Quality (AHRQ). Using the overlapping panel design of the survey, data are collected through a series of 5 rounds of interviews covering 2 full calendar years. Each year, a new panel of sample households is selected, meaning that data are collected simultaneously for 2 panels during each calendar year. The full-year consolidated MEPS-HC data files from 2009 through 2013 provided the data source for this study. We included respondents aged 65 and older, having at least 1 chronic condition (conditions identified based on the study by Goodman et al<sup>13</sup>) and a usual source of care; we excluded respondents with duplicate identifiers and with missing or ineligible values on independent or dependent variables. The final sample size was 16 654.

### *Measures*

**Independent variables.** Previously, PCC measures have been based on structural and process measures reported by health care providers or based on recognition records from health administrative agencies; however, reports from patients regarding their experiences with care are being used more and more to develop robust indicators of PCC.<sup>9,14</sup> MEPS variables

used to assess whether respondents received PCC were selected based on synthesized attributes of PCC, face validity, and similar questions used in previous MEPS published work in operationalizing the PCC.<sup>9-11,15-17</sup> The authors (H.L., L.S., and J.Z.) made initial selections and assignments, and the coauthors (J.A.W., X.K., and M.A.B.) reviewed the selections for face and content validity. Nine items were selected to operationalize 3 distinctive attributes of PCC: whole-person care, patient engagement, and enhanced access to care. Table 1 shows the 9 items and our coding method for computing PCC status. Respondents were categorized into 3 groups based on the synthesized attributes and previous literature.<sup>9,18</sup> The method of categorizing respondents aimed to measure different levels of PCC status, including the comprehensiveness and extent of PCC components that respondents received. In the real world, there were different levels of patient-centered medical home (PCMH) recognition available for a medical practice to earn. Our category method was designed to reflect the real-world situation and the process that diverse practices were poised for continuous improvement in providing PCC to their patients. Based on this principle, respondents were categorized into 3 groups: (1) PCC (fully achieved PCC requirements): including those who had a positive ("yes") response on all items in the whole-person care domain, and had only 1 negative ("no") response in the domains of patient engagement or enhanced accessibility; (2) partial PCC (intermediately achieved PCC requirements): including those who said "yes" to all items in the whole-person care domain, and had at least 1 "yes" in each of the patient engagement domains and enhanced accessibility domain; and (3) non-PCC (lack the core attribute(s) of PCC): including those who said "no" to any item in the whole-person care domain, or who had no positive item in the patient engagement domain or enhanced accessibility domain.

To address potential bias of our PCC classifications, sensitivity analysis was performed to examine associations of number of satisfied PCC attributes, coded as a main predictor (0-3), with overall health care ratings ("using any number from 0 to 10, where 0 is the worst health care possible and 10 is the best health care possible, what number would you use to rate all your health care in the last 12 months").<sup>10</sup> Results were presented in the appendix, which showed that there were positive associations between number of PCC attributes and health care ratings, which indicated our classifications of PCC were valid.

**Dependent variables.** Study outcomes included the receipt of 7 types of preventive screenings and 2 types of health education according to the Guide to Clinical Preventive Services by US Preventive Services Task Force (USPSTF) on screening, counseling, and preventive medication.<sup>19</sup> We coded these variables as dichotomous variables: "yes" or "no." The details of 9 measures, their definitions, and target populations are shown in Table 2.

**Table 1.** PCC Status and Samples.

PCC attributes and items		PCC status		
PCC attributes	Items in MEPS	PCC (n = 5963)	Partial PCC (n = 6973)	Non-PCC (n = 3718)
Whole-person care	Confidence in USC for new and minor health problems	√	√	Any the 4 items get × or
	Confidence in USC for preventive health care	√	√	
	Confidence in USC for ongoing health problems	√	√	
	Confidence in USC for referrals to other health professionals	√	√	
Patient engagement	Usually ask about prescription medications and treatments other doctors may give them	At least 1 √	At least 1 √	Two items get × or
	Always or usually ask the person to help make decisions between a choice of treatments			
Enhanced access	Has no difficulty of accessing the USC provider by phone	At least 1 √	At least 1 √	All 3 items get ×
	USC provider has office hours at night or on the weekend			
	Has no difficulty of accessing the USC provider after hours			
Total number of PCC items required		≥8	6-7	

Note. PCC = patient-centered care; MEPS = Medical Expenditure Panel Survey; USC = usual source of care.

**Table 2.** Outcome Measures, Definitions and Target Patients.

Outcome measures	Definitions	Target patients
Preventive screening		
Blood pressure	Blood pressure check within the past year	Patients ≥65 years of age
Blood cholesterol	Blood cholesterol check within the past year	Patients ≥65 years of age
Routine checkup	Routine checkup within the past year	Patients ≥65 years of age
Blood stool test	Blood stool test within the past year	Patients ≥65 years of age
Breast exam	Breast exam within the past year	Female patients 65-74 years of age
Mammography	Mammogram check within the past 2 years	Female patients 65-74 years of age
Pap smear test	Ever have a Pap smear test	Female patients 65-74 years of age
Health education		
Exercise education	Advice on more exercise within the past year	Patients ≥65 years of age
Diet education	Advice on healthy diet within the past year	Patients ≥65 years of age

**Covariates.** We used the access to care framework by Aday et al<sup>20</sup> to select covariates related to the experience of PCC. According to this framework, utilization of health services is determined by 3 factors: predisposing, enabling, and need. Predisposing factors are biologically or socially constructed factors that influence an individual's inclination to use health care services. In this study, we included age, gender, race and ethnicity, marital status, educational level, employment status, and census region. Enabling factors are resources, the ability of an individual, and the availability of health care services that enable the use of health care. We included household per capita income, health insurance coverage, and managed care status, which was defined as whether a respondent was covered under a managed

care plan (public or private), including plans defined as a health maintenance organization (HMO), or gatekeeper plans. Need factors are the individual's objective and subjective needs for health care services. We included the number of existing chronic conditions, need for help with activities of daily living (ADLs), and need for help with instrumental activities of daily living (IADLs). We also included 2 covariates regarding provider characteristics: the provider type and location.

### Analysis

Our initial analyses focused on standard descriptive statistics and bivariate relationships. Then we conducted design-based

*F* tests<sup>21</sup> to compare the likelihood of receiving each of the 7 recommended preventive screenings and 2 types of health education among the patient groups who had PCC, partial PCC, and non-PCC. We performed multivariate logistic regressions to reveal the relationships between the outcomes and the independent variable after controlling for age, risk, and other covariates. Our final model fit the full model with all possible predictors. Stata/SE version 14.0 (StataCorp LP) was used for all analyses. As the sample design of the MEPS included clustering, stratification, disproportionate sampling, as well as the adjustments for survey nonresponse, it required special consideration when analyzing MEPS data. To obtain accurate national estimates from MEPS data, all analyses were weighted<sup>22</sup> by using the *svy* commands available in Stata. Weights were applied to the total original sample of all age >65. We used standard errors, *P* values, odds ratios (ORs), and 95% confidence interval to interpret effect size and statistical significance.

## Results

### *Demographic and Institutional Characteristics*

Table 3 characterizes the weighted sample for older adults aged 65 and above with at least 1 chronic condition. The final analytic sample size was 16 654, which represented the weighted population of 181.60 million. Overall, 56% of the sample were female. The mean age of included respondents was  $74.3 \pm 0.13$  years. The majority of the respondents were non-Hispanic whites (80%). About 43% of respondents' highest degrees were high school. A higher proportion of respondents lived in the South (37%), a smaller proportion in the Northeast (19%). Respondents were categorized into 3 groups based on their reported PCC items: 5963 in the PCC group, 6973 in the partial PCC group, and 3718 in the non-PCC group. In terms of predisposing factors, there were no significant differences among the 3 groups in race/ethnicity and education level distributions. Compared with PCC and partial PCC samples, the non-PCC sample included more unmarried (50%) and unemployed people (82%). In terms of enabling factors, the household per capita income was higher among PCC and partial PCC respondents than non-PCC respondents. Respondents from the PCC and partial PCC groups had higher rates of Medicare and private insurance coverage than non-PCC respondents. Respondents from the PCC and partial PCC groups also had higher rates of having managed care. Respondents from all 3 groups had about 4 chronic conditions, with >90% having multiple chronic conditions. There were differences in system factors among the 3 groups. The PCC group was more likely to be employed providers of a health care facility (41%), whereas the non-PCC group was more likely to be independent providers not employed by a health care facility (35%, identified as physicians who treated the patient at a facility, but who billed separately).

The standard errors of all survey estimates and associated test statistics have been adjusted for the impact of clustering due to the complex multistage survey design and unequal weighting.

### *Bivariate Results*

Table 4 presents the bivariate associations between PCC and the receipt of 9 types of preventive care. Overall, the results of all comparisons were significant at a type I error of 0.05. There were significant differences in receiving 7 preventive screenings and 2 types of health education across the 3 groups. Among the 3 groups of respondents, PCC respondents had the highest proportions in 7 out of 9 measures, followed by the partial PCC group. PCC respondents reported higher proportions of receiving a blood stool test, and breast exam than non-PCC respondents. The magnitude of differences between the PCC group and the non-PCC group in these 2 measures reached around 10%. The difference between the PCC group and the non-PCC group in blood pressure check within the past 12 months was small (97.6% vs 96.9%). For the other 6 measures, the proportions of the PCC group were 5% to 8% higher than the proportions of the non-PCC group. Notably, the differences of the proportions between the PCC group and the partial PCC group in preventive screening measures were small (within 2.2%), whereas the differences in the 2 health education measures between these 2 groups were higher (4.8% and 4.7%, respectively).

### *Multivariate Results*

Table 5 displays findings from the multiple logistic regression analyses linking PCC status (PCC vs non-PCC and partial PCC vs non-PCC) as the key predictor with the odds of receiving preventive care as alternative outcomes, after controlling for individual predisposing, enabling, and need covariates as well as system covariates. ORs and 95% confidence intervals are shown in the table. Similar to the findings from the bivariate analyses, the PCC group was found to be more likely than the non-PCC group to receive 6 types of preventive screenings and 2 types of health education. The partial PCC group was found to be more likely than the non-PCC group to receive 7 types of preventive screenings, after controlling for individual and institutional characteristics.

Specifically, the PCC group was 2.00 (95% confidence interval [CI]: 1.58-2.56) times more likely than the non-PCC group to obtain cholesterol checks within the past 12 months, 1.81 (95% CI: 1.50- 2.20) times more likely than the non-PCC group to receive routine checkups within the past 12 months, 1.84 (95% CI: 1.54-2.26) times more likely than the non-PCC group to complete a blood stool test within the past 12 months, 1.52 (95% CI: 1.29-1.77) times more likely than the non-PCC group to have a breast exam within the past 12 months, 1.55 (95% CI: 1.36-1.96) times more likely than the non-PCC group to have a mammogram within the previous

**Table 3.** Sociodemographic and Health Characteristics: 2009-2013 US Civilian Noninstitutionalized Population Age 65 and Above With Chronic Conditions.

	Total	PCC	Partial PCC	Non-PCC	P value
Sample size (unweighted)	16 654	5963	6973	3718	
Weighted population (1000)	181 599.05	64 748.36	76 168.68	40 682.01	
Gender, %					.85
Male	43.75	43.95	43.81	43.32	
Female	56.22	56.05	56.19	56.68	
Age, mean (SE)***	74.29 (0.13)	74.09 (0.18)	74.31 (0.15)	74.56 (0.18)	<.001
Race/ethnicity, %					.50
Non-Hispanic white	79.97	79.41	80.61	79.68	
Hispanic	6.90	7.02	6.94	6.65	
Non-Hispanic black	8.22	8.32	8.16	8.20	
Non-Hispanic Asian	3.43	3.65	3.12	3.67	
Non-Hispanic Other Race or Multirace	1.46	1.60	1.17	1.81	
Marital status, %**					<.001
Not married	44.66	41.28	44.65	50.08	
Married	55.34	58.72	55.35	49.92	
Education, %					.16
No degree	19.58	18.49	19.75	21.00	
General equivalency diploma/high school diploma	42.68	42.09	42.89	43.22	
Bachelor's degree/some college/associate degree	21.86	22.32	21.90	21.07	
Advanced degree	15.88	17.10	15.46	14.71	
Employment status, %*					.01
Not employed	80.91	79.16	81.58	82.46	
Employed	19.09	20.84	18.42	17.54	
Region, %**					<.001
Northeast	19.24	24.10	16.25	17.11	
Midwest	22.67	22.51	23.50	21.37	
South	36.68	33.90	39.22	36.35	
West	21.41	19.49	21.03	25.17	
Household per capita income, \$, mean (SE)***	31 110.42 (571.89)	32 553.65 (835.17)	30 736.86 (729.93)	29 512.82 (721.31)	<.001
Insurance coverage, %**					.005
Uninsured	0.71	0.63	0.90	0.46	
Medicare only	36.20	35.88	35.01	38.94	
Medicare and private	52.79	54.12	53.43	49.45	
Medicare and other public only	9.93	8.88	10.35	10.82	
No Medicare and any public/private	0.38	0.50	0.31	0.32	
Managed care status, %*					.03
Managed care	21.33	23.21	22.34	19.78	
Nonmanaged care	78.67	76.79	77.66	80.22	
Need help with ADLs, %					.13
No	93.09	93.15	93.55	92.13	
Yes	6.91	6.85	6.45	7.87	
Need help with IADLs, %*					.04
No	88.45	88.99	88.87	86.81	
Yes	11.55	11.01	11.13	13.19	
Chronic conditions					
Number of chronic conditions, mean (SE)	3.91 (0.02)	3.92 (0.04)	3.92 (0.03)	3.91 (0.04)	.06
% multiple conditions ( $\geq 2$ conditions), %	90.92	90.43	91.48	90.66	.25
% $\geq 5$ conditions, %	34.60	34.67	34.43	34.82	.95
Provider's type, %**					<.001
Facility	36.67	40.84	34.64	33.82	
Person	32.61	32.30	33.49	31.47	
Person in facility provider	30.72	26.86	31.88	34.71	
Provider's location, %**					<.001
Office	82.69	80.73	84.42	82.57	
Hospital, not ER	17.31	19.27	15.58	17.43	

Note. The null hypothesis associated with the *P* value is that no difference in means or proportion across PCC categories. PCC = patient-centered care; ADL = activities of daily living; IADL = instrumental activities of daily living; ER = emergency room.

\**P* < .05. \*\**P* < .01. \*\*\**P* < .001 (based on *t* test for continuous measures and design-based *F* test for categorical measures).



**Table 4.** Preventive Care and Health Education Rates: Comparisons Between PCC Patients and Non-PCC Patients.

	Total	PCC	Partial PCC	Non-PCC	P value
	% (95% CI)				
Sample size (unweighted)	16 654	5963	6973	3718	
Weighted population (1000)	181 599.05	64 748.36	76 168.68	40 682.01	
Blood pressure check within the past 12 months (n = 16 283)	97.57 (97.23-97.86)	97.59 (96.05-98.03)	97.89 (97.40-98.28)	96.94 (96.15-97.57)	.04
Cholesterol check within the past 12 months (n = 16 283)	91.66 (90.91-92.35)	93.44 (92.34-94.39)	92.33 (91.34-93.22)	87.58 (85.84-89.14)	<.001
Routine checkup within the past 12 months (n = 16 283)	91.11 (90.22-91.93)	93.09 (92.03-94.03)	91.28 (90.06-92.36)	87.64 (85.89-89.20)	<.001
Blood stool test within the past 12 months (n = 16 259)	18.81 (17.47-20.24)	21.23 (19.51-23.25)	19.88 (18.04-21.85)	12.83 (11.34-14.48)	<.001
Breast exam within the past 12 months (only for women) (n = 5347)	59.61 (58.04-61.17)	62.94 (60.68-65.15)	60.82 (58.74-62.85)	52.16 (49.24-55.06)	<.001
Mammogram within the previous 24 months (only for women) (n = 4948)	73.55 (72.15-74.91)	75.90 (73.94-77.77)	74.83 (72.79-76.77)	67.48 (64.76-70.10)	<.001
Pap smear test (only for women) (n = 5212)	95.99 (95.35-96.54)	97.18 (96.37-97.82)	97.64 (96.93-98.19)	91.04 (89.12-92.65)	<.001
Healthy diet education (n = 16 285)	51.22 (49.65-52.78)	54.82 (52.70-56.92)	50.03 (47.97-52.10)	47.71 (45.46-49.97)	<.001
Physical activity education (n = 16 291)	50.16 (48.71-51.60)	53.29 (51.25-55.32)	48.63 (46.62-50.65)	48.05 (45.89-50.20)	<.001

Note. The estimates and associated test statistics have been adjusted for the impact of clustering due to the complex multistage survey design and unequal weighting. The actual sample and population size vary because of missing or inapplicable values for different measures. PCC = patient-centered care; CI = confidence interval.

24 months, and 3.34 (95% CI: 2.18-4.88) times more likely than the non-PCC group to receive a Pap smear test. Similarly, the partial PCC group was also more likely to perform better than the non-PCC group in the receipt of health screenings.

In terms of health education measures, PCC status was significantly linked to higher odds of getting the 2 types of health education: The PCC group was 1.31 (95% CI: 1.09-1.50) times more likely than the non-PCC group to receive healthy diet education, and 1.24 (95% CI: 1.09-1.41) times more likely than the non-PCC group to receive physical activity education within the past 12 months.

Significant associations between other predictor variables and preventive care measures were also observed. Results showed that women were less likely than men to receive cholesterol checks (OR: 0.86, 95% CI: 0.73-0.99) and blood stool tests (OR: 0.83, 95% CI: 0.72-0.90) within the past 12 months. Moreover, older age (1-year increase) was associated with a 2% higher odds of receiving blood pressure checks (OR: 1.02, 95% CI: 1.01-1.07) and a 3% higher odds of receiving routine checkups (OR: 1.03, 95% CI: 1.01-1.06). As for race/ethnicity, the results showed that the receipt of several preventive services varied according to racial group, such as cholesterol checks and blood stool tests. Being married and having higher educational attainment were also linked to higher likelihood of receiving some but not all preventive care. In terms of the enabling factors, household per capita income level of US\$50 000 and more was significantly associated with higher odds of getting 5 types of preventive screening services. Notably, the receipt

of blood stool and Pap smear tests was not associated with income level. However, respondents who were covered by Medicare plus private insurance were associated with higher odds of receiving blood pressure tests, routine checkups, and mammograms, compared with the uninsured. Having managed care was associated with higher odds of receiving mammograms and Pap tests. As regards the needs covariates, an elevated number of chronic conditions was significantly associated with higher odds of receiving 6 types of preventive screenings and 2 types of health education.

## Discussion

To our knowledge, this study is among the first to test associations between PCC and a broad array of preventive care services using a nationally representative sample, while specifically focusing on older adults with chronic conditions. Results from the study indicate that the receipt of preventive care services varies significantly by PCC status. In general, respondents from the PCC or partial PCC groups were more likely to receive preventive services than non-PCC respondents. As previous evidence indicated that respondents having higher socioeconomic status (SES) were more likely to receive more comprehensive care,<sup>23,24</sup> we controlled for these potentially confounding factors and still demonstrated that the receipt of preventive screenings and health education for chronic conditions varied by PCC status. The differences shown in our results between the partial PCC and non-PCC groups in the receipt of preventive services were also consistent with results

**Table 5. Multivariate Analysis of Correlates of Preventive Care and Health Education Rates.**

	Preventive care				Health education				
	Blood pressure check within the past 12 months (n = 16 283)	Cholesterol check within the past 12 months (n = 16 283)	Routine checkup within the past 12 months (n = 16 283)	Blood stool test within the past 12 months (n = 16 259)	Breast exam within the past 12 months (for women only) (n = 5347)	Mammogram within the previous 24 months (for women only) (n = 4948)	Pap smear test (for women only) (n = 5212)	Healthy diet education (n = 16 285)	Physical activity education (n = 16 291)
	OR (95% CI)								
Patient-centered care									
Non-PCC	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Partial PCC	1.43 (1.09-1.99)*	1.69 (1.38-2.09)**	1.45 (1.24-1.70)**	1.70 (1.44-2.01)**	1.40 (1.16-1.64)**	1.39 (1.14-1.63)**	3.97 (2.74-5.76)**	1.10 (0.88-1.28)	1.03 (0.84-1.22)
PCC	1.28 (0.98-1.83)	2.00 (1.58-2.56)**	1.81 (1.50-2.20)**	1.84 (1.54-2.26)**	1.52 (1.29-1.77)**	1.55 (1.36-1.96)**	3.34 (2.18-4.88)**	1.31 (1.09-1.50)**	1.24 (1.09-1.41)**
Gender									
Male	Ref.	Ref.	Ref.	Ref.	—	—	—	Ref.	Ref.
Female	1.11 (0.82-1.52)	0.86 (0.73-0.99)*	0.94 (0.79-1.08)	0.83 (0.72-0.90)**	—	—	—	0.97 (0.81-1.11)	0.98 (0.91-1.14)
Age	1.02 (1.01-1.07)*	1.00 (0.99-1.03)	1.03 (1.01-1.06)**	1.00 (0.99-1.02)	0.97 (0.94-0.97)**	0.90 (0.87-0.96)**	0.92 (0.89-0.98)**	0.94 (0.92-0.96)**	0.95 (0.94-0.97)**
Race/ethnicity									
Non-Hispanic white Only	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Hispanic	1.01 (0.70-1.73)	1.66 (1.25-2.14)**	1.28 (0.90-1.78)	1.54 (1.28-1.90)**	1.22 (1.03-1.50)*	1.39 (1.09-1.81)**	0.89 (0.46-1.45)	2.20 (1.77-2.89)**	2.15 (1.80-2.50)**
Non-Hispanic black Only	1.10 (0.72-1.58)	1.40 (1.09-1.79)**	1.77 (1.38-2.23)**	1.39 (1.21-1.60)**	1.57 (1.19-1.97)**	1.33 (1.07-1.65)**	0.94 (0.70-1.39)	1.33 (1.17-1.60)**	1.40 (1.25-1.73)**
Non-Hispanic Asian Only	0.98 (0.62-1.65)	1.65 (1.24-2.14)**	1.58 (1.10-2.21)**	1.38 (1.11-1.74)**	0.89 (0.72-1.07)	0.79 (0.44-0.96)*	0.45 (0.19-0.76)**	1.60 (1.19-2.11)**	1.66 (1.29-2.33)**
Non-Hispanic Other Race or Multirace	1.07 (0.45-2.50)	1.11 (0.56-1.81)	1.65 (0.97-2.80)	0.93 (0.59-1.34)	1.19 (0.88-1.80)	0.96 (0.41-1.84)	1.79 (0.35-4.76)	1.14 (0.81-1.67)	1.42 (0.95-2.00)
Marital status									
Not married	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Married	1.21 (0.93-1.69)	1.28 (1.10-1.56)**	1.15 (0.96-1.40)	1.12 (0.98-1.27)	1.19 (1.14-1.50)**	1.50 (1.21-1.84)**	1.02 (0.54-1.67)	1.15 (1.04-1.26)*	1.08 (0.97-1.23)
Education									
No degree	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
General equivalency diploma/high school diploma	1.20 (0.84-1.68)	1.07 (0.84-1.37)	1.25 (1.06-1.55)*	1.20 (1.03-1.44)*	1.33 (1.14-1.52)**	1.44 (1.12-1.73)**	1.11 (0.89-1.44)	0.92 (0.74-1.12)	1.13 (0.97-1.29)
Bachelor's degree/some college/associate degree	1.73 (1.19-2.44)*	1.44 (1.09-1.90)**	1.58 (1.17-2.06)**	1.30 (1.10-1.58)**	1.46 (1.17-1.86)**	1.51 (1.18-1.95)**	1.87 (1.15-3.10)*	0.91 (0.83-1.20)	1.28 (1.02-1.50)**
Advanced degree	2.01 (1.29-3.58)**	1.38 (1.01-1.84)*	1.33 (1.02-1.89)*	1.29 (1.05-1.60)*	1.44 (1.09-1.75)**	1.83 (1.19-2.67)**	1.17 (0.78-1.97)	0.93 (0.69-1.12)	1.09 (0.98-1.33)
Employment status									
Not employed	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Employed	0.65 (0.44-0.95)*	0.71 (0.54-0.88)**	0.75 (0.60-0.93)**	0.92 (0.71-1.08)	0.94 (0.79-1.11)	1.36 (0.75-1.80)	0.77 (0.37-1.33)	1.01 (0.74-1.22)	0.90 (0.74-1.05)
Region									
Northeast	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Midwest	0.66 (0.43-1.02)	0.79 (0.54-1.09)	0.52 (0.35-0.73)**	0.90 (0.74-1.17)	0.95 (0.76-1.17)	0.98 (0.70-1.33)	0.89 (0.50-1.67)	0.92 (0.71-1.23)	0.94 (0.77-1.09)
South	0.79 (0.52-1.23)	1.03 (0.78-1.39)	0.65 (0.44-0.88)**	1.22 (0.96-1.59)	0.83 (0.69-0.99)*	1.01 (0.83-1.48)	1.10 (0.69-1.69)	0.98 (0.75-1.19)	0.98 (0.85-1.18)
West	0.69 (0.42-1.08)	0.67 (0.47-0.88)**	0.47 (0.33-0.64)**	1.58 (1.19-1.85)**	0.85 (0.69-1.04)	0.98 (0.73-1.28)	1.23 (0.88-2.07)	0.88 (0.73-1.10)	0.95 (0.80-1.17)

(continued)

Table 5. (continued)

	Preventive care				Health education				
	Blood pressure check within the past 12 months (n = 16 283)	Cholesterol check within the past 12 months (n = 16 283)	Routine checkup within the past 12 months (n = 16 283)	Blood stool test within the past 12 months (n = 16 259)	Breast exam within the past 12 months (for women only) (n = 5347)	Mammogram within the previous 24 months (for women only) (n = 4948)	Pap smear test (for women only) (n = 5212)	Healthy diet education (n = 16 285)	Physical activity education (n = 16 291)
Household per capita income									
\$0-\$9999	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
\$10 000-\$24 999	1.45 (0.93-1.89)	1.19 (0.99-1.40)	1.20 (1.01-1.46)*	1.10 (0.90-1.33)	1.02 (0.88-1.17)	1.09 (1.02-1.32)*	1.22 (0.89-1.64)	1.03 (0.91-1.18)	1.05 (0.90-1.24)
\$25 000-\$49 999	1.44 (0.96-2.17)	1.29 (1.09-1.72)*	1.42 (1.11-1.82)**	1.03 (0.81-1.26)	1.29 (1.10-1.59)**	1.37 (1.09-1.88)**	1.44 (0.90-2.34)	1.09 (0.90-1.21)	1.08 (0.88-1.27)
\$50 000 or more	1.89 (1.15-2.92)**	1.45 (1.09-2.03)*	1.52 (1.10-2.09)**	1.26 (0.88-1.59)	1.51 (1.21-1.89)**	1.66 (1.12-2.23)**	1.45 (0.89-2.44)	1.16 (0.98-1.40)	1.14 (0.79-1.33)
Insurance coverage									
Uninsured	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Medicare only	1.71 (0.94-3.20)	1.33 (0.73-2.41)	1.79 (1.01-3.00)*	1.38 (0.84-2.55)	0.77 (0.44-1.25)	2.40 (1.78-4.64)**	1.69 (0.59-4.88)	1.24 (0.80-1.76)	1.38 (1.01-1.88)*
Medicare and private	2.41 (1.17-4.77)*	1.54 (0.80-2.84)	2.01 (1.19-3.41)**	1.26 (0.78-2.08)	0.90 (0.48-1.69)	3.09 (1.85-5.72)**	2.87 (0.91-7.76)	1.21 (0.93-1.90)	1.44 (1.09-2.31)*
Medicare and other public only	2.43 (1.41-4.55)**	1.78 (0.97-3.28)	1.82 (1.05-3.13)*	1.44 (0.82-2.40)	0.79 (0.34-1.48)	2.44 (1.19-4.87)*	1.49 (0.64-4.07)	1.31 (0.71-1.89)	1.31 (0.98-2.11)
No Medicare and any public/private	0.96 (0.20-3.67)	0.61 (0.17-2.11)	1.18 (0.41-3.20)	0.61 (0.17-1.98)	1.31 (0.41-3.54)	1.35 (0.42-4.39)	1.71 (0.42-11.62)	1.15 (0.44-2.85)	1.29 (0.54-2.58)
Managed care status									
Nonmanaged care	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Managed care	1.66 (0.87-1.98)	1.28 (0.77-1.34)	0.96 (0.79-1.21)	1.19 (0.66-3.06)	1.21 (0.91-1.94)	1.89 (1.27-2.76)**	1.19 (1.07-1.68)*	0.77 (0.67-1.28)	0.98 (0.55-1.68)
Need help with ADLs									
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Yes	1.62 (0.67-4.14)	0.91 (0.65-1.34)	0.85 (0.68-1.29)	1.17 (0.89-1.52)	0.93 (0.79-1.17)	0.60 (0.47-0.89)**	0.77 (0.43-1.47)	0.94 (0.68-1.19)	0.73 (0.43-0.92)*
Need help with IADLs									
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Yes	1.04 (0.60-1.86)	0.77 (0.58-1.03)	0.79 (0.63-1.12)	1.11 (0.82-1.40)	0.72 (0.51-0.93)**	0.70 (0.49-0.91)**	0.58 (0.32-1.10)	0.89 (0.70-1.17)	0.80 (0.70-1.05)
Number of chronic conditions	1.70 (1.39-1.97)**	1.47 (1.40-1.59)**	1.30 (1.22-1.46)**	1.07 (1.05-1.12)**	1.01 (0.99-1.10)	1.04 (1.01-1.10)**	1.17 (1.03-1.27)*	1.34 (1.18-1.51)**	1.25 (1.21-1.39)**
Provider's type									
Facility	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Person	1.01 (0.70-1.44)	1.19 (1.01-1.49)*	1.23 (1.03-1.50)*	0.99 (0.78-1.23)	1.19 (1.05-1.58)*	1.22 (1.02-1.45)*	0.88 (0.62-1.39)	1.05 (0.94-1.19)	1.08 (0.94-1.22)
Person in facility provider	1.44 (1.11-2.20)*	1.20 (0.98-1.45)	1.15 (0.97-1.40)	0.85 (0.75-1.06)	1.13 (0.96-1.29)	1.11 (1.01-1.31)*	0.90 (0.62-1.29)	1.00 (0.90-1.13)	1.18 (1.04-1.30)**
Provider's location									
Office	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Hospital, not ER	0.68 (0.55-0.97)*	1.03 (0.84-1.28)	0.84 (0.77-1.12)	1.21 (1.07-1.41)**	1.02 (0.77-1.22)	0.98 (0.88-1.35)	0.98 (0.54-1.71)	1.06 (0.94-1.22)	1.06 (0.89-1.24)

Note. The analyses were weighted to reflect the complex survey design of MEPS. OR = odds ratio; CI = confidence interval; PCC = patient-centered care; ADL = activities of daily living; IADL = instrumental activities of daily living; MEPS = Medical Expenditure Panel Survey; ER = emergency room.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .



observed between the PCC and non-PCC groups in our study. Moreover, comparisons in magnitude of ORs between the PCC and partial PCC groups showed that higher levels of PCC are related to superior preventive care. This finding suggests that more components of PCC in combination may yield higher odds of improvements in receipt of preventive care. The practices will best benefit from PCC model implementation when they adopt a comprehensive array of components of PCC.

PCC has a unique advantage compared with traditional practice, allowing providers to address patient needs and to respect patients' values.<sup>25</sup> In fact, disease-focused and physician-centered care restricts the locus of control to the health provider and treats the disease without taking into account each patient's unique values. In contrast, PCC promotes identifying, respecting, and caring about patients' differences, expressed needs, values, and preferences, and to provide care that reflects the whole-person.<sup>5</sup> This core of PCC provides the foundation for the long-term management of chronic conditions. This, in turn, may have an influence on timely implementation strategies to identify, control, and reduce risk factors for patients and to improve patients' receipt of appropriate preventive services.

Among studies that tested associations between the receipt of preventive services and PCC status (or attributes), the target population was not specifically defined as older adults with chronic conditions and the data used were not nationally representative. Using a random sample of facility-level Veterans Satisfaction Surveys, Flach et al assessed the relationship between PCC attributes and the provision of preventive services and found that the 2 attributes of PCC, defined as improved communication and continuity of care, were associated with increased provision of preventive services, whereas other attributes were not significant.<sup>26</sup> In a cross-sectional patient and practice member survey conducted in 24 primary care offices in New Jersey, Ferrante et al found that higher global PCMH scores were associated with the receipt of preventive services, mainly resulting from positive associations with the whole-person care and personal physician attributes.<sup>27</sup> Several studies exploring the relevance of PCC in other health care settings have also showed positive role of PCC in preventive care.<sup>28,29</sup> Other evidence has highlighted the influence of PCC in other process measures, such as HIV patients' adherence to medication treatment regimens,<sup>29</sup> follow-up treatment for cancer,<sup>30,31</sup> and receipt of palliative care.<sup>32</sup> Although not directly comparable with our work, the associations found between PCC models/attributes and the provision of preventive services were generally consistent with our findings.

Incorporating a broad range of preventive services measures into the evaluation is considered a key indicator for rigorous assessment of PCC. The findings in our study supported positive associations between PCC and the receipt of multiple types of preventive services, findings similar to previous studies.<sup>27,33,34</sup> In the traditional provider-driven care model, preventive screenings were provided when a patient

was seeing a physician for a health problem. Under such situations, fewer opportunities and less time were available for delivering preventive services, thereby limiting the range of preventive health needs of older adults with chronic conditions.<sup>34</sup> Conversely, the PCC model overcomes this drawback by actively engaging patients in their care, tailoring care to their needs, and providing planned preventive services through dedicated preventive health visits.<sup>34</sup>

Our findings should be considered in light of certain limitations. First, we cannot make causal inferences from the analyses due to the cross-sectional nature of the study. Second, although the overall impact of our findings is promising, policy makers may look beyond statistical significance for evidence of clinically meaningful differences. Clinical significance is a subjective judgment and cannot be determined by a single study. Therefore, our study along with other related evidence may play a viable role in promoting decision making to change current arrangements of care delivery. Furthermore, even if these small differences are clinically meaningful, they might not be at a level to justify policy change and investment.<sup>35</sup> Therefore, the minimal clinically important difference (MCID) is imperative to consider in designing future studies. Third, due to the limitation of secondary data, the measure of PCC status in our study was operationalized from the existing variables rather than researcher-initiated measures from prospective data collection. We recognize that the PCC is generally a practice-level model, and acknowledge that our operationalization of having PCC uses respondents' assessments of the care as proxies for practice capabilities. Consequently, bias could result from personal biases; even MEPS data have shown good overall response validity.<sup>36,37</sup> Development of a robust measure of the PCMH for use with secondary data sources continues to be a challenge. Despite these limitations, surveys such as MEPS or the National Survey of Children's Health (NSCH) allow researchers<sup>38-40</sup> to move beyond a simple assessment of having a usual source of care to capture a patient involvement concept that can be described, if not as a complete PCMH, then at a minimum, as more patient-centered. In future work, it would be helpful to conduct primary data collection and build in the perspective of other key players, especially health care providers and practices. A combination of these complementary approaches would provide a more comprehensive measure of PCMH. Finally, MEPS does not allow us to account for all potential covariates, especially for institutional level variables, such as medical equipment and device for preventive services, and other education promotion effort from the provider's institutional level. Future study may link current household datasets with MEPS Area Resource File to explore effects of institutional and external context factors of the outcomes.

Despite the limitations mentioned above, findings from this study highlighted the associations between PCC and receipt of preventive services, contributed to the existing evidence by reviewing important replicable measures of PCC

for older and chronically ill patients. The generalizability of the study was enhanced by the national representativeness of the MEPS sample.

Currently, as PCC is adopted as an emerging care delivery model, many health care organizations are investigating its impact; PCC surveys are undergoing a rigorous development process. Moreover, several existing tools on health care quality are also being used to assess the patient experience of PCC. For example, the CAHPS Clinician & Group Survey (CG-CAHPS) is an AHRQ-sponsored survey instrument designed to measure quality of care from the patients' experiences with health care providers and staff in doctors' offices.<sup>41</sup> Regarding the content of items used to assess patient experience of PCC, we found both CG-CAHPS and our measures cover the core aspects of PCC, including access, whole-person orientation, shared decision making, and enhanced access. For future work, we can conduct primary data research and include both sets of measures to confirm the PCC domains of interest, and we believe each set of measures can also serve as a triangulation approach to the other one to validate a rigorous assessment of PCC.

From a public policy perspective, it is not only important to promote the PCC model in a variety of health care settings, but also essential to incorporate PCC into the care of specific, vulnerable subgroups of the population, such as among chronically ill older adults. This policy implication may be applied to the current Health Home program. The Section 2703 of the Affordable Care Act (ACA) created an optional Medicaid State Plan benefit for states to provide Health Homes for enrollees with multiple chronic conditions. The Centers for Medicare & Medicaid Services (CMS) expects Health Home providers to integrate all primary, acute, behavioral health, and long-term services to treat chronic disease patients under a "whole-person" philosophy.<sup>42</sup>

## Conclusions

The current study highlights the PCC is associated with receipt of preventive care of elderly chronic disease patients. The study adds to the evidence that PCC is associated with improved receipt of preventive care among the elderly with a significant burden of chronic conditions in the United States. Our study is unique in the measures' comprehensiveness and national representativeness and therefore adds solid support to the positive role of the PCC model in care.

To improve chronic care for all patients, the ethics of care and current care imperatives drive us in the direction of advocating for policies that support the improvement efforts of PCC. A better understanding of the fundamental determinants of chronic care quality may help define effective policies and strategies to improve care and health outcomes. Researchers need to continue to investigate optimal PCC models to cope with the current demographic transition and the shifting burden of diseases. This will further inform policy makers to strengthen health care systems, improve population well-being, and reduce health care disparities in the United States.

## Appendix

### Sensitivity Analyses Examining the Relationships Between Number of PCC Attributes and Health Care Ratings.

	Rating of health care (0-10)
	Coefficient (SE)
Number of PCC attributes	
Usual source of care + 0 PCC attribute (reference group)	Ref.
Usual source of care + 1 PCC attribute	1.51*** (0.33)
Usual source of care + 2 PCC attributes	1.99*** (0.34)
Usual source of care + 3 PCC attributes	2.36*** (0.33)

Note. A linear regression was used to estimate health care ratings (from 0 to 10). Control variables included age, gender, race/ethnicity, marital status, educational level, employment status, census region, household per capita income, types of health insurance, whether having managed care, the number of existing chronic conditions, need for help with ADLs, need for help with IADLs, provider's type, and provider's location. PCC = patient-centered care; ADL = activities of daily living; IADL = instrumental activities of daily living.  
\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

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### References

1. Ortman JM, Velkoff VA, Hogan H. An aging nation: the older population in the United States, current population reports. <https://www.census.gov/prod/2014pubs/p25-1140.pdf>. Published May 2014. Accessed October 8, 2016.
2. Ward BW, Schiller JS, Goodman RA. Multiple chronic conditions among US adults: a 2012 update. *Prev Chronic Dis*. 2014;11:E62.
3. Boyd CM, Fortin M. Future of multimorbidity research: how should understanding of multimorbidity inform health system design? *Publ Health Rev*. 2011;32:451-474.
4. Boyd CM, Darer J, Boulton C, Fried LP, Boulton L, Wu AW. Clinical practice guidelines and quality of care for older patients with multiple comorbid diseases: implications for pay for performance. *JAMA*. 2005;294(6):716-724.
5. Institute of Medicine. Crossing the quality chasm: a new health system for the 21st century. <http://www.nationalacademies.org/hmd/~media/Files/Report%20Files/2001/Crossing-the-Quality-Chasm/Quality%20Chasm%202001%20%20report%20brief.pdf>. Published March 2001. Accessed October 8, 2016.
6. Holman H, Lorig K. Patients as partners in managing chronic disease. Partnership is a prerequisite for effective and efficient health care. *BMJ*. 2000;320(7234):526-527.
7. Tsai J, Shi L, Yu WL, Lebrun LA. Usual source of care and the quality of medical care experiences: a cross-sectional survey of

- patients from a Taiwanese community. *Med Care*. 2010;48(7):628-634.
8. Bauman AE, Fardy HJ, Harris PG. Getting it right: why bother with patient-centred care? *Med J Aust*. 2003;179(5):253-256.
  9. Beal A, Hernandez S, Doty M. Latino access to the patient-centered medical home. *J Gen Intern Med*. 2009;24:514-520.
  10. Jones AL, Cochran SD, Leibowitz A, Wells KB, Kominski G, Mays VM. Usual primary care provider characteristics of a patient-centered medical home and mental health service use. *J Gen Intern Med*. 2015;30(12):1828-1836.
  11. Aysola J, Bitton A, Zaslavsky AM, Ayanian JZ. Quality and equity of primary care with patient-centered medical homes: results from a national survey. *Med Care*. 2013;51(1):68-77.
  12. Arend J, Tsang-Quinn J, Levine C, Thomas D. The patient-centered medical home: history, components, and review of the evidence. *Mt Sinai J Med*. 2012;79(4):433-450.
  13. Goodman RA, Posner SF, Huang ES, Parekh AK, Koh HK. Defining and measuring chronic conditions: imperatives for research, policy, program and practice. *Prev Chronic Dis*. 2013;10:120239. doi:10.5888/pcd10.120239.
  14. Schoen C, Osborn R, Doty MM, Bishop M, Peugh J, Murukutla N. Toward higher-performance health systems: adults' health care experiences in seven countries, 2007. *Health Aff (Millwood)*. 2007;26(6):w1717-734.
  15. Bowdoin JJ, Rodriguez-Monguio R, Puleo E, Keller D, Roche J. Associations between the patient-centered medical home and preventive care and healthcare quality for non-elderly adults with mental illness: a surveillance study analysis. *BMC Health Serv Res*. 2016;16(1):434. doi:10.1186/s12913-016-1676-z.
  16. Aysola J, Orav EJ, Ayanian JZ. Neighborhood characteristics associated with access to patient-centered medical homes for children. *Health Aff (Millwood)*. 2011;30(11):2080-2089.
  17. Romaire MA, Bell JF. The medical home, preventive care screenings, and counseling for children: evidence from the Medical Expenditure Panel Survey. *Acad Pediatr*. 2010;10(5):338-345.
  18. Paustian ML, Alexander JA, El Reda DK, Wise CG, Green LA, Fetters MD. Partial and incremental PCMH practice transformation: implications for quality and costs. *Health Serv Res*. 2014;49(1):52-74.
  19. US Preventive Services Task Force (USPSTF). *Published recommendations*. Date unknown. <http://www.uspreventiveservices-taskforce.org/BrowseRec/Index>. Accessed October 8, 2016.
  20. Aday LA, Fleming GV, Andersen A. *Access to Medical Care in the US: Who Has It, Who Doesn't*. Chicago, IL: Pluribus Press; 1984.
  21. StataCorp. Stata statistical software. Release 14. College Station, TX: StataCorp; 2015.
  22. Machlin S, Yu W, Zodet M. Computing standard errors for MEPS estimates. [http://www.meps.ahrq.gov/survey\\_comp/standard\\_errors.jsp](http://www.meps.ahrq.gov/survey_comp/standard_errors.jsp). Published January 2005. Accessed October 8, 2016.
  23. Beydoun HA, Beydoun MA, Liang H, et al. Sex, race, and socioeconomic disparities in patients with aortic stenosis (from a nationwide inpatient sample). *Am J Cardiol*. 2016;118(6):860-865.
  24. Lee DC, Liang H, Shi L. Insurance-related disparities in primary care quality among U.S. type 2 diabetes patients. *Int J Equity Health*. 2016;15(1):124.
  25. Shi L, Lee DC, Chung M, Liang H, Lock D, Sripipatana A. Patient-centered medical home recognition and clinical performance in U.S. community health centers. *Health Serv Res*. 2017;52(3):984-1004. doi:10.1111/1475-6773.12523.
  26. Flach SD, McCoy KD, Vaughn TE, Ward MM, Bootsmiller BJ, Doebbeling BN. Does patient-centered care improve provision of preventive services? *J Gen Intern Med*. 2004;19(10):1019-1026.
  27. Ferrante JM, Balasubramanian BA, Hudson SV, Crabtree BF. Principles of the patient-centered medical home and preventive services delivery. *Ann Fam Med*. 2010;8(2):108-116.
  28. Calveley J, Verhoeven A, Hopcroft D. A patient-centred referral pathway for mild to moderate lifestyle and mental health problems: does this model work in practice? *J Prim Health Care*. 2009;1(1):50-56.
  29. Roberts KJ. Physician-patient relationships, patient satisfaction, and antiretroviral medication adherence among HIV-infected adults attending a public health clinic. *AIDS Patient Care STDS*. 2002;16(1):43-50.
  30. Kahn KL, Schneider EC, Malin JL, Adams JL, Epstein AM. Patient centered experiences in breast cancer: predicting long-term adherence to tamoxifen use. *Med Care*. 2007;45(5):431-439.
  31. Zolnierok KB, Dimatteo MR. Physician communication and patient adherence to treatment: a meta-analysis. *Med Care*. 2009;47(8):826-834.
  32. Yedidia MJ. Transforming doctor-patient relationships to promote patient-centered care: lessons from palliative care. *J Pain Symptom Manage*. 2007;33(1):40-57.
  33. Markovitz AR, Alexander JA, Lantz PM, Paustian ML. Patient-centered medical home implementation and use of preventive services: the role of practice socioeconomic context. *JAMA Intern Med*. 2015;175(4):598-606.
  34. Sarfaty M, Wender R, Smith R. Promoting cancer screening within the patient centered medical home. *CA Cancer J Clin*. 2011;61(6):397-408.
  35. DesRoches CM, Campbell EG, Vogeli C, et al. Electronic health records' limited successes suggest more targeted uses. *Health Aff (Millwood)*. 2010;29(4):639-646.
  36. Zuvekas SH, Olin GL. Validating household reports of health care use in the Medical Expenditure Panel Survey. *Health Serv Res*. 2009;44(5):1679-1700.
  37. Tourangeau R, Kopp B, Tan L. Consumer expenditure survey measurement error study phase 1: proposal on tracking measurement error in the CE. [https://www.bls.gov/cex/research\\_papers/pdf/Tourangeau\\_TrackingError.pdf](https://www.bls.gov/cex/research_papers/pdf/Tourangeau_TrackingError.pdf). Published 2013. Accessed February 26, 2017.
  38. Strickland BB, Jones JR, Ghandour RM, Kogan MD, Newacheck PW. The medical home: health care access and impact for children and youth in the United States. *Pediatrics*. 2011;127(4):604-611.
  39. Strickland BB, McPherson M, Weissman G, van Dyck P, Huang ZJ, Newacheck P. Access to the medical home: results of the national survey of children with special health care needs. *Pediatrics*. 2004;113:1485-1492.
  40. Bethell CD, Read D, Brockwood K; American Academy of Pediatrics. Using existing population-based data sets to measure the American Academy of Pediatrics definition of medical home for all children and children with special health care needs. *Pediatrics*. 2004;113:1529-1537.
  41. Agency for Healthcare Research and Quality (AHRQ). *CAHPS Clinician & Group Survey*. <https://www.ahrq.gov/cahps/surveys-guidance/cg/index.html>. Published 2013. Accessed May 4, 2017.
  42. Centers for Medicare & Medicaid Services (CMS). Health Homes programs. <https://www.medicare.gov/medicaid/tss/health-homes/index.html>. Date unknown. Accessed October 8, 2016.