

Economic Evaluation of Patient-Centered Care Among Long-Term Cancer Survivors

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Cancer is the second-leading cause of mortality in the United States as of 2014, superseded only by heart disease, according to the CDC.¹ Despite this, cancer survivorship rates have increased in recent years due to advances in early detection and treatment.² A “cancer survivor,” as defined by the National Coalition for Cancer Survivorship, is a person who has been diagnosed with cancer, from the time of initial diagnosis through the remainder of the person’s lifetime.³ As of January 2016, there are an estimated 15.5 million cancer survivors in the United States, and this number is expected to increase to 20.3 million by 2026 and to 26.1 million by 2040.²

As the number of cancer survivors in the United States continues to climb over the next decade, specialized long-term care—including, but not limited to, chemotherapy long-term and late-effects management, follow-up visits, and preventive screenings—may be necessary to ensure continuity of remission and prevention of secondary relapse, due to each cancer survivor’s unique medical and social histories. Moreover, cancer survivors are at risk for the development of comorbid conditions associated with poor survival.⁴ This much-needed specialized long-term care often presents an economic challenge for cancer survivors, with some opting to forgo necessary treatments due to their financial concerns.^{5,6} Not only does the high cost of providing specialized long-term care present an economic challenge for the cancer survivors, it can create a high economic burden for society as well. One study estimated the annual excess economic burdens of cancer survivorship among recently diagnosed and previously diagnosed cancer survivors aged 18 to 64 years to be \$16,213 and \$4427, respectively, with excess medical expenditures making up the largest share of the economic burden.⁷ Because of this, it may be necessary to further explore ways to improve the affordability of providing specialized long-term care for cancer survivors, as the current fee-for-service payment system still being used in many oncology practices is costly and ineffective.⁸

One solution to the affordability issue of specialized long-term care among cancer survivors may be through providing patient-centered comprehensive care. Based on a patient-centered medical

ABSTRACT

OBJECTIVES: To evaluate the economic outcomes associated with patient perceptions of patient-centered medical home (PCMH) characteristics among long-term cancer survivors in the United States.

STUDY DESIGN: A retrospective analysis of the 2008 to 2012 Medical Expenditure Panel Survey.

METHODS: A nationally representative sample of adult long-term cancer survivors (≥ 3 years since diagnosis) was categorized into either patient-centered care (PCC) or non-PCC groups based on responses to PCMH model hallmark attributes of “comprehensive care,” “whole-person orientation,” and “accessible care.” The positive perception of all 3 attributes was defined as PCC. The patient perceptions, as well as patient characteristics, were measured at year 1 (baseline), with a propensity score model to balance baseline characteristics. Adjusted total healthcare utilization and healthcare expenditures in 2014 US\$ at year 2 (follow-up) were compared between the PCC and non-PCC groups.

RESULTS: A total of 4288 long-term cancer survivors were identified, with a mean (SD) age of 65.2 (13.8) years. The PCC group was associated with a reduction in mean adjusted healthcare expenditures at follow-up (savings of \$1596 per cancer survivor; $P = .020$). These findings are driven by lower odds of hospitalization (odds ratio, 0.81; 95% CI, 0.66–0.99; $P = .035$) and lower hospitalization-related healthcare expenditures (PCC: \$3323; 95% CI, \$2727–\$3918; non-PCC: \$4912; 95% CI, \$4039–\$5785; $P = .002$) associated with PCC among the population who were 65 years and older. The whole-person orientation attribute had a major impact on reduced healthcare expenditures.

CONCLUSIONS: The positive patient perception of PCMH characteristics was associated with reduced healthcare expenditures in adult long-term cancer survivors.

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home (PCMH) model, this care is guided by a set of joint principles, which include a personal physician, a physician-directed medical practice, whole-person orientation, coordinated and/or integrated care, quality and safety, enhanced access to care, and payment.⁹ The PCMH model encourages patient-centered healthcare services among providers with a triple aim of improved health, improved quality, and controlled cost.¹⁰ Although results from previously published studies have demonstrated the benefits of utilizing a PCMH model for the treatment of other chronic conditions, such as diabetes, asthma, and hyperlipidemia,¹¹⁻¹⁵ or in active cancer patients,¹⁶⁻¹⁹ the economic benefits of its use among long-term cancer survivors have yet to be determined.

This study aimed to investigate the association between patient perceptions of PCMH characteristics of the healthcare they receive and economic outcomes. To guide the future design of a PCMH model among cancer survivors, it is important to understand how each PCMH characteristic of their healthcare is associated with overall healthcare costs. In this study, we evaluated total medical expenditures and healthcare utilization among long-term cancer survivors based on patient perceptions of healthcare in a nationally representative United States sample.

METHODS

Study Design and Data Source

This study was a retrospective analysis of survey data acquired from the 2008 to 2012 Medical Expenditure Panel Survey (MEPS) Household Component longitudinal files (Panels 13-16). MEPS, published by the Agency for Healthcare Research and Quality, is a set of large-scale nationally representative surveys of families and individuals, in addition to medical providers and employers, across the United States.²⁰ The goal of MEPS is to gather data on the usage of medical care and expenditures. Data are collected over 2 years in 5 rounds of in-person interviews.

Study Population

The study population included adults 18 years and older who self-reported that they had ever been diagnosed with cancer, as indicated by the "CANCERY1" variable in the MEPS Household Component. Survey respondents were also asked about their cancer type and the age at which they received their cancer diagnosis. The type of diagnosed cancer was also identified using unique clinical classification coding variables from these self-reported data. Cancer survivors were excluded from this study if they did not have a usual care provider. Furthermore, because the study's population of interest was long-term cancer survivors, cancer survivors were also excluded from this study if the survey was conducted within 3 years of their last cancer diagnosis.²¹

TAKEAWAY POINTS

- ▶ A patient-centered medical home (PCMH) model may reduce healthcare expenditures among adult long-term cancer survivors.
- ▶ The positive patient perception of PCMH characteristics was associated with overall reduced total healthcare expenditures in long-term cancer survivors.
- ▶ These findings are mainly driven by long-term cancer survivors 65 years and older, who had reduced odds of hospitalization and reduced hospitalization-related healthcare expenditures.
- ▶ The PCMH hallmark attribute of "whole-person orientation," but not "comprehensive care" or "accessible care," had a major impact on reduced healthcare expenditures.

Patient Perceptions of PCMH Characteristics

Self-reported patient data were used to determine whether or not cancer survivors perceived their medical care as patient-centered comprehensive care. The definition of patient-centered comprehensive care was adopted from previously published studies by using a set of questions about a patient's interactions with their usual source of care (USC), which focused on whether the patient received "comprehensive care," "accessible care," and care with a "whole-person orientation," all 3 of which are hallmark attributes of a PCMH model.²²⁻²⁶ Cancer survivors who responded positively for all 3 hallmark attributes of a PCMH model at baseline (year 1) were categorized as the patient-centered care (PCC) group. Cancer survivors who did not respond positively to any of the PCMH characteristics or responded positively to only 1 or 2 characteristics were subsequently categorized as the non-PCC group. The list of questions is in the [eAppendix](#) (available at [ajmc.com](#)).

Economic Outcomes

Total healthcare utilization and total healthcare expenditures were measured in the PCC group and the non-PCC group at baseline and at follow-up (year 2). Total healthcare utilization included hospitalizations, emergency department (ED) visits, office visits, primary care provider (PCP; specialties of family medicine and internal medicine) visits, and oncologist visits. Total healthcare expenditures included spending on hospitalizations, office visits, ED visits, and prescriptions in 2014 US\$.

Statistical Analyses

Descriptive statistics were used to summarize baseline characteristics in the PCC and non-PCC groups, with the baseline characteristics including age, age group, years since cancer diagnosis, gender, race/ethnicity, baseline survey year, region, marital status, education level, insurance type, perceived health, cancer type, comorbidities, and Elixhauser comorbidity score.²⁷ Differences between the PCC group and the non-PCC group were compared using Student's *t* test for continuous variables and χ^2 test for categorical variables. Moreover, an inverse probability propensity score (PS) method was used to balance these baseline characteristics between the PCC group and the non-PCC group.²⁸ Baseline characteristics with *P* < .25 (region, marital status, education level, insurance type, perceived health, comorbidity of hypertension, rheumatoid arthritis, depression,

TABLE 1. Baseline Characteristics of 4288 Cancer Survivors

Characteristic	PCC ^a (n = 1883)	Non-PCC (n = 2405)	P ^b
	Mean (SD)		
Age, years	65.2 (13.6)	65.2 (13.9)	.940
Years since cancer diagnosis	10.1 (10.2)	10.1 (9.9)	.885
Elixhauser comorbidity score	6.0 (7.6)	5.8 (7.7)	.306
	n (%)		
Age group			.706
<65 years	823 (43.7)	1065 (44.3)	
≥65 years	1060 (56.3)	1340 (55.7)	
Female gender	1085 (57.6)	1376 (57.2)	.789
Race/ethnicity			.436
White	1420 (75.4)	1823 (75.8)	
Black	227 (12.1)	288 (12.0)	
Hispanic	159 (8.4)	189 (7.9)	
Asian/other	77 (4.1)	105 (4.4)	
Baseline survey year			.006
2008	395 (21.0)	555 (23.1)	
2009	342 (18.2)	495 (20.6)	
2010	302 (16.0)	411 (17.1)	
2011	476 (25.3)	514 (21.4)	
2012	368 (19.5)	430 (17.9)	
Region			.011
Northeast	345 (18.3)	372 (15.5)	
Midwest	418 (22.2)	547 (22.7)	
South	728 (38.7)	902 (37.5)	
West	392 (20.8)	584 (24.3)	
Marital status			<.001
Married/spouse in the house	1145 (60.8)	1326 (55.1)	
Not married/other statuses	738 (39.2)	1079 (44.9)	
Education level			.245
Did not graduate high school	965 (51.2)	1290 (53.6)	
High school diploma	549 (29.2)	682 (28.4)	
College degree and higher	369 (19.6)	433 (18.0)	
Insurance type			.016
Any private	1219 (64.7)	1454 (60.5)	
Public only	601 (31.9)	862 (35.8)	
Uninsured	63 (3.3)	89 (3.7)	

(continued)

chronic pulmonary disease, and unknown skin cancer), as well as age, sex, baseline healthcare expenditures, and ED visits, were added to predict the PS. Generalized linear models with log-rank and gamma distribution were used to test the statistical significance of the total healthcare costs between the 2 groups. Recycled prediction methods were used to estimate the mean expenditures of each group after applying the PS model. Logistic regressions, with a response of 0 indicating no and 1 indicating yes, were used in conjunction with negative binomial models in the determination of the total healthcare utilization analysis. A priori subgroup analyses were

conducted to examine whether the economic effects of PCC were consistent across the 2 subgroups of survivors either younger than 65 years or 65 years and older. Additionally, a secondary analysis was performed to investigate the association between each of the 3 PCMH model hallmark attributes and its potential impact on economic outcomes. A P value of <.05 was accepted for statistical significance. All statistical analyses were performed using SAS, version 9.4 (SAS Institute; Cary, North Carolina), and STATA, version 12 (STATA; College Station, Texas).

RESULTS

A total of 4288 adult patients were identified as long-term cancer survivors. At baseline, 1883 (43.9%) were categorized into the PCC group, while the remaining 2405 cancer survivors (56.1%) were categorized into the non-PCC group (Table 1). For each of the characteristics associated with the 3 hallmark attributes of a PCC (comprehensive care, whole-person orientation, and accessible care), a low of 79% to a high of 99% positive response rate was observed, depending on the characteristic (eAppendix). These positive responses allowed for the differentiation of the PCC group from the non-PCC group.

Overall, the mean (SD) age of a long-term cancer survivor was 65.2 (13.8) years, and the mean (SD) years since cancer diagnosis were 10.1 (10.0). Approximately 75.6% identified themselves as white and 57.4% were female. In general, cancer survivors in the PCC group were more likely to have private insurance, perceive their health as excellent, and have comorbid hypertension, and less likely to have comorbidities of depression and chronic pulmonary disease, compared with cancer survivors in the non-PCC group.

Healthcare Utilization

After applying the PS, the weighted sample showed good balance in baseline characteristics between the PCC and non-PCC groups with small standardized differences. Differences in healthcare utilization between the PCC and non-PCC groups were not statistically significant after applying the PS model (Table 2). Despite this finding, the PCC group, compared with the non-PCC group, had a trend of lower odds of hospitalization and ED visits, as well as decreases in utilization of hospitalizations, ED visits, office visits, and PCP visits.

Healthcare Expenditures

The overall crude mean total healthcare expenditures were similar at baseline between the PCC group (\$11,193; 95% CI, \$10,122-\$12,265) and the non-PCC group (\$11,783; 95% CI, \$11,055-\$12,512; P = .357) (Table 3). At follow-up, the PCC group had significantly lower crude mean total healthcare expenditures (\$11,208; 95% CI, \$10,204-\$12,212) than the non-PCC group (\$13,316; 95% CI, \$12,463-\$14,169; P = .002). Considering baseline differences between the 2 groups using the PS model, the PCC group had significantly lower adjusted mean total healthcare expenditures (\$11,433; 95% CI, \$10,430-\$12,437) than

the non-PCC group (\$13,020; 95% CI, \$12,166-\$13,873), yielding cost savings of \$1587 per cancer survivor ($P = .020$) (Figure).

Subgroup and Secondary Analyses

Subgroup analyses showed that cost savings were from those 65 years and older. Among cancer survivors younger than 65 years, there were no statistical differences in total healthcare expenditures, but a significant decrease in prescription expenditures in the PCC group (\$2580; 95% CI, \$2152-\$3008) compared with the non-PCC group (\$3309; 95% CI, \$2858-\$3760) yielded a cost savings of \$729 per cancer survivor in that subgroup ($P = .023$) (Table 4).

In the 65 years and older subgroup, the PCC group was associated with lower odds of hospitalization compared with the non-PCC group (odds ratio [OR], 0.81; 95% CI, 0.66-0.99; $P = .035$). Moreover, there were statistically significant differences in adjusted total healthcare expenditures between the PCC group (\$11,918; 95% CI, \$10,881-\$12,954) and the non-PCC group (\$14,382; 95% CI, \$13,187-\$15,576; $P = .002$). Hospitalization-related healthcare expenditures were also lower in the PCC group (\$3323; 95% CI, \$2727-\$3918) than in the non-PCC group (\$4912; 95% CI, \$4039-\$5785) in this subgroup analysis ($P = .002$) (Table 4). Other types of costs were not statistically different between the PCC and non-PCC groups.

The secondary analysis indicated that of the 3 hallmark attributes of the PCMH model (ie, comprehensive care, whole-person orientation, accessible care), the whole-person orientation attribute was mainly responsible for the reductions observed in the PCC group's healthcare utilization and healthcare expenditures ($P = .006$). On the contrary, the comprehensive care attribute ($P = .906$) and the accessible care attribute ($P = .905$) did not show any significant impact. From these findings, the whole-person orientation attribute was further analyzed to determine which specific healthcare utilization and/or expenditure types were affected by it. It was revealed that the PCC group had lower adjusted mean total healthcare expenditures (\$11,666; 95% CI, \$10,891-\$12,440) than the non-PCC group (\$13,572; 95% CI, \$12,405-\$14,739), yielding cost savings of \$1906 per cancer survivor in this subgroup ($P = .006$). Furthermore, the whole-person orientation attribute was associated with decreased odds of ED visits (OR, 0.79; 95% CI, 0.68-0.92; $P = .003$) and decreased healthcare expenditures associated with ED visits (cost savings of \$96 per cancer survivor; $P = .024$) (Table 4).

DISCUSSION

The long-term cancer survivor population is more likely to utilize more healthcare resources and accumulates more total medical expenditures over time than adults without a history of cancer, due to their complex medical history and continuous need for rigorous preventive screening, follow-up visits, chemotherapy long-term and late-effect management, and specialized care to prevent secondary relapse of their cancer.^{2,29} In addition, a higher risk for developing comorbid conditions and higher treatment costs further burden the patients. There is an urgent need for a more

TABLE 1. (Continued) Baseline Characteristics of 4288 Cancer Survivors

Characteristic	PCC ^a	Non-PCC	P ^b
	(n = 1883)	(n = 2405)	
	n (%)		
Perceived health			.008
Excellent/very good	487 (25.9)	580 (24.1)	
Good	680 (36.1)	797 (33.1)	
Fair/poor	716 (38.0)	1028 (42.7)	
Cancer type			
Breast cancer	373 (19.8)	448 (18.6)	.329
Prostate cancer	251 (13.3)	332 (13.8)	.902
Skin cancer (nonmelanoma)	301 (16.0)	383 (15.9)	.958
Skin cancer (unknown type)	149 (7.9)	278 (11.6)	<.001
Cervical cancer	102 (5.4)	142 (5.9)	.724
Colon cancer	110 (5.8)	133 (5.5)	.661
Lung cancer	53 (2.8)	78 (3.2)	.418
Cancer (reported as other type)	182 (9.7)	246 (10.2)	.541
Comorbidity			
Hypertension without complication	1104 (58.6)	1338 (55.6)	.049
Rheumatoid arthritis	454 (24.1)	633 (26.3)	.099
Depression	386 (20.5)	579 (24.1)	.005
Diabetes	386 (20.5)	494 (20.5)	.974
Chronic pulmonary disease	321 (17.0)	474 (19.7)	.026
Hypothyroidism	277 (14.7)	344 (14.3)	.707

PCC indicates patient-centered care; PCMH, patient-centered medical home.
^aPCC was defined as positive responses for all 3 PCMH attributes (comprehensive care, whole-person orientation, and accessible care).
^b**Bold** indicates statistical significance ($P < .05$).

TABLE 2. Healthcare Utilization by Category

Utilization Category	PCC ^a	Non-PCC	Adjusted OR (95% CI)	P ^b
	(n = 1883)	(n = 2405)		
Hospitalization, n (%)	295 (15.7%)	426 (17.7%)	0.91 (0.77-1.07)	.256
ED visit, n (%)	371 (19.7%)	548 (22.8%)	0.89 (0.77-1.04)	.137
Adjusted Mean (95% CI) Number of Utilizations				
Hospitalization	0.23 (0.20-0.26)	0.25 (0.22-0.27)	-	.255
ED visit	0.30 (0.27-0.33)	0.33 (0.30-0.36)	-	.119
Office visit	8.20 (7.84-8.55)	8.26 (7.94-8.58)	-	.769
PCP visit	1.84 (1.77-1.91)	1.87 (1.80-1.93)	-	.572
Oncologist visit	0.37 (0.33-0.40)	0.34 (0.31-0.37)	-	.279

ED indicates emergency department; OR, odds ratio; PCC, patient-centered care; PCMH, patient-centered medical home; PCP, primary care provider.
^aPCC was defined as positive responses for all 3 PCMH attributes (comprehensive care, whole-person orientation, and accessible care).
^bP values are from logistic regressions or negative binomial regressions after propensity score.

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TABLE 3. Healthcare Expenditures by Category in 2014 US\$

Expenditure Category	PCC ^a (n = 1883)	Non-PCC (n = 2405)	Cost Savings ^b	P ^{c,d}
	Mean (95% CI)			
Hospitalization				
Baseline year 1 (crude mean)	\$3540 (\$2692-\$4388)	\$2620 (\$2232-\$3008)	–	.038
Follow-up year 2 (crude mean)	\$3304 (\$2520-\$4088)	\$3841 (\$3260-\$4422)	–	.270
Follow-up year 2 (adjusted mean)	\$3358 (\$2604-\$4111)	\$3764 (\$3174-\$4355)	\$406	.413
ED visit				
Baseline year 1 (crude mean)	\$304 (\$247-\$361)	\$338 (\$280-\$397)	–	.420
Follow-up year 2 (crude mean)	\$305 (\$243-\$367)	\$299 (\$251-\$347)	–	.885
Follow-up year 2 (adjusted mean)	\$315 (\$252-\$379)	\$295 (\$246-\$343)	–\$21	.613
Prescription				
Baseline year 1 (crude mean)	\$2601 (\$2361-\$2842)	\$2968 (\$2757-\$3180)	–	.025
Follow-up year 2 (crude mean)	\$2610 (\$2387-\$2833)	\$3165 (\$2913-\$3418)	–	.002
Follow-up year 2 (adjusted mean)	\$2657 (\$2430-\$2885)	\$3051 (\$2811-\$3290)	\$393	.020
Office visit				
Baseline year 1 (crude mean)	\$2760 (\$2375-\$3145)	\$3109 (\$2846-\$3373)	–	.130
Follow-up year 1 (crude mean)	\$2977 (\$2718-\$3237)	\$3362 (\$3081-\$3644)	–	.055
Follow-up year 2 (adjusted mean)	\$3048 (\$2758-\$3338)	\$3328 (\$3049-\$3607)	\$280	.174
Total				
Baseline year 1 (crude mean)	\$11,193 (\$10,122-\$12,265)	\$11,783 (\$11,055-\$12,512)	–	.357
Follow-up year 2 (crude mean)	\$11,208 (\$10,204-\$12,212)	\$13,316 (\$12,463-\$14,169)	–	.002
Follow-up year 2 (adjusted mean)	\$11,433 (\$10,430-\$12,437)	\$13,020 (\$12,166-\$13,873)	\$1587	.020

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

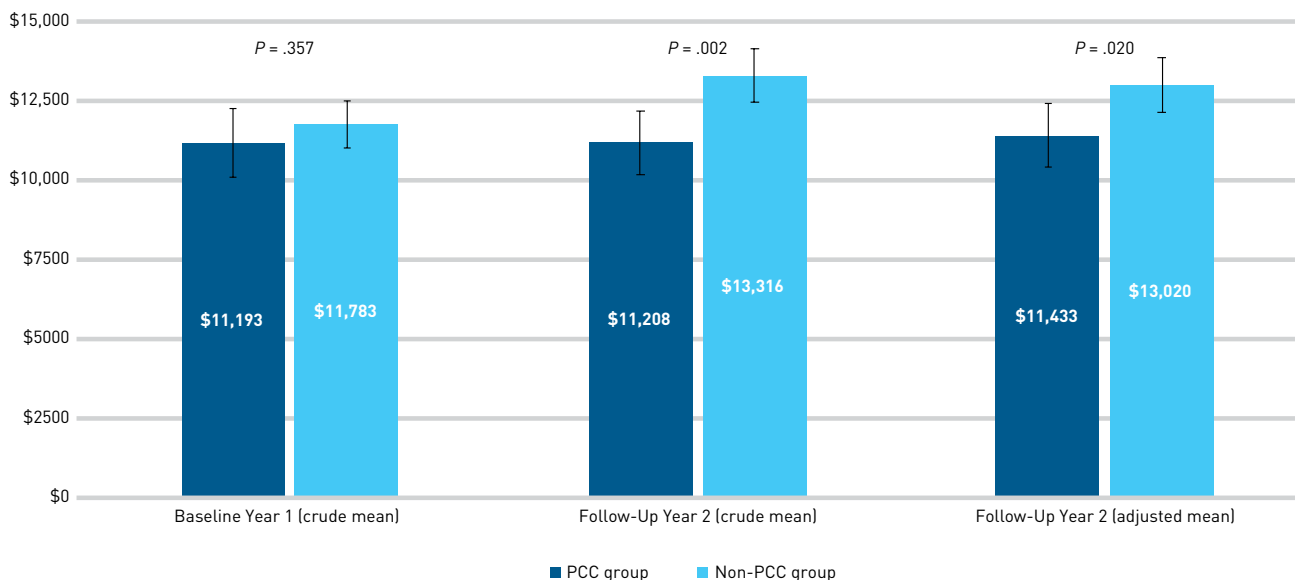
^aPCC was defined as positive responses for all 3 PCMH attributes (comprehensive care, whole-person orientation, and accessible care).

^bCost savings are calculated from the adjusted mean difference of non-PCC group costs minus PCC group costs.

^cP values for crude mean differences are from Student's *t* tests and for adjusted mean differences are from generalized linear models after propensity score.

^d**Bold** indicates statistical significance (*P* < .05).

FIGURE. Mean Total Healthcare Expenditures at Baseline (year 1) and at Follow-Up (year 2)



PCC indicates patient-centered care.

TABLE 4. Subgroup and Sensitivity Analyses in 2014 US\$

	Subgroup Analysis		Adjusted Mean Difference or Adjusted OR (95% CI) ^b	P ^c
	PCC ^a	Non-PCC		
	Mean (95% CI)			
<65 years (n = 1888)				
Healthcare utilization				
Hospitalization	-	-	1.17 (0.88-1.57)	.286
ED visit	-	-	0.84 (0.66-1.07)	.166
Healthcare expenditures				
Total	\$10,696 (\$8809-\$12,583)	\$11,161 (\$10,009-\$12,313)	\$465	.683
Hospitalization	\$3381 (\$1814-\$4948)	\$2237 (\$1561-\$2914)	-\$1144	.144
ED visit	\$252 (\$186-\$318)	\$306 (\$216-\$396)	\$54	.335
Prescription	\$2580 (\$2152-\$3008)	\$3309 (\$2858-\$3760)	\$729	.023
Office visit	\$2709 (\$2322-\$3096)	\$3101 (\$2676-\$3525)	\$392	.181
≥65 years (n = 2400)				
Healthcare utilization				
Hospitalization	-	-	0.81 (0.66-0.99)	.035
ED visit	-	-	0.93 (0.76-1.12)	.435
Healthcare expenditures				
Total	\$11,918 (\$10,881-\$12,954)	\$14,382 (\$13,187-\$15,576)	\$2464	.002
Hospitalization	\$3323 (\$2727-\$3918)	\$4912 (\$4039-\$5785)	\$1589	.002
ED visit	\$369 (\$261-\$478)	\$292 (\$236-\$347)	-\$77	.187
Prescription	\$2716 (\$2486-\$2947)	\$2849 (\$2603-\$3096)	\$133	.440
Office visit	\$3237 (\$2856-\$3617)	\$3471 (\$3101-\$3840)	\$234	.388
Sensitivity Analysis of PCMH Hallmark Attributes				
PCMH Hallmark Attribute	PCC ^a	Non-PCC	Adjusted Mean Difference or Adjusted OR (95% CI) ^b	P ^c
	Mean (95% CI)			
Comprehensive care	\$12,377 (\$11,633-\$13,121)	\$12,466 (\$11,187-\$13,745)	\$89	.906
Whole-person orientation	\$11,666 (\$10,891-\$12,440)	\$13,572 (\$12,405-\$14,739)	\$1906	.006
Accessible care	\$12,381 (\$11,615-\$13,147)	\$12,477 (\$11,111-\$13,842)	\$96	.905
Sensitivity Analysis of "Whole-Person Orientation" by Expenditures/Utilization				
Healthcare utilization				
Hospitalization	-	-	0.92 (0.77-1.08)	.302
ED visit	-	-	0.79 (0.68-0.92)	.003
Healthcare expenditures				
Total	\$11,666 (\$10,891-\$12,440)	\$13,572 (\$12,405-\$14,739)	\$1906	.006
Hospitalization	\$3269 (\$2714-\$3824)	\$4212 (\$3348-\$5076)	\$943	.062
ED visit	\$270 (\$225-\$314)	\$366 (\$290-\$442)	\$96	.024
Prescription	\$2849 (\$2639-\$3058)	\$2996 (\$2700-\$3293)	\$147	.422
Office visit	\$3121 (\$2885-\$3358)	\$3326 (\$2980-\$3671)	\$205	.334

ED indicates emergency department; OR, odds ratio; PCC, patient-centered care; PCMH, patient-centered medical home.

^aPCC was defined as positive responses for all 3 PCMH attributes (comprehensive care, whole-person orientation, and accessible care).

^bAn adjusted mean difference was calculated for healthcare expenditures, and an adjusted OR was calculated for healthcare utilization.

^c**Bold** indicates statistical significance (P < .05).

cost-effective method of managing this patient population.^{8,30-35} A patient-centered comprehensive care model has the potential to provide more benefits to cancer survivors than to other patient cohorts, and this study tried to establish an association between patient perceptions of PCMH characteristics and total medical expenditures to further guide the future design of a PCMH model.

The findings of this study suggest that providing patient-centered comprehensive care may mitigate total healthcare utilization and subsequently reduce total healthcare expenditures among long-term cancer survivors in the United States. In the overall analysis, although there were no significant differences in healthcare utilization, there were significant reductions in adjusted mean healthcare

expenditures at follow-up between the PCC group and the non-PCC group. Subgroup analyses suggest that the majority of the benefits of PCC were seen in the elderly population. In the subgroup of those 65 years and older, cancer survivors in the PCC group had 19% lower odds of hospitalization compared with the non-PCC group, and the savings were mostly from hospitalization-related healthcare expenditures. In the subgroup of those younger than 65 years, the benefits stemmed from reductions in prescription-related healthcare expenditures. These findings suggest that providing patient-centered comprehensive care might be more effective in the elderly population of cancer survivors than in the younger population. Elderly patients usually have more comorbidities and are likely to experience more hospitalizations or ED visits; therefore, patient-centered comprehensive care may play a bigger role in reducing overall healthcare costs. In this study, the population 65 years and older had a higher number of hospitalizations and ED visits compared with the population younger than 65 years, which might have driven our findings. These findings are also supported by previous literature that has suggested that reduction of hospital readmission rates and lowering of inpatient expenditures were more pertinent to the older adult population.^{26,36} However, this study was not able to further explain the reasoning behind these findings.

The secondary analysis performed in this study revealed that of the 3 hallmark attributes of a PCMH, the whole-person orientation attribute contributed the most to the reduction in total healthcare expenditures in long-term cancer survivors, whereas the comprehensive care and accessible care attributes were not associated with savings. This may be due to a ceiling effect for the comprehensive care and accessible care attributes, because their positive responses reached 98.3% and 93.7%, respectively, making it more difficult to assess if they impacted the economic outcomes.

The impact of the whole-person orientation attribute on reducing healthcare utilization and expenditures may be explained by the idea that as clinicians empower cancer survivors to become more engaged in the decision-making process of their own care, the patients become more responsible and adherent to those treatments. As a result, unnecessary healthcare expenditures stemming from treatment nonadherence are reduced. This finding was supported by further evaluating the whole-person orientation attribute in the secondary analysis, which showed significant decreases in total healthcare utilization, specifically in the odds of ED visits, in addition to decreases in ED visit-related healthcare expenditures and total healthcare expenditures.

The significant reductions in total healthcare expenditures and total healthcare utilization among the PCC group in this study, especially the reduced odds of hospitalization and reductions in hospitalization-related expenditures, were mostly consistent with findings from other similarly designed studies evaluating PCMHs. Findings of a study by Cuellar and colleagues suggested that a PCMH model, by the third year of its inception, resulted in lower rates of healthcare utilization and subsequently lower observed total healthcare expenditures.³⁷ Likewise, a study by Cole and

colleagues found diminished healthcare expenditures, as well as fewer hospitalizations, among Louisiana primary care clinics that have adopted the PCMH model in the management of their chronically ill patients.³⁸ One study by Kohler and colleagues reached a different conclusion and found that patients with breast cancer in North Carolina actively receiving treatment in a PCMH model had higher total healthcare expenditures after initial diagnosis via increased total healthcare utilization, possibly due to greater access to their primary and specialty care teams compared with those who were not in a PCMH model.³⁹

However, it is important to note that our study findings should be understood as the economic benefits associated with patient perceptions of their care instead of direct effects of implementation of a structured PCMH model. The definition of PCC relied on cancer survivors' self-reported data; cancer survivors were considered to have received patient-centered comprehensive care if they provided positive responses to statements correlated with common characteristics of a PCMH model, rather than actual enrollment in a PCMH program. This patient perception may be affected by various factors, including characteristics of patients, individual physicians, or the practices in which patients received care. Although this study does not provide direct evidence from the implementation of a PCMH model, the indirect method of measurement may provide an advantage because it allows us to examine unique patient perspectives and compare each of the 3 hallmark attributes of the PCMH model and how each attribute can affect overall economic outcomes.

Limitations and Strengths

This study has several limitations. The PCMH attributes were potentially determined by both primary care and oncology care because the survey respondents did not specify whether their USC was their primary care provider or an oncologist. Therefore, study findings may not serve as evidence of patient perception of oncology care. Another limitation of this study is possible bias from unobserved confounding variables, as commonly seen with other observational studies. In this study, unobserved confounding variables, such as disease severity, may have affected the study findings rather than the PCC. However, observed confounding variables were adjusted with a PS model to maintain balance between the PCC group and the non-PCC group of cancer survivors. Other possible limitations of this study are nonresponse bias or recall bias, which are common in survey-type studies. Therefore, the analysis had to utilize only data that were readily available.

Despite these limitations, this study also has various strengths. To date, there have been a limited number of studies on the effects of implementing a PCMH model for patients with cancer and even fewer studies examining its effects on long-term cancer survivors. The findings derived from this study may be useful in the development of clinical programs for the care of long-term cancer survivors or in aiding the design of future PCMH models for managing other costly chronic conditions. In addition, this study utilized panel data to

investigate the association between patient perceptions of PCMH characteristics at year 1 and economic outcomes at year 2, thereby minimizing limitations that would arise from a cross-sectional study when evaluating outcomes. In addition, a majority of cancer survivors (80%) did not change their responses to the questions on having received care attributable to PCMH characteristics at year 2, which suggests a continuation of similar types of care provided throughout the year. Furthermore, the unique patient perspectives obtained from a nationally representative sample may allow the results to be further applied and generalized to the broader US population.

CONCLUSIONS

The positive patient perception of PCMH characteristics was associated with reductions in mean total healthcare utilization and mean total healthcare expenditures among long-term cancer survivors. Future studies should further investigate the economic benefits of implementing a PCMH model for long-term cancer survivors through an interventional study design, in order to gain a better understanding of the origins of cost savings. ■

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eAppendix. Positive Responses to PCMH Characteristics^a

PCMH Attribute	PCMH Characteristic	PCC^b (n = 1883)	Non-PCC (n = 2405)	Total (n = 4288)
“Comprehensive care”	USC usually asked about medications and treatments prescribed by other doctors ^c	1883 (100%)	1562 (65.0%)	3445 (80.3%)
	USC provided care for new health problems ^c	1883 (100%)	2333 (97.0%)	4216 (98.3%)
	USC provided preventive healthcare ^c	1883 (100%)	2329 (96.8%)	4212 (98.2%)
	USC provided referrals to other health professionals ^c	1883 (100%)	2288 (95.1%)	4171 (97.3%)
	USC provided care for ongoing health problems ^c	1883 (100%)	2318 (96.4%)	4201 (98.0%)
	All “comprehensive care” positive	1883 (100%)	1421 (59.1%)	3304 (77.1%)
“Whole-person orientation”	USC showed respect for the medical, traditional, and alternative treatments with which participant is happy ^d	1883 (100%)	1522 (63.3%)	3405 (79.4%)
	USC asked participant to help decide treatment when there was a choice in treatments ^d	1883 (100%)	1449 (60.3%)	3332 (77.7%)
	USC presented and explained all healthcare options to participant ^c	1883 (100%)	2037 (84.7%)	3920 (91.4%)
	All “whole-person orientation” positive	1883 (100%)	924 (38.4%)	2807 (65.5%)
“Accessible care” ^e	It was not difficult to get to USC’s location ^f	1883 (100%)	2136 (88.8%)	4019 (93.7%)
	It was not difficult to contact USC over the phone about a health problem during regular office hours ^f	1883 (100%)	1537 (63.9%)	3420 (79.8%)
	All “accessible care” positive	1883 (100%)	1379 (57.3%)	3262 (76.1%)
	All PCC positive	1883 (100%)	0 (0%)	1883 (43.9%)

PCC indicates patient-centered care; PCMH, patient-centered medical home; USC, usual source of care.

^aP values for differences between the 2 groups are all <.001.

^bPCC was defined as positive responses for all 3 PCMH attributes.

^c“Yes” was defined as a positive response.

^d“Usually or always” was defined as a positive response.

^eTwo of the characteristics associated with the “accessible care” attribute, USC offered night and weekend office hours and USC spoke the patient’s preferred language or provided translation services, were not included in the final analysis due to the amount of missing data.

^f“Not too difficult or not at all difficult” was defined as a positive response.