RESEARCH ARTICLE

Comprehensive support of family caregivers: Are there health system cost offsets?

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Abstract

Objectives: To examine the effect of the Department of Veterans Affairs' (VA) Program of Comprehensive Assistance for Caregivers (PCAFC) on total VA health care costs for Veterans.

Data Sources: VA claims.

Study Design: Using a pre-post cohort design with nonequivalent control group, we estimated the effect of PCAFC on total VA costs up through 6 years. The treatment group included Veterans ($n = 32\,394$) whose caregivers enrolled in PCAFC. The control group included an inverse probability of treatment weighted sample of Veterans whose caregivers were denied PCAFC enrollment ($n = 38\,402$).

Data Extraction: May 2009–September 2017.

Principal Findings: Total VA costs pre-PCAFC application date were no different between groups. Veterans in PCAFC were estimated to have \$13 227 in VA costs in the first 6 months post-PCAFC application, compared to \$10 806 for controls. Estimated VA costs for both groups decreased in the first 3 years with a narrowing, but persistent and significant, difference, through 5.5 years. No significant difference in VA health care costs existed at 6 years, approximately \$10 000 each, though confidence intervals reflect significant uncertainty in cost differences at 6 years.

Conclusions: Increased costs arose from increased outpatient costs of participants. Sample composition changes may explain lack of significance in cost differences at 6 years because these costs comprise of early appliers to PCAFC. Examining 10-year costs could elucidate whether there are long-term cost offsets from increased engagement in outpatient care.

KEYWORDS

access/demand/utilization of services, health care costs, observational data/quasi-experiments, program evaluation, VA Health Care System

1 | INTRODUCTION

Family caregivers are generally defined as unpaid, untrained persons who assist a cognitively or functionally disabled family member or friend in the home. Policies to support this cadre of individuals have gained traction in the United States over the past 10 years. For example, the Caregiver Advise, Record, Enable (CARE) Act—which requires hospitals to record the name and contact information of the inpatient's primary caregiver in the electronic health record (EHR) prior to discharge, inform caregivers of discharge plans, and provide education to the caregiver—has recently been passed in 39 states, the District of Columbia, Puerto Rico, and the US Virgin Islands.¹ Another policy that was passed on January 2018 called the Recognize, Assist, Include, Support, and Engage (RAISE) Act requires a national strategy to support family caregivers be developed, including a plan to implement evidence-based training and supports.² Beyond the important and basic goals of being able to identify and expand training for caregivers, only 7 percent of whom report having received any training to fulfill their caregiving role,³ increasingly programs allow payments to caregivers as a form of support. These payments arise most commonly as beneficiary-directed home-based care programs, the largest of which are operated by Medicaid in over 25 states (eg, in California it is called In-Home Support Services) and by the US Department of Veterans Affairs (VA) nationally (Veteran-Directed Home and Community-based Services).⁴⁻⁷ In these programs, funds are allocated to the beneficiary and then the beneficiary decides whether to pay a friend/relative or to pay a formal, agency-provided home health care provider. The Cash and Counseling Initiative was a randomized beneficiary-directed program; recent evidence from this program, which required cost neutrality in services, suggested that payment-induced involvement of family members reduced health care costs and improved beneficiary outcomes.⁸

The VA implemented comprehensive caregiver support services in 2011 after passage of the Caregivers and Veterans Omnibus Health Services Act of 2010. A key component of the support services included a monthly stipend paid directly to the family or friend caregiver. Over its first 8 years, the program served over 40 000 caregivers (internal operations data). Known as the Program of Comprehensive Assistance for Family Caregivers (PCAFC), this program supports caregivers of Veterans from the post-9/11 era who need assistance with activities of daily living or with supervision or protection because of the residual effect of injuries sustained during their service. Recent evidence suggests that PCAFC increased total VA health care costs at one-year postapplication date; increased outpatient primary care and outpatient mental health care utilization likely explain the cost increase as there were no increases in acute care utilization (emergency department or inpatient) for PCAFC participants compared to the control group.⁹

In this study, we examine whether longer-term total VA health care costs fell for PCAFC participants; we analyze costs up to six years postapplication. We hypothesized that the observed

What this study adds

- We know in the short term that comprehensive caregiver supports do not result in cost savings, but increases engagement in high-value care, such as primary care and outpatient mental health care.
- Mid- and long-term effects of comprehensive caregiver support are unknown.
- Over time, estimated VA costs for Veterans whose caregivers received comprehensive caregiver support decreased with a narrowing, but persistent and significant, difference from Veterans whose caregivers did not receive comprehensive caregiver support through 5.5 years.
- Increased total costs arose from increased outpatient costs.

short-term increases in use of mental health care and primary care at one year would lead to longer-term total cost offsets overall by reducing low value and potentially avoidable acute care services. In addition to examining total health care costs, we separately examine outpatient and inpatient health care costs to understand sources of cost variation. Understanding the health care cost implications of PCAFC at six years since program inception is critical considering that a new law passed in 2018 expands PCAFC to serve caregivers of Veterans from all service eras. This expansion will begin in 2020 for qualifying caregivers of Vietnam-era Veterans and thereafter will expand to caregivers of Korea-era Veterans. Although the population of caregivers and Veterans from the post-9/11 era have unique characteristics compared to Veteran-caregiver dyads from earlier eras (eg, are younger, have higher rates of blast injuries and traumatic brain injury),¹⁰ understanding 6-year cost implications of PCAFC in its current state is vital to projecting health care costs due to program expansion. Finally, the health care cost implications from PCAFC may help inform other programs that offer consumer-directed supports to disabled persons and their chosen caregivers.

2 | METHODS

2.1 | Analytic methods

The objective of this evaluation was to examine the effect of the PCAFC on Veteran VA health care costs; specifically, we used a pre-post two-group retrospective cohort design⁹ to estimate the average treatment effect among the treated (ATT).^{9,11} The ATT measures the effect of PCAFC on Veteran health care costs among those Veterans whose caregivers were ever enrolled in PCAFC and corresponds with an intent to treat perspective.

2.2 | Sample

The treatment group comprised Veterans whose caregivers applied for PCAFC between program inception in May 2011 and March 31, 2017, and were ever approved. The nonequivalent control group comprised of all Veterans whose caregivers applied to PCAFC by March 31, 2017, and the Veteran was never approved. Even though the caregiver applies for the program with a specific Veteran as the care recipient, the unit of analysis in this paper is the Veteran because we are focusing on Veteran health care costs. Therefore, the inclusion criteria are based on the individual Veteran never being accepted into the program. Enrollment into the program is determined based on the Veteran's needs and the home environment related to the Veteran's overall level of functioning. This determination is made through clinical assessments and observations made by a trained, interprofessional team, which may include social workers, mental health providers, nurses, physicians, and therapists. Veterans and caregivers not approved for the program received standard VA benefits and could also access services and supports from the VA Caregiver Support Program (CSP), which offers trainings, counseling, and other support at each VA medical center nationally.

The cohort included 32 668 Veterans in the treatment group and 39 037 Veterans in the control group. Veterans were excluded if their identification number could not be matched to VA data; they were over 65 years old as of 9/11/2001; they were over age 70 at baseline; they died prior to or on the same day as the application date; their home ZIP code was outside the 50 United States, Washington DC, or Puerto Rico at baseline; or they had a missing comorbidity score at baseline (detailed diagram of all sample exclusions appears in Appendix S1: Figure S1). Baseline was defined using the date of application to PCAFC and represented the end of the preperiod and the beginning of the postperiod in the empirical models. For the treatment group, baseline was the application date of the earliest approved application to PCAFC. For the control group, baseline was the earliest application date to PCAFC.

2.3 | Data sources

Application date, program eligibility determination, caregiver gender, and caregiver relationship to the Veteran were obtained from the Caregiver Application Tracker (CAT), the database used by the VA Caregiver Support Program to record all applications. Outcomes and explanatory variables in the VA electronic health record (EHR) data were abstracted from the VA Corporate Data Warehouse (CDW), the Assistant Deputy Under Secretary for Health for Policy & Planning (ADUSH) Enrollment files, and the Vital Status Mini file. All cost outcomes were constructed from the VA Managerial Cost Accounting (MCA) National Data Extract (NDE) files and Medical SAS® Fee Basis files. The Medical SAS® files along with CDW files provided explanatory variables. Date of death was obtained from the Vital Status Mini file, along with other demographic characteristics (eg, date of birth, gender).

2.3.1 | Outcomes

Cost of VA services was categorized into six-month outcome intervals based on the application date to PCAFC. Each Veteran had at least one six-month interval postapplication as well as two six-month intervals prior to application. Application dates varied, so the number of outcome intervals differed per Veteran; Veterans who applied at program inception in May 2011 had as many as 12 intervals postapplication prior to the end date on 9/30/2017, whereas Veterans who applied to the program in March 2017 only had one interval postapplication. Additionally, the costs for Veterans who died during the outcome period were included in the 6-month period that included their date of death and censored thereafter. Inclusion of utilization data from the preapplication period permitted evaluation of the balance in observed costs, weighted via inverse propensity score methods, of the treated and control groups prior to application. All costs are presented in 2017 US dollars.¹²

2.3.2 | Total health care costs

A total VA-financed Veteran health care cost measure was created by aggregating Veteran inpatient, extended care (eg, nursing home care), outpatient, and pharmacy costs from all VA and VA-purchased sites of care using procedures recommended by the VA Health Economics Resource Center (HERC).^{13,14}

2.3.3 | Inpatient health care costs

An average daily inpatient health care cost was calculated based on the treatment dates. If all treatment dates attributed to a given claim occur within a single six month interval, the associated costs were also attributed to that interval. If the treatment dates for a single inpatient stay occurred over multiple six month intervals, average daily costs were calculated and assigned to the appropriate six-month interval based on the number of days during that interval the stay occurred.

2.3.4 | Outpatient health care costs

Outpatient health care costs included all VA-financed outpatient Veteran health care. VA-provided costs were calculated from the MCA NDE files and VA-purchased care using Medical SAS® Fee Basis files maintained by HERC.

2.3.5 | Explanatory variables in the logistic propensity score model

Baseline explanatory variables in 0-6 months prior to application and 7-12 months prior to application were used to control for

Veteran and caregiver sociodemographic characteristics, access to care factors, and comorbidities as potential confounders that could impact both admittance to PCAFC and Veteran health care utilization. Veteran sociodemographic characteristics included Veteran age, gender, race, ethnicity, marital status, homeless status, service-connection (degree of disability related to or worsened by military service), and enrollment priority level (level of a Veteran's disability and expected cost to VHA). Caregiver sociodemographic characteristics included gender, relationship to Veteran, and whether the caregiver was a Veteran receiving Veterans Health Administration (VHA) care. Access to care factors included straight-line distance to nearest VA Medical Center (VAMC) based on ZIP code of Veteran residence, the corresponding facility complexity level of the nearest VAMC at baseline, and the Veterans Integrated Service Network (VISN) of the nearest VAMC. Finally, we controlled for prevalent comorbidities of post-9/11 Veterans, such as post-traumatic stress disorder, traumatic brain disorder, musculoskeletal conditions, etc, number of VA primary care and mental health visits at baseline, and concurrent Nosos score, a VA-developed comorbidity score akin to a Diagnostic Cost Group score.⁹ Propensity score specification was carefully tested, and the need for higher order terms or interactions was assessed by visually inspecting the estimated distributions of propensity scores and the level of balance achieved via standardized differences.⁹

2.4 | Statistical analysis

Because Veterans were not randomized to enrollment in PCAFC, inherent differences between the treatment and control groups may have existed at the time of application. To address potential confounding, we created inverse probability of treatment weights (IPTW) using propensity scores. Propensity scores were estimated using logistic regression separately by fiscal year (FY) to account for dynamic selection, that is time-varying trends in the acceptance patterns of the program. Over time, eligibility acceptance decisions moved from individual assessments to team-based assessments; therefore, the year-specific propensity scores reflect any accompanying variation in interpretation of eligibility criteria or other program changes over time. We included 44 patient-, caregiver-, and site-level covariates after seeking guidance from clinical researchers and Caregiver Support Program leadership on factors anticipated to possibly influence both health care costs and enrollment into PCAFC (see section Explanatory Variables in the Logistic Propensity Score Model).

Because interest was in the effect of PCAFC on those enrolled, or the ATT, each Veteran in the treatment group was assigned a weight of 1.0, while each Veteran in the control group received a propensity score calculated IPTW. After weighting, the control group constituted a pseudopopulation in which the distributions of the explanatory variables in the control group were weighted to approximate those of the treatment group. To ensure comparability between groups, overlap of propensity scores was assessed and

individuals outside the range of common support in each fiscal year were trimmed from the analytic sample.¹⁵ As a result, 274 treatment group and 635 control group Veterans were excluded; the final analytic sample included 32,394 treatment and 38,402 control group Veterans.

Balance among the analytic sample was assessed using standardized differences, which are insensitive to sample size. Absolute value standardized differences less than 20 percent indicate reasonable covariate balance; those less than 10 percent indicate very well-balanced covariates.¹⁶

2.5 | Primary analysis

The effect of PCAFC on total health care and outpatient costs was evaluated via generalized linear models (GLMs) fit using generalized estimating equations (GEEs) on the weighted cohorts. We planned to model inpatient costs, but fewer than 10 percent of the sample incurred inpatient visits in any given interval. The significant proportion (>90 percent) of the sample with zero costs necessitated a two-part model,¹⁷ but a two-part model incorporating IPTW has not yet been developed. Instead, we descriptively examine inpatient costs for context in combination with outpatient and total cost regression results.

For both total and outpatient costs, the proportions with zero costs were <7 percent across all outcome periods other than 7-12 months prior to application and were small enough to allow for use of a single "one-part" regression model.¹⁷ For each outcome, thorough model specification testing for link function and variance was conducted as recommended by Manning and Mullahy.¹⁸ Results suggested both outcomes be fit with variance proportional to the mean, and that the total costs model be fit with an identity link and outpatient costs with a square root link. To allow for nonlinear trends, each model was specified with dummy-coded time intervals and their interaction with an indicator of enrollment in PCAFC.

Model results were coupled with empirical sandwich standard errors,^{19,20} which are robust to variance misspecification in large sample sizes. Differences in mean costs were calculated by subtracting the control group mean from that of the treatment group at each time point. Confidence intervals for differences in mean estimates were bootstrapped with 1000 samples. All analyses, except the descriptive evaluation of inpatient costs rather than conducting formal regression, were planned a priori with a statistical significance level of 0.05 and conducted in SAS 9.4 and SAS Enterprise Guide 7.1 (SAS Institute). As part of the VA Caregiver Support Program Evaluation Center, the project is a quality-improvement operations project and thereby not subject to Institutional Review Board.

2.6 | Sensitivity analyses

We also performed an a priori subgroup analysis, examining whether total costs differed by timing of the index application date, that is,

for early index date applicers to PCAFC versus late index date applicers to PCAFC. The index date, in instances in which there were multiple different applications to the program, refers to the earliest date for which an application was observed for the control group. For the approved group, the index date is the date of the first approved application. We defined the timing of application as the index application date occurring in FY11 - FY12; in FY13 - FY14; and in FY15 - FY17. This was of interest because there is evidence of program-related time-varying changes that could impact costs based on when an individual applied to PCAFC; for example, there were changes in acceptance rates over time at individual VA medical centers, changes in the team-based assessment process, and changes in the health status of the population that applied for the program.

Lastly, we performed an a priori sensitivity analysis removing all data from those who died during the follow-up period to ensure potentially escalating costs prior to death were not exhibiting undue influence on results. At a reviewer request, we also performed an additional post hoc sensitivity analysis trimming the sample by the year-specific IPTW (recalling that a Veteran's year is the year in which he/she filed an application to the program) to retain the patients with propensity scores in the area of very significant overlap across groups. We removed 6 percent of approved patients ($n = 1964$) and 19.3 percent of denied patients ($n = 7553$). Trimming of additional denied patients ensured that the patient characteristics of the approved group were well reflected in the control group in our estimation of the average treatment effect among the treated. Sensitivity analyses were conducted on total costs and inpatient costs.

3 | RESULTS

3.1 | Descriptive results

Table 1 displays the duration of follow-up for the trimmed overall cohort and classified by Veteran treatment or control group. The majority of censoring occurred due to end of the outcome assessment window, for example, Veterans who applied to PCAFC in later years have fewer follow-up outcome periods. Table 1 also presents number of Veterans deceased during each time interval.

Table 2 displays the characteristics of the unweighted and weighted trimmed analytic samples classified by Veteran treatment or control group status. Multiple characteristics demonstrated large (>20 percent) standardized differences in the unweighted cohort, indicating differences among treatment group Veterans and control group Veterans (Table 2). In the unweighted cohort, treatment group Veterans were younger by 4 years on average, a lower proportion were female, and a lower proportion were of Black or African American race. A higher proportion of treatment group Veterans were white race and Hispanic/Latino ethnicity. The treatment group in the unweighted cohort also had higher counts of VA primary care and mental health care visits in the periods prior to applying to PCAFC and had higher rates of musculoskeletal disorders, tobacco use, and alcohol and drug use dependency/disorders than the control group. In the unweighted cohort, treatment group Veterans had substantially higher rates of post-traumatic stress disorder, depression, and other mental health conditions compared to control group Veterans (Table 2). After applying IPT weighting on the

Postapplication time interval	Included PCAFC application dates	Overall N	Treatment N	Control N
0-6 mo	5/2011-3/2017	70 796	32 394	38 402
7-12 mo	5/2011-9/2016	64 492	31 126	33 366
13-18 mo	5/2011-3/2016	57 530	29 388	28 142
19-24 mo	5/2011-9/2015	50 725	27 293	23 432
25-30 mo	5/2011-3/2015	42 284	24 273	18 011
31-36 mo	5/2011-9/2014	34 663	21 225	13 438
37-42 mo	5/2011-3/2014	26 455	17 548	8907
43-48 mo	5/2011-9/2013	19 972	14 026	5946
49-54 mo	5/2011-3/2013	13 830	10 332	3498
55-60 mo	5/2011-9/2012	9291	7329	1962
61-66 mo	5/2011-3/2012	5226	4334	892
67-72 mo	5/2011-9/2011	2403	1994	409

TABLE 1 Duration of follow-up by treatment arm in trimmed analytical cohort^a

Note: PCAFC, Program of Comprehensive Assistance for Family Caregivers.

^aPostapplication intervals are constructed in 6-month blocks of time. The starting date for each Veteran's 0- to 6-month postapplication interval begins with application date, and 6-month intervals are constructed until September 30, 2017. Veterans are censored at their last complete 6-month block prior to that date. For example, a Veteran with a starting date of July 1, 2016, would have the following 6-month outcome intervals: 0-6 mo and 7-12 mo; this Veteran would not have a 13- to 18-month interval due to the cutoff date of September 30, 2017. Veterans who died during an outcome interval had cost outcomes constructed for that interval, but were censored for any subsequent intervals.

TABLE 2 Baseline descriptive characteristics of the trimmed analytic unweighted and weighted VA caregiver support program treatment group and nonequivalent control group veterans

Baseline characteristics	Unweighted cohort ^a			Inverse probability of treatment weighted cohort		
	Control group	Treatment group	Std. Diff. ^b	Control group	Treatment group	Std. Diff. ^b
Gender, %						
Male	88.3	91.7	11.03	91.5	91.7	0.59
Age, mean (SD)	40.5 (11.4)	36.5 (8.9)	-38.84	36.3 (8.0)	36.5 (8.9)	2.49
Homeless ^c , %	6.7	7.1	1.54	7.0	7.1	0.46
Marital status, %						
Married	64.2	66.4	4.68	66.3	66.4	0.27
Never married/single/ widowed	13.0	15.2	6.15	15.3	15.2	-0.40
Divorced/separated	18.6	16.0	-6.87	16.0	16.0	-0.20
Unknown	4.2	2.4	-9.76	2.3	2.4	0.60
Race, %						
White	57.3	69.5	25.56	71.4	69.5	-4.21
Black	31.9	18.9	-30.00	17.9	18.9	2.76
Other	5.5	6.6	4.99	6.2	6.6	1.89
Unknown	5.4	4.9	-1.92	4.5	4.9	1.83
Ethnicity, %						
Not Hispanic/Latino(a)	84.4	81.4	-7.93	81.2	81.4	0.68
Hispanic/Latino(a)	13.0	16.8	10.91	17.2	16.8	-0.94
Unknown	2.6	1.7	-6.00	1.7	1.7	0.67
Service connected, %						
High (≥70%)	74.3	78.0	8.61	77.4	78.0	1.35
Medium high (50%-69%)	9.1	8.0	-4.13	8.0	8.0	0.00
Medium low (10%-49%)	6.4	4.8	-6.84	4.8	4.8	0.24
Low (<10%) or missing	10.1	9.2	-3.15	9.8	9.2	-2.10
Priority level, %						
Group 1	84.8	87.1	6.62	86.6	87.1	1.52
Groups 2-4	8.5	7.8	-2.61	7.9	7.8	-0.46
Groups 5-8 or missing	6.6	5.0	-6.73	5.4	5.0	-1.74
Number of mental health visits ^d , mean (SD)						
0-6 mo. prior to application	4.4 (8.8)	6.3 (10.2)	20.21	6.4 (9.5)	6.3 (10.2)	-0.95
7-12 mo. prior to application	3.4 (7.5)	4.7 (8.8)	16.29	4.9 (8.2)	4.7 (8.8)	-2.06
Number of VA primary care clinic stops, mean (SD)						
0-6 mo. prior to application	1.4 (1.8)	1.7 (1.8)	12.23	1.7 (1.7)	1.7 (1.8)	-0.81
7-12 mo. prior to application	1.1 (1.6)	1.2 (1.7)	6.59	1.3 (1.6)	1.2 (1.7)	-2.12
Nosos score, mean (SD)	1.1 (1.6)	1.3 (1.7)	10.25	1.3 (1.7)	1.3 (1.7)	-1.95
Diagnoses, %						
Physical comorbidities						
Musculoskeletal disorders/ diseases	59.0	63.5	9.39	63.5	63.5	-0.01
Pain	37.7	47.6	20.25	47.4	47.6	0.50
Hyperlipidemia	26.7	26.1	-1.53	25.4	26.1	1.57
Hypertension	28.0	23.0	-11.35	22.8	23.0	0.52
Traumatic brain injury	15.3	29.2	34.19	30.5	29.2	-2.86

(Continues)

TABLE 2 (Continued)

Baseline characteristics	Unweighted cohort ^a			Inverse probability of treatment weighted cohort		
	Control group	Treatment group	Std. Diff. ^b	Control group	Treatment group	Std. Diff. ^b
Sleep disorders	26.1	25.5	-1.45	25.1	25.5	0.96
Obesity	16.2	16.9	1.97	16.9	16.9	0.15
Headache	23.9	33.3	21.01	34.0	33.3	-1.50
Hearing: loss, pain, other	9.3	12.1	9.21	12.4	12.1	-0.86
Diabetes	11.1	6.6	-15.70	6.1	6.6	1.93
Neoplasm	8.4	7.2	-4.71	7.1	7.2	0.27
Acute myocardial infarction	0.7	0.3	-4.93	0.3	0.3	0.69
Amputation	1.4	2.6	9.08	2.6	2.6	0.15
Alzheimer's or dementia	2.0	2.6	4.32	2.6	2.6	0.22
Vision loss	1.4	1.9	3.89	2.0	1.9	-0.61
Spinal cord injury	0.7	1.6	8.36	2.0	1.6	-2.73
Mental health comorbidities						
Post-traumatic stress disorder	56.2	72.9	35.35	73.3	72.9	-0.93
Depression	46.8	56.2	18.82	57.2	56.2	-1.95
Anxiety	25.3	29.3	8.99	29.5	29.3	-0.52
Tobacco use	18.5	23.2	11.60	22.6	23.2	1.44
Alcohol or substance abuse	18.8	22.2	8.50	22.2	22.2	0.06
Other mental health	13.9	21.4	19.74	22.1	21.4	-1.83
Adjustment reaction	9.4	11.0	5.20	11.1	11.0	-0.33
Bipolar disorder	5.7	6.7	4.27	7.0	6.7	-1.07
Any psychotic disorder	4.2	5.5	6.06	5.9	5.5	-1.60
Miles to closest VAMC ^e , mean (SD)	39.6 (38.8)	37.0 (37.8)	-6.81	38.3 (36.5)	37.0 (37.8)	-3.56
Complexity rating of parent station of nearest VAMC ^e , %						
1a	41.7	36.0	-11.66	36.2	36.0	-0.36
1b	15.7	16.7	2.94	16.5	16.7	0.49
1c	19.1	20.2	2.60	20.2	20.2	0.03
2	14.5	15.3	2.22	15.5	15.3	-0.54
3	9.0	11.7	9.18	11.6	11.7	0.55
Caregiver's relationship to Veteran, %						
Spouse/partner	77.3	82.1	11.75	81.4	82.1	1.83
Mother or father	6.2	8.5	8.86	9.1	8.5	-1.91
Other relative	7.8	5.2	-10.39	5.3	5.2	-0.49
Other nonrelative/not available	8.6	4.2	-18.02	4.2	4.2	-0.28
Caregiver gender, %						
Female	89.5	92.0	8.29	91.7	92.0	1.07
Caregiver is a Veteran ^f , %	11.9	12.1	0.77	11.2	12.1	2.83

Note: Treatment group = Veterans of caregivers approved into PCAFC, control group = Veterans of caregivers who applied to but were denied entry into PCAFC. Std. Diff. = standardized difference, SD = standard deviation, VAMC = Veterans Affairs Medical Center.

Percentages in table may not add to 100% due to rounding.

Veterans Integrated Service Network (VISN) indicator variables (1-21) were also assessed and included in the propensity score model (not shown). Absolute value of standardized mean difference for VISN indicators in the unweighted cohort ranged from 0.1 to 29.58; all VISN indicator variables in the weighted cohort (not shown in table but available upon request) had an absolute value standardized mean difference less than 1.95.

(Continues)

TABLE 2 (Continued)

^aAnalytic cohort: N = 38,402 and N = 32,394 Veterans in the control and treatment groups, respectively.

^bThe standardized difference for continuous variables is calculated as $100 \times \left(\frac{T-C}{T+C} \right)$, where T refers to the treatment group and C refers to the

control group. For discrete variables, $\frac{100 \times (P_T - P_C)}{\sqrt{\frac{(N_T - 1)P_T(1 - P_T) + (N_C - 1)P_C(1 - P_C)}{N_T + N_C - 2}}}$ where P_T and P_C refer to the proportion of the treatment group and the proportion of the control group, respectively, having a given characteristic.

^cAssessed in the year prior to and including application date.

^dDays with outpatient mental health care (if more than one visit on a single day, this counts as one visit). Includes VA mental health clinic stops and visits paid via Fee Basis (assessed through CPT codes).

^eClosest VAMC at the time of application, based upon straight-line distance from Veteran's ZIP code.

^fThis variable was constructed based upon caregivers' social security number matching in the Vital Status Mini File. It may not include caregiver who themselves are Veterans who do not utilize the VA health system (per VA electronic medical records).

FIGURE 1 Model Estimated mean total VA health care costs in 2017 US dollars with estimated differences and 95% bootstrapped confidence limits. NS, not significant.

analytic sample (eg, after trimming), balance between the groups was achieved (eg, standardized differences <10 percent).¹⁶

As the law creating PCAFC stipulates that eligible Veterans are those with service-related injuries acquired during the post-9/11 era, the two most common reasons for denial of entry into PCAFC were administrative, not clinical: (a) caring for a Veteran injured before 9/11/2001 and (b) caring for Veteran with an illness not related to military service.

3.2 | Effect of PCAFC on Veteran total health care costs

Enrollment in the PCAFC was associated with higher estimated total VA and VA-purchased health care costs in the first eleven of

twelve total six-month intervals following application (Figure 1). Veterans in the treatment group were estimated to have \$13 227 in VA health care costs in the first six months after PCAFC application, compared to \$10 806 in the control group. In the first three years since PCAFC application, estimated VA health care costs for both groups decreased; however, this difference persisted and was statistically significant at 5.5 years postapplication. Six years after the application date, Veterans in the PCAFC group were estimated to have \$10 528 in health care costs compared to \$10 055 in the control group. Noting the very wide confidence interval of almost \$6000 in this final six-month interval, the magnitude of the difference dropped to \$473 compared to a difference of \$2420 in the first six months after the application date.

3.3 | Effect of PCAFC on Veteran outpatient health care costs

Treatment and control group Veterans had similar outpatient expenditures leading up to application. However, enrollment in PCAFC was associated with significantly higher outpatient costs in all time periods following application (Figure 2). Veterans in the PCAFC group were estimated to have \$10 973 in outpatient costs in the first six months after application compared to \$7821 in the control group. At six years postapplication, Veterans in the PCAFC group had an estimated \$8311 in outpatient expenditures compared to \$6603 in the control group, a difference of \$1708.

3.4 | Effect of PCAFC on Veteran inpatient health care costs

Treatment and control group Veterans had descriptively similar inpatient cost trends in all time periods following the application date (Figure 3). This provides context that cost differences over time arose from higher outpatient service use among PCAFC participants compared to similar controls.

3.5 | Sensitivity analyses

In the sensitivity analysis of early vs. late index date applications, trends remained consistent with those seen in the primary analyses (Appendix S1: Figure S2A-C). Results showed declining but consistently higher estimated total costs among PCAFC participants over the first five years following application compared to control group Veterans. Among groups with longer follow-up, results were similarly consistent with the primary analyses.

In the sensitivity analysis removing decedents (1.78 percent of those in the treatment arm and 2.91 percent of those in the control arm died during a postapplication outcome interval), average estimated costs were marginally lower but the difference between PCAFC participants and those in the control group remained consistent. In our post hoc sensitivity analysis on the further trimmed sample, the difference in average estimated costs between PCAFC participants and those in the control group remained consistent with our primary results and did not change any conclusions. See Appendix S1: Figure S3A, B for additional details.

4 | DISCUSSION

Results show that there was a significant difference between Veterans in the treatment and control groups regarding total VA health care costs. We find support for a declining difference over time, moving from a difference of approximately \$2500 to just under a \$500 difference in estimated costs between the treated and control group Veterans over a six-year period. Examination of total VA

and VA-purchased inpatient costs shows that the estimated cost differences are not due to higher inpatient costs for treated Veterans, but are primarily driven by increased outpatient care, reflected in the higher outpatient costs. This difference persists at statistically significant levels ($P < .05$) through 5.5 years (but not 6 years) postapplication.

It is also important to consider the context of the effects in the final periods. The confidence intervals increase greatly, and the sample composition changes over time, with just over 400 control group Veterans contributing to the final period (period 12) (Table 1). Due to the fact that acceptance rates were higher in the early years of the program, fewer of the controls than cases had 12 periods of follow-up time (eg, controls came disproportionately from later years); therefore, the cost differences in the final periods of the outcome window may have arisen partly from changes in sample composition of the controls and should be interpreted in that context. Because the cost convergence in year 6 could be entirely due to sample composition changes and confidence intervals reflect significant uncertainty in the estimates, future analysis needs to assess long-term cost differences (eg, using up to 10 years of postapplication data).

With excellent balance on observed covariate characteristics and nearly identical preapplication trends in costs for both groups, we are confident that the estimated difference in costs is attributable to participation in the program, not to other factors (eg, bias by indication). However, as with every quasi-experimental design, it is possible that unobserved factors drive the difference in costs rather than average program effects. Nevertheless, we feel these factors are not introducing much bias because we control for an extensive list of characteristics (44) not only at the Veteran level (health, access to care, demographics) and the caregiver level (eg, relationship to the Veteran), but also at the health system level (eg, VISN-level fixed effects). In addition, the use of time-varying inverse probability of treatment weights means that characteristics that change over time are accounted for in the control group. Hence, the unobserved confounding would have to be substantial to nullify the effects observed here. In addition, if the treatment group had worse health status at baseline than the comparison group on some unobservable factors not included in the models, these cost estimates would reflect the upper bound of the effect of PCAFC on VA spending.

This inquiry of six year costs has advantages over our earlier evaluation of short-term effects of PCAFC on costs.⁹ Specifically, this analysis benefits from a larger sample size due to more elapsed time and a longer follow-up period; more appliers resulted in more people in early outcome periods and longer follow-up allows us to evaluate whether eventual returns on investment are observed. Additionally, in this analysis we applied time-varying inverse probability of treatment weights to account for time-varying trends in the acceptance patterns of the program. Thus, this analysis explicitly accounts for the changing composition of Veterans applying for PCAFC naturally occurring over the life of the program.

Similar to when we performed our initial evaluation of the PCAFC program, increasing access for Veterans remains a top priority of the

FIGURE 2 Model estimated mean total VA outpatient costs in 2017 US dollars with estimated differences and 95% bootstrapped confidence limits. NS, not significant.

FIGURE 3 Weighted mean inpatient costs for the full sample by group and proportion with positive VA inpatient costs in 2017 US dollars by group. For the bottom panel, all treatment and control group members (eg including those with zero mean costs) contribute to the calculation of mean costs [Color figure can be viewed at wileyonlinelibrary.com]

Department of Veterans Affairs.²¹ This analysis shows that over the longer term, PCAFC may increase use of potentially high-value outpatient services and does not increase use of potentially avoidable/low value services such as acute care. Juxtaposing PCAFC against the aforementioned consumer-directed programs such as Cash and Counseling does not lend itself to direct comparison given that the design was different. Rather than giving caregivers a stipend versus not (eg, PCAFC), Cash and Counseling randomized beneficiaries to paying caregivers themselves or to receiving agency-provided care. Many randomized to pay caregivers chose to pay family members and not trained providers. A recent evaluation of this consumer-directed program provided evidence that involving family similarly reduced potentially low value care. Specifically, family involvement in home-based care significantly decreased likelihood of emergency room use, Medicaid-financed inpatient days, likelihood of any Medicaid hospital expenditures, and fewer months with Medicaid-paid inpatient use. Combined with evidence that individuals who have some family involved in home-based care are less likely to have several adverse health outcomes within the first 9 months of the trial, including lower prevalence of infections, bedsores, or shortness of breath, suggests that the lower utilization may be due to better health outcomes.²²

If lessons from PCAFC and post-9/11 Veterans and caregivers apply, expansion to Vietnam-era Veterans in 2020 as part of the MISSION Act could increase health care costs. The VA Health Care System could frame these anticipated health care costs against the evidence provided by caregiver participants that PCAFC is highly beneficial to their lived experiences, such as by reducing their perceived financial strain as they maintain their caregiving role.²³ It will also be important to examine health outcomes of these older Veterans whose caregivers qualify for comprehensive support, over the short and long term. Similarly, examining even longer-term costs of PCAFC, for example, through ten years, will provide additional insight about direct effects of PCAFC and of any spillovers to the health care system.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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