Original Article

Long-Term Care Benefits May Reduce End-of-Life Medical Care Costs

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Abstract

This study explores whether personal care services for functionally dependent or cognitively impaired individuals paid for by a long-term care (LTC) insurance policy can reduce health care utilization and costs at the end of life. This retrospective study uses propensity score matching methodology, hierarchical multiple regression, and Poisson regression to compare 830 decedents who utilized benefits from a voluntary LTC insurance plan ("claimants") to 6860 decedents who never purchased coverage but were similar to claimants on 17 variables, including age, sex, frailty, burden of illness markers, and propensity to have needed LTC services. Claimants using LTC benefits experienced significantly lower health care costs at end of life, including 14% lower total medical costs, 13% lower pharmacy costs, 35% lower inpatient admission costs, and 16% lower outpatient visit costs. They also experienced 8% fewer inpatient admissions and 10% fewer inpatient days. The presence of dementia at the end of life moderated these effects. This study suggests that use of insurance-based LTC services measurably reduces health care expenditures at the end of life. (*Population Health Management* 2014;xx:xxx–xxx)

Introduction

A SIGNIFICANT SHARE of health care resources is consumed during the last months of life.[1–6] In the United States, 10%–12% of overall health expenditures and 27%–30% of Medicare's budget are spent on end-of-life care.[6] These costs are incurred by a disproportionate few; specifically, 30% of Medicare expenditures are attributable to 5% of beneficiaries who die each year.[7] Moreover, about one third of direct health care expenditures in the last year of life are spent in the last month of life.[8] Most of these costs result from either life-sustaining care (eg, mechanical ventilation, resuscitation) or poorly coordinated care (eg, multiple emergency department visits and hospitalizations), which suggests there is potential to reduce or avoid some of these costs and also improve patient care.[9]

The Affordable Care Act, the most significant legislative development toward health care reform since the creation of Medicare and Medicaid, is focused on these same goals—reducing health care costs and improving patient care. Care interventions that improve outcomes and lower costs for the most costly patients—those at the end of life and also the 9 million dually eligible (Medicare and Medicaid) patients—are particularly critical.

However, reducing end-of-life health expenditures is a challenge. Although today greater emphasis is placed on the use of advance directives, hospice, and palliative medicine, per capita medical expenditures in the last year of life for Medicare decedents have remained stable and substantial for decades,[10] though a recent study demonstrated a savings of between $2650 to $6430 for those enrolled in hospice for 1 to 30 days at the end of life.[11] Despite these findings, a number of programs designed to improve quality of life at end of life have yet to significantly reduce costs associated with end-of-life care, perhaps in part because of limited patient acceptance or understanding of these programs.[12]

Excessive medical care at end of life is only one factor in soaring health care spending. Comorbidity is another driver of health care utilization and costs. The average per capita spending by patients with 1 or more chronic medical conditions is more than 5 times greater than spending for those without chronic conditions. Patients with 5 or more chronic conditions are 10 times more likely to be hospitalized and to incur inpatient hospital costs more than 25 times greater than those without chronic medical conditions.[13] Importantly, functional dependencies and cognitive impairment interact with comorbidity to further increase health care utilization and spending. Complex patients with functional dependencies

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generate health care expenditures that are double those of patients with similar levels of comorbidity but who are not functionally dependent.[13] Likewise, Alzheimer's-type dementia and other forms of cognitive impairment drive significantly higher acute health care utilization and costs.[14]

These cost drivers will gain momentum as the baby boom generation reaches retirement age and increasingly acquires multiple chronic conditions and functional or cognitive impairments. A higher incidence of these age-related conditions will produce a corresponding surge in the need for supportive services and personal care at the end of life. Personal care can be formal (paid) or informal (unpaid) and consists of assistance with activities of daily living (ADLs, such as bathing, dressing, transferring, toileting, feeding, and managing incontinence) and instrumental activities of daily living (IADLs, such as managing medications, shopping, house cleaning, arranging transportation, managing finances, and using the telephone). Although some fatal diseases at their terminal stages are associated with a very short period of disability and dependency at the end of life (ie, compression of morbidity), many prevalent age-related disorders such as dementia, degenerative neurological diseases, heart failure, arthritis, and pulmonary and renal disease are associated with a prolonged period of disability requiring years of personal care and supervision.[10] Moreover, personal care needs will become more common as medical advances add years of life but also increase the risk of extended disability and dependency at the end of life.

Although many studies have investigated the impact of advance directives, hospice, and palliative care on health care costs at the end of life, little is known about the impact of long-term personal care and supervision for functionally dependent or cognitively impaired persons on end-of-life medical care costs.[15] This study was designed to explore whether health care utilization and expenditures at the end of life are affected by the availability of paid personal care funded by a long-term care (LTC) insurance plan that provides access to support, oversight, ADL and IADL care, care planning, and care coordination. The study hypothesis is that the availability of paid LTC services and care management at the end of life will reduce health care utilization and cost of care for individuals at the end of life, as compared to those who have LTC needs but do not have access to services paid for by LTC insurance.

The California Public Employees' Retirement System (CalPERS) LTC Program provided the data for this study. It is a self-insured, underwritten, voluntary plan created by the California Legislature in 1994. The first application period began in 1995 and continued through 2008, with current enrollment at over 147,000 CalPERS employees, spouses, parents, and retirees. Like most LTC plans, the CalPERS program is tax qualified and provides LTC benefits at home, in the community, in an assisted living facility, or in a nursing home up to the coverage amounts purchased. The CalPERS LTC Program is voluntary. On average, eligible individuals purchase $120 per day of LTC coverage with a duration of 3 years to unlimited lifetime coverage (over 70% of CalPERS LTC members purchased an unlimited benefit duration). When policyholders become eligible for benefits, the funds can be pooled into a monthly benefit that can be used on specific days of each month; by using less benefits each month, benefits can be extended many years

beyond the duration of benefits purchased. Individuals qualify for benefits when they need regular hands-on assistance with 2 or more ADL dependencies for at least 90 days or require continual supervision for health and safety because of a severe cognitive impairment. At the time of claim, members receive a functional and cognitive assessment. If deemed eligible for benefits, a care manager works with claimants and their families to develop a plan of care that details covered formal (paid) and informal care provided by family and friends. Care managers assist with implementing the plan of care and periodically reassess claimants' functional and cognitive status to address any changes. To date, the Program has paid out over $1.2 billion in LTC benefits for over 14,000 ADL-dependent and cognitively impaired members.

Methods

Data sources

This study was a retrospective analysis examining health care utilization and costs among CalPERS members and covered dependents using 24 months of health care claims data aggregated by the Johns Hopkins Adjusted Clinical Groups System (ACG) and LTC benefits and claims information from Univita's LTC administrative system. CalPERS members and dependents aged 65 and older who died between January 1, 2007 and December 31, 2011 were eligible for the study (N = 21,220).

Pharmacy and medical claims data were gathered in compliance with HIPAA (Health Insurance Portability and Accountability Act) guidelines during 2 time periods (0–12 months and 13–24 months prior to death). The ACG software was used to generate member-level health care utilization counts and costs, predictive risk scores, and risk markers based on claims from each 12-month period. LTC benefits and claims information was used to identify members who had purchased LTC coverage (N = 1961) and the subset who received LTC benefits (ie, submitted claims that ultimately were approved for payment; N = 830). Members whose LTC coverage ended prior to death (N = 240) were excluded. The University of Minnesota's Institutional Review Board approved the study methods.

Description of the study population

The CalPERS population consists of public employees who work for various municipalities, school systems, police and fire departments, California counties, and California state government. They all participate in the California Public Employees Retirement System, and at time of retirement and at a specific age they receive a pension and supplemental health insurance benefits. The study population is older and has more chronic conditions than either 1993–1998 Medicare decedents[16] or 2010 dual eligibles.[17] On average, the CalPERS decedents were age 82.1 at death (vs. 78.5 Medicare decedents). They averaged 5.2 chronic conditions per person (vs. 3.7 Medicare decedents); 85.2% had 2 or more chronic conditions (vs. 72% of dual eligible). Health care utilization was high: rates per 1000 include 1086 inpatient hospital admissions, 1528 emergency department visits, and 23,816 outpatient visits. The average total cost per capita in the last year of life was $18,762. In

comparison, the average Medicare outlay for the last year of life was $26,000 per beneficiary.

Propensity score model

The validity of a retrospective comparison depends largely on the similarity between the treatment and comparison groups. In the current study, the comparison and treatment groups differed on several characteristics that influence health care utilization and costs, such as age, count of chronic conditions, count of prescribed medicinal ingredients, ADL limitations, and the presence of dementia (Table 1). This study used a propensity score matching methodology in a 2-step process to identify members of the comparison group who were likely to have used their benefits had they purchased an LTC policy. Propensity score matching is used in retrospective cohort studies to correct for selection bias related to observable differences between groups.[18,19] Step 1 of the analysis derived a model for receiving LTC benefits. Step 2 of the analysis applied the model to the comparison group to quantify the degree to which each member matched the characteristics of those who received LTC benefits. Sums of squares on critical variables were calculated and used to identify and remove comparison group members who were least similar to the

TABLE 1. CHARACTERISTICS OF TREATMENT AND FULL COMPARISON GROUPS

	Comparison (N=19,019)	Treatment (N=830)	
Age (mean)	82.25	83.23	***
Female (percent)	49%	50%	
Dialysis (percent)[a]	3%	3%	
Facility-based nursing service (percent)[a]	22%	37%	***
Major procedure performed (percent)[a]	19%	16%	*
Active cancer treatment (percent)[a]	10%	9%	
Major ADG count (mean)[a,b]	3.07	3.47	***
ADL limitation (percent)[a]	30%	44%	***
Hospital dominant morbidity types (mean)[a,b]	0.92	0.93	
Chronic condition count (mean)[a]	5.13	5.93	***
Active ingredient count (mean)[a]	13.00	15.03	***
Dementia (percent)[a,b,c]	28%	46%	***
Probability of hospitalization within 12 months (mean)[a]	0.34	0.38	***

*P < .05; ***P < .001.

[a]Generated by the ACG (Adjusted Clinical Groups) software system (complete descriptions of these markers are presented in *The Johns Hopkins ACG® System, Technical Reference Guide, Version 10.0* available for download at < http://www.acg.jhsph.edu >).

[b]A major ADG is one of 8 morbidity types associated with very high expected resource use; hospital dominant morbidity types are ADGs associated with significantly higher risk of hospitalization in the next 12 months.

[c]A member was identified with dementia if NUR11 was present in the ACG output's EDC (expanded diagnosis cluster) codes.

ADG, aggregated diagnosis groups; ADL, activities of daily living.

claimants until no significant differences on important characteristics remained.

Step 1. Among the 1961 members who purchased an LTC policy, stepwise logistic regression was used to examine over 70 variables for their ability to differentiate between those who received benefits prior to death and those who did not. These variables included age, sex, and clinical characteristics likely to be associated with need for LTC services, such as the presence of specific conditions, number of medications filled, evidence of frailty, and probability of inpatient hospital admission. Only the subset of 17 variables that reliably and uniquely enhanced prediction were included in the final model (Table 2). A good model fit was achieved with these 17 variables, χ^2 (17, N=1961)=689.67, $P < .001$, Nagelkerke $R^2 = .40$. Overall, correct classification was 76.3%; specifically, 84.2% of those who did not use their LTC benefits were correctly classified, while 65.5% of those who used their LTC benefits were correctly classified.

Step 2. Employing the ß coefficients from the 17 variables and the constant from the final regression model in Step 1, propensity scores were calculated for each claimant (those who purchased LTC coverage and received benefits; N=830) and each member of the comparison group (those who never purchased LTC coverage; N=19,019). To produce a more accurate comparison, claimants were subdivided into 10 equal-sized groups, or "deciles," based on their propensity score. Comparison group members were assigned to a decile if their propensity scores fell within the range of the claimants' scores in that decile. As expected, the propensity scores of most members of the comparison group fell within decile 1. Outliers based on extreme sums of squared deviations from decile norms were systematically removed from the comparison group until the claimants and comparison groups were equivalent on important covariates within each decile. (*T* tests were used to assess the similarity between treatment and comparison groups within each decile on the 17 covariates plus the propensity score. Three of the 180 *t* tests were statistically significant at $\alpha = .05$. This is considerably fewer significant differences than would be expected by chance.)

Ultimately, 6870 members of the comparison group were retained for analysis. To adjust for the overrepresentation of comparison group members in lower propensity score deciles (members whose characteristics were least like those who received LTC benefits), weights were applied to the comparison group so that the members within each propensity score decile contributed equally to the outcomes analysis. This resulted in an effective comparison group size of 3560. See Table 3 for a detailed description of the characteristics of both the claimant and weighted comparison groups. Although the mean age was significantly higher among the weighted comparison group members, all other characteristics in Table 3 were not statistically significant between the claimant and final weighted comparison groups.

Health care outcome measures

The claimant and comparison groups were compared on the following health care outcomes measures. Cost measures included: total medical, total pharmacy, inpatient hospital

TABLE 2. FINAL STATISTICS FOR LOGISTIC REGRESSION PREDICTING USE OF LTC BENEFITS
AMONG CALPERS MEMBERS WHO PURCHASED LTC INSURANCE (USERS = 830; NON-USERS = 1961)

	B	SE	Wald	df	Sig.	Odds Ratio
Age[a]	.058	.009	41.828	1	.000	1.059
Sex	.175	.117	2.260	1	.133	1.192
Diagnoses used[b]	−.028	.005	29.115	1	.000	.972
Medication count (13–24 mos)[b]	.016	.009	3.050	1	.081	1.016
Probability of hospitalization related to injury[b]	.048	.023	4.351	1	.037	1.049
Probability of extended hospitalization[b]	.026	.007	14.649	1	.000	1.026
Use of nursing services[b]	1.268	.154	68.204	1	.000	3.554
Major procedure performed[b]	−.401	.159	6.397	1	.011	.669
Evidence of frailty[b]	.347	.129	7.287	1	.007	1.415
Count of chronic conditions directly related to use of LTC benefits	.046	.021	4.770	1	.029	1.047
Count of chronic conditions inversely related to use of LTC benefits	−.074	.016	21.684	1	.000	.929
Dementia[b]	1.046	.135	60.509	1	.000	2.847
Depression[b]	.421	.132	10.206	1	.001	1.523
Count of emergency department visits[b]	.086	.039	4.931	1	.026	1.089
Count of outpatient visits[b,c]	−.006	.002	7.529	1	.006	.994
RUB = 5 (13 to 24 mos)[b]	.460	.149	9.479	1	.002	1.584
RUB = 1–3 (13 to 24 mos)[b]	−.200	.139	2.068	1	.150	.819
Constant	−5.274	.743	50.310	1	.000	.005

[a]All variables are based on the 0- to 12-month period prior to death unless otherwise noted. The 13- to 24-month period was selected for some predictors, because the 0- to 12-month period reflected an outcome.

[b]Generated by the ACG (Adjusted Clinical Groups) software system (complete descriptions of these markers are presented in *The Johns Hopkins ACG® System, Technical Reference Guide, Version 10.0* available for download at <http://www.acg.jhsph.edu>).

[c]Resource utilization band (RUB) is a 6-level variable (0–5) that groups individuals with similar expected resource use; higher scores indicate higher expected use.

LTC, long-term care; CalPERS, California Public Employees' Retirement System; SE, standard error.

admission, emergency department, outpatient visit, and skilled nursing facility costs. Utilization measures included: emergency department visits, inpatient hospital admission count, inpatient hospital admission bed days, outpatient visits, skilled nursing facility admission counts, and skilled nursing facility bed days. All outcome measures were based on services utilized in the 12 months before death. As expected, all outcome measures were positively skewed and highly leptokurtic. To better approximate normal distributions, "costs" and "days" measures were transformed using the natural log. The "count" measures (eg, emergency department visits) were transformed using the square root.

TABLE 3. CLAIMANTS' CHARACTERISTICS COMPARED TO WEIGHTED COMPARISON GROUP

Covariate	Claimants	Comparison (weighted)
Number of subjects	830	6870[b]
Age (years)	83.2	83.9**
Sex (percentage female)	50%	54%
Frailty burden[a]	44%	42%
Dementia	46%	45%
Depression	49%	48%
Count of conditions directly related to use (mean)	4.8	4.9
Count of conditions inversely related to use (mean)	6.2	6.1
Diagnoses used[c] (mean)	31.5	31.4
Major procedure performed	16%	17%
Nursing services received	37%	34%
Medication count (13–24 mos., mean)	11.8	11.6
Probability of injury-related hospitalization (mean)	.04	.04
Probability of extended hospitalization (mean)	.14	.14
Emergency visit count (mean)	1.9	1.9
Outpatient visit count (mean)	25.8	24.3
Probability of using services (ie, propensity score, mean)	.62	.61

[a]Frailty burden is extremely high for these groups; the frailty burden for a typical Medicare cohort is approximately 4%.

[b]Because of comparison group weighting (see above) the degrees of freedom for weighted analyses were equivalent to a sample size of 3560 for the comparison group.

[c]The ACG (Adjusted Clinical Groups) software aggregates diagnosis codes into clusters of conditions that are further aggregated to describe burden of illness and predict future resource use. "Diagnoses used" is the count of relevant diagnosis codes that were used by the software.

**Statistically significant difference from the treatment group ($P < .01$).

Hierarchical multiple regression was used to estimate the effect of group (claimant vs. comparison) on health care utilization and costs after accounting for age, sex, frailty, dementia, depression, count of conditions directly related to use of LTC, count of conditions inversely related to use of LTC, diagnoses used, nursing services received, medication count (13–24 mos.), very high expected resource utilization (13–24 mos.), low expected resource utilization (13–24 mos.), probability of injury-related hospitalization, and probability of extended hospitalization. Poisson regression was utilized for untransformed count-based variables where appropriate (ie, the mean and variance are close to 1). Additionally, the effect of LTC benefits on health care utilization and costs was examined separately for members with and without dementia.

Results

Multivariate analyses

A series of hierarchical multiple regressions and Poisson regressions weighted for propensity decile found that the use of LTC benefits in the last year of life was associated with reduced health care utilization and costs after accounting for age, sex, and other covariates related to health care utilization. In each regression, the 14 covariates identified above were entered into the model on the first step, and group status (claimant or comparison) was entered on the second step.

In 7 out of 12 analyses, group status was statistically significant at the second step ($P < .05$). During the 12 months prior to death, claimants had lower costs with respect to total medical care (-14%), total pharmacy care (-13%), inpatient hospital admissions (-35%), and outpatient services (-16%). Claimants also had fewer inpatient hospital admissions, emergency department visits, and inpatient hospital bed days. Claimants had marginally significantly higher skilled nursing facility bed days ($P = .053$), but associated costs were not significantly higher for this group (Table 4).

Subgroup analysis

The presence of dementia complicates medical treatment, and the severity of the disease at later stages often requires a full-time caregiver. Therefore, the impact of LTC services on utilization and costs was examined separately for those with and without dementia. In all, 46% of claimants and 45% of weighted comparison group members had dementia. After segmenting the sample into those with and without dementia, hierarchical multiple regression and Poisson regression were used to assess the effect of LTC benefits on utilization and costs measures. The set of covariates identified above (excluding dementia) was entered into the model on the first step, and group status (claimant or comparison) was entered on the second step. Group status was significant at the second step in 7 out of 12 utilization and cost measures among the non-dementia group, and for 1 out of 12 measures among the dementia group.

For claimants without dementia, use of LTC benefits was associated with significantly lower costs, including 16% lower total medical costs, 18% lower total pharmacy costs, 38% lower inpatient hospital costs and 18% lower outpatient care costs, as well as 26% fewer emergency department visits (Table 5). However, claimants without dementia experienced 6% more skilled nursing facility admissions and used more bed days than those without LTC benefits, likely a reflection of the fact that their LTC benefits provided access by paying for nursing home care when care needs required extensive levels of care. For those with dementia, having LTC benefits was associated with 5% fewer inpatient hospital admission bed days (Table 5). These results suggest that having dementia limits potential savings in health care costs and utilization, which are otherwise associated with those who have LTC insurance, all else being equal.

Discussion

Little is known about the impact of personal care services on health care utilization and expenditures at end of life. In this study, CalPERS members who received personal care

TABLE 4. FINAL REGRESSION RESULTS FOR GROUP STATUS ON UTILIZATION AND COSTS OUTCOMES AFTER ADJUSTING FOR 14 COVARIATES (CLAIMANTS = 830; COMPARISON GROUP = 6870/3560 WEIGHTED)

Outcome (Transformation)	B*	SE	t	Wald χ^2	Sig.	% Diff**
Total medical costs (log)	−.15	.05	−2.76		.006	−13.94%
Total pharmacy costs (log)	−.14	.06	−2.46		.014	−13.18%
Inpatient admission count ***	−.08	.04		4.33	.037	−8.03%
Inpatient admission bed days (log)	−.11	.04	−3.10		.002	−10.13%
Inpatient admission costs (log)	−.43	.12	−3.60		.000	−34.67%
Emergency dept visit count ***	.10	.03		9.08	.003	−10.45%
Emergency dept costs (log)	.01	.09	0.09		.928	
Outpatient visit count (sq rt)	−.04	.06	−0.63		.526	
Outpatient visit costs (log)	−.18	.06	−2.84		.005	−16.32%
Skilled nursing facility admission count (sq rt)	.03	.02	1.56		.120	
Skilled nursing facility bed days (log)	.10	.05	1.94		.053	
Skilled nursing facility costs (log)	.15	.11	1.29		.196	

*A negative coefficient means the treatment group utilized fewer services or had lower costs.
**Calculated as the percent difference between the treatment and comparison groups on the untransformed outcome, while holding all other variables constant at their mean.
***Poisson regression was used (on untransformed variables).
SE, standard error.

TABLE 5. FINAL REGRESSION RESULTS FOR GROUP STATUS ON UTILIZATION AND COSTS OUTCOMES
AFTER ADJUSTING FOR 16 COVARIATES—NON-DEMENTIA AND DEMENTIA SUBGROUPS

Non-Dementia (Claimants = 449; Comparison Group = 4689/1955 Weighted)

Outcome (Transformation)	B*	SE	t	Wald χ^2	Sig.	% Diff**
Total medical costs (log)	−.18	.08	−2.14		.032	−16.35%
Total pharmacy costs (log)	−.21	.08	−2.59		.010	−18.30%
Inpatient admission count** *	−.09	.06		2.48	.115	
Inpatient admission bed days (log)	−.09	.05	−1.89		.058	
Inpatient admission costs (log)	−.48	.16	−2.92		.004	−37.78%
Emergency department visit count***	−.30	.05		31.28	.000	−25.89%
Emergency department costs (log)	−.04	.12	−0.30		.768	
Outpatient visit count (sq rt)	−.02	.08	−0.23		.818	
Outpatient visit costs (log)	−.20	.09	−2.23		.026	−18.16%
Skilled nursing facility admission count (sq rt)	.06	.03	2.21		.027	5.90%
Skilled nursing facility bed days (log)	.14	.07	2.09		.037	13.06%
Skilled nursing facility costs (log)	.23	.14	1.61		.108	

Dementia (Claimants = 381; Comparison Group = 2181/1605 Weighted)

Outcome	B*	SE	t	Wald χ^2	Sig.	% Diff**
Total medical costs (log)	−.06	.07	−0.84		.400	
Total pharmacy costs (log)	−.04	.08	−0.42		.672	
Inpatient admission count***	−.08	.05		2.30	.129	
Inpatient admission bed days (log)	−.11	.05	−2.28		.024	−5.14%
Inpatient admission costs (log)	−.28	.17	−1.62		.105	
Emergency department visit count***	−.05	.04		1.47	.225	
Emergency department costs (log)	.13	.13	1.00		.318	
Outpatient visit count (sq rt)	−.03	.07	−0.40		.689	
Outpatient visit costs (log)	−.09	.09	−1.04		.297	
Skilled nursing facility admission count (sq rt)	.00	.04	0.03		.974	
Skilled nursing facility bed days (log)	.05	.09	0.62		.537	
Skilled nursing facility costs (log)	.04	.18	0.21		.838	

*A negative coefficient means the treatment group utilized fewer services or had lower costs.

**Calculated as the percent difference between the treatment and comparison groups on the untransformed outcome, while holding all other variables constant at their mean.

***Poisson regression was used (on untransformed variables).

SE, standard error.

services and care management through CalPERS' LTC insurance program were matched by age, sex, and a number of comorbidities and disease severity markers with CalPERS members who did not purchase and thus did not have access to CalPERS' LTC benefits.

CalPERS members who purchased LTC coverage and subsequently used their benefits consumed fewer health care services and incurred substantially lower direct health care costs during the last 12 months of their lives than a comparable group of individuals who did not have LTC benefits and were unable to rely on insurance-paid benefits for personal care and supervision. Specifically, use of LTC benefits, services, and care management was associated with lower total medical costs, total pharmacy costs, outpatient costs, and inpatient care costs as well as reduced utilization as measured by hospital admissions, inpatient days of care, and emergency department visits. The difference in costs was substantial. Total medical costs in the last year of life were 14% lower and pharmacy costs were 13% lower for those who used LTC benefits. A subgroup analysis that excluded individuals with dementia showed an even stronger difference in end-of-life health care utilization and costs for non-demented individuals who used LTC benefits. For those without dementia, total medical costs were 16% lower and total pharmacy costs were 18% lower in the last year of life.

Eligible claimants required hands-on assistance with 2 or more ADLs or continual supervision because of cognitive impairment and were reimbursed for LTC expenses up to $150 per day, depending on the coverage amount purchased. In the CalPERS LTC Plan, covered services included care management, hands-on ADL care, supervision for a cognitive impairment, and IADL care and services in conjunction with the ADL care and supervision. This care could have been provided at home, in the community, in an assisted living facility, dementia unit, or nursing home.

There are several reasons why having insurance-paid LTC services may have had a favorable impact on end-of-life health care utilization and costs. From a clinical standpoint, providing regular hands-on personal assistance with ADLs as well as assistance with meals, medications, and transportation to and from primary care visits for functionally disabled individuals should result in better care coordination, improved health status, and also guard against avoidable declines in health status. Specifically, care management and hands-on assistance with personal care and

IADLs likely improved medication compliance, nutrition, socialization, and fall prevention and thus helped individuals avoid hospital admissions and readmissions—all of which would lead to lower health care utilization and cost. Supervision from a care manager and in-home care provider for those with cognitive deficits also could explain the dementia subgroup's lower use of hospital days because of better compliance with medical regimens and reduced wandering and other unsafe behavior.

Another reason LTC benefits and services may have reduced end-of-life health care utilization and costs is the focus of hands-on care. Personal care (nonclinical care) is supportive not curative. Individuals with insurance-paid LTC benefits had a care manager in place whose goal was to coordinate services that enable disabled claimants to live as independently as possible. Without coordinated support from a care manager, families with needs must rely on traditional medical care services where the mind-set is to cure, sometimes without regard to expense. Finally, CalPERS LTC benefits included a hospice care benefit that likely led those with LTC coverage to access hospice services and supportive personal care services sooner, thus preventing expensive medical interventions or facility-based care at the end of life.

Claimants with dementia demonstrated few measurable differences in utilization or costs compared to the comparison group members who also have dementia, perhaps because late-stage dementia requires extensive, around-the-clock supervision and intensive ADL care often available only in nursing homes. Therefore, it is likely that both claimants and comparison group members with dementia received nursing home care during the last year of life. Additionally, in the CalPERS LTC program care managers end their involvement with claimants and families when claimants successfully transfer to facility-based LTC. Given that access to health care for both claimants and comparison group members with dementia was likely managed entirely by nursing homes, it is not surprising that utilization and costs were similar between these groups.

Study limitations

This study has a number of limitations that should be acknowledged. First, medical care utilization and costs were derived from claims data and therefore out-of-pocket costs for care incurred by patients and their families were not considered. Thus, the true total cost of care is unknown. However, health care benefit plans were similar for both the treatment and comparison groups in this study, so one can assume the relative differences in measures of costs and utilization to be the same across all members of our study.

Second, health care claims data do not fully describe functional and cognitive status. However, substantial information on the levels of disability and cognitive impairment were inferred based on the ACG system output, and the groups were equated on these characteristics through propensity score matching.

Third, although the study demonstrated an impact of health care utilization and costs associated with having and using LTC benefits and care management, this study did not conclusively identify the specific mechanisms by which receipt of personal care services lower health care use and costs at end of life.

Fourth, in the absence of random assignment to conditions (having LTC insurance vs. not having LTC insurance), the study team cannot be certain that the claimants and comparison group were equivalent on variables not captured in the analysis.[19] Propensity score matching is one of the best methods for approximating a comparison group, but people who buy and maintain LTC coverage are likely to differ from those who do not buy coverage in ways undetectable through the available data sources (eg, most notably household income, assets, employment status, marital status, education), and that could influence end-of-life care needs and costs.[20]

Another ''unknown'' is whether members of the comparison group may have purchased LTC insurance through a private insurance company and not through CalPERS, or obtained personal care using their own resources or through Medicaid funding. It is highly unlikely that study members purchased LTC coverage on their own given the very low market penetration of private LTC insurance in general (less than 7% of adults across all ages),[21] and as State pensioners most likely would not meet Medicaid's eligibility criteria. However, to the extent that individuals and families without access to CalPERS-paid LTC benefits received such personal care makes these results conservative; specifically, if some members of the comparison group received personal care, but the group with CalPERS LTC insurance had lower health care utilization and costs in the last year of life, then the impact of having access to LTC services and care management (regardless of payer) is even greater than measured here.

Despite these limitations, this study provides evidence and plausible explanations for a positive impact of personal care, supervision, and care planning available through LTC insurance on health care costs and utilization in the last year of life.

Conclusion

As the US population ages, longevity increases, and the prevalence of disabling and dementing diseases rises, it is imperative to develop treatment strategies to lower health care costs. Hospice, advance directives, and palliative care improve both cost of care and the quality of life at the end of life, but have yet to substantially drive down end-of-life costs of care. This research shows that the availability of paid LTC services and care management at the end of life was linked to favorable outcomes on a number of key components of health care utilization and cost of care, as compared to the experience of comparable individuals without LTC services provided by LTC coverage. Furthermore, these findings inform important policy decisions surrounding the care and management of dual eligible populations under the Accountable Care Act and the emerging debate over the financing of LTC services in the United States. One of the important tenets of the Affordable Care Act is the manner in which Medicare and Medicaid financing of care for dual eligible individuals is combined, providing a source of funding for both acute and LTC services and potentially expanding the population of dually eligible individuals through Medicaid eligibility expansion in many states. This study attempts to establish that the

provision of paid LTC services and active care management has a positive impact on the cost of acute care at the end of life. Given the significant ''end-of-life'' care costs for any population, but in particular for those who are dually eligible, this study has important implications for ways in which the provision of LTC services would likely have an impact on acute care utilization and costs at the end of life.

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