Original Article

Paying for Palliative Care in Medicare: Evidence From the Four Seasons/Duke CMMI Demonstration

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Abstract

Context. Palliative care improves patient and family outcomes and may reduce the cost of care, but this service is underutilized among Medicare beneficiaries.

Objectives. To describe enrollment patterns and outcomes associated with the Center for Medicare and Medicaid Innovation expansion of a multisetting community palliative care program in North and South Carolina.

Methods. This observational study characterizes the Center for Medicare and Medicaid Innovation cohort's care and cost trajectories after enrollment. Program participants were age-eligible Medicare fee-for-service beneficiaries living in Western North Carolina and South Carolina who enrolled in a palliative care program from September 1, 2014, to August 31, 2017. End-of-life costs were compared between enrolled and nonenrolled decedents. Program administrative data and 100% Medicare claims data were used.

Results. A total of 5243 Medicare beneficiaries enrolled in the program from community (19%), facility (21%), small hospital (27%), or large hospital (33%) settings. Changes in Medicare expenditures in the 30 days after enrollment varied by setting. Adjusted odds of hospice use were 60% higher (OR = 1.60; CI = 1.47, 1.75) for enrolled decedents relative to nonenrolled decedents. Participants discharged to hospice vs. participants not had 17% (OR = 0.83 CI = 0.72, 0.94) lower costs. Among enrolled decedents those enrolled for at least 30 days vs. <30 days had 42% (OR = 0.58, CI = 0.49, 0.69) lower costs in the last 30 days of life.

Conclusions. Expansion of community palliative care programs into multiple enrollment settings is feasible. It may improve hospice utilization among enrollees. Heterogeneous program participation by program setting pose challenges to a standardizing reimbursement policy.   *J Pain Symptom Manage 2019;58:654−661. © 2019 American Academy of Hospice and Palliative Medicine. Published by Elsevier Inc. All rights reserved.*

Key Words
Palliative care, hospice, demonstration project, CMMI, pilot project, advanced care planning, community-based services

Key Message

Question: How does the expansion of a community palliative care program impact end-of-life outcomes?

Findings: Enrolled decedents had greater rates of hospice use than nonenrolled decedents. Among enrollees, those discharged to hospice vs. not and those with at least 30 days vs. <30 days enrolled had lower end-of-life expenditures.

Meaning: The expansion of community palliative care programs into multiple sites and settings is feasible and associated with increased hospice utilization; however, meaningful differences in length of stay and cost by location of model entry and exit pose challenges to standardizing reimbursement policies across care settings.

Introduction

The Affordable Care Act established the Center for Medicare and Medicaid Innovation (CMMI) and funded the demonstration and evaluation of

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innovative payment and care delivery models. The intention was to scale interventions throughout the Center for Medicare and Medicaid Services (CMS) programs if they reduce costs to CMS while at least holding quality of care for patients constant. Palliative care interventions hold great potential for achieving the CMS actuary threshold because of the growing evidence that palliative care not only improves quality of care and patient satisfaction but may also decrease utilization of high-cost care and associated costs.[1–4] By providing high-touch care that is not currently reimbursable by the Medicare program, such programs intend to yield cost savings and improved patient outcomes and satisfaction downstream by reducing high-cost care encounters such as emergency department visits and hospital admissions.

In 2014, Four Seasons Compassion for Life received an award to demonstrate its community-based palliative care program in western counties of North and South Carolina, through CMMI's second round of Health Care Innovation Awards program.[5] The Health Care Innovation Awards program funds organizations to test payment and delivery models for high-need patients, including multiple models that focus on the care and treatment of patients with advanced, life-limiting illness.[6] Four Seasons' community-based palliative care model is delivered by an interdisciplinary team of physicians, nurse practitioners, physician assistants, social workers, and chaplains.[7] This team delivers care focused on symptom management and assisting patients, caregivers, and families to plan for and make health care decisions. The care team served patients in both inpatient and outpatient settings, (specifically hospital, facility, home, and clinic settings) while also following up patients through care transitions between these settings.[8]

This study describes the patients who were enrolled in the Four Seasons demonstration cohort and provides preliminary estimates for the model's impact on end-of-life (EOL) care utilization and Medicare-financed costs. These results illuminate both the challenge that the model poses to the application of nonexperimental inference methods and the challenges to defining eligibility and constructing a payment model for a palliative care benefit in the Medicare program.

Methods

In this retrospective study, we characterize the CMMI enrollment profile, care, and cost trajectories after enrollment and evaluate EOL costs for the cohort relative to a comparison group of decedents in North and South Carolina. As previously described, the intervention involves 1) a lead palliative care provider organization (Four Seasons); 2) motivated partner organizations that span settings, in which local patients receive care (hospitals, facilities, and clinics); 3) workforce development, focused on nonphysician providers; 4) clinician education conducted through the palliative care immersion course and continued mentoring; 5) interdisciplinary teamwork through interprofessional practice collaboration; and 6) quality assessment/quality improvement.[7,8]

Data Sources

Patients' dates and locations of enrollment and discharge were collected by Four Seasons. We used Medicare claims to measure health services utilization and expenditures for 100% of fee-for-service beneficiaries in North and South Carolina for years, 2013 to 2017, which included claims data for linked members of the demonstration cohort and Medicare beneficiaries from surrounding counties that were used to construct our comparison group. Quality Data Collection Tool for Palliative Care was used to collect enrollee information including the Palliative Performance Scale (PPS) score.[9]

Treatment Group

The palliative care treatment cohort includes Medicare beneficiaries enrolled in the palliative care demonstration project. The intervention cohort is a referred sample of age-eligible Medicare beneficiaries who 1) were not enrolled in Medicare Advantage plans at the time of entry into the demonstration project and 2) had a life-limiting illness with an expected prognosis of less than three years. We included patients with acceptable matches by social security number plus either 1) exact date of birth match, or 2) sex match plus any two date of birth components (month/day/year) match, or 3) date of birth ± three days, or 4) date of birth with month and day flipped. To ensure complete comorbidity and cost data, only beneficiaries with continuous fee-for-service coverage for the 6 months before death are included in the multivariable analyses.

Four participating providers enrolled patients into the model in the following timeframes: 1) Four Seasons (start date September 2014), 2) Hospice of Catawba Valley (Catawba) in North Carolina (start date March 2015), 3) a large hospital in the Greenville Health System (Greenville) in South Carolina (start date March 2016), and 4) a large hospital in the Mission Health System (Mission) in Western North Carolina (start date June 2016). Although Four Seasons was an established program extending into additional counties, the other three enrollment sites were new. Enrollment in the demonstration project across all four project partners concluded on August 31, 2017.

Patients were enrolled into the palliative care intervention through referrals, predominantly from small hospitals, long-term care facilities, and physicians. The community-based palliative care model was designed to be site agnostic because patients could enter the model through a physician referral in all settings—hospital, skilled nursing facility (SNF), assisted living facility (ALF), clinic visit, or through a home visit. Patients could then exit the model through death, by enrolling in hospice, by discharging alive, or could still be enrolled at the censor date for this study. If a participant was still enrolled in the CMMI program at the end of data collection, the length of stay is censored at August 31, 2017, whereas time alive after enrollment was censored at the earliest of death date or December 31, 2017. If a patient has multiple enrollment spans, the earliest enrollment date and the last discharge date are used to calculate length of stay.

Comparison Group

The comparison cohort includes Medicare age-eligible decedents with continuous fee-for-service enrollment in the last 6 months of life living within the demonstration counties and contiguous counties unless they were ever enrolled in the demonstration project. Beneficiaries with one or more days in Medicare advantage in the 180 days before death were excluded.

Key Measures

Outcomes: The hospice death service ratio (DSR) was defined as the percentage of enrolled decedents who died in hospice. To characterize participation in the model for patients in the intervention cohort, we examined the number of days that patients were enrolled in the palliative care model by entry and exit type, the number of patient days alive after enrollment in the model, and Medicare costs per day during 30 days before and after enrollment in the model. Costs for the initial inpatient stay were allocated to the pre-period for CMMI participants referred during the inpatient stay due to the inability of the intervention to modify inpatient reimbursement in the prospective payment system where each diagnosis-related group has a payment assigned to it, regardless of the actual resources utilized; thus, the description by mode of exit is important for understanding the heterogeneity in the enrollees cost trajectories to inform implementation of community-based palliative care in other settings. Finally, we compared hospice use in the last 180 days of life and Medicare expenditures over 180, 90, and 30 days before death among enrolled decedents to decedents in the comparison group. Costs were inflated to 2017 dollars using the Consumer Price Index, and comorbidities were defined using the Healthcare Cost and Utilization Project chronic condition indicators.

Statistical Analysis

We used a two-tailed paired sample *t*-test to compare costs per day in the 30 days before and after palliative care enrollment. Differential survival by sex was assessed using Kaplan-Meier estimation. Hospice use in the last 180 days of life was evaluated using a logistic regression model with a binary indicator for CMMI enrollment. EOL costs were evaluated using a generalized linear model predicting Medicare charges (log) over 180, 90, and 30 days before death. Beneficiaries with one or more days in Medicare Advantage in the 180 days before death were excluded from the multivariable analysis, including 215 enrollees were fee-for-service at baseline but later switched to Medicare Advantage. Estimates are adjusted for patient demographics, comorbidities, and fixed effects for county and year. A categorical indicator for enrollment care setting was included in the model to control for the differential selection bias across enrollment settings. To evaluate EOL cost differences among enrollees by care trajectory within the program, we used binary indicators for enrollment of 30 days or greater and discharge to hospice from the program.

Although medication costs are an important component of EOL costs, Part D data were only available through 2016 and limited to the subgroup of Medicare decedents with continuous Part D coverage in the last 180 days of life. As a sensitivity analysis, we conducted the same analysis as the primary paper on the subgroup with complete Part D data to determine whether the inclusion of Part D costs would change our results. Because the results were consistent in the subgroup analysis, we presented the costs for Parts A and B in the full sample for improved generalizability relative to the subgroup selecting Part D coverage.

Results

Intervention Group

As of August 31, 2017, the CMMI community palliative care demonstration program enrolled 5225 Medicare beneficiaries across 14 counties in North and South Carolina (see Table 1). The most common primary clinical diagnoses for referrals into palliative care were dementia, cancer, chronic obstructive pulmonary disease, congestive heart failure, and other conditions. A greater proportion of enrollees were women (68.4%). At the initial palliative care visit, women had a similar average PPS score to men (0.440 and 0.441, respectively). Female participants were enrolled for a median of 26 days, vs. 17 days for men, with

Table 1
Characteristics of CMMI Enrollees and Decedents Compared With Non-CMMI Decedents in Comparison Counties (2014−2017)

Characteristic	CMMI Total N(%) or Mean (SD)	CMMI Decedents N(%) or Mean (SD)	Non-CMMI Decedents N(%) or Mean (SD)
Patients, n	5225	3635	48,487
Age	81.4 (8.8)	82.6 (8.8)	82.3 (8.9)
Male, %	2172 (41.5)	1616 (44.4)	21,957 (45.3)
White, %	4804 (91.9)	3366 (92.6)	44,354 (91.5)
Palliative Performance Scale score	0.43 (0.17)	0.41 (0.17)	n/a
Number of comorbidities	n/a	7.47 (2.2)	5.90 (2.5)
Comorbidities at end-of-life, %			
6+ Comorbidities	n/a	2974 (81.8)	27,687 (57.1)
Cancer	n/a	1201 (37.1)	13,696 (28.2)
Dementia/Alzheimer's	n/a	2951 (81.2)	30,608 (63.1)
Cardiology	n/a	3487 (95.9)	44,358 (91.5)
Respiratory	n/a	2140 (58.9)	24,518 (50.6)
Gastrointestinal diseases	n/a	1998 (55.0)	17,699 (36.5)
Hospice in last 180 days, %	n/a	2468 (67.9)	27,597 (56.9)
CMMI enrollment characteristics			
Days enrolled, median (IQR)	17 (5−135)	11 (4−66)	n/a
Days enrolled	105 (177.32)	71 (136.48)	n/a
Days alive after enrollment, median (IQR)	138 (20−352)	46 (10−173)	n/a
Days alive after enrollment	230 (263.42)	127.81 (185.29)	n/a
CMMI enrollment setting, %			
Home/clinic	991 (19)	553 (15)	n/a
Facility	1102 (21)	729 (20)	n/a
Small hospital	1393 (27)	993 (27)	n/a
Large hospital	1739 (33)	1360 (37)	n/a
CMMI discharge status, %			
Death	733 (14)	724 (20)	n/a
Hospice	1902 (36)	1782 (49)	n/a
Other discharge	1903 (36)	1014 (28)	n/a
Enrolled at end of period	687 (13)	115 (3)	n/a

CMMI= Center for Medicare and Medicaid Innovation Palliative Care Demonstration; IQR, interquartile range.

annual mortality rate of 60.6%, vs. 69.1% for men (Fig. 1).

Enrollment Characteristics

Beneficiaries were enrolled from four care settings: community, which included referrals from home or outpatient clinic (19%); facility, which included ALF and SNF (21%); small hospitals with less than 250 beds (27%); or large hospitals with 250 beds or more (33%). Length of participation in the model was highly skewed with a median of 17 days and a mean of 105 days. On average, participants survived 230 days after enrollment. Days in the model vary substantially by model enrollment and discharge setting (Fig. 2). Patients who enrolled from a large hospital ($N = 1739$) had a stay of 15.9 days. Patients who enrolled from a small hospital ($N = 1393$) had a mean 80.3 days enrolled. Patients who entered palliative care while living in a facility (SNF or ALF, $N = 1102$) had mean stays of several months, on average, with 193.1 mean days enrolled. Those who were enrolled from home or outpatient clinic ($N = 991$) had mean 199.4 days enrolled. One-third of participants were discharged to hospice (36%),

one-third were discharged alive but not to hospice (36%), and 14% died during enrollment. The remaining 13% were still enrolled in the program at the end of the study period.

Decedents in Intervention and Comparison Groups

Decedents in the CMMI group had an average 7.5 comorbidities (SD = 2.2) compared with 5.9 (SD = 2.46) comorbidities for non-CMMI decedents in adjacent and comparison counties (list in Appendix) ($N = 48,487$)). Compared with non-CMMI decedents, CMMI decedents had greater rates of cancer (33% vs. 28.2), Alzheimer's and related dementias (81.2% vs. 63.1%), cardiovascular (95.9 vs. 91.5), respiratory (58.9 vs. 50.6), and gastrointestinal (55.0% vs. 36.5%) diagnoses. The hospice DSR was higher among CMMI decedents (67.9%) than non-CMMI decedents (56.9%).

Pre-Enrollment and Post-Enrollment Costs

Medicare-financed Parts A and B spending per member per day in the 30 days before and after palliative care model entry are compared in Table 2. The absolute magnitude of the difference varied by the
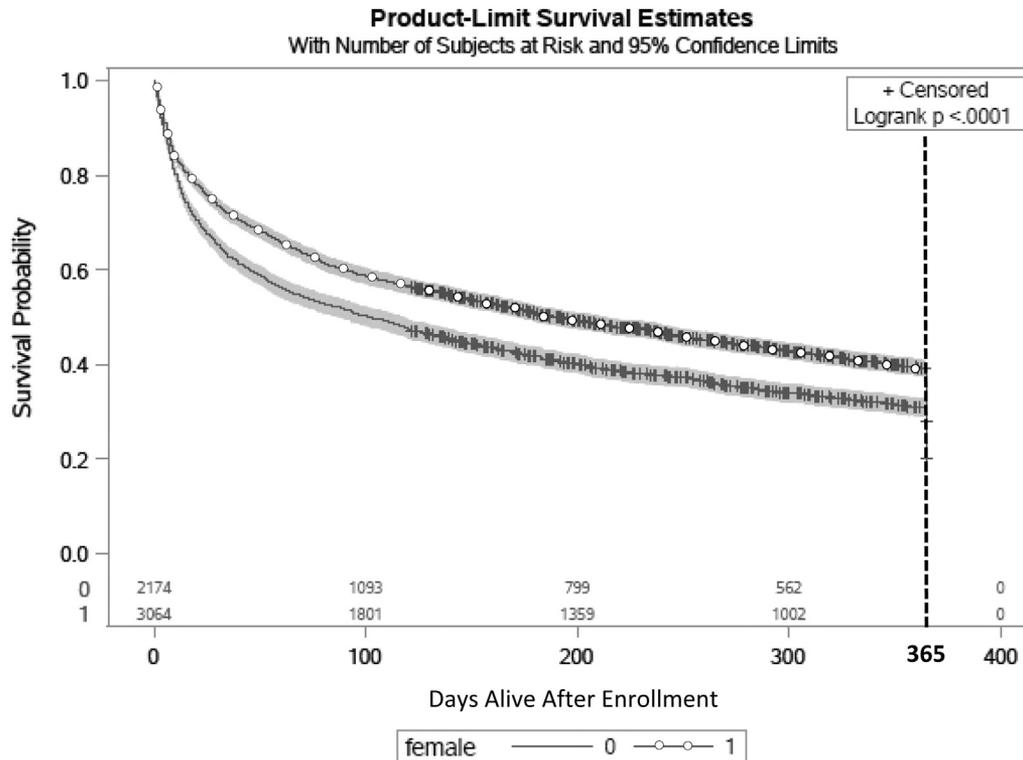
Fig. 1. Kaplan-Meier survival curves by gender in the year after CMMI enrollment. CMMI = Center for Medicare and Medicaid Innovation.

mode of entry into palliative care. Total per member per day spending was significantly lower in the 30 days after palliative care entry for patients enrolled from a facility or a large hospital; however, the
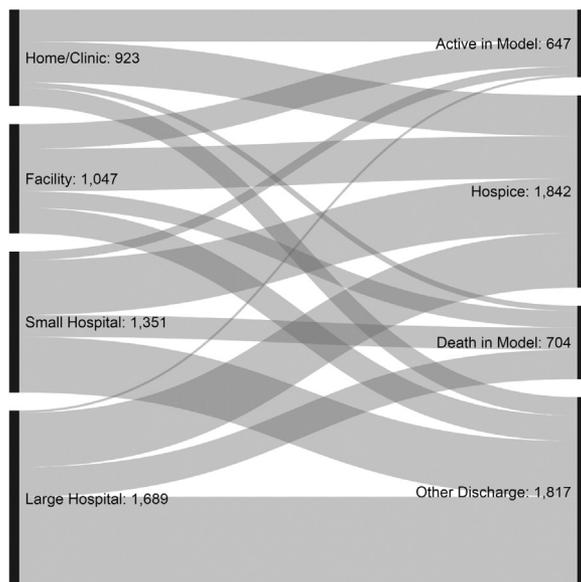

Fig. 2. Number of CMMI participants by enrollment setting and discharge status at the end of the study period. Note: 215 CMMI participants excluded because of Medicare Advantage use. CMMI = Center for Medicare and Medicaid Innovation.

post-enrollment costs were significantly higher for patients enrolled from a small hospital. Patients enrolled from the community had no significant difference between pre- and post-enrollment costs. For patients enrolled from either large hospitals or facility, post-enrollment costs were significantly lower than pre-enrollment costs for patients who discharged to hospice; however, costs were significantly higher than pre-enrollment costs for patients enrolled from a small hospital and discharged to hospice.

End-of-Life Outcomes

Relative to decedents in the comparison group, adjusted odds of hospice enrollment were 60% greater (OR = 1.60; CI = 1.47, 1.75) for CMMI participants (Appendix Table 1), with a DSR of 67.9% for enrollees vs. 56.9% for nonenrollees with a mean stay of 33.6 and 45.6 days among users, respectively. CMMI enrollees had extreme health care needs, resulting in significantly higher Medicare expenditures in the last 30, 90, and 180 days of life relative to decedents in the comparison group even after adjusting for available covariates (Fig. 3). The magnitude of the difference is specific to the enrollment care setting, with increases of 59% (OR = 1.59, CI = 1.28, 1.98), 95% (OR = 1.95, CI = 1.66, 2.30), and 83% (OR = 1.83, CI = 1.61, 2.07) in the last 30 days for enrollees from the community setting, small hospitals, and large

Table 2
Medicare Expenditures Per Day in the 30 Days Before and After Enrollment in the CMMI Palliative Care Model

Enrollment Setting	Location of Model Exit				
	Dead	Hospice	Alive	Still in Model	Total
Small hospital					
Patients, *n*	210	524	533	84	1351
Cost pre ($)					
Mean (SD)	473.28 (310.96)	463.35 (341.41)	415.48 (329.14)	362.26 (436.18)	441.68 (340.02)
Median	360.55	355.53	322.40	287.15	337.84
Cost post ($)					
Mean (SD)	462.71 (549.23)	520.21 (309.61)[a]	453.58 (457.95)[b]	419.51 (286.86)	478.74 (415.56)[a]
Median	330.36	489.62	395.49	420.70	423.745
Large hospital					
Patients, *n*	283	521	864	21	1689
Cost pre ($)					
Mean (SD)	816.89 (654.90)	586.61 (444.09)	737.10 (974.00)	696.51 (418.18)	703.54 (791.49)
Median	655.18	442.29	526.46	563.58	508.59
Cost post ($)					
Mean (SD)	329.15 (323.77)[a]	417.24 (266.51)[a]	527.71 (486.04)[a]	795.21 (1744.92)	463.69 (451.01)[a]
Median	250.26	354.08	454.14	337.49	378.45
Facility					
Patients, *n*	160	406	244	237	1047
Cost pre ($)					
Mean (SD)	349.46 (317.16)	315.23 (338.93)	435.12 (391.64)	213.88 (294.43)	325.46 (347.44)
Median	299.26	191.12	389.59	74.27	210.88
Cost post ($)					
Mean (SD)	300.09 (515.97)	223.95 (268.31)[a]	249.63 (252.05)[a]	116.76 (166.03)[a]	217.31 (304.83)[a]
Median	129.12	149.28	186.81	48.77	119.86
Home/clinic					
Patients, *n*	51	391	176	305	923
Pre-CMMI ($)					
Mean (SD)	172.76 (251.56)	165.27 (415.22)	166.33 (292.07)	138.22 (270.43)	156.95 (341.82)
Median	36.92	58.08	50.63	38.71	49.36
Post-CMMI ($)					
Mean (SD)	272.88 (503.87)	169.16 (231.81)	151.36 (252.14)	108.35 (196.73)[b]	151.40 (250.78)
Median	83.21	81.10	39.56	21.97	49.05

CMMI = Center for Medicare and Medicaid Innovation; SD = standard deviation.
215 CMMI participants excluded because of Medicare Advantage use.
[a]*P*-value < 0.01.
[b]*P*-value < 0.05.

hospitals settings respectively; however, there was no significant difference for those enrolled from a facility (Appendix Table 2). Compared with participants with less than 30 days enrolled, beneficiaries with 30 or more days enrolled had 42% (OR = 0.58, CI = 0.49, 0.69) and 21% (OR = 0.79, CI = 0.70, 0.90) lower Medicare costs in the last 30 and 90 days of life, respectively. Among CMMI participants, discharge to hospice vs. not is associated with significant reductions in costs of 17% (OR = 0.83 CI = 0.72, 0.94), 28% (OR = 0.72, CI = 0.65, 0.79), and 32% (OR = 0.68, CI = 0.63, 0.75) in the last 30, 90, and 180 days of life, respectively.

Discussion

The CMMI program was created by the Affordable Care Act with the goal of scaling and evaluating novel care models intended to improve quality of life while holding cost to Medicare constant. This study found the palliative care demonstration project was successful in identifying the sickest of the sick, with two-thirds of the cohort dying within one year. Previous

evaluations of the CMMI Four Seasons Demonstration reported enrollees had a mean hierarchical condition category score of 3.46, indicating a very sick cohort even relative to other programs targeting high-risk patients.[10] CMMI decedents had greater EOL costs and number of comorbidities relative to nonenrolled decedents, indicating the extreme health care needs of the cohort. Enrolled decedents had greater rates of hospice use than nonenrolled decedents, with a DSR of 67.9% compared with 48% for all Medicare decedents nationally and 56.9% for the comparison cohort. Among CMMI participants, those discharged to hospice vs. not and those enrolled at least 30 days vs. <30 days enrolled had lower EOL expenditures.

Meaningful differences in length of stay and cost by location of model entry and exit informs development of policies to encourage palliative care referral and use in Medicare beneficiaries. This demonstration project was designed to be care setting-agnostic, in contrast to most existing community palliative care models, where patients typically enroll from the home or outpatient clinic setting. In the expansion of enrollment to other care settings, we found that patients enrolled from the
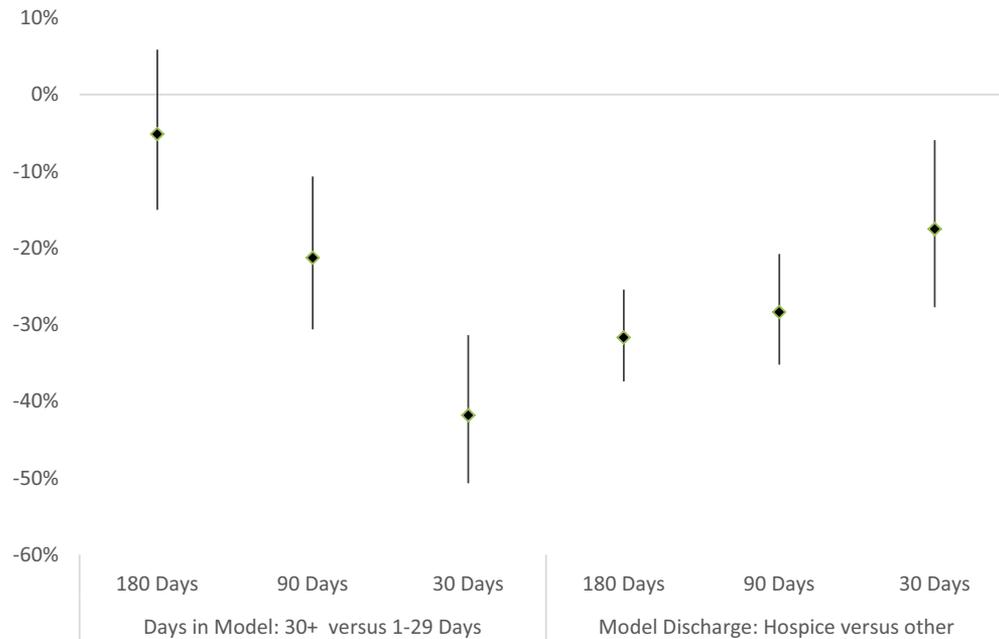
Fig. 3. Percent change in Medicare expenditures in the last 180, 90, and 30 days of life associated with characteristics of CMMI model episode characteristics among enrolled decedents. Note: Exponentiated coefficients from a single generalized linear model predicting Medicare charges (log) over 180, 90, and 30 days before death for Medicare fee-for-service decedents in Four Seasons service area and comparison counties. Estimates are adjusted for patient demographics, comorbidities, and fixed effects for county and year. CMMI = Center for Medicare and Medicaid Innovation.

outpatient setting have much lower costs (pre- and post-enrollment) than beneficiaries enrolled from higher acuity care settings. This poses challenge to determining which patients should be eligible for a palliative care benefit, which providers should be eligible to provide it, and how to set the payment rate. Tighter eligibility criteria and safeguards like re-certification may be utilized to increase the potential for cost reduction. In addition, the differences in resource use by enrollment site suggest that a pallia-tive care payment model developed by Medicare may benefit from a setting-specific payment model such as used in the hospice per diem.

Despite widely cited studies supporting the cost-saving potential of palliative care literature, the inability to consistently detect cost savings in the post-period in this demonstration may be explained by both Medicare payment mechanisms and the inability to identify a credible comparison group.[11,12] Hospital internal cost information has demonstrated that some aggressive therapies and associated costs can be avoided via palliative care; however, for hospital care, Medicare often pays a prospective amount based on diagnosis. As a result, any savings in cost reduction accrue to the institution, not to Medicare. As alterna-tive payment models proliferate, the studies intending to detect cost savings of palliative care will be less fruit-ful because reimbursement is increasingly discon-nected from resource use in value-based payment models. As CMS considers the expansion palliative

care approaches to dealing with serious illness, the di-minishing value of additional evidence should be considered.

In addition, the selection bias for palliative care pro-grams is difficult to overcome in a nonrandomized design. Palliative care eligibility relies on indicators of functional status and frailty, as measured in the PPS, but these measures are not routinely collected in Medicare claims.[13–15] Decedent control groups may be matched on time of death but also biased by the inclusion of sudden deaths and high-functioning patients who do not need intensive care and sup-ports.[16] Our project has been working on sophisti-cated matching methods that might identify a more relevant control group in the context of increasing needs and costs near the EOL; however, currently, the inability to define an appropriate counterfactual group using claims data prevents us from drawing any causal inference from these descriptive analyses.

To better match on geographic and provider differ-ences, the comparison group included decedents in counties participating in the CMMI project. However, we were unable to validate whether beneficiaries in the comparison group received palliative care. In Medi-care claims, the ICD-10 Z55.1 and ICD-9 V66.7 palliative care codes are not a sensitive marker for palliative care. Community-based palliative care is increasingly the standard of care for the seriously ill in these counties, in part due to cultural shifts motivated by the presence and activities of the CMMI demonstration project. The

likelihood of spill-over effects and contamination of the control group by exposure to palliative care strategies similar to the CMMI model would bias the estimate for effects of the CMMI model toward the null.

In health care, the expectation of cost neutrality is unique to hospice and now palliative care, where coverage for therapies is typically based on their efficacy and ability to improve patient and caregiver outcomes. Given the challenges of using reimbursement to measure resource use, alternative measures may be needed. For example, hospice enrollment could be considered as a surrogate outcome that reflects reduced resource utilization at the EOL and high-quality EOL care. We found that the CMMI demonstration significantly increased odds of hospice enrollment. Patient-centered care, symptom control, and alignment with patient and caregiver preferences are also important outcomes to consider in evaluating palliative care models.

The expansion of community palliative care programs into multiple sites and enrollment settings is feasible and may improve hospice utilization among enrollees; however, meaningful differences in length of stay and cost by location of model entry and exit pose challenges to standardizing reimbursement policies across care settings. Although more time must elapse before a full impact analysis of the palliative care intervention can be conducted, this early evaluation found inconsistent trends Medicare expenditures for patients' pre- and post-enrollment in the CMMI cohort. Balancing quality of care with cost is essential in the development and broader application of palliative care payment models in Medicare.

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References

1. Temel JS, Greer JA, Muzikansky A, et al. Early palliative care for patients with metastatic non-small-cell lung cancer. N Engl J Med 2010;363:733−742.

2. Greer JA, Tramontano AC, McMahon PM, et al. Cost analysis of a randomized trial of early palliative care in patients with metastatic Nonsmall-cell lung cancer. J Palliat Med 2016;19:842−848.

3. DiMartino LD, Weiner BJ, Hanson LC, et al. Inpatient palliative care consultation and 30-day readmissions in oncology. J Palliat Med 2018;21:62−68.

4. Dunn EJ, Markert R, Hayes K, et al. The influence of palliative care consultation on health-care resource utilization during the last 2 Months of life: report from an integrated palliative care program and review of the literature. Am J Hosp Palliat Care 2018;35:117−122.

5. Centers for Medicare & Medicaid Services. Health Care Innovation Awards. Innovation Center Home Web site. 2019. Available from https://innovation.cms.gov/initiatives/Health-Care-Innovation-Awards/. Accessed January 22, 2019.

6. Bishop L, Reese M, Koomson P, Kooyer S. Sutter health advanced illness management (AIM) 2016 program update (QI815) - journal of pain and symptom management. J Pain Symptom Manage 2019;55:2.

7. Bull J, Kamal AH, Harker M, et al. Standardization and scaling of a community-based palliative care model. J Palliat Med 2017;20:1237−1243.

8. Bull J, Kamal AH, Harker M, et al. Tracking patients in community-based palliative care through the Centers for Medicare & Medicaid services Healthcare innovation project. J Palliat Med 2017;20:1231−1236.

9. Kamal AH, Kavalieratos D, Bull J, Stinson CS, Nicolla J, Abernethy AP. Usability and acceptability of the QDACT-PC, an electronic point-of-care system for standardized quality monitoring in palliative care. J Pain Symptom Manage 2015;50:615−621.

10. Gilman B, McCall N, Bogen K, et al. Evaluation of the round two health care innovation awards (HCIA R2) third annual report. Cambridge, MA: Mathematica Policy Research, 2018.

11. Morrison RS, Augustin R, Souvanna P, Meier DE. America's care of serious illness: a state-by-state report card on access to palliative care in our nation's hospitals. J Palliat Med 2011;14:1094−1096.

12. Morrison RS, Dietrich J, Ladwig S, et al. Palliative care consultation teams cut hospital costs for Medicaid beneficiaries. Health Aff (Millwood) 2011;30:454−463.

13. Gilman B, Dale S, Peterson D, et al. Evaluation of the round two health care innovation awards (HCIA R2): Second annual report. Cambridge, MA: Mathematica Policy Research, 2017.

14. Kelley AS, Bollens-Lund E. Identifying the population with serious illness: the "Denominator" challenge. J Palliat Med 2018;21:S7−S16.

15. Fuller RL, Hughes JS, Goldfield NI. Adjusting population risk for functional health status. Popul Health Manag 2016;19:136−144.

16. Brumley R, Enguidanos S, Jamison P, et al. Increased satisfaction with care and lower costs: results of a randomized trial of in-home palliative care. J Am Geriatr Soc 2007;55:993−1000.

Appendix

Comparison Counties
Alexander
Alleghany
Ashe
Avery
Buncombe
Burke
Caldwell
Catawba
Cherokee
Cherokee
Clay
Cleveland
Gaston
Graham
Greenville
Haywood
Henderson
Iredell
Jackson
Lincoln
Macon
Madison
McDowell
Mitchell
Oconee
Pickens
Polk
Rutherford
Spartanburg
Swain
Transylvania
Watauga
Wilkes
Yancy
York

Appendix Table 1
Predicting Any Hospice Claim Within 180 Days of Death

	Odds Ratio	Lower CI	Upper CI
CMMI member	1.602[a]	1.465	1.752
65 to 69	0.397[a]	0.372	0.423
70 to 74	0.519[a]	0.489	0.551
75 to 79	0.618[a]	0.585	0.654
80 to 84	0.758[a]	0.72	0.799
85+	Ref		
Female	1.241[a]	1.195	1.29
White	1.391[a]	1.301	1.488
>5 Comorbidities	0.998	0.935	1.065

CI = 95% confidence interval; CMMI = Center for Medicare and Medicaid Innovation.
Logit model also controls for chronic condition indicators, death year, death month, and county fixed effects.
[a]$P < 0.001$.

Appendix Table 2
Estimated Percent Change in Medicare Charges Over 180, 90, and 30 Days Before Death by CMMI Status

	180 day	90 day	30 day
N = 51,984	Estimate (CI)	Estimate (CI)	Estimate (CI)
CMMI entry			
Home/clinic/other	1.35[a] (1.17, 1.56)	1.41[a] (1.20, 1.67)	1.59[a] (1.28, 1.98)
Facility	1.28[a] (1.12, 1.47)	1.20[b] (1.03, 1.48)	1.13 (0.92, 1.39)
Small hospital	1.52[a] (1.36, 1.69)	1.63[a] (1.44, 1.85)	1.95[a] (1.66, 2.30)
Large hospital	1.55[a] (1.43, 1.69)	1.68[a] (1.53, 1.85)	1.83[a] (1.61, 2.07)
No CMMI	ref	ref	ref
CMMI moderators			
CMMI 30+ vs <30 days	0.95 (0.85, 1.06)	0.79[a] (0.70, 0.90)	0.58[a] (0.49, 0.69)
Hospice discharge vs other	0.68[a] (0.63, 0.75)	0.72[a] (0.65, 0.79)	0.83[b] (0.72, 0.94)

CI = 95% confidence interval; CMMI = Center for Medicare and Medicaid Innovation.
The table presents exponentiated coefficients from a generalized linear model predicting Medicare expenditures (log) over 180, 90, and 30 days before death for 100% Medicare fee-for-service decedents age 65+ years in Four Seasons service area and comparison counties. Beneficiaries with one or more days in Medicare advantage in the 180 days before death were excluded.
[a]$P < 0.001$.
[b]$P < 0.01$.

Appendix Table 3
Days in Palliative Care Model by Model Entry and Exit Points

Location of Model Entry	Location of Model Exit				
	Dead	Hospice	Discharge Alive	Still Alive and in Model	Total
Small hospital					
Patients, *n* (%)	216 (16)	529 (38)	560 (40)	88 (6)	1393 (27)
Mean days (SD)	50.3 (102.8)	62.9 (142.7)	63.8 (130.0)	362.9 (237.4)	80.3 (158.3)
Median (IQR)	9 (3−43.5)	7 (3−40)	15 (5−55)	328 (166.5−511.5)	12 (4−64)
Large hospital					
Patients, *n* (%)	291 (17)	536 (31)	891 (51)	21 (1)	1739 (33)
Mean days (SD)	8.8 (23.1)	13.1 (37.3)	13.4 (32.7)	290.3 (174.1)	15.9 (48.3)
Median (IQR)	4 (2−8)	4 (2−8)	5 (3−9)	335 (186−425)	5 (3−9)
Facility					
Patients, *n* (%)	168 (15)	422 (38)	260 (24)	252 (23)	1102 (21)
Mean days (SD)	126.2 (180.7)	131.9 (174.7)	152.8 (177.4)	381.7 (268.8)	193.1 (226.1)
Median (IQR)	54 (16−137.5)	58 (18−174)	86 (38−199.5)	280 (172−551.5)	112 (31−276)
Home/clinic					
Patients, *n* (%)	58 (6)	415 (42)	192 (19)	326 (33)	991 (19)
Mean days (SD)	156.9 (168.1)	130.1 (159.9)	159.9 (144.6)	318.6 (205.4)	199.4 (193.2)
Median (IQR)	86.5 (33−235)	70 (20−168)	112.5 (48.5−235.5)	246 (175−411)	147 (46−280)
Total					
Patients, *n* (%)	733 (14)	1902 (36)	1903 (36)	687 (13)	5225
Mean days (SD)	59.7 (125.6)	78.8 (144.4)	62.1 (122.7)	346.6 (235.4)	105.3 (177.3)
Median (IQR)	9 (3−49)	14 (2−78)	10 (4−59)	279 (172−475)	17 (5−135)

IQR = interquartile range; SD = standard deviation.