



The Effects of Dementia Care Co-Management on Acute Care, Hospice, and Long-Term Care Utilization

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BACKGROUND/OBJECTIVES: Although nurse practitioner dementia care co-management has been shown to reduce total cost of care for fee-for-service (FFS) Medicare beneficiaries, the reasons for cost savings are unknown. To further understand the impact of dementia co-management on costs, we examined acute care utilization, long-term care admissions, and hospice use of program enrollees as compared with persons with dementia not in the program using FFS and managed Medicare claims data.

DESIGN: Quasi-experimental controlled before-and-after comparison.

SETTING: Urban academic medical center.

PARTICIPANTS: A total of 856 University of California, Los Angeles (UCLA) Alzheimer's and Dementia Care program patients were enrolled between July 1, 2012, and December 31, 2015, and 3,139 similar UCLA patients with dementia not in the program. Comparison patients were identified as having dementia using International Classification of Diseases-9 codes and natural language processing of clinical notes. Coarsened exact matching was used to reduce covariate imbalance between intervention and comparison patients.

INTERVENTION: Dementia co-management model using nurse practitioners partnered with primary care providers and community organizations.

MEASUREMENTS: Average difference-in-differences per quarter over the 2.5-year intervention period for all-cause hospitalization, emergency department (ED) visits, intensive care unit (ICU) stays, and number of inpatient hospitalization days; admissions to long-term care facilities; and hospice use in the last 6 months of life.

RESULTS: Intervention patients had fewer ED visits (odds ratio [OR] = .80; 95% confidence interval [CI] = .66–.97) and shorter hospital length of stay (incident rate ratio = .74; 95% CI = .55–.99). There were no significant differences between groups for hospitalizations or ICU stays. Program participants were less likely to be admitted to a long-term care facility (hazard ratio = .65; 95% CI = .47–.89) and more likely to receive hospice services in the last 6 months of life (adjusted OR = 1.64; 95% CI = 1.13–2.37).

CONCLUSION: Comprehensive nurse practitioner dementia care co-management reduced ED visits, shortened hospital length of stay, increased hospice use, and delayed admission to long-term care. *J Am Geriatr Soc* 00:1-8, 2020.

Keywords: dementia; care management; healthcare utilization

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Several health system-based dementia care management programs have been developed to better meet the needs of persons with Alzheimer's disease and other dementias and their family caregivers. These programs have used care managers or coordinators and care management software to improve dementia care quality, reduce behavioral and psychological symptoms of dementia, and reduce caregiver strain.¹⁻⁷ Three models using advance practice nurses for dementia care management have shown positive effects on healthcare utilization. As compared with usual care, the Indiana Healthy Aging Brain Center reduced emergency department (ED) visits, inpatient hospitalizations, and

30-day readmissions.⁸ The University of California, Los Angeles (UCLA) Alzheimer's and Dementia Care (ADC) program delayed long-term nursing home admissions and reduced total cost of care for fee-for-service (FFS) Medicare beneficiaries by \$601 less per patient per quarter (95% confidence interval [CI] = $-\$1,198$ to $-\$5$) and was cost neutral after accounting for program costs to UCLA, but it did not reduce hospitalizations or ED visits.⁹ The Emory University Integrated Memory Care Clinic reduced the rate of ambulatory-sensitive hospitalizations.¹⁰ To further understand the impact of nurse practitioner dementia care co-management on acute and long-term care and hospice utilization, we examined Medicare FFS and Medicare managed care claims data of UCLA ADC program enrollees and matched persons with dementia who also received care at UCLA.

METHODS

Description of the Clinical Program

The UCLA ADC program¹¹ is based in an academic healthcare system and uses nurse practitioner dementia care specialists partnered with primary care providers and community-based organizations to provide comprehensive coordinated care for patients with Alzheimer's disease and other dementias.^{12,13} The program consists of five key components: patient referral, structured needs assessments of patients and their caregivers, creation and implementation of individualized dementia care plans, monitoring and revising care plans, and continuous telephone access for assistance and advice. Each dementia care specialist cares for up to 300 patients and is assisted by a bachelor's-trained dementia care assistant who facilitates scheduling and makes telephone calls to stable patients. ADC enrollees must be referred by a UCLA physician, have a diagnosis of dementia, and cannot be living in a nursing home or enrolled in hospice at the time of ADC enrollment. Most referring providers are primary care providers.¹⁴ Patients are not required to have a caregiver to enroll in the program, although nearly all identify a family or friend caregiver.

Data Sources

For Medicare FFS beneficiaries, we used Medicare Part A and B claims files and beneficiary summary files (including demographics, Medicare enrollment status, and chronic conditions) from January 1, 2012, to June 30, 2016, provided to UCLA for their Medicare Shared Savings Program (MSSP). For patients enrolled in a Medicare Advantage plan during the study period, we obtained all institutional and professional claims from health plans contracted with UCLA and willing to share claims data. We used California Public Health Department mortality data to identify dates of death, supplemented by programmatic files for individuals enrolled in the ADC program.

Participants

Of the 1,430 patients enrolled in the ADC program for one or more quarters between July 1, 2012, and June 30, 2016, 465 (33%) were not enrolled in FFS Medicare, not

attributed by Medicare to the UCLA MSSP (i.e., not attributed to the UCLA Medicare Accountable Care Organization [ACO]), or were enrolled in a managed Medicare plan from which UCLA was unable to obtain claims data. We also excluded from analyses the ADC enrollees who did not have at least one quarter of claims data before ADC enrollment date (N = 56); patients enrolled in hospice at the time of ADC enrollment (N = 11); and those receiving long-term care in a nursing facility at the time of ADC enrollment (N = 25). Long-term nursing home care was defined as 3 consecutive months of claims for skilled nursing facility care in the 6 months before the date of ADC enrollment.¹⁵ This left us with 873 ADC participants eligible for matching.

We selected the comparison population from UCLA patients not enrolled in the ADC who were also attributed to the UCLA Medicare MSSP or enrolled in a UCLA Medicare Advantage plan who met two criteria: (1) had at least one claim for a dementia-related International Classification of Diseases, Ninth Revision (ICD-9) code (331.0, 331.11, 331.19, 331.2, 331.7, 290.0, 290.10, 290.11, 290.12, 290.13, 290.20, 290.21, 290.3, 290.40, 290.41, 290.42, 290.43, 294.0, 294.10, 294.11, 294.20, 294.21, 294.8, 797), and (2) were identified as having dementia using an algorithm, validated by the investigators, that used natural language processing of clinical notes within the UCLA electronic health record.¹⁶ We allowed patients in the intervention group with at least two quarters of data before ADC enrollment (N = 332) to serve as controls until the date they entered the ADC program.¹⁷

For each comparison patient, a pseudo-enrollment date was established as a random date falling between 90 days after cohort entry (defined as January 1, 2012, or the start date of Medicare coverage) and 90 days before the end of study period, death, or end of inclusion in UCLA MSSP. This required comparison patients to have at least one quarter of data before and after their pseudo-enrollment date. To match the inclusion criteria for the intervention group, comparison patients were also excluded if they were enrolled in hospice on their pseudo-enrollment date or were receiving long-term care in a nursing home before the pseudo-enrollment date. Using this approach, we identified 3,304 comparison patients eligible for matching.

Study Period

Intervention and comparison patients were followed from January 1, 2012, to June 30, 2016. Using an intention-to-treat analysis, individual patients were followed from when they entered the cohort, based on MSSP attribution date or managed care enrollment date, until death, end of study, end of Medicare coverage, or the beginning of ADC enrollment (for intervention patients serving as controls before program entry).

Matching

We used coarsened exact matching, a nonparametric approach to reducing covariate imbalance between treatment and controls where intervention and comparison patients are binned on a set of predetermined variables.^{18,19} Coarsened exact matching can offer improvements in power compared with traditional 1:n matching techniques

because fewer controls are “pruned” from the analysis, and the technique simulates stratified random sampling (on the binned variables) versus propensity score matching that mimics simple random sampling. We used the following variables for binning: age (≤ 75 , 76–80, 81–85, 86–90, 90+), Medicare coverage type (FFS, managed care), year of enrollment/pseudo-enrollment date (2014 or before or after 2014), average quarterly costs over the year before enrollment/pseudo-enrollment ($\$0$ – 100 , $\$101$ – 1999 , $\geq \$2,000$). We also calculated a propensity score for ADC enrollment and included four bins based on propensity score quartiles.

These variables were used in the logistic regression model to calculate propensity score: sex, ethnicity (Hispanic vs non-Hispanic), dual Medicare-Medicaid coverage, prior quarter outpatient visits, prior quarter hospitalizations, and chronic condition warehouse (CCW) variables: Alzheimer’s disease, any cancer, pelvic or hip fracture, rheumatoid arthritis/osteoarthritis, depression, chronic kidney disease, hyperlipidemia, chronic obstructive pulmonary disease, ischemic heart disease, heart failure, atrial fibrillation, and acute myocardial infarction. A total of 17 ADC patients and 165 comparison patients were not able to be binned using these variables, and they were excluded from the final analytic cohort. After comparison and intervention patients were binned, probability weights were calculated. ADC participants received a weight of 1, and controls were assigned weights above 0 that are designed to balance the number of intervention and control units within each strata; the weights were applied to all subsequent analyses. We used the *cem macro* developed by Berta et al. to implement the coarsened exact matching in SAS.²⁰

OUTCOME MEASURES

Quarterly Outcomes

We calculated utilization measures for each patient in up to eight quarters pre- and post-enrollment (intervention group) or pseudo-enrollment (comparison group) date. Due to small sample sizes of patients who had been followed for more than 2 years, we averaged the utilization for quarters 9 to 12 post-enrollment or post pseudo-enrollment. For each patient, we calculated the following utilization measures for each quarter: inpatient hospitalization (yes vs no), ED visit without hospitalization (yes vs no), intensive care unit (ICU) stay (yes vs no), and number of inpatient hospitalization days.

Long-Term Nursing Home Admission

For each patient, we calculated days from enrollment or pseudo-enrollment date until long-term nursing home entry, death, end of study, or end of Medicare coverage. Using a previously validated algorithm for Medicare Part A and B claims data,¹⁵ long-term care admission was defined as 3 consecutive months of claims with nursing facility place of service codes or nursing facility care Current Procedural Terminology codes with entry into long-term care defined as the first month in which nursing home physician service claims were observed in the absence of skilled nursing facility claims. Once a participant was defined as long-term care, the status did not change.

Hospice Use

Hospice analysis included the 187 cases and 415 controls who died during our study follow-up period. For this analysis, we included deaths that occurred even if a patient was previously censored for loss of coverage. We defined hospice use in the last 6 months of life to include any patient who had a hospice discharge in the 6 months preceding death. Death within 7 days of hospice enrollment was defined as having a death date within 7 days of the hospice admission date. We also counted the total number of days that cases and controls were enrolled in hospice.

STATISTICAL ANALYSIS

Quarterly Outcomes

We used a difference-in-differences (DID) approach to estimate the average treatment effect of the intervention by comparing average outcomes between ADC patients and the comparison group across the eight quarters pre- and nine quarters post-intervention periods. The final quarter was an average of quarters 9, 10, 11, and 12 in the post-intervention period. We estimated population average, or “marginal” effects, for all quarterly outcomes using general estimating equations with exchangeable correlation structures to account for within patient correlation over time. For the binary outcomes (hospitalization, ED visit, and ICU stay), we used logit models, and for hospital length of stay we used a Poisson distribution with a log link. In each regression, we applied the probability weights ascertained by the coarsened exact matching macro. All models included quarter as a fixed effect, an indicator for intervention versus control, and a quarter-by-intervention interaction. To obtain a single estimate for the DID effect over the entire implementation period, we weighted each quarterly estimate according to the number of participants enrolled in each quarter. Then we calculated the average weighted effects in the pre- and post-period for the intervention and control group separately. Finally, we used the following linear combination to calculate the final DID per quarter per 1,000 patients: (weighted post-intervention mean event rate – weighted pre-intervention mean event rate) – (weighted post-period mean event rate for controls – weighted pre-period mean event rate for controls).

Long-Term Nursing Home Admission

We used Cox proportional hazard models accounting for the competing risk of death to estimate the hazard ratio of long-term nursing home placement for ADC patients versus comparison patients. We used the Fine and Gray approach²¹ to address the competing risk of death that models the cumulative incidence function. Patients were censored at the end of the study period or on loss of MSSP coverage.

Hospice Use

We used logistic regression models to estimate odds ratios (ORs) for hospice use in the last 6 months of life and death

within 7 days of hospice enrollment. We used negative binomial regression to model counts of days enrolled in hospice. We calculated raw estimates and estimates adjusted

for CCW conditions that differed between the two groups of decedents including Alzheimer's disease, depression, and hyperlipidemia.

Table 1. Descriptive Characteristics of ADC and Control Participants

	Comparison group N (%)	ADC participants N (%)	P value
No. of persons	N = 3,139	N = 856	
Mean no. of quarters in post-intervention period (SD)	5.6 (3.8)	6.9 (3.6)	<.001
Age, y, mean (SD)	84.2 (7.9)	83.4 (7.5)	.01
Female	2,082 (66.3)	569 (66.5)	.93
Race: White	1,912 (60.9)	526 (61.4)	.78
Ethnicity: Hispanic	285 (9.1)	86 (10.0)	.39
Fee-for-service Medicare	2,351 (74.9)	641 (74.9)	1.00
Dual Medicare-Medicaid eligible	261 (8.3)	67 (7.8)	.64
Chronic conditions			
Alzheimer's disease	1,422 (45.3)	396 (46.3)	.62
Cancer	377 (12.0)	101 (11.8)	.87
Pelvic or hip fracture	53 (1.7)	12 (1.4)	.57
RA or OA	748 (23.8)	200 (23.4)	.78
Depression	936 (29.8)	289 (33.8)	.03
CKD	777 (24.7)	200 (23.4)	.40
Hyperlipidemia	1,168 (37.2)	304 (35.5)	.36
COPD	189 (6.0)	39 (4.6)	.10
Ischemic heart disease	639 (20.4)	170 (19.9)	.74
Acute myocardial infarction	15 (.5)	5 (.6)	.71
Heart failure	450 (14.3)	115 (13.4)	.50
Atrial fibrillation	319 (10.2)	79 (9.2)	.41
Mean quarterly utilization and cost in year before enrollment			
Total Medicare cost (SD)	\$9,460 (23,859)	\$8,159 (21,635)	.22
Hospitalizations per 1,000 (SD)	283.9 (976.4)	217.2 (755.8)	.06
ED visits per 1,000 (SD)	302.7 (993.6)	325.2 (854.3)	.55

Note: Table 1 shows characteristics of treatment and control groups after coarsened exact matching using age, mean quarterly total Medicare cost in year before enrollment/pseudo-enrollment, Medicare coverage type (fee-for-service vs managed Medicare), and quartile of propensity score. If a patient did not have 12 months of claims data in the year before enrollment or pseudo-enrollment, costs were annualized based on available months of claims data. Results are weighted based on coarsened exact matching bins.

Abbreviations: ADC, Alzheimer's and Dementia Care Program; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; ED, emergency department; OA, osteoarthritis; RA, rheumatoid arthritis; SD, standard deviation.

Table 2. Difference-in-Differences Estimates for Acute Care Utilization Outcomes

Events per quarter per 1,000 patients	ADC participants		Comparison group		Average DID per quarter per 1,000 patients ^a	DID estimate ^b OR (95% CI)
	Pre-intervention	Post-intervention	Pre-period	Post-period		
	Mean (standard error)					
Hospitalizations	37.1 (2.6)	51.0 (2.8)	46.5 (1.7)	68.9 (1.9)	-8.5	.88 (.71-1.08)
ED visits	49.7 (3.0)	55.0 (2.9)	48.5 (1.8)	63.2 (1.8)	-9.4	.80 (.66-.97)
ICU stays	24.9 (2.2)	32.2 (2.3)	30.5 (1.4)	46.6 (1.6)	-8.8	.79 (.6-1.03)
Hospital days	208.8 (20.4)	317.9 (24.0)	284 (15.4)	553.2 (23.1)	-160.1	IRR (95% CI) .74 (.55-.99)

Note: All models included nine quarters of post-intervention follow-up, with quarters 9 to 12 averaged into one quarter unit of observation. $P < .05$ are bolded.

Abbreviations: ADC, Alzheimer's and Dementia Care program; CI, confidence interval; DID, difference-in-differences; ED, emergency department; ICU, intensive care unit; IRR, incident rate ratio; OR, odds ratio.

^aAverage DID per quarter per 1,000 patients was calculated as (weighted post-intervention mean event rate - weighted pre-intervention mean event rate) - (weighted post-period mean event rate for controls - weighted pre-period mean event rate for controls).

^bDID estimate was calculated a weighted linear combination of the quarterly effects in the pre- and post-treatment periods for the ADC and comparison group using the Stata lincom command.

Analyses were completed using Stata v.14.1 (StataCorp, College Station, TX) and SAS software v.9.4 (SAS Institute, Cary, NC). This study was approved by the UCLA institutional review board (IRB 13-001480).

RESULTS

Table 1 summarizes the demographic and other baseline information for the 856 ADC program participants and 3,139 comparison patients in the final analytic cohort. Most patients were female (66%), white (61%), had FFS Medicare (75%), and were in their mid-80s on average. A total of 8% were dually insured with Medicare and Medicaid.

Table 2 indicates the effect of the ADC program on acute care utilization. Although hospitalizations and ICU stays did not differ significantly between groups, participants in the ADC program had 9.4 fewer ED visits and 160.1 fewer hospital days per quarter per 1,000 participants compared with the control group patients (Figure 1).

Among those who died during the follow-up period, 47% (N = 87/187) of ADC decedents and 35% (N = 146/415) of control decedents (adjusted OR = 1.64; 95% CI = 1.13–2.37) received hospice services in the last 6 months of life. The average length of time spent on hospice was longer for those in the ADC program compared with control patients: 28.3 days (standard deviation [SD] = 50.0) versus 17.2 days (SD = 43.0), respectively (P = .14).

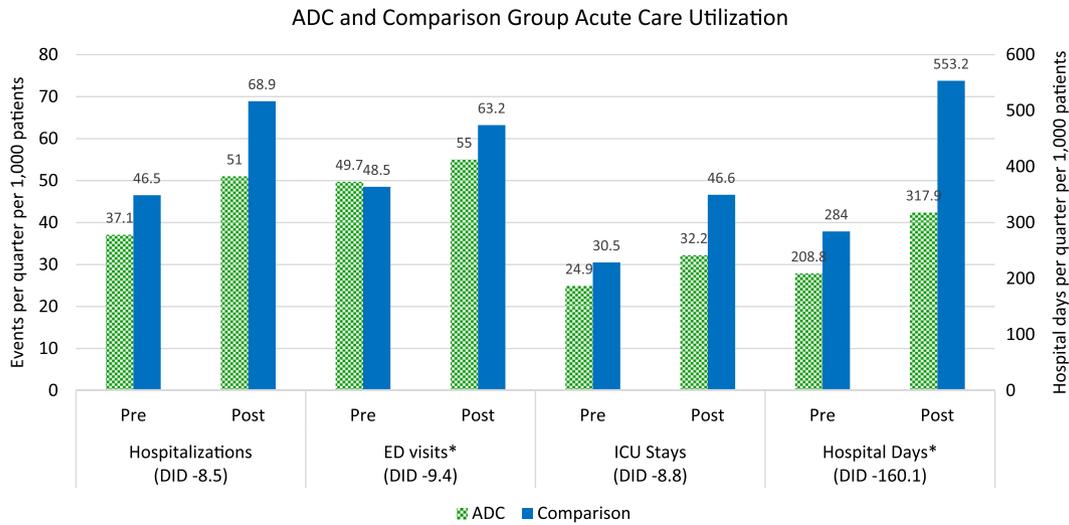


Figure 1. Alzheimer’s and Dementia Care (ADC) program and comparison group acute care utilization. DID, difference-in-differences. ED, emergency department; ICU, intensive care unit. Average DID per quarter per 1,000 patients was calculated as: (weighted post-intervention mean event rate – weighted pre-intervention mean event rate) – (weighted post-period mean event rate for controls – weighted pre-period mean event rate for controls). Hospital days are shown using a range of 0 to 600 days; other outcomes are shown using a range of 0 to 80 events. *P < .05.

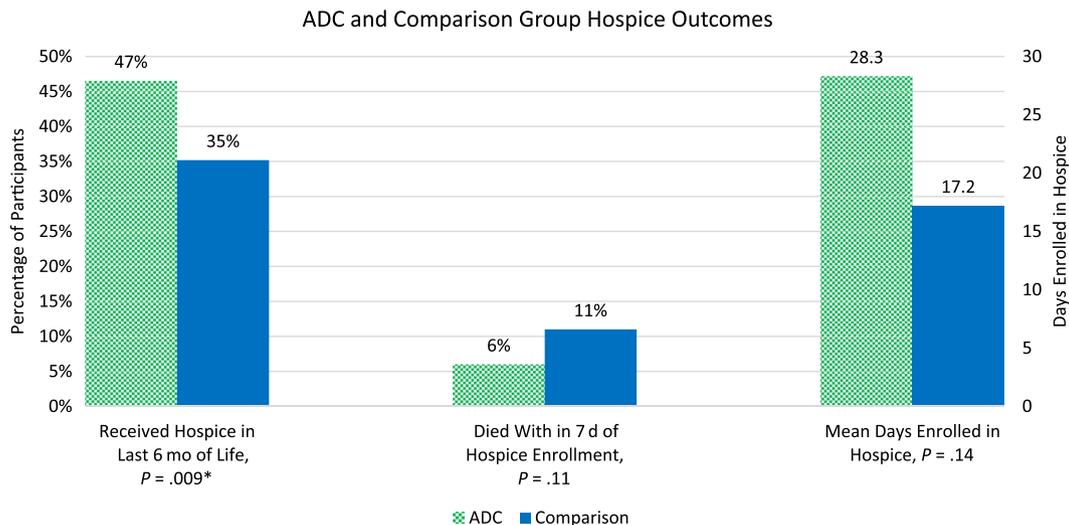


Figure 2. Alzheimer’s and Dementia Care (ADC) program and comparison group hospice outcomes. Analyses included 187 ADC cases and 415 comparison patients who died during the study follow-up period. *Adjusted odds ratio = 1.64, 95% confidence interval = 1.13–2.37. [Color figure can be viewed at wileyonlinelibrary.com]

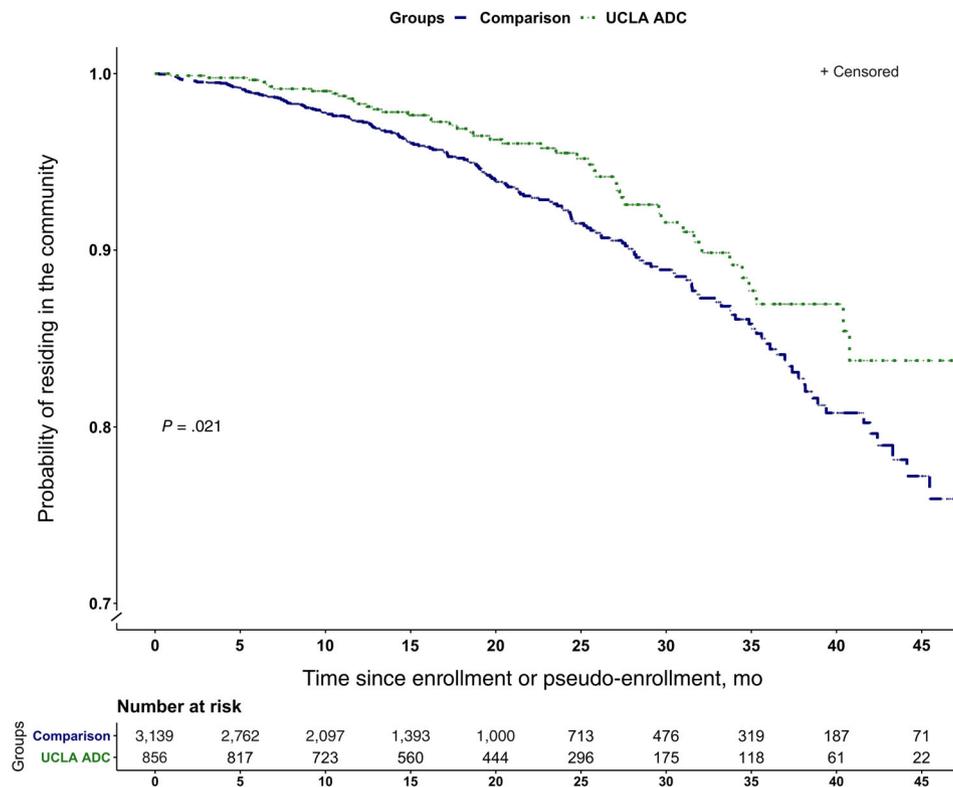


Figure 3. Kaplan-Meier plots of long-term nursing home admission. ADC, Alzheimer's and Dementia Care program. The P value is calculated using a log-rank test comparing the University of California, Los Angeles (UCLA) ADC and comparison group over time. The y axis is presented for the interval of .7 to 1.0. [Color figure can be viewed at wileyonlinelibrary.com]

Fewer ADC participants died within 7 days of hospice enrollment (6% of ADC participants vs 11% of control patients; $P = .11$). However, neither of these differences were statistically significant in adjusted models (Figure 2).

Time to nursing home admission was delayed for program participants. In an adjusted proportional hazards model, ADC participants were less likely to be admitted to a long-term care facility (hazard ratio = .65; 95% CI = .47–.89). Figure 3 shows Kaplan-Meier estimates for long-term care nursing home admission for both ADC participants and control patients.

DISCUSSION

Previous research on a health system-based comprehensive dementia care management program has demonstrated cost savings compared with a propensity-matched FFS control group but was unable to examine where these cost savings occurred.⁹ Using MSSP claims data and a newly generated control group that included managed care participants who were drawn from the same health system, we were able to identify several sources of cost savings. The ADC program had significant effects on ED visits (reduced by 20%) and hospital lengths of stay (reduced by 26%), but effects on ICU stays (21% reduction) and hospitalizations (12% reduction) were not significant.

Although intensive co-management of dementia might be anticipated to reduce hospitalizations, these are often the result of medical comorbidities or medical complications of dementia (e.g., aspiration pneumonias, falls) that may be

less modifiable. However, once hospitalized, discharge considerations are important. Dementia care specialists who communicate with the inpatient team can facilitate earlier discharge by providing additional information, assisting with goals of care discussions, and preparing caregivers for patients returning home. The reduction in ED visits may result from better care coordination by dementia care specialists facilitating urgent care visits to primary care providers and specialists.

Another important finding was the higher rate of ADC participants receiving hospice services in the last 6 months of life. Using chart review, we previously demonstrated the high rates of hospice use among persons in the program.²² In this study using a more robust quasi-experimental design, we were able to confirm that these rates were significantly higher than among persons with dementia receiving usual care, another potential source of cost savings. Finally, we were able to confirm previous research⁹ that dementia co-management delays long-term nursing home care; this reduction benefits state Medicaid programs that bear most of the burden for long-term care costs as well as patient families who pay out of pocket for this care.

These findings should be interpreted in the context of the study's strengths and limitations. By focusing on a single health system and using FFS MSSP and Medicare Advantage claims data, we were able to capture comprehensive utilization data on intervention and control patients within the same health system. Although the selection of patients for the program was not randomized, the use of coarsened exact matching simulates stratified random

sampling, and intervention and control patients were very similar across demographic and clinical characteristics available in claims data. However, Medicare claims data do not contain detailed clinical information about disease severity, functional status, caregiver,^{2,3} or referring provider characteristics that may affect program referral or healthcare utilization, and we were unable to control for these potential confounders. We also lacked detailed information about ADC program participation, such as visit or call frequency or use of community services.

Another limitation of the study was that we were not able to obtain complete cost data from Medicare managed care health plans, and thus total cost of care could not be included as an outcome for these analyses. Nor did we account for outpatient visit utilization that may be increased in comprehensive dementia care management if lower cost outpatient services are substituted for more expensive acute care use. Finally, one-third of ADC enrollees could not be included because they were not enrolled in FFS Medicare, not attributed by Medicare to the UCLA MSSP (i.e., not attributed to the UCLA Medicare ACO), or UCLA was unable to obtain claims from their Medicare Advantage plan.

In conclusion, a comprehensive nurse practitioner co-management program can reduce acute care utilization and increase hospice use. The resulting cost savings accrue to hospitals and insurers rather than medical groups that bear the costs of providing the services. Medicare Advantage plans and health systems that are tightly integrated with medical providers are well positioned to implement such programs that also improve quality of care⁴ and clinical outcomes²⁴ for persons with dementia and their caregivers. Widespread adoption within systems that rely primarily on FFS payment will require changes in current reimbursement policies.²⁵ As the number of persons with dementia rises, the inadequacies of current usual care will result in unnecessary costly care that does not achieve good quality or clinical outcomes. Programs such as the UCLA ADC can provide a solution if financial incentives are aligned to promote their implementation.

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