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Health Care Utilization Among Elderly Medicare Beneficiaries With Coexisting Dementia and Cancer

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Abstract

Objective: The goal of this research is to delineate health care utilization among elderly Medicare beneficiaries with coexisting dementia and cancer compared with those with dementia alone, cancer alone, or neither condition. **Method:** The study cohort included 96,124 elderly patients aged 65 years and older who resided in the Mid-South region of the United States and were enrolled in Medicare during 2009. Multivariate regression analyses were used to examine health care utilizations while adjusting for sociodemographic characteristics. **Results:** Those with coexisting dementia and cancer diagnoses had higher rates of hospitalizations, hospital readmissions within 30 days, intensive care unit use, and emergency department visits compared with those with dementia only, cancer only, and those with neither condition. Patients with coexisting dementia and cancer also had a higher number of primary care visits and specialist visits. **Conclusion:** There is a greater need for developing tailored care plans for elderly with these two degenerative health conditions to address their unique health care needs and to reduce financial burden on the patients and the health care system.

Keywords

health care utilization, dementia, cancer, elderly, Medicare

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Introduction

One in nine elderly persons in the United States is affected by dementia, including Alzheimer's disease (AD), resulting in more than 5 million elderly individuals with these diseases (Alzheimer's Association, 2014, Weuve et al., 2014). The risk of developing dementia increases with age; more than 32% of elderly persons aged 85 or older have been clinically diagnosed with dementia (Fargo & Bleiler, 2014). In addition, the elderly population is more likely to suffer from multiple chronic conditions. About two third of elderly persons have two or more chronic conditions, and the prevalence of multiple chronic conditions also increases with age (Kunik et al., 2003; Maslow, 2006). In particular, the prevalence of having a cancer diagnosis among elderly aged 65 and older is more than 20% (Hewitt, Rowland, & Yancik, 2003). The negative impact of other chronic conditions on elderly people with dementia is more significant given their advanced ages. Impaired cognitive function may also impede patients' abilities to communicate with caregivers and physicians, leading to suboptimal care, unmet health care needs, and poor health outcomes (Hildreth & Church, 2015; Robinson, Buckwalter, & Reed, 2005).

Given the high prevalence of cancer and dementia among elderly, the combined effects of cancer and dementia on patient's health, health care utilization, and health care costs are conceivably very high (Prince et al., 2015). However, the literature is scarce on patterns of health care utilization among patients with coexisting dementia and cancer. A recent study found that people aged 65 years and older with coexisting dementia and cancer had significantly more hospitalizations in the last 3 months of life than those without coexisting dementia and cancer (Teno et al., 2013). Similar results were found in other studies for cancer-only patients who reported more hospitalizations during the end-of-life stage, including higher use of intensive care unit (ICU) in the last month of life (Chastek et al., 2012; Morden et al., 2012). However, few studies have examined the health care utilizations among elderly

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people who are not in the end-of-life stage and suffer from these two coexisting conditions.

Elderly patients with coexisting dementia and cancer have additional health care needs and require delicate coordination among primary care physicians, neurologists, oncologists and other specialists to monitor cancer recurrence, treat complications, and manage complicated treatment protocols (Cascioli, Al-Madfai, Oborne, & Phelps, 2008; Kales et al., 1999; Stirling et al., 2010). The fragmented health care systems in the United States aggravate the complexity of care, which results in patients feeling overwhelmed when dealing with multiple providers and complicated systems (Schubert et al., 2008). Furthermore, inefficient communications among patients, caregivers, and physicians may create barriers in the efficient flow of clinical information among the providers, leading to uncoordinated and sometimes conflicting treatment regimens and medications (Bradford, Kunik, Schulz, Williams, & Singh, 2009). Consequently, patients with coexisting dementia and cancer diagnoses may have higher rates of emergency department (ED) visits, hospitalizations, hospital readmission rates, and poor health outcomes compared with those without these coexisting conditions.

In addition, there are large regional variations in health care utilization patterns due to different health care systems, diverse patient populations, varying disease loads, and unique local cultures (Gornick et al., 1996). The Mid-South region of the United States is known for high rates of multiple chronic conditions and higher rates of health care services utilization compared with national and state averages (Census, Centers for Disease Control and Prevention, National Center for Health Statistics, 2013). However, it is not known whether the health care needs of patients with coexisting diseases, such as dementia and cancer, are sufficiently met in this region. In the current study, we systematically examine the health care utilization patterns among patients with coexisting dementia and cancer, and compare them with those with one of the two conditions or neither condition. A better understanding of these patterns is crucial for developing cost-efficient and coordinated care plans for this patient population.

Subjects and Methods

Study Cohort

We obtained the 100% Medicare claims data from the Centers for Medicare & Medicaid Services (CMS). Based on the denominator file, we identified 161,553 elderly people aged 65 or older who reside in the Mid-South region of the United States (including east Arkansas, north Mississippi, and southwest Tennessee). We excluded 16.7% patients who were in any Health Maintenance Organizations (HMO) and additional 19% without both Part A and B Medicare eligibility because their claims are usually handled by different agencies, thus having incomplete Medicare claims history. In addition, 4.8% patients who passed away during January 2009 were also not included in the study because health care utilization during the month prior to death is likely to be exceptionally high. The final study sample size consisted of 96,124 Medicare beneficiaries.

Medicare claims for inpatient facilities, outpatient facilities, and physician services (Carrier files) were used to identify elderly individuals with dementia, including AD. This was accomplished by using the International Classification of Diseases Clinical Modification, Ninth Revision (ICD-CM-9) diagnosis codes (290.x, 294.0, 294.1x, 294.2x, 294.8x, 331.0, and 331.82), which are similar to the CMS definition of chronic conditions (Gorina & Kramarow, 2011). We also used ICD-9 diagnosis codes (140.x-209.x, excluding 173.x for nonmelanoma skin cancer) to identify patients with cancer.

This study was approved by the Institutional Review Board of the University of Memphis, and the data request was approved by the Review Committee for CMS. As this study was a secondary data analysis from a nonidentified administrative database, no informed consent was necessary.

Outcome Variables

CMS Inpatient Medpar files were used to identify hospitalizations, readmissions within 30 days of discharge, length of stay, ICU uses, discharge statuses, discharge destinations, and psychiatric hospital stays. Inpatient Medpar files and outpatient claims were used to identify ED visits. We used Carrier files to identify physician visits using Berenson-Eggers Type of Service (BETOS) codes (M1A, M1B) for primary care physicians and psychiatric services (Yu, McBean, & Virnig, 2007). Primary care physicians included general practitioners, family physicians, internists, geriatricians, and nurse practitioners. Psychiatric services delivered by a psychologist or psychiatrist based on the physician specialty were coded accordingly. We also obtained information about neurologist and oncologist visits from the Carrier files. Nursing home stays and hospice uses were identified through Medpar and Hospice files as well. Health care–associated costs were obtained from their respective claim files.

Covariables

The denominator file was used to identify sociodemographic characteristics of Medicare beneficiaries, including gender, race/ethnicity, age, state of residence, Medicare and Medicaid dual eligibility, and vital status. We obtained information about Part D prescription drug coverage status by matching the denominator file to the Part D file. Zip code–level socioeconomic indicators, including the percentage of elderly with less than high school education and below poverty levels, were obtained from the 2010 census data that linked to Medicare claims by zip codes. We created urban and

suburban status based on the zip code data. Charlson's Comorbidity Scores (CCS) were developed by searching for ICD-9 diagnoses in both facility and carrier claims using the Deyo–Romano algorithm (Charlson, Pompei, Ales, & MacKenzie, 1987; Deyo, Cherkin, & Ciol, 1992; Romano, Roos, & Jollis, 1993). The resulting scores were further categorized as 0, 1, 2, 3, or 3+.

Data Analysis

We conducted both descriptive and multivariate analyses. Patients' sociodemographics, zip code characteristics, and comorbidities were compared among the four groups—coexisting dementia and cancer, dementia only, cancer only, and neither dementia nor cancer which serves as the reference group. Student *t* tests and chi-square tests were used to test differences for continuous and categorical variables, respectively. To adjust for covariables, we used logistic regression for binary coded outcome variables (e.g., hospitalization, readmission within 30 days of discharge, ED visit, and ICU use) to obtain the odds ratios (OR). Multiple linear regression was used for continuous outcome variables (e.g., hospital length of stay and natural log–transformed costs). The zero-inflated Poisson regression was used for count variables with a large percentage of zeros (e.g., number of hospitalization, number of emergency visit, number of days in nursing home, and number of physician care visits). The zero-inflated model was appropriate for variables with excess zeros, such as the number of hospitalizations, in which 78% of the sample reported not being hospitalized. The model is essentially a two-stage model in which the probability of being hospitalized was estimated first, followed by the estimation of Poisson regression among people with a nonzero probability of hospitalizations. Statistical significance was assessed using a two-sided test with a significance of $p < .05$. All analyses were performed using SAS© version 9.4 (SAS Inc., Cary, NC).

Results

Patients' sociodemographic and zip code–level characteristics are shown in Table 1. Overall, people with coexisting dementia and cancer were more likely to be female (53%), Caucasian (67%), and between the ages of 75 and 84 years (46%). Similarly, people with dementia only were more likely to be female (73%), Caucasian (66%), and above the age of 85 years (44%). Cancer-only patients were more likely to be males (53%), Caucasians (75%), and in the relatively younger age group between 65 and 74 years (48%). Education level and urban status were similar across all groups, with the majority of all groups having above a high school education and residing in suburban areas. Patients in the dementia-only group had the highest Part D coverage (66%) and higher Medicare and Medicaid dual eligibility (41%) than patients in other groups. Except for breast cancer, which was more likely to be diagnosed in patients with dementia, there was no significant difference in the distribution of cancer diagnoses between patients with and without dementia. Patients with coexisting cancer and dementia were more likely to have comorbidities (81%) identified by CCS than those with dementia only (52%) or cancer only (58%). Patients with coexisting dementia and cancer diagnoses and a dementia-only diagnosis had similar levels of nursing home utilization (49% and 50%, respectively), while those with coexisting diagnoses were more likely to have utilized hospice services (21%). Patients with coexisting diagnoses were also more likely to die within a year (28%).

Table 2 presents patterns of health care utilization among these four categories of patients, and Tables 3 and 4 provide OR and 95% confidence interval (CI) for health care utilization by these groups. All comparisons were against those with neither cancer nor dementia unless specified otherwise. Patients with coexisting dementia and cancer diagnoses had the highest rate of hospitalizations (30.68%, OR = 4.9; 95% CI = [4.3, 5.6]), followed by those with dementia-only (25.96%) and cancer-only diagnoses (19.23%). The average number of hospitalizations for patients with coexisting dementia and cancer diagnoses was 1.47 ($SD = 1.53$, OR = 1.69; 95% CI = [1.59, 1.80]), with dementia patients being hospitalized an average of 0.99 times and cancer-only patients being hospitalized an average of 0.54 times. The average length of stay for these hospitalizations was 7.41 days ($SD = 6.61$) for those with coexisting diagnoses ($p < .01$), 7.00 days ($SD = 8.00$) for those with dementia only, and 6.31 days ($SD = 6.38$) for those with cancer only. Similarly, the percentage of patients with three or more hospitalizations was highest among those with coexisting diagnoses (19.86%, OR = 4.8; 95% CI = [4.1, 5.6]), followed by patients with dementia only (11.92%) and cancer only (5.23%).

Among those with prior hospitalizations, the 30-day readmission rate was also highest among those with coexisting dementia and cancer (23.47%, OR = 2.2; 95% CI = [1.9, 2.7]), followed by those with dementia only (18.91%) and those with cancer only (16.13%), compared with those with neither cancer nor dementia. In contrast to other groups, coexisting dementia and cancer patients spent longer times in the hospital following readmissions, with stays averaging to 8.23 days ($SD = 8.40$) for patients with coexisting diagnoses, 7.60 days for those with dementia only, and 7.70 days for those with cancer only. Like many of the other variables analyzed, the rates of ED visits were also highest among patients with coexisting dementia and cancer diagnoses (74.34%, OR = 4.0; 95% CI = [3.5, 4.6]), followed by those with dementia only (61.91%) and cancer only (33.78%). Furthermore, the rates of ICU use were highest among those with coexisting condition (38.93%, OR = 1.0; 95% CI = [0.9, 1.2]) compared with those with dementia only (35.39%), cancer only (35.55%), and

Table 1. Demographic Characteristics of Elderly Medicare Beneficiaries in the Four Subgroups.

Demographics	Coexisting dementia and cancer (*n* = 1,294), *n* (%)	Dementia only (*n* = 8,533), *n* (%)	Cancer only (*n* = 11,696), *n* (%)	Neither dementia nor cancer (*n* = 74,601), *n* (%)
Gender				
Male	603 (46.60)	2,300 (26.95)	6,242 (53.37)	28,752 (38.54)
Female	691 (53.40)	6,233 (73.05)	5,454 (46.63)	45,849 (61.46)
Race and ethnicity				
Caucasian	866 (66.92)	5,650 (66.21)	8,782 (75.09)	55,197 (73.99)
African American	421 (32.53)	2,820 (33.05)	2,825 (24.15)	18,287 (24.51)
Hispanic	1 (0.08)	12 (0.14)	45 (0.38)	133 (0.18)
Asian	4 (0.31)	18 (0.21)	32 (0.27)	508 (0.68)
Other	2 (0.15)	33 (0.39)	12 (0.10)	476 (0.64)
Age groups				
65-74	208 (16.07)	1,338 (15.68)	5,627 (48.11)	41,700 (55.90)
75-84	600 (46.37)	3,403 (39.88)	4,602 (39.35)	24,016 (32.19)
85+	486 (37.56)	3,792 (44.44)	1,467 (12.54)	8,885 (11.91)
Education (zip level)				
<10% having below high school degree	1,129 (87.25)	7,323 (85.82)	10,485 (89.65)	66,492 (89.13)
>10% having below high school degree	165 (12.75)	1,210 (14.18)	1,211 (10.35)	8,109 (10.87)
Poverty level (zip level)				
<10% below poverty	615 (47.53)	3,953 (46.33)	4,432 (37.89)	29,900 (40.08)
>10% below poverty	679 (52.47)	4,580 (53.67)	7,264 (62.11)	44,701 (59.92)
Location				
Urban	317 (24.50)	2,068 (24.24)	2,525 (21.59)	16,235 (21.76)
Suburb	977 (75.50)	6,465 (75.76)	9,171 (78.41)	58,366 (78.24)
Prescription drug insurance coverage (Part D)				
Yes	780 (60.28)	5,657 (66.30)	5,743 (49.10)	34,721 (46.54)
No	514 (39.72)	2,876 (33.70)	5,953 (50.90)	39,880 (53.46)
Dual eligibility				
Yes	421 (32.53)	3,534 (41.42)	1,153 (9.86)	8,801 (11.80)
No	873 (67.47)	4,999 (58.58)	10,534 (90.14)	65,800 (88.20)
Site of primary cancer				
Leukemia	393 (30.37)	NA	3,870 (33.09)	NA
Prostate	336 (55.72)	NA	3,673 (58.84)	NA
Breast	204 (29.52)	NA	2,488 (45.62)	NA
Lung	137 (10.59)	NA	1,226 (10.48)	NA
Colon	152 (11.75)	NA	1,186 (10.14)	NA
Bladder	87 (6.72)	NA	789 (6.75)	NA
Kidney	44 (3.40)	NA	518 (4.43)	NA
Uterine	20 (2.89)	NA	228 (4.18)	NA
Ovarian	13 (1.88)	NA	193 (3.54)	NA
Other	224 (17.31)	NA	946 (8.09)	NA
Medical comorbidity				
With comorbidity	1,050 (81.14)	4,470 (52.38)	6,818 (58.29)	16,195 (21.71)
Without comorbidity	244 (18.86)	4,063 (47.62)	4,878 (41.71)	58,406 (78.29)
Ever in nursing home				
Yes	628 (48.53)	4,230 (49.57)	529 (4.52)	2,167 (2.90)
No	666 (51.47)	4,303 (50.43)	11,167 (95.48)	72,434 (97.10)
Ever in hospice program				
Yes	267 (20.63)	1,007 (11.80)	644 (5.51)	658 (0.88)
No	1,027 (79.37)	7,526 (88.20)	11,052 (94.49)	73,943 (99.12)
Expired				
Yes	364 (28.13)	1,491 (17.47)	1,059 (9.05)	1,636 (2.19)
No	930 (71.87)	7,042 (82.53)	10,637 (90.95)	72,965 (97.81)

Table 2. Health Care Utilization by Elderly Medicare Beneficiaries in the Four Subgroups.

Health-related outcomes	Coexisting dementia and cancer (*n* = 1,294), *n* (%)	Dementia only (*n* = 8,533), *n* (%)	Cancer only (*n* = 11,696), *n* (%)	Neither dementia nor cancer (*n* = 74,601), *n* (%)
Rate of hospitalizations*	397 (30.68)	2,220 (25.96)	2,249 (19.23)	7,566 (10.11)
Percent with 3 or more hospitalizations*	257 (19.86)	1,017 (11.92)	612 (5.23)	1,208 (1.62)
Number of hospitalizations, *M* (*SD*)	1.47 (1.53)	0.99 (1.37)	0.54 (1.02)	0.22 (0.65)
Among those hospitalized				
Average length of stay (days) for hospitalizations, *M* (*SD*)	7.41 (6.61)	7.00 (8.00)	6.31 (6.38)	5.41 (7.57)
Number of hospital readmissions within 30 days, *M* (*SD*)	0.50 (0.91)	0.40 (0.84)	0.29 (0.70)	0.18 (0.56)
Rate of hospital readmissions within 30 days*	211 (23.47)	820 (18.91)	602 (16.13)	1,078 (9.84)
Percent with 2 or more hospital readmissions within 30 days*	102 (11.35)	387 (8.92)	230 (6.16)	346 (3.16)
Average length of stay (days) for hospital readmissions within 30 days, *M* (*SD*)	8.23 (8.40)	7.60 (6.94)	7.70 (6.87)	6.26 (5.63)
Number of intensive care unit use, *M* (*SD*)	0.52 (0.76)	0.47 (0.76)	0.45 (0.73)	0.40 (0.68)
Rate of intensive care unit use*	350 (38.93)	1,535 (35.39)	1,327 (35.55)	3,597 (32.82)
Percent with ≥3 intensive care use*	23 (1.78)	91 (1.07)	74 (0.63)	154 (0.21)
Number of ED visits, *M* (*SD*)	2.54 (2.56)	2.22 (1.74)	1.75 (1.31)	1.56 (1.18)
Rate of ED visits*	962 (74.34)	5,283 (61.91)	3,951 (33.78)	16,274 (21.28)
Percent with ≥3 ED visits*	348 (36.17)	1,565 (29.62)	692 (17.51)	2,028 (12.46)
Number of physician care visits, *M* (*SD*)	5.75 (6.42)	5.20 (5.76)	3.47 (3.65)	2.66 (3.23)
Percentage with ≥6 physician care visits*	483 (37.33)	2,954 (34.62)	2,379 (20.34)	10,515 (14.09)
Number of days in nursing homes, *M* (*SD*)	50.77 (46.37)	58.21 (57.91)	35.77 (37.55)	40.73 (43.58)
Hospice stay*	267 (20.63)	1,007 (11.80)	644 (5.51)	658 (0.88)
Number of days in hospice, *M* (*SD*)	31.56 (59.49)	39.67 (75.47)	25.47 (46.06)	38.83 (80.42)
Psychiatric outpatient visit	0.95 (3.71)	1.22 (5.74)	0.16 (1.69)	0.14 (0.71)
Neurologist visit	0.49 (1.27)	0.39 (1.10)	0.16 (0.80)	0.12 (0.70)
Oncologist visit	1.01 (2.70)	0.60 (0.69)	1.84 (3.96)	0.08 (0.80)
Discharge location*				
Community	797 (41.66)	3,289 (38.90)	4,678 (73.66)	12,555 (76.16)
Nursing home	658 (34.40)	3,039 (35.94)	473 (7.45)	1,410 (8.55)
Hospice	113 (5.91)	343 (4.06)	324 (5.10)	222 (1.35)
Expired	97 (5.07)	393 (4.65)	337 (5.31)	547 (3.32)
Other	248 (12.96)	1,392 (16.46)	539 (8.49)	1,752 (10.63)
Average Medicare payment (cost in US$)				
Per hospitalization, *M* (*SD*)	9,202.20 (9,278.00)	8,775.04 (9,674.69)	10,286.42 (11,541.85)	9,450.00 (72,046.19)
Per hospital 30-day readmissions, *M* (*SD*)	10,310.22 (10,921.59)	9,767.89 (9,211.75)	11,416.96 (13,036.11)	9,790.40 (9,563.52)

Note. All comparisons were against those with neither cancer nor dementia. *T* test or chi-square test. ED = emergency department.
*$p < .05$, **$p < .0001$.

with neither condition (32.82%). The percentage of those with three or more ICU visits was highest for patients with coexisting diagnoses (1.78%, OR = 1.4; 95% CI = [0.9, 2.3]), followed by dementia-only (1.07%) and cancer-only (0.63%) patients.

Among the comparison groups, all patients with dementia, either alone (35.94%) or in conjunction with cancer (34.40%), were more likely to be discharged to a nursing home facility than the cancer-only patient group. Of the patients who were discharged to nursing homes, patients with coexisting dementia and cancer diagnoses spent an average of 50.77 days (*SD* = 46.37, OR = 1.22; 95% CI = [1.20, 1.24]) compared with those with neither cancer nor dementia, whereas dementia-only patients spent an average of 58.21 days and cancer-only patients spent an average of 35.77

Table 3. Regression Models for Health Care Utilization in the Four Subgroups.

	Adjusted OR[a] (95% CI)		
	Coexisting dementia and cancer	Dementia only	Cancer only
Rate of hospitalization	4.9 [4.3, 5.6]**	3.7 [3.5, 3.9]**	1.3 [1.2, 1.4]**
Percent with 3 or more hospitalizations	4.8 [4.1, 5.6]**	4.1 [3.7, 4.5]**	1.4 [1.2, 1.5]**
Among those hospitalized			
Rate of 30-day readmission	2.2 [1.9, 2.7]**	2.0 [1.8, 2.2]**	1.5 [1.3, 1.6]**
Percent with >2 hospital readmission within 30 days	3.1 [2.5, 4.0]**	2.9 [2.5, 3.4]**	1.6 [1.3, 1.9]**
Rate of intensive care use	1.0 [0.9, 1.2]	1.0 [1.0, 1.1]**	0.9 [0.8, 1.0]
Percent with ≥3 intensive care use	1.4 [0.9, 2.3]	1.5 [1.1, 1.9]**	1.1 [0.8, 1.4]
Rate of ED visits	4.0 [3.5, 4.6]**	3.5 [3.3, 3.7]**	0.9 [0.9, 1.0]
Percent with ≥6 physician care visits	2.7 [2.3, 3.1]**	2.5 [2.3, 2.7]**	1.1 [0.9, 1.2]
Hospice stay	1.6 [1.4, 1.8]**	1.9 [1.8, 2.0]**	0.9 [0.9, 1.0]**

Note. OR = odds ratio; CI = confidence interval; ED = emergency department; SES = socioeconomic status.
[a]Reference group is "Neither dementia nor cancer"; models were adjusted for age, race, sex, state subsidy status (SES indicator), medical comorbidities, and location.
*$p < .05$. **$p < .0001$.

Table 4. Multivariate Poisson Regression Models for Health Care Utilization in the Four Subgroups.

	Adjusted OR[a] (95% CI)		
Variables	Coexisting dementia and cancer	Dementia only	Cancer only
Number of hospitalization	1.69 [1.69, 1.80]**	1.63 [1.56, 1.69]**	1.12 [1.07, 1.17]**
Among those hospitalized			
Number of hospital readmissions within 30 days	1.36 [1.15, 1.60]**	1.43 [1.28, 1.60]**	1.09 [0.96, 1.24]*
Number of intensive care unit use	1.02 [0.90, 1.19]**	1.19 [1.09, 1.32]**	0.95 [0.88, 1.04]**
Number of ED visits	1.42 [1.36, 1.48]**	1.33 [1.30, 1.37]**	1.00 [0.98, 1.03]
Number of physician care visits	1.42 [1.36, 1.48]	1.33 [1.30, 1.37]*	1.00 [0.98, 1.03]**
Number of days in nursing home	1.22 [1.20, 1.24]**	1.40 [1.38, 1.42]**	0.86 [0.85, 0.88]**
Number of days in hospice	0.76 [0.74, 0.78]**	0.91 [0.90, 0.93]	0.57 [0.56, 0.59]**

Note. OR = odds ratio; CI = confidence interval; ED = emergency department; SES = socioeconomic status.
[a]Reference group is "Neither dementia nor cancer"; models were adjusted for age, race, sex, state subsidy status (SES indicator), medical comorbidities, and location.
*$p < .05$. **$p < .0001$.

days. Furthermore, the percentage of patients discharged to hospice care was higher among those diagnosed with coexisting dementia and cancer (5.91%) than it was for dementia-only (4.06%) or cancer-only (5.10%) patients. Of those discharged to hospice care, patients with coexisting diagnoses spent an average of 31.56 days (*SD* = 59.49, OR = 0.76; 95% CI = [0.74, 0.78]), patients with dementia only spent an average of 39.67 days, and cancer-only patients spent an average of 25.47 days.

Compared with those with neither cancer nor dementia, patients with coexisting diagnoses had an average of 5.75 (*SD* = 6.42, OR = 1.42; 95% CI = [1.36, 1.48]) primary care visits, whereas dementia-only patients averaged 5.20 visits and cancer-only patients averaged 3.47 visits. The percentage of having six or more primary care visits was 37.33% (OR = 2.7; 95% CI = [2.3, 3.1]) among coexisting dementia and cancer patients, relative to 34.62% for dementia-only patients, and 20.34% for cancer-only patients.

Finally, the average Medicare payments per hospitalization were US$9,202 for coexisting dementia and cancer patients, US$8,775 for dementia-only patients, and highest, US$10,286, for cancer-only patients. The same trend was seen for the average Medicare payment for 30-day readmission, but payments were even higher. For 30-day readmissions, average Medicare payments were US$10,310 per coexisting dementia and cancer patient,

US$9,768 for dementia-only patients, and US$11,417 for cancer-only patients.

Discussion

In the current study, we found that elderly patients with coexisting cancer and dementia diagnoses had the highest health care utilization compared with other groups in the study, suggesting some synergistic and detrimental effects of having both diseases, particularly the higher rates of hospitalizations, readmission within 30 days of discharge, and ED visits. Cancer patients demand more health care services than noncancer patients due to the frequent follow-up visits required for continuing cancer treatment, dealing with treatment complications, and monitoring potential cancer recurrence (Cascioli et al., 2008). In addition, cancer patients have higher comorbidities than other patients, which may require more primary care and specialist visits (Smith et al., 2008). Patients with dementia are generally older and frailer than those without dementia (Van Iersel et al., 2006). Therefore, their health care needs are expected to be relatively higher. Our findings on the synergistic effect of both diseases have demonstrated that there are significant unmet health service needs among patients with coexisting conditions (Bowd & Loos, 1996).

The complexity involved in both dementia and cancer care requires much attention from physicians during clinical visits. Competing demands among the dementia care, the cancer care, and care for comorbidities (Jaen, Stange, & Nutting, 1994) could be one of the main reasons for the higher use of health care services in this group. Also, uncoordinated care may be equally problematic among patients with both diseases (Bremner et al., 2015; Seow et al., 2014). Due to financial disincentives, patient–physician contact in primary care usually lasts only about 15 min, making it impossible for physicians to address patients' multiple health needs. For patients with coexisting dementia and cancer, communication between physicians and patients is further hindered by patient's impaired cognitive abilities and often relies on informal caregivers (Bradford et al., 2009; Hildreth & Church, 2015). Many nonurgent but critical medical issues are neglected during these primary care visits, resulting in frequent ED visits or hospitalizations.

Furthermore, care coordination for comorbid patients is suboptimal due to the complicated referral process and fragmented health care system (Hing, Decker, & Jamoom, 2015; Parekh & Barton, 2010; Schubert et al., 2008). Even though all elderly patients have Medicare insurance, many health care providers are not willing to accept new Medicare patients, especially those in Medicaid (dual eligible), partly due to financial reasons and limited time slots, creating further barriers for elderly to seek adequate care (Fitzpatrick, Powe, Cooper, Ives, & Robbins, 2004). Specialists such as geriatricians, oncologists, and geriatric oncologists should take a more proactive role in the coordination of care for these patients, as they could be a better position at prioritizing the health needs of elderly patients with coexisting dementia and cancer. In addition, care coordination after hospitalization may be lacking because many of these elderly patients with dementia are often discharged with incomplete recovery (Cummings, 1999). Although they are often discharged to skilled nursing facility or other long-term care facilities, not all medical records are successfully transferred to the care facilities due to different electronic medical record systems, unrelated institutions that lack formal communications, and other structural barriers (Naylor & Keating, 2008). All these factors could lead to higher health care utilization.

Previous studies have shown that health care utilization increases substantially for cancer patients during the end of life (Chastek et al., 2012; Cox, 1993; Edelman, Kuhn, Fulton, & Kyrouac, 2006; Zhang et al., 2009). Another study also concluded that health care cost increased significantly during end-of-life care and higher costs were associated with poor quality of care during the last month of life (Zhang et al., 2009). We found that health care utilization was higher even before the end of life for patients with cancer, especially for patients with coexisting cancer and dementia. Similarly, we found that hospitalizations and ED visits were in general higher among dementia patients, not only during the end of life. Many of these hospitalizations and visits could be avoided if these patients had received timely and coordinated care during their regular physician visits.

Our study found that patients with only cancer had the highest hospitalization cost compared with other groups, whereas those with coexisting cancer and dementia had the lowest per hospitalization cost. Given that patients with coexisting cancer and dementia are likely to have worse health conditions, patients and family members may opt for less aggressive or palliative treatment, resulting in relatively lower cost. In addition, the higher cost in cancer-only patients may hide the variation of cost by cancer types and cancer stage. For example, some elderly patients with prostate cancer may elect watchful waiting, whereas patients with a Stage III colorectal cancer may incur significant higher cost due to expensive chemotherapy and radiation therapy. However, our administrative data were not able to discern this information.

A large percentage of urban residents in the Mid-South are African Americans and of lower socioeconomic status. This segment of the population is also more likely to be concentrated in zip codes with limited access to health care services. It is well known that elderly people with low socioeconomic status have difficulties getting transportation to visit health care providers, which leads to inadequate but complicated office visits when they do have a chance to see a physician (Fitzpatrick et al., 2004). As discussed earlier, competing demands

for physician's time can result in many health problems being neglected during a medical visit. In addition, disparities in health care access and utilization, including for cancer and dementia care, may aggravate already poor health outcomes among minority populations.

Strengths and Limitations

This study has several strengths. First, we used 100% Medicare claims in this area to obtain a complete profile of health care utilization among the elderly with these conditions. This has advantages over typical survey research because surveys are often unable to reach many low-income and frail elderly patients. Second, we included comprehensive indicators of health care utilization to explore the disparity patterns among certain categories of diseases that were not available in other studies. However, our study also has a few limitations. The major limitation is that Medicare claims are administrative data. Aside from procedures and diagnoses, no clinical information, such as disease severity, symptoms of cancer and dementia, and other health issues, is available. Thus, we were not able to fully account for patients' health statuses. In addition, patients with more advanced cancer stages may have higher health care utilizations. Dementia, cancer, and comorbidities were identified through ICD-9 diagnosis on the claims, which may underestimate the true prevalence of some conditions or overestimate others. Although sophisticated algorithms are available to account for these discrepancies, they still suffer from issues such as underestimating the prevalence (Gorina & Kramarow, 2011; Newcomer, Clay, Luxenberg, & Miller, 1999). Finally, our study sample and analyses were limited to a specific region. However, these findings should be generally applicable to other regions with similar demographics and, to a large extent, reflect the national issues as well.

Conclusion

We found that patients with coexisting cancer and dementia diagnoses had higher rates of health care utilization, in particular higher hospitalization, readmission within 30 days of discharge, and ED visits, thus leading to an overall higher health care costs. The increased utilization of health care services among patients with coexisting dementia and cancer compared with patients with either disease alone suggests that care plan for such complex patients should be improved; and a tailored health care protocol should be developed. Our findings point to a critical need for implementing a comprehensive and coordinated care plan for this patient population, and call for geriatricians to take a proactive role in caring for these patients.

Declaration of Conflicting Interests

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References

Alzheimer's Association. (2014). 2014 Alzheimer's disease facts and figures. *Alzheimer's & Dementia*, *10*, e47-e92.

Bowd, A. D., & Loos, C. H. (1996). Needs, morale and coping strategies of caregivers for persons with Alzheimer's disease in isolated communities in Canada. *American Journal of Alzheimer's Disease & Other Dementias*, *11*(3), 32-39.

Bradford, A., Kunik, M. E., Schulz, P., Williams, S. P., & Singh, H. (2009). Missed and delayed diagnosis of dementia in primary care: Prevalence and contributing factors. *Alzheimer Disease & Associated Disorders*, *23*, 306-314. doi:10.1097/WAD.0b013e3181a6bebc

Bremner, K. E., Krahn, M. D., Warren, J. L., Hoch, J. S., Barrett, M. J., Liu, N., . . . Yabroff, K. R. (2015). An international comparison of costs of end-of-life care for advanced lung cancer patients using health administrative data. *Palliative Medicine*, *29*, 918-928. doi:10.1177/0269216315596505

Cascioli, T., Al-Madfai, H., Oborne, P., & Phelps, S. (2008). An evaluation of the needs and service usage of family carers of people with dementia. *Quality in Ageing and Older Adults*, *9*(2), 18-27.

Census, Centers for Disease Control and Prevention, National Center for Health Statistics. (2013). *Overall cancer death rate—Population estimates for census 2000 and 2010*. Retrieved from http://www.healthindicators.gov/Indicators/Cancer-deaths-total-per-100000_486/Profile/ClassicData

Charlson, M. E., Pompei, P., Ales, K. L., & MacKenzie, C. R. (1987). A new method of classifying prognostic comorbidity in longitudinal studies: Development and validation. *Journal of Chronic Diseases*, *40*, 373-383.

Chastek, B., Harley, C., Kallich, J., Newcomer, L., Paoli, C. J., & Teitelbaum, A. H. (2012). Health care costs for patients with cancer at the end of life. *Journal of Oncology Practice*, *8*(6), 75s-80s. doi:10.1200/JOP.2011.000469

Cox, C. (1993). Service needs and interests: A comparison of African American and white caregivers seeking Alzheimer assistance. *American Journal of Alzheimer's Disease & Other Dementias*, *8*(3), 33-40.

Cummings, S. M. (1999). Adequacy of discharge plans and rehospitalization among hospitalized dementia patients. *Health & Social Work*, *24*, 249-259.

Deyo, R. A., Cherkin, D. C., & Ciol, M. A. (1992). Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. *Journal of Clinical Epidemiology*, *45*, 613-619.

Edelman, P., Kuhn, D., Fulton, B. R., & Kyrouac, G. A. (2006). Information and service needs of persons with Alzheimer's disease and their family caregivers living in rural communities. *American Journal of Alzheimer's Disease & Other Dementias*, *21*, 226-233.

Fargo, K., & Bleiler, L. (2014). Alzheimer's association report. *Alzheimer's & Dementia*, *10*, e47-e92.

Fitzpatrick, A. L., Powe, N. R., Cooper, L. S., Ives, D. G., & Robbins, J. A. (2004). Barriers to health care access among the elderly and who perceives them. *American Journal of Public Health*, *94*, 1788-1794.

Gorina, Y., & Kramarow, E. A. (2011). Identifying chronic conditions in Medicare claims data: Evaluating the chronic condition data warehouse algorithm. *Health Services Research*, *46*, 1610-1627.

Gornick, M. E., Eggers, P. W., Reilly, T. W., Mentnech, R. M., Fitterman, L. K., Kucken, L. E., & Vladeck, B. C. (1996). Effects of race and income on mortality and use of services among Medicare beneficiaries. *New England Journal of Medicine*, *335*, 791-799.

Hewitt, M., Rowland, J. H., & Yancik, R. (2003). Cancer survivors in the United States: Age, health, and disability. *The Journals of Gerontology, Series. A: Biological Sciences & Medical Sciences*, *58*, M82-M91.

Hildreth, K. L., & Church, S. (2015). Evaluation and management of the elderly patient presenting with cognitive complaints. *Medical Clinics of North America*, *99*, 311-335.

Hing, E., Decker, S., & Jamoom, E. (2015). Acceptance of new patients with public and private insurance by office-based physicians: United States, 2013. *NCHS Data Brief*, *195*, 1-8.

Jaen, C. R., Stange, K. C., & Nutting, P. A. (1994). Competing demands of primary care: A model for the delivery of clinical preventive services. *The Journal of Family Practice*, *38*, 166-171.

Kales, H. C., Blow, F. C., Copeland, L. A., Bingham, R. C., Kammerer, E. E., & Mellow, A. M. (1999). Health care utilization by older patients with coexisting dementia and depression. *American Journal of Psychiatry*, *156*, 550-556.

Kunik, M. E., Snow, A. L., Molinari, V. A., Menke, T. J., Souchek, J., Sullivan, G., & Ashton, C. M. (2003). Health care utilization in dementia patients with psychiatric comorbidity. *The Gerontologist*, *43*, 86-91.

Maslow, K. (2006). *Early onset dementia: A national challenge, a future crisis*. Washington, DC: Alzheimer's Association.

Morden, N. E., Chang, C. H., Jacobson, J. O., Berke, E. M., Bynum, J. P., Murray, K. M., & Goodman, D. C. (2012). End-of-life care for Medicare beneficiaries with cancer is highly intensive overall and varies widely. *Health Affairs*, *31*, 786-796. doi:10.1377/hlthaff.2011.0650

Naylor, M., & Keating, S. A. (2008). Transitional care. *The American Journal of Nursing, 108*(Suppl. 9), 58-63. doi:10.1097/01.NAJ.0000336420.34946.3a

Newcomer, R., Clay, T., Luxenberg, J. S., & Miller, R. H. (1999). Misclassification and selection bias when identifying Alzheimer's disease solely from Medicare claims records. *Journal of the American Geriatrics Society*, *47*, 215-219.

Parekh, A. K., & Barton, M. B. (2010). The challenge of multiple comorbidity for the US health care system. *Journal of the American Medical Association*, *303*, 1303-1304.

Prince, M. J., Wu, F., Guo, Y., Robledo, L. M. G., O'Donnell, M., Sullivan, R., & Yusuf, S. (2015). The burden of disease in older people and implications for health policy and practice. *The Lancet*, *385*, 549-562.

Robinson, K. M., Buckwalter, K. C., & Reed, D. (2005). Predictors of use of services among dementia caregivers. *Western Journal of Nursing Research*, *27*, 126-140. doi:10.1177/0193945904272453

Romano, P. S., Roos, L. L., & Jollis, J. G. (1993). Presentation adapting a clinical comorbidity index for use with ICD-9-CM administrative data: Differing perspectives. *Journal of Clinical Epidemiology*, *46*, 1075-1079.

Schubert, C. C., Boustani, M., Callahan, C. M., Perkins, A. J., Hui, S., & Hendrie, H. C. (2008). Acute care utilization by dementia caregivers within urban primary care practices. *Journal of General Internal Medicine*, *23*, 1736-1740.

Seow, H., Brazil, K., Sussman, J., Pereira, J., Marshall, D., Austin, P. C., . . .Barbera, L. (2014). Impact of community based, specialist palliative care teams on hospitalisations and emergency department visits late in life and hospital deaths: A pooled analysis. *British Medical Journal, 348*, Article g3496.

Smith, A. W., Reeve, B. B., Bellizzi, K. M., Harlan, L. C., Klabunde, C. N., Amsellem, M., . . . Hays, R. D. (2008). Cancer, comorbidities, and health-related quality of life of older adults. *Health Care Financing Review*, *29*(4), 41-56.

Stirling, C., Andrews, S., Croft, T., Vickers, J., Turner, P., & Robinson, A. (2010). Measuring dementia carers' unmet need for services—An exploratory mixed method study. *BMC Health Services Research*, *10*, Article 122.

Teno, J. M., Gozalo, P. L., Bynum, J. P., Leland, N. E., Miller, S. C., Morden, N. E., . . . Mor, V. (2013). Change in end-of-life care for Medicare beneficiaries: Site of death, place of care, and health care transitions in 2000, 2005, and 2009. *Journal of the American Medical Association*, *309*, 470-477.

Van Iersel, M. B., Verbeek, A. L., Bloem, B. R., Munneke, M., Esselink, R. A., & Rikkert, M. G. (2006). Frail elderly patients with dementia go too fast. *Journal of Neurology, Neurosurgery, and Psychiatry*, *77*, 874-876. doi:10.1136/jnnp.2005.084418

Weuve, J., Hebert, L. E., Scherr, P. A., & Evans, D. A. (2014). Deaths in the United States among persons with Alzheimer's disease (2010-2050). *Alzheimer's & Dementia*, *10*, e40-e46.

Yu, X., McBean, A. M., & Virnig, B. A. (2007). Physician visits, patient comorbidities, and mammography use among elderly colorectal cancer survivors. *Journal of Cancer Survivorship*, *1*, 275-282.

Zhang, B., Wright, A. A., Huskamp, H. A., Nilsson, M. E., Maciejewski, M. L., Earle, C. C., . . . Prigerson, H. G. (2009). Health care costs in the last week of life: Associations with end-of-life conversations. *Archives of Internal Medicine*, *169*, 480-488.