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Comparison of Costs of Care between Patients with Alzheimer's Disease and Dementia with Lewy Bodies

Carolyn W. Zhu, PhD^{1,2}, Nikolaos Scarmeas, MD, MSc^{3,4}, Karina Stavitsky, BS^{3,4}, Marilyn Albert, PhD⁵, Jason Brandt, PhD⁵, Deborah Blacker, MD, ScD⁶, Mary Sano, PhD^{1,7}, and Yaakov Stern, PhD^{3,4}

1 *This work is from the Geriatric Research, Education, and Clinical Center (GRECC) and Program of Research on Serious Physical and Mental Illness, Targeted Research Enhancement Program (TREP), James J. Peters VA Medical Center, Bronx NY*

2 *Brookdale Department of Geriatrics, Mount Sinai School of Medicine, New York, NY*

3 *Cognitive Neuroscience Division of the Taub Institute for Research in Alzheimer's Disease and the Aging Brain, New York, NY*

4 *Gertrude H. Sergievsky Center and the Department of Neurology, Columbia University Medical Center, New York, NY*

5 *Department of Psychiatry and Behavioral Sciences, Johns Hopkins University, Baltimore, MD*

6 *Department of Psychiatry, Massachusetts General Hospital, Harvard Medical School, Boston, MA*

7 *Department of Psychiatry, Mount Sinai School of Medicine*

Abstract

Objectives—To compare total costs of care and its major components for community-living patients with Alzheimer's disease (AD) or dementia with Lewy bodies (DLB).

Design—Cross-sectional analysis of baseline data from the Predictors II Study.

Setting—Three university-based AD centers in the US.

Participants—Community-living patients clinically-diagnosed with probable AD (n=170) or DLB (n=25) with a modified Mini-Mental State examination (mMMS) score \geq 30, equivalent to a score of approximately \geq 16 on the Folstein Mini-Mental State Examination (MMSE).

Measurements—Patient and informant reported on patients' use of direct medical care, direct non-medical care, and informal care. Patients' clinical and demographic characteristics included global cognitive status (measured by MMSE), functional capacity (measured by Blessed Dementia Rating Scale, BDRS), psychotic symptoms, behavioral problems, depressive symptoms, extrapyramidal signs, comorbidities, age, and sex. Costs were compared using covariate matching methods.

Results—Unadjusted total costs and direct medical costs were not significantly different between AD and DLB patients. Compared to AD patients, unadjusted indirect costs were significantly higher

Address Correspondence To: Carolyn W. Zhu, Geriatric Research, Education, and Clinical Center (GRECC), James J. Peters VA Medical Center, 130 West Kingsbridge Road, Bronx NY, 10468. Email: carolyn.zhu@msm.edu, Telephone: 718-584-9000 ext 3810, Fax: 718-741-4211.

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and unadjusted direct non-medical costs were significantly lower among DLB patients. After adjusting for age, sex, cognitive and functional status, differences in all cost components between DLB and AD patients were no longer statistically significant.

Conclusions—Apparent cost differences were largely attributed to differences in patients' cognitive and functional status. However, the small sample size for DLB patients may have limited power to detect statistically significant differences in costs of care between these groups.

Keywords

dementia; Alzheimer's disease; dementia with Lewy bodies; cost of care; economics

INTRODUCTION

The high costs of Alzheimer's disease (AD), the most common cause of dementia in older adults, are well documented. Dementia with Lewy bodies (DLB), however, has only recently been recognized as the second most common form of dementing illnesses.¹ While a number of studies have compared clinical and pathological characteristics of patients with DLB and those with AD, studies on costs of care for patients with dementing illnesses have focused almost exclusively on AD, with limited effort to examine costs of care for patients with DLB.^{2, 3} In this study, we aim to compare total costs of care and its major components for community-living patients with a clinical diagnosis of DLB to those with a clinical diagnosis of AD. Our aim is to shed light on the possible differences in costs of care between patients with DLB and AD who live in the community.

METHODS

Sample

The sample used in this study is drawn from the Predictors II cohort, which began recruitment in 1998, and consists of 223 AD patients from three sites: Columbia University Medical Center, Johns Hopkins School of Medicine, and Massachusetts General Hospital. Inclusion and exclusion criteria were fully described previously.^{4, 5} Briefly, all patients were diagnosed in a consensus conference with at least two faculty physicians specializing in dementia and one faculty neuropsychologist. The conference is part of the function of each site's Alzheimer's Disease Research Center (ADRC). Subjects brought in this conference were patients seen by neurologists at both outpatient and inpatient settings. Diagnoses assigned were not limited to AD but included all other dementia types such as DLB, frontotemporal dementia, vascular dementia, mixed dementia, as well as non-dementia diagnoses such as mild cognitive impairment, depression, anxiety and other diagnoses. At the onset of the Predictors II study we began specifically enrolling not only AD patients but also DLB patients. Patients with AD were diagnosed according to the NINDS-ADRDA criteria for probable AD⁶ and patients with DLB were diagnosed according to the 1996 consensus guidelines for DLB⁷. At entry, all patients had a modified Mini-Mental State examination (mMMS) score ≥ 30 , equivalent to a score of approximately ≥ 16 on the Folstein Mini-Mental State Examination (MMSE).^{8, 9} Because the focus of this study was on community-living patients, we excluded 28 patients who did not live at home. Our analysis sample consists of baseline data from 170 patients with probable AD and 25 patients with DLB.

Measures

Patient characteristics and cost outcomes used in this study are briefly described below. Details of the measures and the costing methods used were reported in earlier studies.^{10, 11}

Clinical and Demographic Characteristics—Disease progression was characterized by transition from milder stages of dementia to more severe stages, measured by MMSE.⁸ Lower MMSE scores indicate worse cognitive status. Blessed Dementia Rating Scale (BDRS) Parts I (Instrumental Activities of Daily living, IADLs) and II (Basic Activities of Daily living, BADLs) was used to assess patients' functional capacity.¹² Higher BDRS scores indicate worse functional status. Columbia University Scale for Psychopathology in Alzheimer's Disease (CUSPAD), a semi-structured interview administered by a physician or a trained research technician, was used to measure patients' psychotic, behavioral, and depressive symptoms.^{13, 14} We used the Unified Parkinson's Disease Rating Scale (UPDRS) to measure the extrapyramidal signs (EPS).¹⁴ Patients' medical histories were used to construct a modified version of the Charlson index of comorbidity.^{15, 16} Patients' age, ethnicity, sex, highest level of education, and marital status also were recorded.

Outcomes—Patients and informants reported utilization of seven domains of direct medical and non-medical care. Direct medical care included hospitalization, outpatient treatment and procedures, assistive devices, and medications. Direct non-medical care included home health aides, respite care, and adult day care. We converted physical quantities of resource use into costs using prices obtained from public databases as described in detail in earlier reports.^{10, 11} All cost values were adjusted to constant 2004 dollars using the medical care component of the Consumer Price Index.¹⁷ Informal caregiving time for basic and instrumental activities of daily living was asked of up to three caregivers. BADLs included eating, dressing, and personal care. IADLs included shopping, chores, personal business, and transportation. We summed hours reported for each task to obtain an estimate of total caregiving hours each patient received. We used the national average hourly earning for all private industries for each year as the hourly wage rate to estimate unpaid caregiving costs.¹⁷

Analysis

In this study, we use covariate matching methods to estimate differences in costs of care for patients with a diagnosis of DLB and those with a diagnosis of AD. Covariate matching methods stem from the potential outcomes framework described by Neyman.¹⁸ Under this framework, each individual has two possible outcomes Y (e.g., costs of care): $Y=Y_0$ if the individual has AD, and $Y=Y_1$ if the individual has DLB. If both outcomes could be observed simultaneously in the same patient, differences in costs of care if the individual has DLB and costs of care if the individual has AD would simply be $Y_1 - Y_0$. However, Y_0 and Y_1 are never observed simultaneously in the same patient; one of the two outcomes is always missing. In this case, differences in the outcomes (e.g., costs of care) for the two patient groups may be due to differences in characteristics not intrinsic to the diseases but which nevertheless affect the outcome (e.g., possible differences in age between the DLB patients and AD patients recruited in the study). One way to overcome this difficulty of not observing both outcomes simultaneously is by closely matching individuals in the two groups by characteristics (covariates) that affect the outcomes, and imputing the value of the missing outcome. Through this matching, differences in outcomes due to differences in these characteristics can be reduced or eliminated. In this analysis, matching was conducted by calculating a distance score, computed as the weighted sum of the squared differences in the covariates, between each possible pair of AD and DLB patients, and selecting the patients with the lowest distance scores. The matching procedure was performed using Stata's *nmatch* function.¹⁹

To ensure that differences in the cost outcomes could be attributed to differences intrinsic to the diseases (e.g., higher percentages of hallucination in DLB patients) and not to global levels of dementia, patients were matched on their MMSE scores. Because our earlier work showed that functional status was importantly associated with disease costs,^{10, 11} patients also were

matched on their BDRS scores. Because costs of care may be different by sex and age,²⁰ we matched the patients on these two variables as well.

RESULTS

Table 1 presents demographic and clinical characteristics for AD and DLB patients in this sample. There were no differences between patients with AD and DLB in age, race, education, and marital status, but there were significantly more men in the DLB group. Although there were slightly more spouse caregivers of DLB patients, differences in caregiver-patient relationships were not statistically significant between AD and DLB patients. Clinical Dementia Rating (CDR)²¹ was not significantly different between AD and DLB patients. DLB patients had significantly worse BDRS scores (5.9 vs 3.4, $p=0.001$) but only slightly worse MMSE scores than AD patients (20.5 vs 22.1, $p=0.07$). As expected from their diagnoses,⁷ DLB patients were more likely to have psychotic symptoms (60% vs 31.2%, $p=0.005$) and behavioral problems (64.0% vs 42.4%, $p=0.04$). Presence of depressive symptoms and EPS were not significantly different between the two patient groups.

Table 2 presents total and component costs of care for AD and DLB patients. Average annual costs for caring for DLB patients (\$35,143) were higher than that for AD patients (\$25,129), however, the differences were not statistically significant. Compared to AD patients, direct non-medical costs were significantly lower (\$947 vs \$1,478) and indirect costs were significantly higher (\$23,036 vs \$17,136) among DLB patients.

Table 3 present unadjusted and adjusted differences in costs of care for AD and DLB patients. There were no significant differences in unadjusted total costs and direct medical costs between AD and DLB patients, however, compared to AD patients, unadjusted indirect costs were significantly higher and unadjusted direct non-medical costs were significantly lower among DLB patients. After matching by age and sex, between-group differences for indirect costs and direct non-medical costs remained. After additional matching by MMSE, between-group differences for indirect costs was only marginally significant and for direct non-medical costs it was no longer statistically significant. After additional matching by functional status, between-group differences in costs of care between DLB and AD patients were no longer statistically significant.

DISCUSSION

In this study, we compared baseline costs of care for patients with a clinical diagnosis of DLB to those with a clinical diagnosis of AD after matching on demographic characteristics, severity of cognitive impairment, and functional status. Results suggest that costs of care for patients with DLB are higher than costs of care for patients with AD. However, after patients were matched on cognitive and functional status, while the magnitude of the cost differences remains large, they were no longer statistically significant.

To the best of our knowledge, only two studies to date have compared costs for DLB and AD patients;^{2, 3} both reported higher total costs for DLB patients. Several differences between our study and the earlier studies should be noted. First, patients in our study were somewhat younger (mean age for DLB and AD patients were 74 and 75, respectively), as compared to the earlier studies (mean age for DLB and AD patients were 77 and 78 in Bostrom and colleagues and 80 and 75 in Murman and colleagues, respectively). Second, patients included in our study were at earlier stages of dementia: average MMSE score for our sample of DLB patients were 20.5 as compared to 15.2 and 17.2 in earlier studies and average MMSE scores for our sample of AD patients were 22.1 as compared to 17.0 and 16.9 in earlier studies. More importantly, our study only included patients living in the community. Murman and colleagues

included patients in various living arrangements (e.g., community, nursing homes, assisted living facilities, foster care homes) and reported that differences in costs were mainly due to differences in utilization of long-term care facilities between these two groups of patients. Because the study did not separately report costs of care for patients living in the community and those living in institutional settings, it is unclear whether costs of care for patients with DLB and AD differ for those who live in the community.

The main limitation of this study, as is often the case with studies that include DLB patients, is that the sample size for DLB patients used in this study was small. However, our sample size is comparable to the only earlier study comparing costs for DLB and AD patients.^{2, 3} Using the average total costs for DLB and AD patients reported in this study, we computed that our sample size yields 52% power to estimate the difference in total costs (assuming two-tailed tests at significance level of 0.05). To achieve 80% power in detecting differences in total costs between DLB and AD patients, a sample size of 80 patients in each group is needed. Because of the difficulty in assembling a large number of DLB patients according to strict criteria, our study is useful as a first attempt at estimating differences in costs of care for community living DLB and AD patients.

It should also be noted that results reported in this study are from a cross-sectional analysis. Possible differences in rates of decline between these two groups of patients may lead to differences in disease costs over time. Studies show that patients with DLB have worse outcomes than patients with AD, including more rapid cognitive decline, increased risks of falls and fractures, and increased risk of mortality. Together, these studies suggest that over time, cost increases for DLB patients may be more pronounced than those for AD patients. It is worth noting that differential rates of decline are consistent with the cross-sectional findings of large but statistically insignificant differences in costs between these two groups when patients are at earlier stages of dementia reported in our study and higher costs among DLB patients than AD patients in later stages of the disease reported in earlier DLB cost studies.^{2, 3} Given the substantial increase in costs of care among AD patients over time reported in the literature,^{10, 11} costs of care for DLB patients may assume greater proportions of total costs of care in the future. Future work using longitudinal data is necessary to examine differences in longitudinal trajectories of disease costs for these patients.

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Author Contributions:

Carolyn W. Zhu: conception and design, analysis and interpretation of data, drafting of manuscript, critical revision of manuscript for important intellectual content. Nikolaos Scarmeas and Yaakov Stern: conception and design, acquisition of data, critical revision of manuscript for important intellectual content. Karina Stavitsky, Marilyn Albert, Jason Brandt, Deborah Blacker, and Mary Sano: acquisition of patients and data, critical revision of manuscript for important intellectual content.

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Table 1
Demographic and Clinical Characteristics of AD and DLB Patients.

Variables	DLB (n=25)	AD (n=170)
Demographic Characteristics		
Age, means years (sd)	73.5 (8.0)	75.0 (7.6)
Women (%) ^{***}	24.0	55.3
Race (%)		
White	100.0	95.3
Other race	0.0	4.7
Years of schooling, mean (sd)	14.5 (3.5)	14.5 (3.3)
Marital Status (%)		
Married	76.0	68.2
Widowed	20.0	24.7
Never married/divorced/separated	4.0	7.0
Caregiver-patient relationship (%)		
Spouse	66.7	60.0
Adult children	33.3	30.3
Other family members and friends	0.0	9.7
Clinical Characteristics		
MMSE, mean (sd) [*]	20.5 (4.3)	22.1 (3.8)
BDRS total, mean (sd) ^{***}	5.9 (3.6)	3.4 (2.2)
Presence of psychotic symptoms (%) ^{***}	60.0	31.2
Presence of behavioral problems (%) ^{**}	64.0	42.4
Presence of depressive symptoms (%)	32.0	19.4
Presence of extrapyramidal signs (%)	14.3	12.0
Charlson comorbidity index, mean (sd)	0.6 (0.9)	0.7 (0.9)
Years since symptoms, mean (sd)	4.6 (2.4)	4.2 (2.2)

* ,** ,*** p<0.10, 0.05, 0.01.

MMSE=Mini-Mental State Examination (range=0–30); BDRS=Blessed Dementia Rating Scale (range=0–17).

Table 2

Total and Component Costs of AD and DLB Patients.

Variables	DLB (n=25)	AD (n=170)
Total	35,143	25,129
Direct Medical Cost	12,081	8,027
Medications	3,185	2,900
Assistive Devices **	241	135
Outpatient Tests and Treatment	1,789	1,894
Hospitalizations	6,937	3,096
Direct Non-medical Cost ** *	947	1,478
Home Health Care* **	739	1,262
Respite Care	166	162
Adult Day Care	71	85
Indirect Cost **	23,036	17,136

** ,*** p<0.05, 0.01.

Table 3
Adjusted and Unadjusted Cost Differences for DLB and AD patients.

Variables	Unadjusted Cost Differences	Adjusted Cost Differences		
		1	2	3
Total cost	10,015	8,543	1,763	1,600
Direct medical cost	4,055	1,893	1,512	1,067
Direct non-medical cost	-531 ^{***}	-1,264 ^{**}	-886	-777
Indirect cost	5,901 ^{**}	10,287 ^{**}	6,617 [*]	5,038

^{*}, ^{**}, ^{***} p<0.10, 0.05, 0.01.

¹ adjusted by age and sex,

² adjusted by age, sex, and Mini-Mental State Examination (MMSE, range=0–30),

³ adjusted by age, sex, MMSE, and Blessed Dementia Rating Scale (BRSD, range=0–17).