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Baseline Differences and Trajectories of Change for Deceased, Placed, and Community Residing Alzheimer's Disease Patients

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Abstract

This study identifies predictors of placement or death in a large ethnically/racially diverse sample of moderately impaired Alzheimer's disease (AD) patients residing in the community. Patients and caregivers were followed for 18 months with four assessments at six month intervals. Multinomial regression was used to identify caregiver and patient baseline characteristics and changes over time as predictors of patient placement in a long-term care facility (n=180), patient death (not preceded by placement, n=187), or remaining in the community at home (n=583). Our findings reveal important differences between death and placement when compared to continued home care. Both death and placement are significantly associated with increased ADL limitations (Exp(B)=1.285, p=.017; Exp(B)=0.1.202, p= 0.038, for death and placement, compared to home care, respectively), having a non-spouse caregiver (Exp(B)=0.325, p=0.026; Exp(B)=0.386, p=0.050, for death and placement respectively), and being a male patient (Exp(B)=0.367, p=.003; Exp(B)=0.439, p= 0.016, for death and placement, respectively). Death and placement differ with respect to health service use, race, and group assignment. Whites are more likely to be placed rather than remain at home when compared to African American (Exp(B)=.520, p=.028) or Hispanic (Exp(B)=0.338, p<.005) patients, whereas being assigned to the control condition as opposed to active treatment (Exp(B)=.515, p=.008), having a male caregiver (Exp(B)=0.482, p=.043), and increasing patient health service use (Exp(B)=1.105, p=.015) are associated with increased mortality. Placed and deceased patients are further differentiated from each other by the fact that caregivers of placed patients report an increase in being bothered by memory problems when compared to caregivers of deceased patients (Exp(B) =.577, p=.006). Patients who are placed, die, or remain at home have unique trajectories which vary as a function of the reference group used for comparison. Increasing bother with memory problems is uniquely associated with placement relative to death while increasing health service use in the form of physician contacts and nurses visits is uniquely associated with death among community residing AD patients.

Keywords

Alzheimer's disease; institutionalization; death; caregiving; community care

INTRODUCTION

Institutional placement and death of patients with Alzheimer's disease (AD) are sentinel events in the progression of this illness. Numerous studies report predictors of institutional placement¹⁻⁶ or death⁴⁻¹⁰ in community residing AD populations. Factors such as level of functional impairment of the patient, ethnicity/race (White as opposed to African American or Hispanic), living alone, and caregiver burden are consistently associated with patient institutional placement, while factors such as level of cognitive impairment, co-morbidities, age, and institutional residence are associated with patient mortality. Overall, this literature has enhanced our understanding of predictors of placement and death both within AD patient groups and between AD and non-AD populations. However, few of these studies have simultaneously examined all three outcomes (placement, death, and continued home-based care) and include both caregiver and AD patient variables in predictive models.

Understanding factors influencing the trajectory of dementing disorders in a caregiving context is critical to both clinicians and caregivers who may benefit from being able to plan for and understand important patient transitions. Brodaty et al.⁴, who made an important early contribution to the literature in this area, showed that both baseline status and rates of change in patient and caregiver characteristics are important predictors of placement and death. Dementia severity and rate of patient deterioration were important predictors of nursing home placement, and rate of patient decline was also predictive of death. Increased caregiver psychological distress was related to patient placement and death, while caregiver training in home management of dementia helped delay both outcomes. Similar results were reported by McClendon et al.⁶, who found that patient baseline levels and rates of change in Activities of Daily Living (ADL) and behavioral problems were related to patient mortality. They also found that caregiver coping style is an important predictor of patient survival such that use of wishful-intrapsychic coping (WIC) strategies (e.g. wished for change and had fantasies about how things might turn out) by caregivers shortened survival time of patients. The authors hypothesize that the adoption of WIC on the part of caregivers might reduce the amount of person-centered care that a patient receives. Limitations of these studies include small samples with relatively few cases of patient placement and mortality that are distributed over varying follow-up periods, little racial/ethnic diversity in study populations, and varying levels of family caregiver involvement in providing support and assistance to the patient.

This study complements the existing literature by examining predictors of placement, death, or continued home care in a large and ethnically/racially diverse (n=1222) sample of moderately impaired AD patients who were receiving, on average, eight hours of daily care from family caregivers. These patients and their caregivers were enrolled in the Resources for Enhancing Alzheimer's Caregiver Health (REACH) project, a series of treatment trials with several active intervention and control groups at six sites throughout the United States, funded by the National Institute on Aging and the National Institute of Nursing Research.

The ethnic/racial diversity of the sample enabled us to examine the role of race/ethnicity (African American, Hispanic/Latino, and White) in a context in which all caregivers met the same criteria for care demands and were intensely involved in the care of the patient. We examine all three end-points (institutionalization, death without institutionalization, and continued home care) simultaneously, using multinomial regression, in contrast to the many studies which report proportional hazard models for time to institutionalization or death. Multinomial regression allows us to identify caregiver and patient characteristics and changes in these characteristics that differentiate patients who die without being placed, are placed in a nursing home, or remain in the community at home. Our goal is to predict the first event that occurs, whether it be placement or death. Thus, deaths that occur after placement are considered part of the placement cohort even though patients ultimately died. Finally, like the Brodaty et

al. study⁴, having a caregiver intervention component enabled us to assess the effects of caregiver involvement in caregiver intervention programs on patient end points.

METHODS

Recruitment and Eligibility Criteria

The REACH sample included 1222 family caregivers/patient dyads recruited from memory disorder clinics, primary care clinics, social service agencies, or physicians' offices at the six sites (Birmingham, AL; Boston, MA; Memphis, TN; Miami, FL; Palo Alto, CA; Philadelphia, PA) with special attention to enrolling diverse participants. Blacks/African Americans were a key focus at Birmingham, Boston, Memphis, and Philadelphia and Hispanics/Latinos at Miami and Palo Alto. Outreach efforts to the community at all sites included radio, television, targeted newsletters, public service announcements, and community presentations. The REACH project included a series of treatment trials testing the efficacy of different social-behavioral interventions at six sites throughout the United States. The interventions consisted of psychoeducational, behavioral, and environmental modification interventions designed to improve the health and well-being of caregivers of dementia patients. All sites included a control condition (see Wisniewski et al.¹¹, for detailed information regarding the REACH interventions, sample, design, and measures, and Gitlin et al.¹², and Belle et al.¹³, for intervention outcomes), and all caregivers were randomly assigned to either active treatment lasting six months or control at each site. Group assignment (active treatment vs. control) was a predictor variable in the multinomial models to test for possible intervention effects.

Eligibility criteria for caregivers included being over the age of 21, having the cognitive ability to complete a screening battery, and living with and providing care for a relative with Alzheimer's disease and related disorders (ADRD) for a minimum of four hours per day for at least the past six months. Caregivers also had to plan to remain in the area for at least the next six months, the duration of the intervention. Caregivers were not screened for depression, socio-economic status, or health status other than being under active cancer treatment which was an exclusion criterion.

Care recipients met NINDS-ADRDA criteria for possible or probable Alzheimer's disease and had to score less than 24 on the Mini-Mental State Exam (MMSE)¹⁴, reflecting moderate to severe cognitive impairment. Additionally, they had to have at least one limitation in basic ADLs or at least two dependencies in their Instrumental Activities of Daily Living (IADLs)¹⁵. These criteria were designed to ensure that caregivers were involved in daily tasks and responsibilities that could be burdensome. Other requirements were logistical and included having a telephone, planning to remain in the geographic area for at least six months, and competency in languages specified by each study site (i.e., either English or Spanish).

Predictor Measures

Caregiver and patient assessments were standardized with respect to content, timing of data collection (baseline, 6, 12, and 18 months), and method of administration (in-person interview by certified assessors). The timing of the interviews was chosen to reflect short (6 months), moderate (12 months), and long-term (18 months) outcomes relative to the course of the disease process.

Demographic and background measures and characteristics of the sample are discussed in detail by Wisniewski et al.¹¹. We focus here on the measures used in these analyses. Specific psychometrically-based guidelines governed the selection of REACH measures¹⁶. Preference was given to established measures with appropriate psychometric properties that had been used

with ADRD family caregivers and had acceptable measurement properties for ethnically diverse samples.

Key patient measures were an assessment of help needed by the care recipient and provided by the caregiver with regard to six personal ADLs^{11, 17}. Patient cognitive function was assessed by administering the MMSE. The MMSE yields a score of 0–30 with higher scores indicating better functioning. *The Revised Memory and Behavior Problems Checklist* (RMBPC)¹⁸ as modified by REACH¹⁹ was used to measure patient problem behaviors and the extent to which they upset or bothered the caregiver. Caregivers were asked whether their care recipients manifested any of 24 problem behaviors (7 memory, 8 depressive, and 9 disruptive) during the past week. If caregivers responded yes, they were asked how bothered or upset they were for each reported behavior using a 5-point scale ranging from 0 (*not at all*) to 4 (*extremely*). Upset or bother scores were calculated by computing a mean of scores across all behaviors within each subscale. These mean scores ranged from 0 to 4. Care recipient formal service use was measured with a 5-item scale assessing whether or not any one of five services (visits to a physician, visits to a nurse, emergency room visits, hospital stays, short-term nursing home stays) was used and how often during the past month²⁰. Two types of indicators were derived from this measure—the number of different services used and the total frequency of their use per month. All measures except for MMSE were assessed at each of the four measurement points among care recipients residing in the community (baseline, 6 month, 12 month, and 18 month follow-up).

Outcome Measures

Three care recipient outcome measures were assessed: institutional placement, death, and continued residence in the home with the caregiver. Institutional placement was defined as a permanent placement in a long-term care facility and, therefore, did not include short-term stays for rehabilitation. Dates of death and placement were obtained from the family caregiver. Given our interest in either placement or death as an initial end-point, persons who were placed and later died were included in the placed cohort and excluded from the deceased cohort since placement was the first event they experienced. Thirty-four care recipients died after placement. We compared caregivers and care recipients of this subgroup with the deceased group on baseline caregiver and care recipient characteristics and found that caregivers of patients who were placed before dying were significantly older at baseline than caregivers of those who died in the community (68.8 versus 62.6 years of age; $T_{219} = -2.54$, $p = .012$).

RESULTS

Sample Characteristics

As shown in Table 1, the caregiver sample was, on average, 61.7 years old (SD 13.4 years). Over half of the caregivers were Caucasian/White (58%), 23% were Black/African American, and 18% were Hispanic/Latino. Caregivers received no compensation for the services they provided, and nearly all were either spouses (48%) or children (41%). A small percentage (2%) were siblings, and the remaining 9% of caregivers represented a combination of grandchildren, nieces, and nephews. Eighteen percent were male. The mean amount of time that the caregivers had provided care was 4.3 years (SD 4.3 years), and the mean amount of time providing care during the course of a day was 7.9 hours (SD 5.1 hours). None of the caregivers received compensation for the care they provided.

The patients' average age was 78.7 years (SD 8.2 years). Forty-five percent of the patients were men; 58% of the patients were Caucasian/White, 24% were Black/African American, and 17% were Hispanic/Latino. The average Mini-Mental State Exam was 12.6 (SD 7.5); the mean score

for the RMBPC was 10.3 (*SD* 4.2), and patients were impaired an average 3.3 (*SD* 2.0) of six ADLs.

Outcomes

180 patients were placed in a long-term care facility, and 187 patients died in the course of the 18 month follow-up period without having been previously placed. Of the remaining 855 patients, 583 continued to receive home-based care from a family member throughout the 18 month follow-up period, and 272 had incomplete data or were lost to follow-up.

Because we were interested in baseline differences and rates of change for each of the three outcome groups in relation to each other, we used multinomial regression as our primary analytic tool. Based on the existing literature on predictors of placement and mortality, we first examined distributions of predictor variables and change scores in relation to the three outcomes. This was followed by testing regression models using variables that were best able to discriminate among the three outcomes along with key demographic characteristics. Change was assessed by first entering the baseline value of a particular variable followed by the follow-up value of the same variable, as opposed to using change scores. This has the advantage of controlling for baseline values. Two multivariate models are presented in this paper; one using baseline predictor variables only, and the other using baseline and changes in key predictors during the first six months of follow-up. We used the first 6-month interval change scores in order to maximize the number of placed and deceased individuals available for analysis, and because rates of change were larger during this period than subsequent assessment intervals. The results are summarized in Table 2 and Table 3.

Baseline Predictors of Outcomes—Using patient and caregiver baseline values and demographic characteristics as predictors, we found that the odds of being institutionally placed, compared to remaining at home, were significantly lower for those with higher MMSE scores ($\text{Exp}(B)=0.955$, $p=.001$), and the odds of either dying or being placed, compared to being cared for at home, were significantly lower for African Americans ($\text{Exp}(B)=0.605$, $p=.031$ and $\text{Exp}(B)=0.474$, $p=.002$, respectively) and Hispanics ($\text{Exp}(B)=0.542$, $p=.017$ and $\text{Exp}(B)=0.520$, $p=.013$, respectively) when compared to Whites, and significantly lower for females ($\text{Exp}(B)=.353$, $p=.000$ and $\text{Exp}(B)=.558$, $p=.040$, respectively) (Table 2). Other factors statistically significantly associated with death of relative to continued home care were older age ($\text{Exp}(B)=1.003$, $p=.008$) and more ADL limitations ($\text{Exp}(B)=1.289$, $p=.000$). More ADL limitations were also associated with higher odds of death when placement was used as the reference group ($\text{Exp}(B)=1.262$, $p=.000$).

We also explored interactions between race/ethnicity and patient/caregiver variables but found no statistically significant interaction effects.

Baseline and Change Predictors of Outcome—Change scores could not be computed for those individuals who were placed or died prior to the first follow-up assessment, so they were excluded from these analyses. Of the 180 placed patients, 54 were placed during the first six months, and 81 of the 187 deceased patients died during the first six months. We analyzed differences between patients who were placed or died between baseline and six months and those who were placed or died after the 6-month assessment. For patients who were placed during the first six months, compared to those placed later, caregivers reported at baseline being more bothered by patient memory problems (means 1.54 and 1.14, respectively; T-test $178=2.90$, $p=.004$), disruptive behaviors (means 2.06 and 1.66, respectively; T-test $178=2.14$, $p=.033$), and the patient's depressive behaviors (means 1.92 and 1.45; T-test $178=2.35$, $p=.020$). Patients who died earlier in the study compared to those who died later used more health services (means 1.20 and .92; T-test $185=2.03$, $p=.044$) more frequently per month (means 2.46 and

1.44; $T_{185}=2.38$, $p=.019$), had more disruptive behaviors (means 3.12 and 1.97, respectively; $T\text{-test } 185=4.26$, $p<.000$), depressive behaviors (means 3.15 and 2.34; $T\text{-test } 185=2.53$, $p=.012$), and more memory related problem behaviors (means 11.14 and 8.92; $T\text{-test } 185=3.62$, $p<.000$). Caregivers of patients who died earlier were significantly more depressed at baseline (means 17.30 and 12.76, respectively; $T_{185}=2.87$, $p=.005$), reported more health service use for themselves (means 1.01 and .77, respectively; $T\text{-test } 185=2.00$, $p=.032$), more stress symptoms (means 1.57 and 1.12, respectively; $T\text{-test } 185=2.22$, $p=.028$), and were more likely to be randomized into active treatment than control condition ($X^2=6.73$, $p=.009$) than those who died later.

Only patients who were placed or who died after the initial 6-month follow-up assessment could be used in the longitudinal analyses since no longitudinal data were available for those who died before this assessment. Baseline characteristics and change scores during the first six months were used as predictors in multinomial regression analysis. Using in home care as the reference group, the odds of being placed were significantly lower for patients who were female ($\text{Exp}(B)=.439$, $p=.016$), African American ($\text{Exp}(B)=0.520$, $p=.028$), and Hispanic/Latino ($\text{Exp}(B)=0.338$, $p<.005$) as opposed to White, and were significantly higher for those who exhibited increases in ADL limitations ($\text{Exp}(B)=1.202$, $p=.038$). Patients who were placed were also less likely to have a spouse as a caregiver ($\text{Exp}(B)=0.386$, $p=.050$).

Patients were less likely to die versus stay in home care if they were female ($\text{Exp}(B)=0.367$, $p=.003$), had a female caregiver ($\text{Exp}(B)=0.482$, $p=.043$), or had a spouse for a caregiver ($\text{Exp}(B)=0.325$, $p=.026$). Patients were more likely to die versus stay in home care if they experienced an increase in health service use ($\text{Exp}(B)=1.105$, $p=.015$) and an increase in ADL limitations ($\text{Exp}(B)=1.285$, $p=.017$). A closer examination of the types of services used by our patients shows that the change is primarily due to increased visits to a physician and nurses visits as opposed to emergency room visits, hospitalizations, or short-term nursing home stays. Finally, the odds of patient death were lower ($\text{Exp}(B)=0.515$, $p=.008$) if the caregiver was assigned to active treatment.

Increases in caregiver reports of being bothered by memory problems were associated with lower odds of the patient dying than being placed ($\text{Exp}(B)=.577$, $p=.006$). There was also a marginal intervention effect ($\text{Exp}(B)=.550$, $p=.054$) such that patients of caregivers who received an active intervention were less likely to die (greater odds of being placed than dying) when compared to control group caregivers.

DISCUSSION

Placement and mortality among AD patients are sentinel outcomes important to both clinicians and family members. They also have far-reaching policy implications because of the high costs of long-term care on the one hand and the detrimental health effects of being an AD caregiver on the other²¹. Improving our understanding of factors that contribute to these outcomes can help clinicians and family members anticipate and plan for these events and inform patient and caregiver interventions. The findings of this study enhance our understanding of AD patient placement and mortality in four areas.

First, our findings reveal important differences between death and placement when compared to continued home care. Both death and placement are associated with increased ADL limitations, having a non-spouse caregiver, and being a male and patient. They differ with respect to health service use, race, and group assignment. Compared to persons who remain at home, patients who are placed are more likely to be White as opposed to African American or Hispanic; caregiver assignment to the control condition as opposed to active treatment and increasing patient health service use are associated with increased mortality. Placed and

deceased patients are further differentiated from each other by the fact that caregivers of placed patients report increased levels of being bothered by memory problems when compared to caregivers of deceased patients. The picture that emerges from these analyses is that increasing functional declines as measured by limitations in ADL are associated with both placement and death. However, increases in caregiver reports of being bothered by memory problems are associated with placement, while increases in patient health service use are associated with death. Increasing health service use may contribute to a reduction in memory-related behavior problems, thus causing less upset about memory problems; alternatively, increasing memory problems or at least their increasing negative impact on the caregiver may be causally linked to the caregiver's decision to institutionalize their relative. These findings suggest that placed patients may be at earlier stages of the illness where memory problems are salient to the caregiver while those who die are at a later stage, characterized by higher levels of disability and more comorbidities. Of note, patient problem behaviors as measured by the RMBPC are not significantly related to either placement or death.

Our findings that death is associated with increased health service utilization are consistent with those of Newcomer et al.⁹, showing that increased use of health services such as visiting nurses, physician visits, and emergency rooms along with increased ADL limitations may be an important signal of impending death for AD patients being cared for at home. A closer examination of the types of services used by our patients shows that the change is primarily due to increased visits to a physician and nurses visits as opposed to emergency room visits, hospitalizations, or short-term nursing home stays. The combination of increasing medical problems and decreasing memory problems may be a useful predictor of impending death among AD patients residing in the community.

Second, our findings show that risk factors for mortality and placement in AD patients vary depending on which reference group is used. For example, decreases in being bothered by memory problems predict mortality when placement is used as the comparison group, but this factor does not differentiate mortality from continued community residence. These findings are consistent with conclusions reached by other investigators pointing out that risk factors for AD outcomes may vary widely depending on the populations studied, whether one includes incident or prevalent cases, location in a disease trajectory, and length of follow-up^{5, 7}. Our findings underscore the choice of reference group as a factor in predictive models of AD outcomes. The implications of the choice of reference group and findings are a critical factor when comparing information across studies. Additionally, the differences highlight the possibility that the large number of risk factors may interact in complex ways toward a particular end-point.

Third, the literature consistently shows that African American and Hispanic caregivers are less likely than Whites²² to institutionalize their relative with AD, in part because minorities have less access to this resource, different family structure, proximity of family members, and different attitudes toward institutionalization²³. Our findings also demonstrate this effect. To shed more light on these findings, we explored interactions between race/ethnicity and patient/caregiver variables but found no statistically significant interaction effects. Determining the underlying factors behind these institutionalization differences remains an important question for future research as the findings may enable longer community residence of AD patients of all race/ethnic backgrounds. One possibility is that these race/ethnicity differences are mediated by caregiver coping style or intensity of involvement in caregiving⁶.

Fourth, we show that survival was associated with being assigned to an active intervention condition. A similar finding was reported by Brodaty et al.⁴, but ours is different in two respects. First, we focus only on deaths that occur while the patient is still at home being cared for by a family caregiver, whereas Brodaty⁴ and others⁶⁻⁹ include deaths that occur after nursing home

placement. Thus, our mortality effect is not mediated by placement and shows that death at home is conceptually different from death in a nursing home and the two should not be combined. Second, the intervention effect on survival appears only after we include change variables in the analysis, suggesting that changes in health service use, memory problems, and ADL limitations unmask the effects of intervention. In contrast, the Brodaty et al.⁴ study found that including change variables eliminated the intervention mortality effect, suggesting the survival was mediated by intervention-related reductions in caregiver distress. Our findings are more difficult to explain and may be related to the comparatively high mortality rates during the first six months among individuals assigned to intervention condition. Since these individuals were not included in our longitudinal analysis, our findings may reflect the selective impact of psychosocial interventions on caregivers providing support to patients who were relatively robust. Another possibility is that caregivers who received an intervention delivered more effective care. This is an intriguing finding that deserves follow-up in future studies of AD mortality and caregiver interventions.

Finally, we note a number of limitations of our study. Most of the patient status variables used in this analysis are based on caregiver reports and may be influenced the nature of the caregiving experience. The analysis would have been enriched by additional objective patient status indicators. However, the caregiver plays an important role in the outcomes of interest. It could, therefore, be argued that their perspective is paramount in developing predictive models of placement and mortality. As is the case for all descriptive studies, we cannot assume causality between predictor and outcome variables. Nevertheless, the consistency and logic of findings in our cross-sectional and longitudinal analysis argue strongly for some causal relationships. For example, it seems reasonable to conclude that the caregiver's level of upset or bother with problem behaviors of the patient is an important factor in the decision to place the patient in a long-term care facility.

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Fig. 1.

Venn diagram showing predictors and their relation to three outcomes. Predictors located inside overlapping regions are shared and do not differentiate outcomes. Predictors located outside adjacent circles differentiate between adjacent outcomes. The higher probability event is indicated by letter in parentheses (D=Deceased; P=Placed). > denotes an increase in the identified variable.

Table 1

Baseline characteristics of caregivers and patients by patient outcome status (deceased, placed, community residing/home care)

	Deceased	Placed	Community Residing	Total Sample
	N=187*	N=180	N=583	N=950
CG Age				
Mean (SD)	62.6 (13.3)	63.7 (14.0)	60.8 (13.2)	61.7 (13.4)
Median	64	66	62	63
PT Age				
Mean (SD)	80.4 (7.6)	79.4 (8.0)	77.9 (8.3)	78.7 (8.2)
Median	81	80	78	79
CG Race (1 missing)				
White N(%)	121 (64.7)	121 (67.2)	306 (52.6)	548 (57.7)
AA N(%)	38 (20.3)	31 (17.2)	154 (26.5)	223 (23.5)
Hispanic N(%)	28 (15.0)	25 (13.9)	120 (20.6)	173 (18.2)
Other N(%)	0 (0)	3 (1.7)	2 (.3)	5 (.5)
CG relationship to PT				
Spouse N(%)	90 (48.1)	94 (52.2)	277 (47.5)	461 (48.5)
Non-spouse N(%)	97 (51.9)	85 (47.8)	306 (52.5)	489 (51.5)
Intervention				
Control N(%)	68 (36.4)	67 (37.2)	188 (32.2)	323 (34.0)
Intervention N(%)	119 (63.6)	113 (62.8)	395 (67.8)	627 (66.0)
CG Gender				
Female N(%)	156 (83.4)	142 (78.9)	483 (82.8)	781 (82.2)
PT Gender				
Female N(%)	91 (48.7)	94 (52.2)	337 (57.8)	522 (54.9)
ADL Limitations				
Mean (SD)	4.1 (1.9)	3.4 (1.9)	3.1 (2.1)	3.3 (2.0)
Median	4	4	3	3
Range 0–6				
RMBPC memory – bother				

	Deceased	Placed	Community Residing	Total Sample
Mean (SD)	1.1 (1)	1.3 (.9)	1.1 (.9)	1.1 (.9)
Median	1	1.2	1	1
Range 0–4				
PT Health Serv Use (# per month) –				
Mean (SD)	1.9 (2.7)	1.8 (2.6)	1.7 (2.3)	1.7 (2.4)
Median	1	1	1	1
PT Mini Mental –				
Mean (SD)	11.2 (7.1)	11.4 (6.7)	13.4 (7.7)	12.6 (7.5)
Median	11	11	14	13
Range: 0–30				

* Excludes deaths that occurred after placement (n= 34). These participants are included in the Placed group since placement was the first event they experienced.

Notes: CG=Caregiver, PT=AD Patient

Table 2

Multinomial regression analysis of baseline predictors of patient outcomes (deceased, placed, community residing/home care)

Variable	Comparison	Exp(b)	95% Exp(b) interval	P
CG Age	Deceased vs. Community Residing	1.008	.985 to 1.031	.508
	Placed vs. Community Residing	1.009	.986 to 1.033	.446
	Deceased vs. Placed	.998	.971 to 1.027	.916
PT Age	Deceased vs. Community Residing	1.003	1.001 to 1.006	.008
	Placed vs. Community Residing	1.002	.999 to 1.004	.202
	Deceased vs. Placed	1.002	.999 to 1.005	.272
CG relationship to PT Ref cat: notspouse	Deceased vs. Community Residing	.587	.281 to 1.226	.156
	Placed vs. Community Residing	.656	.303 to 1.419	.284
	Deceased vs. Placed	.895	.363 to 2.206	.810
Intervention Ref cat: control	Deceased vs. Community Residing	.930	.642 to 1.347	.701
	Placed vs. Community Residing	.901	.620 to 1.310	.584
	Deceased vs. Placed	1.032	.660 to 1.614	.889
CG Gender Ref cat: male	Deceased vs. Community Residing	.667	.372 to 1.195	.173
	Placed vs. Community Residing	.608	.338 to 1.093	.096
	Deceased vs. Placed	1.097	.558 to 2.157	.788
PT Gender Ref cat: male	Deceased vs. Community Residing	.353	.208 to .599	.000
	Placed vs. Community Residing	.558	.321 to .972	.040
	Deceased vs. Placed	.633	.338 to 1.185	.153
CG Race African American Ref cat: White	Deceased vs. Community Residing	.605	.383 to .956	.031
	Placed vs. Community Residing	.474	.293 to .767	.002
	Deceased vs. Placed	1.277	.713 to 2.287	.412
Hispanic Ref cat: White	Deceased vs. Community Residing	.542	.327 to .898	.017
	Placed vs. Community Residing	.520	.310 to .872	.013
	Deceased vs. Placed	1.043	.551 to 1.973	.898
PT ADL limitations	Deceased vs. Community Residing	1.289	1.162 to 1.429	.000
	Placed vs. Community Residing	1.021	.924 to 1.128	.682
	Deceased vs. Placed	1.262	1.115 to 1.430	.000
RMBPC memory bother	Deceased vs. Community Residing	.987	.810 to 1.204	.899
	Placed vs. Community Residing	1.136	.936 to 1.378	.196
	Deceased vs. Placed	.869	.687 to 1.099	.242
PT Health Serv Use (# services per month)	Deceased vs. Community Residing	1.020	.949 to 1.097	.591
	Placed vs. Community Residing	1.052	.980 to 1.129	.162
	Deceased vs. Placed	.970	.893 to 1.054	.468
PT Mini Mental Status	Deceased vs. Community Residing	.983	.956 to 1.010	.225
	Placed vs. Community Residing	.955	.929 to .982	.001

Variable	Comparison	Exp(b)	95% Exp(b) interval	P
	Deceased vs. Placed	1.029	.995 to 1.064	.094

Notes: CG =Caregiver; PT =AD patient; CG relationship to PT 0=not spouse, 1=spouse; Intervention 0=control, 1=treatment; CG and PT gender 0=male, 1=female; PT ADL's higher score = more limitations in Activities of Daily Living; RMBPC memory bother higher score = more reported distress over PT's memory related problem behaviors; PT Health Serv higher score = more patient related health services utilization per month; PT Mini Mental Status higher score = higher cognitive ability as measured by MMSE; PT Race, Categorical predictor with White as reference category

Table 3

Multinomial regression analysis of baseline and change variables for patient outcomes (deceased, placed, community residing/home care)

Variable	Comparison	Exp(b)	95% Exp(b) Intrv	P
CG Age	Deceased vs. Community Residing	1.028	.996 to 1.061	.082
	Placed vs. Community Residing	1.025	.996 to 1.055	.092
	Deceased vs. Placed	1.003	.965 to 1.043	.884
PT Age	Deceased vs. Community Residing	1.003	1.000 to 1.006	.070
	Placed vs. Community Residing	1.001	.998 to 1.004	.486
	Deceased vs. Placed	1.002	.998 to 1.006	.351
CG relationship to PT Ref cat: not spouse	Deceased vs. Community Residing	.325	.121 to .877	.026
	Placed vs. Community Residing	.386	.149 to 1.000	.050
	Deceased vs. Placed	.841	.248 to 2.852	.781
Intervention Ref cat: control	Deceased vs. Community Residing	.515	.316 to .838	.008
	Placed vs. Community Residing	.936	.588 to 1.490	.781
	Deceased vs. Placed	.550	.299 to 1.009	.054
CG Gender Ref cat: male	Deceased vs. Community Residing	.482	.238 to .977	.043
	Placed vs. Community Residing	.617	.302 to 1.261	.186
	Deceased vs. Placed	.781	.327 to 1.867	.579
PT Gender Ref cat: male	Deceased vs. Community Residing	.367	.188 to .715	.003
	Placed vs. Community Residing	.439	.225 to .857	.016
	Deceased vs. Placed	.835	.367 to 1.900	.668
CG Race African American Ref cat: White	Deceased vs. Community Residing	.612	.337 to 1.110	.106
	Placed vs. Community Residing	.520	.290 to .930	.028
	Deceased vs. Placed	1.177	.550 to 2.522	.675
Hispanic Ref cat: White	Deceased vs. Community Residing	.570	.279 to 1.165	.123
	Placed vs. Community Residing	.338	.158 to .725	.005
	Deceased vs. Placed	1.685	.636 to 4.461	.294
Time 1 PT ADL limitations	Deceased vs. Community Residing	1.091	.905 to 1.316	.361
	Placed vs. Community Residing	.951	.805 to 1.123	.556
	Deceased vs. Placed	1.147	.914 to 1.440	.237
Time 2 PT ADL limitations	Deceased vs. Community Residing	1.285	1.045 to 1.579	.017
	Placed vs. Community Residing	1.202	1.010 to 1.431	.038
	Deceased vs. Placed	1.069	.833 to 1.371	.602

Variable	Comparison	Exp(b)	95% Exp(b) Intrv	P
Time 1 RMBPC memory bother	Deceased vs. Community Residing	1.137	.820 to 1.576	.441
	Placed vs. Community Residing	.823	.613 to 1.106	.196
	Deceased vs. Placed	1.381	.920 to 2.072	.119
Time 2 RMBPC memory bother	Deceased vs. Community Residing	.721	.518 to 1.004	.053
	Placed vs. Community Residing	1.249	.962 to 1.623	.095
	Deceased vs. Placed	.577	.391 to .851	.006
Time 1 PT Health Service Use (# services per month)	Deceased vs. Community Residing	.909	.797 to 1.035	.151
	Placed vs. Community Residing	1.039	.947 to 1.140	.418
	Deceased vs. Placed	.875	.754 to 1.014	.077
Time 2 PT Health Service Use (# services per month)	Deceased vs. Community Residing	1.105	1.020 to 1.197	.015
	Placed vs. Community Residing	1.004	.909 to 1.109	.938
	Deceased vs. Placed	1.100	.984 to 1.231	.095

Notes: CG =Caregiver; PT=AD patient; CG relationship to PT 0=not spouse, 1=spouse; Intervention 0=control, 1=treatment; CG and PT gender 0=male, 1=female; PT ADL's higher score = more limitations in Activities of Daily Living; RMBPC memory bother higher score = more reported distress over PT's memory related problem behaviors; PT Health Serv higher score = more patient related health services utilization per month; PT Mini Mental Status higher score = higher cognitive ability as measured by MMSE; CG Race, Categorical predictor with White as reference category