Impact of Adult Day Services on Behavioral and Psychological Symptoms of Dementia

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Purpose: This study explored whether adult day service (ADS) use was associated with reductions in behavioral and psychological symptoms of dementia (BPSD) in individuals with dementia. Design and Methods: We used a quasi-experimental design to compare a group of 133 persons with dementia (PWDs) who initially enrolled in an ADS program to a control group not using these services (n = 68). Caregivers used a 24-hour log on multiple, consecutive days to report on five domains of BPSD. Results: We used growth-mixture modeling techniques to model change in the BPSD domains over a 2-month period as well as to handle the preponderance of zeros that were inherent in the data. Results showed a relationship between ADS use and caregivers’ report of fewer nighttime sleep-related problems for their PWDs. We found trends for other domains, specifically depressive symptoms and agitated behavior, but no significant group differences emerged for these and the other domains. Implications: The findings of ADS use on PWDs’ duration of nighttime sleep problems provide some evidence of the benefits of ADS; the findings also support its utility as part of the continuum of care for PWDs and their caregivers. For other behavior domains, enhanced or more targeted behavioral strategies coupled with ADS might offer caregivers and their PWDs the best possible combination for ameliorating BPSD.

Key Words: Adult day care, Behavior problems in dementia, Dementia caregiving

Of the various challenges associated with dementia, generally the most difficult for family caregivers are the behavioral disturbances and mood symptoms of the person with dementia (PWD; Aneshensel, Pearl, Mullan, Zarit & Whitlatch, 1995; Pruchno & Resch, 1989). These symptoms include agitation, restlessness, depressive behaviors, wandering, difficulties performing activities of daily living, sleep problems, and delusions and hallucinations (e.g., Auer, Monteiro, & Resch, 1996; Cohen-Mansfield & Libin, 2005; Cummings, Diaz, Levy, Binetti, & Litvan, 1996; Sweare & Drachman, 1996; Teri et al., 1992; Yaffe et al., 2002). These symptoms are further exacerbated by the cognitive and memory deficits associated with dementia, which leave many people with dementia unable to initiate and sustain activities. This, in turn, often leads to inactivity, restlessness, and boredom in some PWDs, and it may cause others to resist help and insist on performing daily activities they are no longer capable of doing. Behavioral symptoms such as these create intense demands on the caregiver, both physically and emotionally, and are risk factors for a poorer sense of well-being among caregivers (Aneshensel et al., 1995) as well as for the institutionalization of the PWD (Gaugler, Kane, Kane, & Newcomer, 2005; Hope, Keene, Gedling, Fairbugn, & Jacoby, 1998).

Behavioral and mood symptoms in dementia can be viewed as an interaction of biological and psychosocial factors. Neurodegenerative changes as well as deficiencies in certain neurotransmitters (e.g., serotonin, norepinephrine, and acetylcholine) have been linked to increased rates of behavior and mood symptoms (e.g., Assal et al., 2004; Cummings, Mega, & Gray, 1994; Herrmann, Lantcort, & Khan, 2004; Kirby & Lawlor, 1995; Lantcort, Herrmann, & Mazzotta, 2001; Tekin, et al., 2001). Although these neurodegenerative processes increase the likelihood of behavioral and mood disturbances in dementia, their
incidence may also be under the control of psychosocial factors. Guided by applied behavioral models, research has identified antecedent or triggering events for specific episodes of behavior and consequences or reinforcers of the events (e.g., Burgio, 1996; Livingston et al., 2005; Teri, Logsdon, Uomoto, & McCurry, 1997). Behavior management approaches that manipulate these contingencies, by removing or modifying triggering events to problem behavior, show promising results. Work has been done, for example, on management of urinary incontinence, and similar approaches have also been effective in treating problems such as agitation and verbal disruptions (Burgio, 1996; Schnelle et al., 1989), although the number of controlled studies is limited.

Restless and disruptive behaviors, otherwise known as agitated symptoms, are reported to be the most common cause for psychiatric consultation by caregivers. Cohen-Mansfield and colleagues reported that approximately 63% of adults attending day care centers exhibit such behavior, and that these estimates rose to 90% when caregivers were asked to report on their relatives (Cohen-Mansfield, Werner, Watson, & Pasis, 1995). Standard medical treatment for these behaviors is the prescription of neuroleptics such as haloperidol (Haldol) or thiothixene (Navane). Medication can be effective, but often, especially in the case of chronically agitated PWDs, medications fail to help (Lehninger, Ravindran, & Stewart, 1998). As an example, a PWD who is otherwise pleasant and calm might become belligerent and irritable when she is unable to perform the task asked of her or cannot remember the answer to a question. In this case, medications are not usually effective. The more effective approach could be nonpharmacological; strategies such as distracting the patient or providing pleasant activities can downplay memory impairment and emphasize the person’s successes.

Mood and depressive symptoms also present a serious concern for the PWD; approximately 20% to 30% of demented patients develop a major depression (Fitz & Teri, 1994). The standard treatment includes a thorough medical examination and exclusion of other medical conditions followed by aggressive treatment with antidepressants. However, nonpharmacological treatments can be equally effective, in combination with a drug protocol or as a stand-alone strategy in the case of minor depressive symptoms. These strategies are similar to those for agitated symptoms, and they include such things as positive engagement of the PWD in pleasant activities and exercise, which have shown success in curbing depressive symptoms and improving mood (Teri et al., 1997, 2003).

Another common cause for medical consultation is sleep problems of the PWD. Up to 70% of demented patients have been reported to have disturbances in sleep, which generally occur because of changes in their sleep architecture; namely, they awaken more easily and have difficulty with time cues (confusing night from day). Nonpharmacological approaches to improve nighttime sleep include physical activity, reducing daytime naps, light exposure, and consistent night routines (Morin et al., 1999).

Despite the promise of the behavioral approaches just described, the standard treatment for the behavioral and mood symptoms found in dementia remains the use of antipsychotic medications, most commonly risperidone, quetiapine, and olanzapine, which have a lower profile of side effects than do older neuroleptics such as haloperidol (Schneider, et al., 2006). Still, research has shown the utility of these drug treatments to be limited, and there are increasing questions about the safety and efficacy of these medications. In a comprehensive review, Sink and colleagues (Sink, Holden, & Yaffe, 2005) found evidence for efficacy of only two antipsychotic medications, namely, olanzapine (Zyprexa) and risperidone (Risperdal), but noted that improvements in symptoms were modest at best and that there was an increased risk of stroke associated with their use (see also Ballard & Cream, 2005). In addition, the U.S. Food and Drug Administration issued a black-box warning in 2005 based on findings of increased mortality among people with dementia in a 10-week trial of atypical antipsychotics. Given the health risks and limited efficacy of these pharmacological treatments, a focus on nonpharmacological approaches is inherently appealing and in many cases can be more effective than drugs for managing a PWD (Lehninger et al., 1998).

The most successful application of behavioral approaches for PWDs has been the work by Teri and associates (Teri et al., 1997; Teri, et al., 2003) that focused on the treatment of depressive symptoms. In an initial study, people with comorbid depression and dementia participated in a program that increased their engagement in pleasant activities. Simultaneously, caregivers were taught contingency management procedures to address their relative’s depressive behaviors. Results showed a reduction in depressive symptoms among the participants who received the treatment as compared with a usual treatment and a wait-list control group. In a subsequent study in which family caregivers were trained to engage their PWD in regular exercise, the PWD in the exercise group had lower depressive symptoms, fewer sleep problems, and better physical functioning, as compared with controls. These results were found after 3 months and at a 2-year follow-up.

One of the more promising ways of addressing care needs for PWDs living in the community is through adult day service (ADS) programs (U.S. Department of Health and Human Services, 2006). These programs provide structured activities that utilize participants’ remaining abilities, and they give caregivers a break from the often continuous pressures to provide care and supervision. ADS programs
are widely available in most states and communities and are continuing to gain in popularity. ADS is not as costly as alternatives such as having paid help come to the home, or placing the PWD in a long-term-care institution, and their use has been linked to positive caregiver outcomes. In perhaps the largest controlled trial to date, family caregivers who enrolled a relative with dementia into an ADS program had significantly lower care-related stressors and lower feelings of depression and anger after 3 months, compared with a control group not using ADS (Zarit, Stephens, Townsend, & Greene, 1998). Recently, further evidence on the short and long-term benefits of ADS augmented with care management support was provided by Gitlin and colleagues, who reported additional benefits for caregivers such as improved self-efficacy, improved self-confidence, and enhanced well-being (Gitlin, Reever, Dennis, Mathieu, & Hauck, 2006). Although the focus of these studies were on benefits of ADS on family caregivers, qualitative findings were caregivers’ reports of improvements in their relative’s behaviors, including improved mood, decreased agitation, and improved sleep following ADS. These findings were supported by research conducted by Zank and Schacke (2002), who reported behavioral improvement for a mixed sample of older adults using ADS. In addition, the study by Gitlin and colleagues reported caregivers’ increased confidence in managing problems, suggesting that care receivers’ behavior might have improved, although this relationship was not directly examined. Aside from these findings, however, there has been only limited research on how ADS might help dementia patients themselves.

In the present study we extend that research by exploring the effects of participation in ADS on the behavior and mood symptoms of the PWD immediately after ADS use and on days when not using ADS. People who suffer from dementia often have difficulty initiating and sustaining activities, and family caregivers often do not have the skill, time, or energy to engage them in activities or keep them busy. Consequently, they are often inactive or nap frequently during the day, which may cause subsequent difficulty at night, when they resist going to bed or have trouble falling asleep. The activities provided through a high-quality ADS can reduce inactivity by keeping the PWD active and engaged during the day, thus enabling the individual to sleep better at night (Dowling, 1996). In addition, many ADS programs provide pleasant, structured, and meaningful activities that reduce aimless and restless behavior and expose participants to social contact that improve their activity levels and mood (Teri et al., 1997; Woodhead, Zarit, Braungart, Rovine, & Femia, 2005).

In this study, we investigated whether participation in ADS is associated with reductions in behavioral and psychological symptoms of dementia (BPSD). A group of PWDs, and their caregivers, who initially enrolled in an ADS program were compared with a control group not using these services. We hypothesized that, over a 2-month period, the ADS group would show improvement in certain BPSD domains compared with the control group. The decision to use a 2-month period was to explore the short-term effects of ADS use as well as to maximize the sample size for the analysis. We examined the change over time by assessing the changes in both the occurrence and duration of the behavior domain over the 2-month period, hypothesizing that these would both decrease in the ADS group compared with the control group not using ADS. We further hypothesized three domains of BPSD to be affected by ADS use: depressive symptoms, agitation behaviors, and nighttime sleep problems. To test the specificity of ADS, we also included two additional domains, that is, behaviors related to activities of daily living (ADLs) and memory problems, which we hypothesized not to be affected by ADS use.

Methods
Participants

For the study, we recruited caregivers and their PWDs from 21 counties in New Jersey and 1 county in Eastern Pennsylvania in two ways: (a) those referred by respite agencies (for the control group) and adult day centers (for the treatment group) participating in the Dementia Day Care Program of the NJ Statewide Respite Care Program, and (b) those recruited for both groups from mailings to local Alzheimer’s Association chapters, newspaper announcements, and Alzheimer’s Support Group leaders. Caregivers of the PWD were contacted by project staff and screened for eligibility over the telephone. Potential participants had to be the primary caregiver for a family member with a diagnosis of dementia, reside with the PWD in the community, not have used an ADS previous to the start of the study, and write, read, and speak English with some degree of fluency. In addition, all PWDs in the control group had to be sufficiently mobile (i.e., not bedridden or homebound) to otherwise be able to attend an ADS program. Through our recruitment efforts, we had 150 caregivers and their PWDs in the ADS group, and 84 in the control group.

Procedures

Caregivers reported on a wide range of indicators about themselves and their PWD during a face-to-face interview in their home. Interviews were conducted by trained interviewers and lasted about 90 minutes on average. After the completion of the initial interview, caregivers were left two copies of the behavior and mood measure, the Daily Record of Behavior (DRB), and given detailed instructions on how to complete the forms after observing...
their relative’s behavior for two 24-hour periods (Braungart, Zarit, Femia, Hofer, & Stephens, 2006; Femia, Leitsch, Zarit, & Stephens, 2000, 2002; Leitsch, Lyons, Zarit, & Greene, 1998). In the ADS group, the initial and DRB interviews were completed prior to the PWD’s first day of ADS attendance. In both groups, the caregivers were not specified to stay at home for the sole purpose of observing their relative; rather, they were instructed to carry out their daily routine as usual and self-select the observations days when they were already planning to be at home with their relative for most of the day (not gone for more than four consecutive hours). In several cases, the observation period was over a weekend.

Following the initial assessment, caregivers were recontacted at 1 month, 2 months, 3 months, 6 months, and 12 months. At each contact, interviewers conducted the DRB telephone interview, and at 3, 6, and 12 months, they did a repeat home assessment in addition to the DRB telephone interview. For the present study, we used data up to 2 months (i.e., three waves). At each of the telephone interviews, caregivers were given or sent four copies of the DRB and asked to observe and report on their relative’s behavior and mood on assigned days, following the same procedure as just described. In the ADS group, the assigned observation days were 2 days on which the PWD attended an ADS, and on 2 days when they did not attend an ADS but were at home with their caregiver. In the control group, the assigned days were 4 days when the PWD and caregiver were at home. The days did not have to be consecutive, and, again, caregivers selected days when they were already planning to be at home with their relatives (often the weekend) for at least two thirds of the day. We instructed interviewers to schedule the calls within the shortest amount of time possible over no more than a 2-week period.

ADS Participation

Participants in the ADS group came from 23 ADS programs throughout New Jersey. To be eligible, the PWDs had to be enrolled in the program for at least 2 days per week and attend at least 4 hours each day, which was considered to be the minimum threshold amount from which ADS effects could be detected (Zarit et al., 1998; Zarit, Stephens, Townsend, Greene, & Femia, 2003). As part of the larger study, staff at these ADS programs reported on the PWDs’ behavioral symptoms in the DRB on the same days as assessed by caregivers and as well as identified the activities that the PWDs engaged in at ADS that day (see Woodhead et al., 2005). They were also instructed to attach a copy of that month’s activity calendar. On average, participants attended the program 3 days per week for about 6 hours (roughly 9:00 a.m. to 3:00 p.m.) over the 2-month study period. They engaged in five to six different activities each day in addition to activities related to daily routines (i.e., lunch), which included 30 minutes of physical activities on average, 1 to 2 hours of social activities, and about 1 hour of cognitively stimulating activities (Woodhead et al., 2005).

Measures

Demographic and Background Information.—During the initial in-person interview, caregivers reported their relative’s as well as their own age, gender, race, education, and marital status. Caregivers also provided a history of when they first noticed their relative’s memory problems, when they first received a diagnosis, and how long they have been providing care (in months).

ADL Dependency.—Caregivers reported on the amount of help their relative required on seven instrumental activities of daily living (IADLs) and six physical activities of daily living (PADLs; see Lawton & Brody, 1969). The IADLs included taking medications, doing housework, shopping for food, cooking and preparing food, doing laundry, taking transportation, and using the telephone. The PADLs included eating, dressing, grooming, bathing, toileting, and getting in and out of bed. Each item was rated on a scale ranging from zero (the relative could perform the activity without help all of the time) to three (the relative was unable to do by himself or herself all of the time). For IADLs and PADLs, we summed the individual items to create scores of overall ADL dependency. Internal consistencies were high for both scales (IADL, $\alpha = 0.79$; PADL, $\alpha = 0.92$).

Cognitive functioning of the PWD.—We used the Mini-Mental Status Exam (MMSE) to assess the orientation, memory, and cognitive functioning of the PWD (Folstein, Folstein, & McHugh, 1975). This assessment was done by the trained interviewer during the home interview. Scores ranged from 0 to 30, with lower scores indicating a higher degree of cognitive impairment.

Daily Record of Behavior (DRB).—The DRB consisted of 44 items in 12 behavioral domains, which included eating, bathing, dressing, toileting, mood and anxiety, naps, restless behavior, disruptive behavior, memory problems, reality problems, positive behaviors, and sleep disturbances. Our research group developed the measure for the study as an expansion of the widely used Revised Memory and Behavior Problems Checklist (Teri et al., 1992), adding items from other scales that expanded the range of behaviors that were assessed and using nontechnical descriptions of behaviors that could be recognized by caregivers (for a detailed description of the measure, see Braungart et al., 2006; Leitsch et al., 1998). Previous work by our research group

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Table 1. Items Within Each BPSD Domain

<table>
<thead>
<tr>
<th>Domain</th>
<th>Description</th>
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<tbody>
<tr>
<td>Depressive symptoms</td>
<td>Expressing sadness or hopelessness; crying, tearing; commenting on death of self or others; talking about feeling lonely; commenting on being worthless, a failure, or burden</td>
</tr>
<tr>
<td>Agitated behavior</td>
<td>Pacing; following caregiver around; appearing restless or anxious; trying to leave; being physically aggressive (hitting, spitting, pushing, etc.); arguing, complaining; screaming, shouting, yelling; threatening to hurt others; talking loudly or rapidly</td>
</tr>
<tr>
<td>Nighttime sleep disturbances</td>
<td>Resisted or struggled at bedtime; have trouble falling asleep; waking caregiver up during the night</td>
</tr>
<tr>
<td>Activities of daily living</td>
<td>Resistance or struggle with eating, dressing, or bathing</td>
</tr>
<tr>
<td>Memory</td>
<td>Losing, hiding, misplacing things; forgetting what day it is; difficulty concentrating on a task; started but did not finish something</td>
</tr>
</tbody>
</table>

Note: BPSD = behavioral and psychological symptoms of dementia.

showed that the DRB had good test–retest reliability and a strong correlation to traditional weekly measures, reaching over 90% agreement between daily and weekly measures (Femia et al., 2002; Femia, Leitsch, Zarit, Greene, & Stephens, 2000; Leitsch, Femia, Zarit, Greene, & Stephens, 2000). The internal reliabilities were expectedly in the low to medium range ($\alpha = 0.40$ for sleep to $\alpha = 0.73$ for memory problems) because of the nature of the DRB, which, as a risk scale, meant that the occurrence of one type of behavior in a domain may actually decrease the rate of occurrence of another, because the person cannot engage in both behaviors at the same time. This is especially true for daily measures in which behavior is assessed within restricted periods of time.

Caregivers were instructed to complete their DRB logs throughout the day, coding their PWD’s behaviors that occurred over two 24-hour periods at baseline and four 24-hour periods at 1 and 2 months. Each daily log was divided into four phases of the day, which we devised on the basis of logical breakpoints, before and after a caregiver leaves for and returns from work or stops off and picks up his or her relative from ADS: waking to 9:00 a.m., 9:00 a.m. to 4:00 p.m., 4:00 p.m. to bedtime, and nighttime. The night period probed for sleep disturbances and other behavior problems throughout the night. The morning after each 24-hour period, interviewers called the caregivers and guided them through the DRB and the four phases of the day. These calls averaged 20 minutes, suggesting that the log did work as intended. We deemed the data from these phases to be valid only if the caregivers were present with the PWD for at least two thirds of the time period. If not, we coded the data as missing (this happened for only three control cases and five ADS cases). For each phase, caregivers reported on all of the items, responding whether the behavior occurred during this time period (yes or no), the frequency of its occurrence (i.e., the number of times the behavior occurred), how long the behavior lasted (in minutes), and the degree to which the behavior upset them (1 = not at all; 5 = very upsetting). For frequency, caregivers responded in an open-ended way, providing an estimate of the number of times a behavior occurred during the time period. In the cases in which caregivers found it difficult to estimate the duration of a behavior, such as those that were more discrete (i.e., memory problems), interviewers probed the caregivers for more information on the behavior and coded it as occurring for a minimum duration of 1 minute. If a caregiver mentioned that the behavior occurred throughout the day, the interviewer worked with the caregiver to come up with a reasonable and acceptable estimate of its frequency and duration.

For the present study, we combined three of the four ADL-related items (resistance with eating, bathing, and dressing) to create a single ADL domain, and we combined the restless and disruptive domains to create a single agitation domain. We did not include toileting in the ADL domain because our factor analysis results showed that it loaded poorly with the other ADL items. Examples of items within each domain are listed in Table 1. In total, we used five BPSD domains for the study: depressive symptoms, agitated behavior, nighttime sleep disturbances, ADL-related behaviors, and memory problems. We did not include the three other domains, namely, reality problems, naps, and positive behaviors, in the present study. Positive behavior was the subject of a study previously published by this research group (Robertson, Duncan, Rovine, Zarit, & Femia, in press); naps by themselves were not considered a problematic behavior, and reality problems showed very little variability and very low frequency among caregivers.

We constructed summary variables by taking the sum of the frequency of the behavioral items within each domain and multiplying this number by the reported average duration of the behavior, which gave us a value that represented the total duration of the behavior. We performed this procedure for each of the 2 days at baseline, and separately for the morning, afternoon, and evening time periods except
sleep, which was given its own separate time period. Then, for each time period of the day, we took the mean value between Day 1 and Day 2 observations. In the analyses presented here, we used only the evening and sleep time periods, which corresponded to the time following ADS use, when the effects of the program could be expected to be greatest. For comparability of observation, we also looked at the evening and night periods on days without day care. At 1 and 2 months, in the ADS group we performed the same procedure for the 2 ADS days and the 2 non-ADS days. In the control group, we randomly selected 2 of the 4 days to be compared with the treatment group’s ADS days, and we selected the remaining 2 to be compared with the treatment group’s non-ADS days.

Inspection of the DRB variables revealed the presence of a few outliers. These were a few instances in which the caregiver reportedly was exposed to a behavior problem for the entire time period (in some cases, for every minute of the time period). As these values greatly skewed the distribution, we made the decision to perform a Winsor transformation of the data. We did this by first identifying the outlier and then examining that case’s other data values at other waves. An examination of the univariate distribution of the data showed that over 96% of values fell within a 60-minute duration; hence, we recoded the values in the tail of that distribution. We recoded the first outlying value within the line of data to 60 minutes, corresponding to 1 hour of exposure to the behavior during the time period, and in the instance in which there was more than one outlier present (i.e., a caregiver reporting a high value at 1 month and another high value at 2 months), we Winsorized the next outlier by roughly the same interval change, which in almost all cases was 10 to 20 minutes more. This procedure resulted in a maximum Winsorized value of 100 minutes. After we completed these transformations, we still found the distribution of scores to be highly skewed; hence, we made the decision to conduct a log transformation of the data. We did this by adding a value of one to the data prior to the transformation, thus accommodating the zero values in the data set.

**Analysis Procedures**

To address the potential issues surrounding the internal validity of the quasi-experimental nature of the present study, we used propensity score modeling to balance the differences between the treatment and control groups on covariates. Propensity score modeling divides research participants into subclasses on the basis of a caregiver’s vector of covariates (Rosenbaum & Rubin, 1984). The advantages to using propensity scores in quasi-experimental designs include an increased power to detect statistical differences between groups, the ability to represent a number of covariates without losing degrees of freedom, and an improved balance of the distribution of covariates between the treatment and control groups (Edwards, 1997; Rosenbaum & Rubin, 1984; Tabachnik & Fidell, 2007). Following the procedures outlined by Rosenbaum and Rubin and by Edwards, we included 13 possible covariates (caregiver and PWD age, gender, and education; relationship between the caregiver and PWD; time since onset of dementia; MMSE, IADL, and PADL impairment; and use of antidepressant medication, behavioral medication, and acetylcholinesterase inhibitor) in a stepwise logit regression procedure that predicted classification into treatment status (ADS or control). We divided the resulting distribution of propensity scores, p (probability of being in the treatment group), into quintiles and recoded it into a five-level variable representing the caregiver’s propensity subclass (the first subclass had the lowest probability of being in the ADS group and the highest subclass had the highest probability). We included this variable as a control variable in the subsequent growth models.

We then used growth-mixture modeling techniques to model the change in the five BPSD domains over time. These types of models describe change in censored outcomes that are deemed continuous but nonnormally distributed (Muthén, 2004). Specifically, we constructed zero-inflated Poisson models (ZIP), as they are able to handle situations involving a preponderance of zeros and, in those instances in which the observed counts exhibit more variability than what is predicted by the Poisson distribution, the condition called overdispersion (Gardner, Mulvey, & Shaw, 1995; Lambert, 1992; Slymen, Ayala, Arredondo, & Elder, 2006). To address overdispersion, ZIP techniques estimate the appropriate standard errors of the regression estimates and p values (Gardner et al.). Further, the ZIP modeling approach addresses the hypothesis that there are two groups contributing to the excess of zeros. A first group is a subpopulation of research participants who could have a meaningful zero value at all time points by not experiencing the behavior at all. A second group includes those who may experience the behavior at the start but who have the potential to reach values of zero through exposure to the intervention. These cases are part of the Poisson process, which includes a portion of zeros and values greater than zero. In more specific terms, it is first assumed that an individual can be classified as either belonging in the zero class or not (a zero count has a probability equal to one); second, if the individual is in the nonzero class, the probability of a zero count is expressed by the Poisson distribution. The probability of being in each of these two classes can then be modeled by covariates.

This strategy improves upon traditional analytic approaches, in which a common way of handling this type of data would be to delete individuals with
zeros at all waves, to convert the data to a dichotomy (such as “occurred–did not occur”), or to proceed with an ordinary linear regression. These approaches have been shown to produce biased estimates, and, at the most, produce inefficient results by throwing away data that are otherwise valid (Gardner et al., 1995; Lambert, 1992).

For this study, ZIP modeling compared the trajectories of BSPD domains over a 2-month period, with group membership (ADS vs controls) and propensity subclass as the covariates predicting baseline status, linear, and quadratic slope. We used the Mplus 3.1 program (Muthén & Muthén, 2005) to run the models. To test model fit, ZIP models use the Bayesian information criterion, or BIC, values (Volinsky & Raftery, 2000) rather than the usual log-likelihood chi-square difference test. Lower BIC values indicate an improvement over a previous model. Specific analyses were as follows.

First, we made a comparison of the trajectory of BSPD scores of ADS and control participants over time on days when ADS users attended day care (ADS Day) and on randomly selected days for control participants. We made the comparison for the time period immediately following ADS use, 4 p.m. to bedtime, and for the nighttime period. Second, we made a comparison of the trajectory of scores of ADS and control participants over time on days when ADS users did not attend ADS (n-ADS Day) and on randomly selected days in the control group. This analysis allowed us to explore a possible generalization of ADS effects on non-ADS days.

Results

Descriptive Information

We recruited a total of 234 participants for the study, and of these we included 201 in the final sample—133 in the ADS group and 68 in the control group. The 33 participants whom we did not include were those whose relatives died, were hospitalized, or were institutionalized before the 3-month interview, or otherwise dropped out of the study before the DRB interview could be conducted. These PWDs tended to be older ($p < .05$) with caregivers who were also slightly older ($p < .05$) than those who remained in the study. The demographic characteristics of the 201 study participants and their PWDs are shown in Table 2. Caregivers were primarily women (79% in the control group; 82% in the ADS group) who were either wives or daughters of the PWD. In the control group, 45% were wives and 31% were daughters (or daughters-in-law), whereas in the ADS group, the proportions were reversed: 28% were wives and 52% were daughters. This difference was statistically significant. In both groups, husbands and sons represented the minority of caregiver relationships. In terms of age, caregivers in the ADS group were slightly younger (60.2 years vs 66.0 years in the control group), which was explained by the fact that more individuals in this group were adult daughters.

Turning to the characteristics of the PWDs, we found that the majority of PWDs were female (51% in the control group and 59% in the ADS group), and they were, on average, almost 80 years of age. As shown in Table 2, the caregivers estimated their relatives’ onset of dementia symptoms as occurring about 5 years ago in the control group and about 4
years ago in the ADS group. This difference was statistically significant. Looking at MMSE scores, however, we found that the groups were comparable, with an average score of about 14 in both groups, a value well below the 23-point cutoff for probable dementia. In terms of IADL impairment, the PWDs were also comparable (about 6.5 impairments out of a possible 7), although for PADLs, the ADS group was less impaired (3.0 vs 3.8 in the control group; $F = 7.02; df = 1; p = .01$). Finally, in terms of medication use, the groups were comparable, with half or slightly more than half of the individuals taking an acetylcholinesterase inhibitor, a behavioral medication, or an antidepressant medication. Overall, the sample of PWDs represented could be characterized as being in the moderate to moderately severe stages of dementia.

The differences that emerged between the ADS and control groups suggested that the groups did differ systematically enough to threaten their comparability. This provided a further rationale for us to utilize a propensity score to balance the distribution of many covariates simultaneously rather than control for each observed covariate separately.

Baseline Reports of Behavior

Table 3 shows the proportion of caregivers reporting the occurrence of each of the five BPSD domains as well as the median duration (in minutes) of the behavior for those who reported the behavior. We used the median values and interquartile ranges instead of the mean value because of the level of skewness in the data. Baseline results showed memory problems and agitated behavior as the most common behaviors, with the majority of caregivers in both groups reporting the behavior. Agitated behaviors were reported by 65% in the control group and 58% in the ADS group, and memory problems were reported by 60% and 67% in the control and ADS groups, respectively. These were followed closely by nighttime sleep problems, which were reported by 58% in the control group and 44% in the

Table 3. Behavior Domain Descriptive Results for Control and ADS Groups

<table>
<thead>
<tr>
<th>Domain</th>
<th>Control Group</th>
<th></th>
<th>ADS Group: ADS Days</th>
<th>ADS Group: Non-ADS Days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>1 Month</td>
<td>2 Month</td>
<td>1 Month</td>
</tr>
<tr>
<td>Depressive symptoms</td>
<td>% reporting behavior</td>
<td>22</td>
<td>21</td>
<td>26</td>
</tr>
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<td></td>
<td>Median</td>
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<td>2.8</td>
<td>3.0</td>
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<tr>
<td></td>
<td>Range</td>
<td>1–11</td>
<td>1–60</td>
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<tr>
<td>Agitated behavior</td>
<td>% reporting behavior</td>
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<td>54</td>
<td>48</td>
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<tr>
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<td>10.0</td>
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<tr>
<td></td>
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<tr>
<td>Sleep (nighttime)</td>
<td>% reporting behavior</td>
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<td>62</td>
<td>49</td>
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<tr>
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<td>2–60</td>
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<tr>
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<td>% reporting behavior</td>
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<td>54</td>
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</tr>
<tr>
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<tr>
<td></td>
<td>Range</td>
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<td>1–21</td>
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Note: Control group = group that does not use day care; ADS = adult day service; ADL = activity of daily living. Boldface indicates median value.
ADS group. The less commonly reported behaviors were ADL-related problems (37% and 44% in the control and ADS groups, respectively) and mood (22% and 24% in the control and ADS groups, respectively). Despite slight differences in the reported occurrence, no significant group differences emerged on any of the behavior domains, as indicated by examining the intercept parameter of the ZIP models.

Turning to the duration of the behaviors, we found that several findings emerged. The longest enduring behavior domains (reported at baseline) were agitated behavior, lasting a median value of roughly 15 minutes in the control group and 25 minutes in the ADS group, and overnight sleep problems at 15 minutes in the control group and 20 minutes in the ADS group. These reported differences between groups were not statistically significant. ADL behaviors were of a slightly shorter duration with a median value of 8 minutes in the control group and 15 minutes ADS group. This difference was statistically significant ($z = 2.1; p < .05$) at baseline. Mood disturbances were of a shorter duration—approximately 4 minutes in the control group and 5 minutes in the ADS group. Finally, memory problems were the most “fleeting,” lasting 2 minutes or less for both groups. For these two behavior domains, the differences in duration were not statistically significant.

### Behavior Change Over 2 Months

Table 4 shows the results of the ZIP regression models, comparing the ADS and control groups on ADS days and non-ADS days, and controlling for the propensity subclass. The coefficients presented are for the slope estimates (i.e., change over time) of the ZIP growth model. The logit part of the model assessed whether or not the occurrence of the behavior showed a significant increase or decrease over time (a decrease is indicated by a positive coefficient). The Poisson part of the model assessed whether or not the duration of the behavior increased or decreased over the 2-month period (a decrease is indicated by a negative coefficient). We ran these models separately for ADS and non-ADS days for each of the five behavior domains, and in all cases we were interested in whether there were group differences over time and whether these differences would emerge in ADS versus non-ADS days. We tested both linear and quadratic models, and, with the
exception of memory problems, we retained the linear models as they presented a more parsimonious fit.

Of the three domains hypothesized to be influenced by ADS use (depressive symptoms, agitated behavior, and nighttime behaviors), only nighttime sleep problems showed a significant group effect over time. Looking at the logit part of the model, we found that the coefficient for group (−0.28) was not statistically significant, suggesting that the occurrence of the behavior did not significantly differ between groups over time. The observed difference was in the Poisson part of the model (coefficient = −0.16; p < .05), indicating that the duration of nighttime problems showed a greater decline over 2 months in the ADS group compared with the control group. Interestingly, although this difference emerged when we were comparing the control group with the ADS group on ADS days, there were no group differences when we were comparing the control group with the ADS group on non-ADS days. This suggested a stronger impact of ADS on days when a PWD used day care compared with when he or she did not. To more closely examine this possibility, we followed up with a set of nested within-group ZIP models, focusing on the ADS group alone and analyzing whether the day (ADS vs non-ADS) significantly influenced the occurrence and duration over time. Findings supported a trend that the duration, but not the occurrence, of nighttime sleep problems did go down on days after the person attended ADS compared with days when he or she did not attend (p = .054).

For depressive symptoms and agitated behavior, the results of the group comparisons showed no significant group differences on either the occurrence or the duration of the behaviors over time (see Table 4). As in the aforementioned case, these results were followed up with a series of within-group ZIP analyses comparing behaviors on ADS and non-ADS days. For depressive symptoms, results showed that within the ADS group, depressive symptoms had a significantly lower occurrence over time on ADS days as compared with non-ADS days (p = .02). There was also a marginally significant trend of reduced incidence on non-ADS days (p = .054). For agitated behavior, results showed a trend towards reduced incidence over time on ADS days (p = .05) but not a significant effect on non-ADS days.

For ADL-related behavior and memory problems, there were no significant differences between groups on either the occurrence or the duration of behaviors. A follow-up series of within-group analyses also revealed no significant ADS versus non-ADS day findings. Figures 1 and 2 show these results.

### Discussion

In previous research that we conducted, we documented benefits of ADS use to caregivers’ stress appraisals and mood (Zarit et al., 1998). The results of the present study extend those findings, providing evidence that ADS programs can also benefit the person attending the program by decreasing the duration of nighttime sleep problems when they occur. Focusing on the ADS group alone, we found that there was further evidence that these benefits were stronger on days after the PWD used ADS than on days when the PWD was at home. Although other behavior domains showed no significant ADS versus control group differences, results from the within-group analyses suggested a greater decline in the occurrence of depressive symptoms and agitation behaviors on ADS days as compared with non-ADS days. As we predicted, memory problems and ADL-related problems did not differ between groups or show differences between days.

Overall, the findings of the present study are encouraging as well as limited by several factors. One notable issue is the short-term nature of the study, as it focuses on behavior changes over a 2-month period. It is possible that looking across a longer time frame could produce different results or show certain benefits to be weakened, strengthened, or sustained over time. Another issue is that despite the expectation that behavior problems are quite common in dementia as well as findings from our own pilot data, a sizable group of caregivers did not report the occurrence of specific domains of behaviors during the observation periods. As a result, the effective sample size for any analysis, and subsequent statistical power for detecting differences, was reduced. Missing data was also an issue, which was due to the normal attrition of participants over time (about 9% in each group at 2 months) but exacerbated by the number of observational reports that were deemed invalid when the caregiver was not able to report behaviors for the whole observation period (an additional 10%). This issue was partly offset by our decision to look at the first three waves of data (baseline to 2 months), which thus maximized the sample size and reduced the impact of
missingness. Nevertheless, this attrition could have had an impact caused by differences in the characteristics of participants who were missing data—who tended to be older, have older PWDs, and more often came from the ADS group. An additional problem was the variability in the scores for duration of behavior problems, although this was partly addressed by the transformations that were performed and the modeling techniques that were employed.

A major consideration in this study is the use of a quasi-experimental design to evaluate treatment outcome (Shadish, Cook, & Campbell, 2001). This design is an appropriate strategy when random assignment to treatment and control conditions is not possible, but its success depends on the equivalence of participants in each condition. In the present study, we established inclusion criteria that would improve comparability; for instance, all participants in the control condition had to be sufficiently mobile to be able to attend an ADS program. We also utilized statistical methods (i.e., propensity score modeling) to balance the potential difference between groups and employed growth curves for the main analysis. The latter strategy emphasizes intraindividual change, thus reducing somewhat the concerns about lack of equivalency (Almeida, 2005); despite these efforts, however, it is ultimately difficult to fully account for differences between the groups that could have contributed to the findings.

The finding of a significant decrease in the duration of overnight sleep problems is consistent with interventions conducted by McCurry, Gibbons, Logsdon, Vitiello, & Teri (2005), who found improvement in sleep among people with dementia after
training caregivers in sleep hygiene practices. Strategies included giving PWDs a daily exercise regimen, minimizing their naps during the day, having them perform a consistent nighttime routine, and restricting their caffeine and alcohol intake. In the present study, the ADS participants with dementia engaged in about 30 minutes of daily physical activity (see Woodhead et al., 2005), and only 13% of participants took naps while at the program. This was compared with 75% of participants who took naps on non-ADS days. The findings of our within-group analyses, that the duration of nighttime sleep disturbances was reduced on ADS days, provides additional evidence that daytime exercise or activity, such as provided in ADS programs, can impact nighttime sleep. These results suggest the need for further study to explore the extent to which targeted activities and training might improve sleep.

In contrast, the other behavior problems we focused on may require more specific and targeted intervention than ADS alone. In the case of depressive symptoms, no significant between-group findings emerged, although in the within-group analyses we found some evidence for a reduced incidence of problems on ADS days and a trend on non-ADS days. Prior work by our research group (Woodhead et al., 2005) showed that, while at their ADS program, PWDs experienced a decrease in depressive symptoms over a 3-month period. Those findings are consistent with interventions conducted by Teri and colleagues (Teri et al., 1997, 2003), who showed that engaging in pleasant activities as well as exercising and using behavioral management strategies were associated with lower depressive symptoms in the person suffering from dementia. Although the findings of this study are encouraging, additional research is needed on the specific ADS mechanisms that come into play that impact caregivers' reports following ADS use.

Turning to agitated behavior, again we found that no significant between-group differences emerged, although in the within-group analyses, we found a trend toward a slight decrease in the incidence of the behavior. In the study by Woodhead and colleagues (2005), agitation decreased over time, but only among ADS users who attended programs with higher levels of engaging activities, that is, where participants were actively involved (e.g., games, arts and crafts, singing, drama, or discussion groups). The findings in the present study are again encouraging, but they must be explored further. It is plausible that the benefits of activities on agitation are found during and immediately after participation in the activity, but that they are less apparent if engaging activities are not sustained at home by the caregiver. In contrast to Teri's work (Teri et al., 1997, 2003), which trained family caregivers to implement behavioral interventions, ADS programs do not systematically work with caregivers to implement similar behavioral strategies. The study by Gitlin and colleagues (2006) tested the benefits of ADS augmented by case management support, in which caregivers received additional training and support. Such a program could target caregivers' strategies for behavioral management in the home, which could improve outcomes.

The U.S. Department of Health and Human Service has assigned ADS to play a key role in state and national initiatives to support older people and their family caregivers living in the community (U.S. Department of Health and Human Services, 2006). Their interest stems from both the social and economic value of ADS programs, that is, the delay of institutionalization on the part of informal caregivers and the economic savings associated with that delay. The federal government has begun efforts to rebalance the long-term-care system by expanding home and community-based services for elderly and disabled persons and their caregivers. These initiatives include the National Family Caregiver Support Program, Aging and Disability Resource Centers, Real Choice Systems grants, and the Money Follows the Person initiative. Findings from this study and previous studies can inform federal policy makers to ensure that ADS programs are a choice offered to families under these programs.

The ADS programs that participated in this research were supported in part by a statewide initiative in New Jersey that subsidized payments by families of PWDs (Greene & Feinberg, 1999). This initiative makes ADS use affordable to more people and provides an underpinning of financial support to the programs. The Georgia Division of Aging Services have developed a mobile day care program, in which staff and supplies travel to different remote areas of the state and offer ADS programs 2 to 3 days per week. This concept is being considered in other states; as another alternative, adult day centers are being colocated with senior centers so that a non-demented spouse and his or her demented spouse can attend and benefit from their respective programs. Unfortunately, availability in many parts of the country remains limited, and many caregivers are still unaware of adult day programs and their benefits, or access them only when faced with a crisis in caregiving. In a recent national survey, Cox (2003) found that current ADS programs are able to meet only about 40% of the estimated need, and 56% of all counties in the United States are underserved. In raw numbers, this translates to an additional 5,145 centers nationwide that are needed to serve older adults, particularly those in rural areas.

Although improving availability and access needs to account for a large part of state and national efforts, attention also should be directed on the quality of individual programs. Merely attending a center does not imply benefits; rather, active participation in a well-designed program that targets well-being, socialization, and the physical health of participants is necessary to effect positive change.
in the person suffering from dementia. Future studies of the impact of ADS on behavioral and other dementia-related problems could adopt a more strategic approach to targeting people for intervention. Behavior problems may be responsive to certain kinds of interventions and not others. People with a particular type of problem could then be matched with the right types of activities at the ADS that are likely to have an impact. There may also be a need to involve caregivers in the treatment plan so that they could carry over some of these strategies to the home. Behavioral strategies for dementia have considerable potential for improving the circumstances of PWDS and their caregivers at relatively low cost and little risk of adverse effects. Although the purpose of ADS is often providing respite to the caregiver, there is considerable potential for implementing behavioral strategies as well as partnering with caregivers in their application.

References
Cox, N. (2003). A national study of adult day services. Paper presented at the annual conference of the National Adult Day Services Association, Miami Beach, FL.

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