

The Cost-Effectiveness of a Behavior Intervention with Caregivers of Patients with Alzheimer's Disease

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OBJECTIVES: To examine the cost-effectiveness of a randomized, clinical trial of a home-based intervention for caregivers of people with dementia.

DESIGN: This cost-effectiveness analysis examined Resources for Enhancing Alzheimer's Caregivers Health (REACH II), a multisite, randomized, clinical trial, from June 2002 through December 2004, funded by the National Institute on Aging and the National Institute of Nursing Research, of a behavioral intervention to decrease caregivers' stress and improve management of care recipient behavioral problems.

SETTING: Community-dwelling dementia caregiving dyads from the Memphis REACH II site.

PARTICIPANTS: Of Memphis' random sample of 55 intervention and 57 control black and white dyads, 46 in each arm completed without death or discontinuation. Family caregivers were aged 21 and older, lived with the care recipient, and had provided 4 or more hours of care per day for 6 months or longer. Care recipients were cognitively and functionally impaired.

INTERVENTION(S): Twelve individual sessions (9 home sessions and 3 telephone sessions) supplemented by five telephone support-group sessions. Control caregivers received two "check in" phone calls.

MEASUREMENTS: Incremental cost-effectiveness ratio (ICER), the additional cost to bring about one additional unit of benefit (hours per day of providing care).

RESULTS: At 6 months, there was a significant difference between intervention caregivers and control caregivers in hours providing care ($P = .01$). The ICER showed that in-

tervention caregivers had 1 extra hour per day not spent in caregiving, at a cost of \$5 per day.

CONCLUSION: The intervention provided that most scarce of caregiver commodities—time. The emotional and physical costs of dementia caregiving are enormous, and this intervention was able to alleviate some of that cost. *J Am Geriatr Soc* 56:413–420, 2008.

Key words: dementia; behavioral interventions; cost-effectiveness

The increasing prevalence of dementia and the associated increase in dementia-related healthcare costs have prompted a call for cost-effective interventions that increase caregivers' ability to provide home care for persons with dementia.¹ This article presents the first cost-effectiveness analysis of a randomized, clinical trial of a home-based intervention for caregivers of people with dementia.

In 2000, 4.5 million people in the United States had Alzheimer's disease (AD).² Researchers^{3–7} have forecasted an increase in this number to 13.2 million by 2050 and an associated rise in care costs.^{8–10} Ten years ago, the U.S. cost of dementia care was nearly \$100 billion, including medical and long-term care, home care, and lost caregiver productivity.¹ More-recent estimates are \$18,408 per patient per year for mild AD, \$30,096 for moderate AD, and \$36,132 for severe AD.¹¹ Based on these estimates, national costs will be more than \$350 billion per year by 2050, excluding inflation.

Currently, informal caregivers provide most of the care for those with dementia. Informal costs of care provided by the family and other caregivers are often higher than formal costs. For community-dwelling patients with dementia, in 1994, formal care costs were \$15,886 and informal costs \$20,812 per year,⁸ highlighting the amount of time that caregivers spend providing care. In 1997 dollars, the total annual caregiving cost per care recipient for black, Hispanic, and white caregivers¹² amounted to \$23,436 for

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informal services and \$8,064 for formal services. Additionally, dementia costs U.S. businesses \$61 billion per year, including \$36.5 billion in absenteeism and lost productivity.¹³ Interventions that enable caregivers of people with dementia to enhance their coping skills and management of care-recipient behaviors may decrease caregiver burden, improve caregiving skills and quality of life for care recipient and caregiver,¹⁴⁻¹⁷ and reduce the cost of care.

This study evaluated the cost-effectiveness of Resources for Enhancing Alzheimer's Caregivers Health (REACH II), a national, multicomponent, randomized, clinical trial, from June 2002 to December 2004, of an intervention for family caregivers of patients with AD or related disorders that was funded by the National Institute on Aging and the National Institute of Nursing Research. The data reported in this paper are from the Memphis site only, which had a health economist to assist in the capture of intervention costs.

METHODS

Resources for Enhancing Alzheimer's Caregivers Health II

Five sites (Birmingham, Memphis, Miami, Palo Alto, and Philadelphia) and a Coordinating Center in Pittsburgh participated, with 642 black, Hispanic, and white caregiving dyads. Each site obtained local institutional review board approval. After written informed consent was obtained, caregivers were randomly assigned to the intervention (323 participants) or control (319 participants) arm within each of the three racial or ethnic groups. The intervention included five components that targeted five problem areas linked to caregiver risk and quality of life: caregiver burden, emotional well-being, self-care and healthy behaviors, social support, and care-recipient problem behaviors.

The 6-month intervention included modules focusing on information, safety, caregiver health and well-being, and behavior management for the care recipient. Twelve individual sessions were delivered in the caregivers' home (9 sessions) and through telephone (3 sessions), supplemented by five telephone-administered support-group sessions of five to six caregivers. Control caregivers received two brief "check in" phone calls. An assessment battery including measurements of depression, burden, self-care, health, and social support was administered at baseline and 6 months postrandomization.¹⁸ The primary outcome comprised standardized differences between baseline and 6-month follow-up for each of five measures central to caregiver quality of life: caregiver burden (Zarit Burden Interview),¹⁹ depression and emotional well-being (Center for Epidemiologic Studies Depression Scale (CES-D)),²⁰ self-care activities and healthy behaviors, social support (received support, satisfaction with support, and negative interactions and support), and care-recipient problem behaviors (Revised Memory and Behavior Problem Checklist (RMBPC)).²¹

Hispanic and white intervention caregivers experienced significantly greater improvement in quality of life than those in the control group ($P < .001$ and $P = .04$, respectively), as did black intervention spouse caregivers ($P = .003$). Prevalence of clinical depression was also lower for intervention caregivers at the 6-months endpoint ($P = .001$).¹⁸ An underlying assumption was that the inter-

vention would reduce caregiver stress and improve the caregiver's ability to manage behavior problems, leading to a decrease in the amount of time the caregiver spent in caregiving activities.

Sample Selection

Caregivers were aged 21 and older, lived with the care recipient, and had provided at least 4 hours of supervision or direct care per day for at least the previous 6 months. Caregivers were excluded if they were enrolled in another study or if they or their care recipients had an illness or disability that would prohibit them from study participation. Care recipients had a diagnosis of AD or related dementia (ADRD) or scored less than 24 on the Mini-Mental State Examination (MMSE)²² and had at least one limitation in activities of daily living (ADLs)²³ or two in instrumental activities of daily living (IADL2).²⁴

Caregiver Data

Caregiver demographics included age, sex, race, education, marital status, and income. Caregiving variables included duration of caregiving, relationship to care recipient, caregiver bother, and hours spent providing daily care. Bother was measured using the RMBPC bother score,²¹ with higher scores indicating more bother. Caregiver depression was measured using the CES-D,^{20,25} with higher scores indicating more depressive symptoms. Caregivers were also asked about the use of formal healthcare services in the month preceding data collection. Supportive services for the combined dyad included homemaker, aide, meals, transportation, home care nurse, senior center, and day care. Physician and other provider visits, emergency department visits, hospitalizations, and nursing home stays were captured for caregiver and care recipient.

Care Recipient Data

Care recipient demographics included age, sex, and race. Factors that could influence hours of care, including use of cognitive enhancing medications, were examined. Cognitive status was measured using the MMSE, with higher scores indicating better cognitive abilities. ADLs were assessed using a modified Katz ADL scale²³ and IADLs with the Lawton and Brody scale.²⁴ For both scales, higher scores indicate greater impairment. Dementia behaviors were assessed using the RMBPC dementia behaviors score,²¹ with higher scores indicating more behaviors.

Baseline characteristics were compared using chi-square for contingency tables or independent-samples *t*-tests, as appropriate. $P \leq .05$ was considered statistically significant, and those $> .05$ and $< .10$ were considered trends toward significance.

Incremental Cost-Effectiveness Ratio

Cost-effectiveness was examined using the incremental cost-effectiveness ratio (ICER).²⁶ The ICER, the additional cost incurred to bring about one additional unit of benefit per day per caregiver, is computed as follows.

$$\text{ICER} = \frac{\Sigma \text{Cost}_{\text{Intervention CG}} - \Sigma \text{Cost}_{\text{Control CG}}}{(\text{NCHS}_{\text{Intervention CG}} - \text{NCHS}_{\text{Control CG}}) \times 30 \text{ days} \times 6 \text{ months}}$$

where $\sum \text{Cost}_{\text{Intervention CG}}$ and $\sum \text{Cost}_{\text{Control CG}}$ represent the sum of costs per intervention caregiver and per control caregiver, respectively, up to the 180-day endpoint of the study, and $\text{NCHs}_{\text{Intervention CG}}$ and $\text{NCHs}_{\text{Control CG}}$ are the average noncaregiving hours per participating intervention and control caregiver respectively per day at the endpoint.

Cost-effectiveness analysis (CEA) requires the use of a single, composite outcome that represents multiple components of outcomes and at the same time produces a CEA outcome that can be meaningfully interpreted²⁷ (e.g., years of life gained, days of work gained).^{28–30} For this study, a noncaregiving hour represents an assortment of benefits from the intervention and produces a CEA outcome that can be meaningfully interpreted as cost per hour of noncaregiving time gained. The ICER represents the cost of an additional hour of noncaregiving time that can be “purchased” by the intervention. ICER calculation requires data on noncaregiving hours and dollar cost for intervention and control caregivers.

Noncaregiving Hours

Each caregiver was asked to report number of hours per day “actually doing things” for the care recipient. Daily noncaregiving hours were 24 hours minus the average number of hours of care. Beyond its face validity, the REACH caregiver question about time spent doing things for the care recipient has not formally been the subject of a reliability and validity study, although it is included as one of four component items in the Caregiver Vigilance Scale.³¹ In collecting the caregiving hours data, to assure reliability, the question was asked of all caregivers according to a protocol specifying that question wording and its place in the instrument battery remained identical across all interviews. The present study provides evidence of construct validity, in the finding of an interaction effect favoring the treatment group. Intervention and control group data were compared using repeated measures analyses of variance to examine between-group differences in change in average number of

noncaregiving hours per day from baseline to 6 months, controlling for any significant or trended baseline variables as covariates.

Intervention and Control Costs

Following the Panel on Cost-Effectiveness in Health and Medicine recommendations,^{27,32,33} intervention and control costs were calculated for staff training time for intervention and control protocols, staff time spent in preparation and wrap-up, staff time in intervention and control group protocols, caregiver time, supervisor and staff supervision time, travel time and mileage, and materials.

Intervention delivery time was documented on the delivery assessment form. For the other task categories, time and number of staff involved were recorded for each activity. Research activity time (e.g., data collection) was not included.

Personnel cost was per-hour salary cost, using annual salary and benefits and a work year of 2,087 hours, for time spent on study tasks, rounded up to the nearest 5 minutes. Costs for materials were actual costs. Travel costs were mileage reimbursement of \$.032 per mile for the distance and personnel cost during travel time to and from participants’ homes, calculated using MapQuest software (America Online, Inc., Denver, CO). The Department of Labor rate for a home care aide during the study period (\$8.12) provided a standard estimate of costs for caregivers’ time.

RESULTS

Sample

Of 55 intervention and 57 control group caregivers, 46 in each group completed the 6-month study without death or loss to follow-up. There was a trend toward fewer female caregivers in the intervention group ($P = .05$), as shown in Table 1. Also, intervention group caregivers had been providing care longer than control group caregivers ($P = .047$) and spent fewer hours in care recipient care ($P = .04$). Care

Table 1. Intervention and Control Caregiver Baseline Characteristics

Characteristic	Control (n = 46)	Intervention (n = 46)	P-Value*
Age, mean $\pm$ SD	58.6 $\pm$ 3.9	61.0 $\pm$ 13.2	.40
Female, %	91.3	73.9	.05
Black, %	54.3	47.8	.68
Income > \$20,000, %	65.2	75.6	.36
Education > 12 years, %	89.1	87.0	1.00
Relationship to care recipient			.13
Spouse	34.8	43.5	
Child	47.8	52.2	
Other	17.4	2.2	
Caregiving years, mean $\pm$ SD	2.7 $\pm$ 2.2	4.1 $\pm$ 4.3	.047
Revised Memory and Behavior Problem Checklist bother score (range 0–96), mean $\pm$ SD	19.1 $\pm$ 14.3	15.1 $\pm$ 9.9	.13
Center for Epidemiological Studies Checklist (range 0–30), mean $\pm$ SD	9.4 $\pm$ 6.6	8.2 $\pm$ 4.9	.34
Hours spent caregiving, mean $\pm$ SD	8.4 $\pm$ 4.5	7.1 $\pm$ 4.5	.04
Physician visits per month, mean $\pm$ SD	3.4 $\pm$ 2.2	3.3 $\pm$ 2.2	.90
Support group visits per month, mean $\pm$ SD	1.4 $\pm$ 1.1	1.0 $\pm$ 0.5	.39

* Chi-square or *t*-test for independent samples, as appropriate.
SD = standard deviation.

Table 2. Intervention and Control Care Recipient Baseline Characteristics

Characteristic*	Control (n = 46)	Intervention (n = 46)	P-Value*
Female, %	45.7	69.6	.03
Cognitive enhancer, % yes	41.3	54.3	.30
Age, mean $\pm$ SD	78.5 $\pm$ 10.3	78.5 $\pm$ 9.6	.98
Mini-Mental State Examination score (range 0–30), mean $\pm$ SD	12.0 $\pm$ 8.1	15.4 $\pm$ 7.4	.04
Number of activities of daily living care recipient had trouble with (range 0–6), mean $\pm$ SD	3.5 $\pm$ 2.1	3.0 $\pm$ 1.9	.24
Number of instrumental activities of daily living care recipient had trouble with (range 0–8), mean $\pm$ SD	7.0 $\pm$ 1.1	6.6 $\pm$ 1.7	.20
Revised Memory and Behavior Problem Checklist behavior score (range 0–72), mean $\pm$ SD	24.6 $\pm$ 10.3	22.0 $\pm$ 8.6	.19
Physician visits per month, mean $\pm$ SD	2.7 $\pm$ 2.0	2.7 $\pm$ 2.4	.95
Emergency department visits per month, mean $\pm$ SD	1.0 $\pm$ 0.0	1.3 $\pm$ 0.5	.44
Home care visits per month, mean $\pm$ SD	3.6 $\pm$ 4.0	2.9 $\pm$ 2.3	.63
Day care days per month, mean $\pm$ SD	11.4 $\pm$ 8.2	10.9 $\pm$ 2.3	.89

* Chi-squared or *t*-test for independent samples, as appropriate.

SD = standard deviation.

recipients in the intervention group were more likely to be women ($P = .03$) and had higher MMSE scores ($P = .04$), as shown in Table 2. There was no significant difference in formal healthcare use between control and intervention dyads, caregivers, or care recipients. Sample sizes were small. Only physician visits, support group visits, emergency department visits, home care nurse visits, and day care days had at least five people total that reported service use.

Time Spent Caregiving

Controlling for baseline differences, intervention caregivers decreased caregiving hours per day, whereas control group caregivers did not ($P = .01$), as shown in Table 3. The difference between intervention and control caregivers in baseline values for average caregiving hours per day was controlled for in this analysis. The difference between intervention and control group caregivers remained after controlling for caregiver and care recipient sex, care recipient MMSE score, and years of care.

Results of Costs for Intervention and Control Groups

Staff Salary Costs

Staff hourly costs were \$21.11 for interventionists, \$28.99 for first-line supervisor, and \$51.46 for second-line supervisor.

Staff Training Time and Costs

Initial training for individual-session intervention components, including readings, review of all intervention materials,

lectures, observations, role plays, written tests, and certification, was a one-time event. Additional training time was needed when interventionists delivered a module for the first time. Thirteen hours of this training were identical to control group training and were allocated between the two groups for cost calculation. Total nonprorated times are shown on Table 4 to highlight time involved in each study condition. Support group training also included initial and additional training time for the first support group. Total staff intervention training time was 104 hours (97.5 hours prorated for cost calculation). Supervision training time was calculated for staff and first- and second-line supervisors. Training cost per intervention caregiver was \$101 and per control caregiver was \$10, as shown in Table 5.

Staff Intervention Time and Costs

Preparation and wrap-up times for each module varied, from 2.5 hours for the introduction and behavioral management modules to 0.5 hours for the safety, stress management, mood management, and closure modules. Some modules were only presented once for each caregiver (e.g., introduction), others might be presented more than once (e.g., managing behavioral problems, stress management). On average, for each caregiver, 1.7 behavioral management modules and 6.7 stress modules were presented.

Each telephone social support group took 1 hour for initial setup (e.g., calling caregivers) and 2.0 hours preparation and wrap-up for each of the five sessions, for a total of 11 hours for five support group sessions and a staff cost of \$232 per support group.

Table 3. Change in Daily Hours of Care

		Time of Measurement		Interaction Effect		
		Baseline	6 Month			
Variable	N	Mean ± Standard Deviation		Degrees of Freedom	F	P-Value*
Intervention	46	7.1 ± 4.5	5.8 ± 4.0	1	6.65	.01
Control	46	8.4 ± 4.5	8.4 ± 4.4			

* Analysis of covariance controlling for baseline values.

Table 4. Hours of Resources for Enhancing Alzheimer's Caregivers Health II Intervention and Control Components During 6 Months

Program Component	Control	Intervention	In Home	Telephone Support
Initial training per interventionist	15.5	98.2	86.2	12.0
Additional training time for new modules per interventionist	—	5.8	3.8	2.0
Training supervision per supervisor	1.0	6.3	5.0	1.3
Preparation and wrap-up per caregiver	0.3	13.8	11.6	2.2
Session activities per caregiver	0.5	20.5	15.5	5.0
Supervision and support per staff member per week	0.2	1.2	1.0	.3
Staff travel time per caregiver	—	5.1	5.1	—
Caregiver time per caregiver	0.5	20.5	15.5	5.0

Preparation and wrap-up for each control group call (e.g., notes, safety alerts that needed to be discussed) was approximately 10 minutes. Total intervention preparation and wrap-up cost per caregiver was \$291, as shown in Table 5. Control group preparation and wrap-up cost was \$7 per caregiver.

Staff cost for the intervention delivery for each caregiver was \$348, with staff cost of \$327 for 15.5 hours of individual-session delivery and \$21 for 5.0 hours of support group delivery (each hour shared with four other caregivers). Staff cost for delivery of two 15-minute calls to control caregivers was \$11 per person.

Supervision Cost

Over 26 weeks the two interventionists and one first- and one second-line supervisor spent 1.5 hours per week each in supervision activities, with control group supervision approximately 15 minutes per week for each staff member. Supervision cost per intervention caregiver was \$105, with time allocated to the two components based on their hours. Control supervision per caregiver was \$17.

Travel Expenses

For nine in-home visits, average round trip travel was 22.3 miles (range 0.8–61.0 miles) for a total of 201 miles per caregiver and 34 minutes (range of 1–72 minutes) for 5.1 hours total per caregiver. Travel expenses to and from the in-home sessions included staff time cost of \$108 and mileage reimbursement of \$64, for a total travel cost for each caregiver of \$172 per person.

Materials Costs

Materials were \$30 for each intervention participant and \$5 for each control participant.

Caregiver Time and Cost

With an estimated cost per hour for caregiver's time of \$8.12, the cost per intervention caregiver over 6 months was \$167 (individual session cost of \$126 and support cost of \$41). Cost per control group caregiver was \$4.

Table 5. Total Per-Person Cost of Resources for Enhancing Alzheimer's Caregivers Health II Intervention for All Caregivers During 6 Months

Intervention Component	Control	Intervention	Intervention Components	
			In Home	Telephone Support
			\$*	
Total training cost†	10	101	86	15
Staff costs	8	90	77	13
First-line supervisor costs	1	4	3	1
Second-line supervisor costs	1	7	6	1
Preparation and wrap-up	7	291	245	46
Session delivery	11	348	327	21
Supervision and support†	17	105	79	26
Travel (mileage)	—	64	64	—
Travel (staff time cost)	—	108	108	—
Materials	5	30	30	—
Caregiver time	4	167	126	41
Total per person	54	1,214	1,065	149

* Costs rounded to nearest dollar amount.

† Costs allocated between intervention and control groups, according to hours for each.

Incremental Cost-Effectiveness Analysis

Numerator—Total REACH II Time and Cost

Total cost for the REACH II intervention was \$1,214 per intervention caregiver, with intervention costs per caregiver of \$1,065 for the individual sessions component and \$149 for the support group component. Costs per control caregiver were \$54.

Denominator—Noncaregiving Hours

To determine average noncaregiving hours at the 6-month endpoint, control group noncaregiving hours per day at 6 months (24.0–8.4) were subtracted from intervention group hours per day at 6 months (24.0–5.8), for a difference of 2.6 hours per caregiver per day. Because the intervention and control groups differed by 1.3 noncaregiving hours at baseline, this amount was subtracted from the 2.6-hour difference at 6 months, which left a net group-by-time interaction effect of 1.3 more noncaregiving hours per day for the intervention group.

Incremental Cost-Effectiveness Ratio

Using the total costs for the intervention and control groups and the outcome of noncaregiving hours, the incremental intervention cost-effectiveness ratio was computed as

$$ICER = \frac{\Sigma \text{Cost}_{\text{Intervention CG}} - \Sigma \text{Cost}_{\text{Control CG}}}{(\text{NCHs}_{\text{Intervention CG}} - \text{NCHs}_{\text{Control CG}}) \times 30 \text{ days} \times 6 \text{ months}}$$

$$ICER = \frac{\$1,214 - \$54}{(2.6 - 1.3) \times 30 \text{ days} \times 6 \text{ months}} = \$4.96$$

Thus, the results show that the 6-month intervention is cost-effective if one is willing to spend \$4.96 per day for 1 extra hour of noncaregiving time per day for each caregiver. In addition, when interpreted in the cost-benefit sense, the intervention can be thought of as being financially positive because it results in \$10.56 (\$8.12 of caregiver hourly wage $\times$ 1.3 hours) of time gained versus \$4.96 of intervention cost per hour per day per caregiver.

DISCUSSION

This study examined the cost-effectiveness of a multicomponent psychosocial intervention to decrease the stress and burden of caregivers of people with dementia and improve their ability to manage behavioral problems of the care recipient. REACH II was one of the first studies to systematically assess the efficacy of a multicomponent intervention in a racially and ethnically diverse dementia caregiving sample. Moreover, the current study is the first cost-effectiveness analysis comparing an in-home-based family caregiving intervention with a control condition. At the end of 6 months, there was a significant difference between intervention caregivers and control caregivers in hours providing care, such that the caregivers in the intervention group had more time to allocate to noncaregiving activities. For the 6 months, total cost for each intervention caregiver was \$1,214, and total cost for each control caregiver was \$54.

The ICER showed that, for an additional hour of noncaregiving time per day, intervention costs were \$4.96 per day per caregiver (\$893 total over 6 months). The intervention would be even more cost-effective if the reduction in hours spent caring extends beyond the 6-month period without additional intervention. The unit cost (hour) in-

vestment decreases with increase in length of intervention effect.

A major limitation of the study was the lack of additional follow-up data after the intervention ended. These data would have allowed the sustainability of the intervention effect to be determined, although it is not unreasonable to assume that the intervention effects would last for at least 6 months. Other caregiving studies with similar interventions have shown that intervention effects can last 3 to 8 months,^{34–37} up to 1 year,^{38–41} or up to 18 months.⁴² In one cost-effectiveness study⁴³ of a multicomponent institution-based dementia intervention,¹⁷ in addition to significant psychological improvement, cost savings of \$5,975 (1990 U.S. dollars) were evident at 39 months. Further study to determine duration of intervention effect would be beneficial.

Another study limitation was the lack of objective healthcare utilization data. Although no significant differences were reported, data were according to caregiver report for use of services by the dyad, the caregiver, and the care recipient and covered only the month preceding baseline and 6-month follow-up data collection. Numbers were small, and examination of Medicare services use is an area for future study.

Because family caregiving accounts for a large proportion of the care of those with AD, providing relief to families is an important goal. At the beginning of the study, caregivers reported an average of approximately 8 hours per day providing care. At the end of the intervention, hours providing care had remained the same for control group caregivers and decreased for intervention caregivers. Although this cost-effectiveness analysis focused on the Memphis site, findings were similar across all REACH II sites, which included the three racial and ethnic groups: whites, blacks, and Hispanics. One intriguing area for future research is to investigate whether spending less time in caregiving activities is related to health outcomes.

Although 68% of the Memphis REACH II caregivers were not working, providing additional time may be even more critical for those who are still working to allow them to provide care without excessive loss of job productivity or having to quit their job. Twenty-five (27.5%) of the 92 caregivers had quit work to care for their care recipient, and 14.3% reported reducing their work hours to provide care. Less time spent in caregiving tasks might make it possible for caregivers to remain employed and reduce work interruptions, although time costs for participating in interventions may affect homemakers and retired or employed caregivers differently, competing not only with caregiving tasks, other familial obligations, and personal needs, but also real wage earnings and may influence who chooses to participate in an intervention.

In addition to the intervention, other factors had the potential to influence the outcome of noncaregiving hours. Recent research has shown that caregivers whose care recipients use cognitive enhancers may gain additional time per day not spent in providing care.^{44,45} For the REACH study, there was no significant difference between the intervention and control groups in use of cognitive enhancers at baseline. The percentage of control care recipients using cognitive enhancers was 43.2% at baseline and 47.7% at 6-month follow-up, and intervention care recipients' use was 56.8% at baseline and 52.3% at follow-up.

Other factors, including care recipient behaviors, caregiver bother, and depression, could have influenced the amount of time spent providing care, but there was no difference in these factors between the intervention and control groups at baseline. The 6-month change in the REACH II multicomponent outcome, which included caregiver burden, emotional well-being, self-care and healthy behaviors, social support, and care recipient problem behaviors, was significantly different between the intervention and control groups. Further study of the potential contribution of each of these five components to the time saved is warranted.

For the purposes of translating this study to an agency setting, the cost estimates may be biased upward for several reasons. For example, in an agency setting, the caseload typically is larger, suggesting that the costs of the intervention would be less. The two Memphis interventionists continued to work with all 103 caregivers during the course of the study, including those whose care recipient died or was placed in an assisted living or nursing home facility, but these additional caregivers were not included in the cost analysis breakdowns. For example, if all 56 intervention caregivers had been included in the intervention training cost analysis, because they benefited from the training, costs for that component would have been \$83 per caregiver, instead of \$101, indicating greater cost-effectiveness. At least one of the REACH II sites used interventionists with bachelors degrees (as opposed to masters degrees in Memphis), which would further decrease personnel costs, which were the major component of intervention costs. In addition, although caregiver time for participation is valuable and a cost to them and an important component of the cost-effectiveness analysis, these costs of \$167 per caregiver would not be part of an agency's costs. Because the intervention included two distinct components, each with separate costs, future work could investigate whether both are necessary to achieve this intervention effect.

As AD progresses, costs increase, from \$9,239 per year in early stages to \$19,925 in later stages.⁴⁶ Costs increase based on cognitive levels and comorbid conditions, although costs are 21% lower for patients who live at home than for those who are institutionalized.⁴⁷ The REACH II intervention was designed to assist caregivers of people with dementia who were providing care at home to enhance their coping skills and management of care recipient behaviors. The intervention significantly improved caregiver quality of life—caregiver burden, depression and emotional well-being, self-care and healthy behaviors, social support, and care recipient problem behaviors. It also provided that most scarce commodity for caregivers—time—in an additional hour per day not providing direct care. Although most caregivers of people with dementia express a desire to provide care in the home, the emotional and physical costs to caregivers are enormous. This intervention was able to alleviate some of that cost.

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