

E-Care: A Telecommunications Technology Intervention for Family Caregivers of Dementia Patients

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Objective: *This study evaluated the effectiveness of a technology-based psychoeducational intervention for family caregivers of dementia patients. An additional objective was to determine if the intervention could be implemented by a community-based social service agency. Methods:* *Forty-six caregivers were randomly assigned to either a technology-based intervention or an information-only control condition. Results:* *Caregivers assigned to the intervention condition reported a significant decrease in burden postintervention and those who evidenced high depression at baseline experienced a significant decline in depression. Conclusion:* *This study provides evidence that technology offers a cost-effective and practical method for delivering interventions to caregivers.* (Am J Geriatr Psychiatry 2007; 15: 443-448)

Key Words: Caregivers, dementia, technology

Family members who care for relatives with dementia provide a great service to their loved ones and society as a whole, but do so at considerable cost to themselves.^{1,2} The burden on family members and society will continue to grow, as the number of individuals with Alzheimer disease and related dementias increases to as many as 16 million by 2050.^{1,3}

Numerous intervention studies have addressed caregiving and on the whole these interventions have been able to achieve small to moderate success in improving caregiver outcomes.⁴ In general, interventions that combine different strategies and that provide caregivers with diverse services and supports tend to generate larger effects than do narrowly focused interventions. However, providing a wide array of services at high intensity is costly. Thus, one challenge facing intervention researchers and social service providers is how to deliver services to caregivers in a cost-effective manner.

Researchers are beginning to explore how technology can be used to facilitate or augment caregiver interventions. The literature suggests that technologies such as telephone and the Internet are both feasible and acceptable within the context of caregiving.^{5,6} However, research examining the impact of technology-based interventions on caregiver outcomes is limited and the findings from existing studies are mixed.⁷

The objectives of this pilot study were to evaluate the effectiveness of a technology-based psychoeducational caregiver intervention and determine if the intervention could be implemented by a social service agency that provides community and residential programs for older adults and their families (Council for Jewish Elderly [CJE]), using staff typically available in such agencies.

Received July 24, 2006; revised December 25, 2006; accepted January 15, 2007. This research was conducted at the Council for Jewish Elderly, Chicago, IL. The authors thank Chin Chin Lee, Sankaran Nair, Dolores Perdomo, Amy Zann, and Sandra Berg for their assistance with this project. From the Council for Jewish Elderly, Chicago, IL (SF, CH, DP); Department of Psychiatry, University of Chicago Medical School, Chicago, IL (SF); Department of Psychiatry and Behavioral Sciences, Center on Aging, University of Miami Miller School of Medicine, Miami, FL (SJC); Department of Psychiatry, University Center for Social and Urban Research, University of Pittsburgh, Pittsburgh, PA (SJC); Mental Health Services and Policy Program, Department of Psychiatry, Northwestern University Feinberg School of Medicine, Evanston, IL (ZM). Send correspondence and reprint requests to Sanford Finkel, M.D., 3127 Greenleaf Ave., Wilmette, IL 60091. e-mail: sfinkel104@aol.com

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METHODS

Eligibility Criteria

Eligibility criteria for caregivers (CG) included: providing care for a relative with Alzheimer disease or related dementia for a minimum of four hours per day for at least the past six months; being over the age of 21 years; living with or in the same geographic vicinity as the patient; having a telephone; planning to remain in the geographic area for at least six months; and competency in English.

The care recipient (CR) had a physician diagnosis of Alzheimer disease or another type of dementia and a Mini-Mental State Exam (MMSE) score less than 23.⁸ Dyads were excluded if the CG or CR had a terminal illness with life expectancy of less than six months, was in active treatment for cancer, was blind or deaf; or if the CR had an MMSE score of 0 and was bedbound (or nursing home admission was planned within six months).

Procedures

The study was approved by the institutional review boards of the participating agency. Written consent was obtained from caregivers and patients (or assent). Following an in-home baseline assessment, eligible participants (N=46) were randomly assigned to the intervention or information only control condition. A follow-up battery (full follow-up, bereavement battery, placement battery) was administered to study participants 6 months postintervention by certified assessors who were masked with respect to treatment condition. Battery modifications included elimination of measures that were not relevant to the changed status of the caregiver (e.g., burden if the CR died), inclusion of measures to assess outcomes appropriate to the situation (e.g., bereavement scale), and modifications to measures to eliminate items no longer appropriate.

Description of Treatment Conditions

The intervention was modeled after the intervention developed at the Miami, Florida site of the Resources for Enhancing Alzheimer's Caregiver Health (REACH) program⁹ and focused on provision of information about the disease and community re-

sources and strategies to enhance safety, communication, self-care, social support, and management of problem behaviors. The intervention differed from the REACH trial in that in that the customized Computer-Telephone Integration System (CTIS)⁹ was the primary vehicle for intervention delivery and the intervention was delivered by staff at the Council for Jewish Elderly (certified clinical social workers).

The CTIS system involved the use of screen phones that presented available features in hierarchical menus (text and voice) and enabled users to: 1) place and receive calls, 2) send and retrieve messages, 3) access a range of information and services, and 4) conference with several people simultaneously. Each caregiver was provided with a screen phone and received training on use of the system during the first home visit. The intervention occurred over 6 months and included two in-home sessions (initial and last session) and 12 sessions conducted via the CTIS system. There were eight individual educational/skill building sessions and six support group sessions (six caregivers and a facilitator), which were interspersed. Caregivers in the control condition received basic educational materials, two brief (<15 minute) telephone check-in calls at three and five months postrandomization, and were invited to participate in a workshop following the six-month assessment.

Outcome Measures

The 10-item version of the Centers for Epidemiologic Studies Depression Scale (CES-D)¹⁰ was used to measure caregiver depression. The 24-item Revised Memory and Behavior Problems Checklist (RMBPC)¹¹ was used to assess caregiver burden. Caregivers' health care behaviors were assessed using a nine-item modified version of the Caregiver Health and Health Behaviors scale¹² that measured self-care activities such as scheduling medical appointments. All items were scored as no/yes. A Received Social Support scale from the Inventory of Socially Supportive Behaviors^{13,14} was used to assess social support. The scale consists of three items (rated on four-point Likert scales ranging from "never" to "very often") that assess tangible, emotional, and informational sources of received support. Three questions assessing the primary domains of the Revised Memory and Behavior Problem

Checklist (memory, depression, and disruption) were used to assess change inpatient problem behaviors (rated on five-point scales ranging from “substantial improvement” through “substantial decline”).

Caregivers also completed a project evaluation questionnaire and those in the intervention condition completed a questionnaire that evaluated the CTIS system.

Data Analytic Strategy:

Five analysis of covariance (ANCOVA) models compared intervention versus control groups on the outcome measures. Prior to ANCOVA analyses, two variables (CESD Depression and CG Bother) were log-transformed to maintain normality.

Pretest was the covariate and treatment group was the between-subject factor. If inclusion of a Pretest \times Treatment Group factor yielded a significant interaction, this term was included, and group differences in adjusted posttest means were evaluated at the mean and at the 25th and 75th percentiles of the dependent variable at pretest. Correlated-sample *t*-tests were conducted separately within the treatment and control groups to assess within group change (using untransformed scores).

Effect sizes (Cohen's *d*) for intervention versus control differences are presented; *d* statistics are made positive for effects where intervention “outperforms” control, taking into account the valence of each scale. For cases involving care recipient death or placement, RMBPC posttest assessments were not applicable.

RESULTS

Sample Demographics

Forty-six subjects were randomly assigned to treatment ($N=23$) and control ($N=23$) conditions. Of the 23 caregivers assigned to the treatment condition, four declined follow-up, one died, and one was hospitalized and could not be contacted. Three caregivers assigned to control declined follow-up, and one could not be interviewed due to illness. Of the 17 remaining caregivers in the intervention condition,

three had placed the care recipient in a nursing home by follow-up and one care recipient had died. Of the 19 remaining control cases, five care recipients had died by follow-up and two had been placed in nursing homes.

Of the 36 retained participants, average CG and CR ages were 64.6 and 83.4 years, respectively. Most of the sample was female (67.6% of CGs, 69.4% of CRs) and educated beyond high school (86.1% of CGs, 57.5% of CRs). The CG sample was primarily white (91.7% white, 8.3% black). Forty-four percent of the CGs were spouses and 53% were children of the CRs. On average, CGs reported spending 17.9 hours “on duty” with the CRs each day, and 9.1 hours actively doing things for the CRs. No significant differences were detected between CGs assigned to the treatment condition versus those assigned to the control condition on any of the above variables at baseline. Ninety-four percent of the CRs had a physician's diagnosis of Alzheimer disease; the remaining 4% ($N=2$) had a diagnosis of vascular dementia.

Treatment Implementation and Treatment Adherence

Seventy-six percent ($N=13$) of the treatment participants completed all eight individual intervention sessions and 18% ($N=3$) participated in seven sessions; only one caregiver missed two sessions. Eighty percent of the support group sessions were attended. Eighty-nine percent ($N=17$) of the caregivers assigned to the control group received both phone contacts. Average contact for those in the intervention condition was approximately eight hours over the six months (mean: 7.87 hours, SD: 1.82) with a range of 6 to 12 hours. For those in the control condition, average contact time was about 43 minutes (mean: 0.72 hours, SD: 0.25) with a range of 0.33 hours to 1.05 hours.

Outcome Analyses

Although no significant main effects of treatment group were detected, for two variables, treatment versus control differences were found to depend on initial level of the variable (prerandomization). For these two variables these significant interactions were included in the ANCOVA model. With respect

to depression, as baseline depression increased, caregivers in the intervention group demonstrated significantly greater improvements in depression ($t_{32} = 2.74, p = 0.010$). Adjusting regression estimates to the 75th percentile of depression at baseline, the expected change for depression was significantly greater than for those in the treatment condition as compared to those in the control condition ($t_{32} = 2.88, p = 0.007$, Table 1). Similar results were obtained for received social support. As baseline support increased, those in the intervention condition were more likely to maintain that support ($t_{30} = 2.25, p =$

0.032). Adjusting regression estimates to the 75th percentile of baseline social support, the expected reduction in support was significantly greater for control than for treatment ($t_{30} = 2.19, p = 0.036$, Table 1).

Effect sizes adjusted to the pretest mean favored treatment over control and ranged from $d = 0.33$ to $d = 0.77$ (positive d values indicated that the adjusted posttest mean was more favorable in the treatment versus control condition). Although these effect sizes were all in the expected direction, none were significant at $p < 0.05$. It is promising, however, that with-

TABLE 1. Treatment Versus Control Pretest and Posttest Means and Adjusted Means, Inferential Tests of Within-Group Change, and Inferential Tests of Group Differences in Adjusted Change With Associated Effect Size Statistics (Cohen's d)

Group	N	Pretest	Posttest	t^a	p Value	Adjusted Pretest	Adjusted Posttest	t (p) Values	d
Self-care ^b									
Intervention	17	5.86	6.65	1.91	0.074	5.75	6.60	1.09	0.36
Control	19	5.65	5.99	0.78	NS	5.75	6.03	(0.284)	
Received support ^{cd}									
Intervention	16	2.88	3.69	2.21	0.043	3.15	3.87	-1.27	0.33
Control	18	3.39	3.22	0.29	NS	3.15	3.21	(0.214)	
Adjusted to 25th percentile (2.00)									
Intervention						2.00	3.11	0.06	-0.02
Control						2.00	3.15	(0.953)	
Adjusted to 75th percentile (4.25)									
Intervention						4.25	4.59	-2.19	0.67
Control						4.25	3.27	(0.036)	
CES-D ^{cd}									
Intervention	17	7.24	4.53	-2.97	0.009	7.16	4.32	1.70	0.42
Control	19	9.53	9.32	-0.24	NS	7.16	6.01	(0.099)	
Adjusted to 25th percentile (4.00)									
Intervention						4.00	3.21	-0.43	-0.13
Control						4.00	2.82	(0.670)	
Adjusted to 75th percentile (11.00)									
Intervention						11.00	5.43	2.88	0.89
Control						11.00	10.09	(0.007)	
RMBPC: Behavior Frequency									
Intervention	13	10.38	9.17	-1.72	NS	9.80	8.57	1.43	0.54
Control	12	9.18	9.51	0.41	NS	9.80	10.16	(0.167)	
RMBPC: CG bother ^d									
Intervention	13	18.54	12.74	-2.56	0.025	15.69	10.42	1.78	0.77
Control	12	16.11	18.89	1.06	NS	15.69	16.88	(0.089)	

Degrees of freedom for t -tests comparing groups on adjusted change are given by the formula $df = N - 3$ for Self-Care and RMBPC scales and by the formula $df = N - 4$ for models with significant interaction terms (Received Support and CES-D). N refers to the total number of cases (combining intervention and control samples).

^aCorrelated sample t -tests within intervention group. Degrees of freedom given by the formula $df = n - 1$ where n refers to the number of pairs of scores within each group.

^bHigh scores represent better health/functioning.

^cIndicates inclusion of significant Pretest \times Treatment interaction term; thus, treatment versus control differences in adjusted means were evaluated at the full sample 25th and 75th percentiles, as well as at the full sample mean.

^dIndicates that regression models and tests were performed on log-transformations of indicated scales to maintain approximately normal error variation. In these cases, the mean adjustment was to the log-transformed scale mean and not to the untransformed scale mean. Adjusted log-transformed scale means were inverse transformed to clarify pretest score values on the original metric.

CES-D: Center for Epidemiologic Studies Depression Scale; RMBPC: Revised Memory and Behavior Problems Checklist; NS: no significant differences.

in-group improvement was significant for burden, depression, and received social support for those in the intervention group.

The results from the project evaluation indicated that 100% of the caregivers in the intervention group benefited from the intervention as compared to 74% of those assigned to control (two-tailed Fisher's exact $p = 0.047$). Significantly more caregivers assigned to intervention indicated improved confidence concerning caregiving ($\chi^2 = 6.12$, $p = 0.013$) and an improvement in ability to provide care ($\chi^2 = 4.36$, $p = 0.037$). The majority of caregivers (94%) found the support groups valuable and 65% indicated that participation in the groups improved their caregiving skills. Most caregivers found the CTIS network to be helpful (75%), valuable (76%), and easy to use (93%).

DISCUSSION

This pilot study examined the feasibility and effectiveness of a social/behavioral caregiver intervention delivered via a technology system. Although components of this intervention have been evaluated in other studies, this is the first attempt to deliver a complex multicomponent caregiver intervention almost exclusively via computer telephone technology. The findings from this study are promising. Modest to large effect sizes favoring treatment were obtained for all major outcomes of the study equivalent to or greater than those reported for much more labor-intensive treatments involving one-on-one interactions between interventionists and caregiver⁵ over an extended period of time. Caregivers in the treatment arm with high levels of depressive symptoms exhibited statistically significant positive changes in depression and those with high levels of support showed relatively greater capacity to maintain that support. Caregivers in the treatment arm also reported increased confidence in their skills as caregiv-

ers and their ability to deal with difficult caregiving challenges.

The findings show that existing technology can be used to deliver a multicomponent intervention effectively and efficiently. The intervention required only two in-person home sessions, and all other components were delivered via the computer/telephone system. The caregivers were very receptive to using the technology and found it easy to use. Technology-based interventions may be more cost-effective because they eliminate the need for health care professionals and caregivers to travel and enhance the ability of caregivers to access existing resources and programs.

Another unique aspect of this study was that the intervention was implemented by a community agency with health care professionals who were not intervention researchers. Training was also minimal and included 1 day of formal training with monitoring by a clinical supervisor which are standard components of most intervention programs. Thus this study demonstrates the feasibility of implementing this type of program in community settings.

The results of this study are encouraging and suggest that a relatively short intervention program delivered via technology can provide support and reduce depression among family caregivers. However, limitations of the study included a small sample, lack of a time-equivalent comparison condition, and one follow-up assessment postintervention. Future studies are needed to evaluate the long-term impact of these types of programs with larger and more diverse samples. The effectiveness of using a technology-based intervention also needs to be evaluated relative to an in-person version of the intervention. Finally, consistent with the need for more translational research, it is important to determine if the intervention can be implemented by other community-based social service agencies.

This work was supported by the Braun Fund.

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