Advances in science have resulted in earlier diagnosis of cognitive disorders such as mild cognitive impairment (MCI) and early-stage Alzheimer's disease (AD). MCI is often prodromal to AD and may be the first indication that there is a cognitive disorder. Considering that there are no disease-modifying agents to reverse or halt this neurodegenerative process, nonpharmacological strategies aimed at slowing the progression of the disease and helping individuals maintain independence as long as possible are in demand. Cognitive training has shown some promise in improving or maintaining cognitive function thereby facilitating individual independence for a longer period of time (Yu et al., 2009). Despite the presumed benefits of cognitive training, studies exploring the effectiveness of cognitive training have shown conflicting results (Clare & Woods, 2003). One possible reason for this is the lack of ecological validity of the training.

The concept of ecological validity serves as the rationale for testing these interventions in the home environment.

ABSTRACT

This intervention study compared an in-home cognitive training program to life story interview in 68 individuals with mild cognitive impairment or early-stage Alzheimer’s disease. Family caregivers participated in sessions and reinforced learning between sessions. Analyses of covariance controlling for baseline levels were conducted. In comparison with the life story group, participants in the cognitive training group demonstrated significant improvement in all face-name association measures, several of the money-related tasks, and one of two event-related memory tasks. There were no differences in language outcomes or caregiver ratings of functional tasks except shopping. Caregivers in the life story group reported higher perceived satisfaction from being a caregiver. Comparison with earlier studies suggests in-home training is modestly more effective than office-based intervention. Results suggest that improvements are related to specific training and do not generalize to other tasks. Focusing on tasks of critical significance to participant and caregiver is recommended.
Ecologically valid programs are those that map directly to everyday behaviors and focus on real-life problems (Wilson, 1996). Attention is given to the interaction of intrapersonal characteristics and the environment (Sallis, Owen, & Fisher, 2008). In-home interventions that have ecological validity may help people with MCI and early-stage AD adapt the cognitive strategies learned to everyday living and maintain independence. Research studies testing cognitive training programs that can be implemented in the home to help people with MCI and early-stage AD maintain their functional independence as long as possible are needed.

The purpose of this study was to evaluate the effect of a caregiver-supported, in-home cognitive training program on the functional performance of individuals with MCI and early-stage AD and on the mood, reactivity, and satisfaction of their caregivers. To control for the amount of effort and attention required for cognitive training, the effects of the cognitive training program were compared with more general mental stimulation of a life story interview of equivalent intensity and duration.

It was hypothesized that:
- Compared with the life story group, the in-home cognitive training participants will demonstrate higher levels of functional performance related to memory, calculation, and independent activities of daily living (ADLs) at posttest.
- Compared with the in-home cognitive training participants, the life story group participants will demonstrate higher levels of language performance at posttest.
- Caregivers of the in-home cognitive training participants will report fewer depressive symptoms, lower levels of reaction to problem behaviors, and higher levels of satisfaction with the outcomes of the intervention than will caregivers of life story participants.

Memory and calculation functionality were specifically addressed in the cognitive training. It was further hypothesized that the gains in memory and calculation would generalize to improvement in ability to carry out independent ADLs. The effortful, stimulating conversation involved in discussing one’s life story was expected to result in improved language performance in the comparison group.

BACKGROUND

Cognitive training involves identifying the individual’s cognitive abilities and deficits and addressing them through implementation of a set of tasks that focus on particular cognitive functions, such as memory, attention, language, calculation, or executive function (Martin, Clare, Altgassen, Cameron, & Zehnder, 2011; Yu et al., 2009). There is some evidence to support the effectiveness of cognitive training in improving or maintaining cognitive function in older adults with early-stage AD. It has commonly been offered in group or individual sessions in the clinical setting. The tasks involved range from pencil-and-paper practice to sophisticated, computer-based strategies. There is also a substantial range in the frequency and duration of training sessions. An important finding from a systematic review of nonpharmacological interventions for people with AD and dementia (Yu et al., 2009) is that cognitive training in combination with cognition-enhancing medications appears to yield the best results if the training were structured and focused on a specific cognitive domain. Areas of improvement noted include memory, learning, problem solving, ADLs, and decision making (Yu et al., 2009).

Loewenstein, Acevedo, Czaja, and Duara (2004) examined the effects of cognitive training on specific cognitive and functional tasks in individuals with early-stage AD who were stabilized on a cholinesterase inhibitor (taken for at least 8 weeks). Participants who met inclusion criteria were randomized to one of two groups. The intervention group (n = 25) participated in two 45-minute cognitive training sessions twice per week for a total of 24 weeks. The sessions combined spaced-retrieval, dual cognitive support, procedural memory activation, visuo-motor processing activation, and functional skills. The control group (n = 19) participated in an equal number of mental stimulation sessions that included tasks such as computer games, word-finding activities, and recall of recent or remote events. The training was administered in individual sessions in a clinical setting. Participants in the cognitive training group achieved higher scores on a Face-Name Association Test, Orientation, and Making Change for a Purchase Test, as compared with the mental stimulation group (p < 0.05). The researchers concluded that individuals with early-stage AD achieved cognitive and functional gains after attending a targeted cognitive training program. Interestingly, those tasks that were maintained over time related to real-world activities. The authors recommended further research exploring the effect of more ecologically valid programs on cognitive and functional improvements.

The study reported in this article used a similar approach to cognitive training; however, unlike the Loewenstein et al. (2004) study, the sample included people with MCI as well as those with early-stage AD and the intervention was conducted in the home setting.

Other studies have shown the benefits of using cognitive training to enhance the use of external memory aids. Bourgeois et al. (2003) conducted a study comparing the efficacy of two cognitive training approaches (spaced-retrieval...
and modified cueing hierarchy) for teaching people with dementia to use external memory aids to achieve a specific goal. External memory aids included memory books, activity reminder cards, and physical cues such as name tags or labels. Spaced-retrieval has been shown to be an effective approach to assist learning and memory (Camp, 2006; Landauer & Bjork, 1978). This behavioral technique involves the practice of receiving and incorporating information followed by multiple attempts of retrieval over increasingly longer periods. Cueing hierarchy takes a step-by-step approach to cueing based on the participants’ response (Bollinger & Stout, 1976). For this study (Bourgeois et al., 2003), 25 older adults with dementia were recruited from long-term care and adult day care facilities, the majority of whom were diagnosed with either moderate-stage AD or unspecified dementia. The findings suggest that participants were able to gain new knowledge using both approaches; however, the use of spaced-retrieval as a cognitive training method seemed to be a better approach for enhancing the use of external memory aids as evidenced by: (a) more participants were able to master a stimulus-response goal compared with a cueing hierarchy goal, $F(1, 24) = 4.99, p < 0.050$; and (b) more goals were maintained in the stimulus response group versus the cueing hierarchy group, $Z = -2.33, p < 0.02$ (Bourgeois et al., 2003). The authors concluded that cognitive training can be an effective strategy to help people with dementia successfully use external memory aids to achieve a targeted behavior.

Memory books or wallets serve as sensory or environmental cues for personal information to support retrieval of associated semantic information from memory storage. They have also been helpful to caregivers because they can redirect the person with dementia to this external memory aid and reduce the frequency of repetitive questions. Further, they provide a place to record daily activities and other personal information such as names of family members and special events. The use of spaced-retrieval in combination with external cues such as a memory book or wallet and having family members reinforce the training can enhance effectiveness (Camp, Foxx, Stevens, & O’Hanlon, 1996; McKitrick & Camp, 1993). Many of these latter studies have focused on people with later stage dementia. Emerging research involves exploring effectiveness of interventions in people much earlier in the disease—MCI to early-stage AD.

Researchers testing the efficacy of a multifactorial cognitive training intervention in community-dwelling older adults with MCI compared with those who did not receive the training found that episodic memory performance can be improved with training (Belleville et al., 2006). Improvement was found in the intervention group on face-name association ($p < 0.01$) and delayed list recall ($p < 0.01$). In addition there was a positive effect on self-reported memory and overall feelings of well-being. Despite the limitations, notably a relatively small sample size ($n = 47$), lack of randomization, and relatively short length of the study (eight weekly group sessions lasting approximately 2 hours), the results suggest this kind of intervention may be beneficial in a group at high risk for progression to AD.

A systematic review of 15 additional cognitive intervention programs for individuals with MCI suggested that both individual and group training sessions offer effective treatment options (Jean, Bergeron, Thivierge, & Simard, 2010). The sample size for the studies reviewed ranged from 1 to 193; none were conducted in the home. Most of the studies had a small sample size (less than 30 participants). Some focused on memory only, whereas others took a multifaceted approach targeting several cognitive domains. The number of training sessions ranged from 1 to 12; only one involved both a participant and a program partner. Considering the variation among studies, the authors called for larger, randomized controlled trials.

These studies provide evidence that cognitive training incorporating spaced-retrieval, functional task training, and use of external memory aids (compensatory strategies) may be an effective way to enhance functional performance in older adults with MCI and early-stage AD. Ecological validity may be achieved by conducting the training in the home using the patient’s own stimulus materials. As the population ages and more older adults are diagnosed with MCI or AD, we anticipate there will be increasing demand for evidence-based cognitive training that can be done in the home.

**METHOD**

A functionally oriented, in-home cognitive training program was compared with an effort and attention control group in which participants and their caregivers engaged in organized, sequential life story interviews (Atkinson, 1998) of equal duration and intensity.

**Design**

A two-group intervention and comparison (life story interview) experimental design with random assignment to treatment group was used. The examiners were blinded to treatment group assignment. Participants were tested immediately prior to initiation of the 12-week treatment and at the end of treatment.
Sample

Participants were recruited from the University's Memory and Wellness Center. Individuals who were on a waiting list for therapeutic programs and had expressed an interest in training programs for memory problems and those who responded to announcements at the center and in the press were consented and enrolled in accordance with the University's Institutional Review Board-approved protocol. Inclusion criteria were: (a) clinical diagnosis of MCI or probable early-stage AD based on a comprehensive evaluation of cognitive status, which included, at minimum, a physical examination, laboratory testing, and neuropsychological testing as well as neuroimaging of the brain as indicated, and confirmed by report of the findings from a medical provider or health record; (b) Mini-Mental State Examination (MMSE) score of 19 or higher and overall Clinical Dementia Rating (CDR) score of ≤1; (c) stabilized medication regimen with an anticholinesterase inhibitor approved by the U.S. Food and Drug Administration; and (d) caregiver willing to participate as a therapy extender. Exclusion criteria were evidence of vascular dementia, stroke, Parkinson's disease, acute psychosis, mental retardation, or history of traumatic brain injury.

Procedures

Initial screening of individuals who expressed an interest in participating was done at the Memory and Wellness Center by a clinical psychologist and one of the co-investigators (D.H.). Those who had not undergone a comprehensive evaluation of AD were referred to a memory disorder center or neurologist for comprehensive evaluation and diagnosis prior to study enrollment. Those who met the inclusion criteria were given further information about the study (both the person with cognitive impairment and the caregiver), and consent procedures were completed. Once the consent was obtained, participants were pretested at the center and randomly assigned to either the cognitive training group or life story group. All testing was done at the center by examiners blinded to treatment group assignment under the supervision of a neuropsychologist, providing a uniform setting for evaluation of outcomes (Bédard et al., 1995).

Interventions

Participants in both groups received two 1-hour treatment sessions per week in their homes for 12 weeks (24 sessions total). Reinforcement was done by caregivers on non-treatment weekdays after training by the interventionists.

The cognitive training protocol focused on tasks that were directly relevant to real-world behaviors of consequence to both participant and caregiver and based on two premises: (a) that generalizability is facilitated by in-home treatment and use of familiar, participant-supplied stimuli materials; and (b) that improvement in cognition-related function of individuals with MCI or early-stage AD is facilitated by tapping procedural memory and potentiated when a substantial amount of cognitive support is provided at both encoding and retrieval (Loewenstein et al., 2004).

The cognitive training protocol used these principles and focused on tasks directly relevant to real-world behaviors.

Spaced Retrieval. The original spaced-retrieval paradigm was extended by incorporating additional cognitive support at encoding and retrieval.

- Face-Name Association began with standard pictures but proceeded to work with personal photos of individuals the participant and caregiver selected as relevant to them.
- Object Location used placement of important personal items (e.g., keys, eyeglasses, wallet) within the home by participant and caregiver and increasingly long recall intervals for location of objects.

Functional Task Training.

- Telephone directory search, use of directory assistance, placing an emergency call, and use of personal telephone numbers from the participant's Memory Notebook.
- Appointment Management using scripted messages, changing appointments and making calls at assigned times.
- Money Management, including checking bank balances, paying actual bills, making change, and balancing the participant's checkbook.
- Medication Management using the daily dose reminder system and Memory Notebook.
- Meal Preparation using reminder systems and routines to prepare simple meals.

Compensatory Strategies.

- Memory and Orientation Notebook containing important personal information, a personal appointment calendar, and health information including meal and medication schedules. The notebook served as an external memory aid.
- Memory Place, a consistent, convenient location for important personal items (e.g., eyeglasses, keys, wallet) created in the home to aid object location.
- Daily Dose Reminder system to support self-administration of medications.

The modules of the 12-week, 24-session, cognitive training program were designed to be systematic and sequential in nature, incorporating all of the above tasks.
The comparison life story interview intervention was based on Atkinson’s (1998) life story interview and followed a systematic and sequential format of modules designed for a 12-week, 24-session program, as well. At each session, research assistants recorded participants’ life narrative verbatim using laptop computers. Topics were sequenced over the 24 sessions, beginning with a brief life summary in the first session, followed by ancestry and birth circumstances in the second session, proceeding through early childhood, school years, adult years, and so forth. Printed copies of previous session narratives were given to participant and caregiver to review, edit, and correct. They were also encouraged to discuss the topics between sessions. Unlike traditional life review, participants and caregivers were not guided toward or encouraged to engage in reflection or processing of life struggles and conflicts, however.

Manuals detailing the activities and tasks undertaken at each treatment session are available from the authors.

Measures

Baseline and outcome measures of participant achievement and caregiver response focused on memory-related functional performance; language; and caregiver mood, reactions, and satisfaction. Periodic checks of raters’ accuracy were done by the investigators, observing randomly selected pretest and posttest evaluations to prevent rater drift.

Screening Measures. The MMSE (Folstein, Folstein, & McHugh, 1975) is probably the most widely used measure to screen for cognitive impairment (Setter, Neumiller, Johnson, Borson, & Scanlan, 2007). Validated against clinical diagnosis, the MMSE tests orientation, attention, registration, calculation, recall, and language. High (0.89) test-retest reliabilities have been reported. It has been reported to discriminate between individuals with and without dementia (Overall, 1989) and to be useful in staging dementia (Perneczky et al., 2006). A number of strategies to minimize the effect of age and education have been developed (Iverson, 1998; Uhlmann & Larson, 1991).

The CDR (Morris, 1993) is a clinical staging instrument for dementia. It characterizes six domains of cognitive and functional performance: memory, orientation, judgment and problem solving, community affairs, home and hobbies, and personal care. The necessary information to make each rating is obtained through a semi-structured interview of the individual and a reliable informant or collateral source (e.g., a family member). The CDR table provides descriptive anchors that guide the clinician in making appropriate ratings based on interview data and clinical judgment. In addition to ratings on a 5-point scale for each domain (except personal care, which is rated on a 4-point scale), an overall CDR score is derived by standard algorithm. This score is useful for globally staging the level of impairment: 0 = no impairment; 0.5, 1, 2, and 3 indicate very mild, mild, moderate, and severe dementia, respectively (Morris, 1993).

Participant Outcome Measures. The Fuld Object Memory Evaluation (OME, Fuld, 1977, 1978, 1980) is a selective reminding test that requires the individual to identify 10 common household items (i.e., button, scissors, ball, ring, matches, cup, playing card, nail, key, bottle) by touch. Those items incorrectly identified by the participant are then visually presented to the person for identification. The examiner then provides the name of any object that is misnamed after visual inspection. After all objects are placed back into the bag, the participant is then presented with a distractor task lasting 30 or 60 seconds. During each recall trial, the person is allowed 60 seconds to recall all of the contents of the bag. The participant is then selectively reminded of those items that were not recalled and then administered another distractor task. This sequence of recall trials followed by selective reminding cues interspersed with distractor tasks continues for three trials. The total number of target items recalled across the three trials is then tabulated.

The Direct Assessment of Functional Status (DAFS, Loewenstein et al., 1989) was developed to objectively measure a wide array of functional capacities required for independent living. The DAFS functional scale has been extensively validated; interrater, test-retest reliabilities, convergent, and discriminative validities have been established. The subtests of telephone and financial management as modified by Loewenstein et al. (2004) were used in this study.

The Face-Name Association task as adapted by Loewenstein et al. (2004) involves presentation of 10 faces and related names in three learning trials prior to final testing. Immediate and 30-minute recall are assessed by asking the participant to provide the correct name when presented with the face.

Phonemic Fluency and Controlled Oral Word Association are measures of verbal and semantic fluency. In this study, participants were asked to generate as many names of animals (the most frequently used oral word association), fruits, and words beginning with the letters F, A, and S as possible in 60 seconds (Rosen, 1980). Norms are available for the animal category and FAS letters (Tombaugh, Kozak, & Rees, 1999).

The Picture Description Test was originally developed as part of the Arizona Battery for Communication Disorders (Bayles & Tomaeda, 1991) but was omitted from the final published battery due to the religious nature of the original
picture (*Easter Morning* by Norman Rockwell). It was administered annually for 5 years to evaluate the changes in oral discourse of 116 individuals with AD and 59 controls (Tomoeda & Bayles, 1993). Participants’ descriptions of the picture within the 3-minute time limit were recorded and transcribed, and the transcription checked for accuracy. From analyzing the 456 responses obtained, eight measures of discourse were generated: total words, information units, conciseness, circumstances, frustrations, aborted phrases, revisions, and ideational repetitions. Interscorer reliability in five randomly selected samples ranged from 0.90 to 0.99 (Tomoeda & Bayles, 1993). Total words, information units, and conciseness were the measures found to most consistently track the performance of the individuals with AD. Conciseness is calculated as a ratio of information units to total number of words.

For this study, *Spring*, an alternative Norman Rockwell picture without religious significance, was used. Participants’ responses were audiorecorded and transcribed. Transcriptions were checked for accuracy by an independent reviewer. Transcribed responses were then scored for total words and information units, and conciseness was calculated. Interscorer reliability on a subset of 13 recorded and transcribed responses was 0.99 for the total number of words and 0.97 for the number of information units.

**Event-Related Prospective Memory Task.** Two functional tasks were designed to test participants’ ability to recall what they were told to do when a timer goes off after 30 minutes. Instructions were given to remove cash from an envelope (task 1) or remove a bottle of water from the refrigerator, pour the water into a cup, and drink it (task 2) when the timer goes off. Maximum score is 26 points if all steps are done correctly without prompting, 6 if done with a prompt to do something because the timer went off, and 3 points if the task is done when directed to do it (Einstein, Holland, McDaniel, & Guynn, 1992; Einstein & McDaniel, 1990; Schmittle-Edgecombe & Wright, 2004).

Caregivers were also asked to report level of functional independence of the participant at baseline and posttest. The Bayer Activities of Daily Living Scale (B-ADL) is a 25-item list of daily activities that may be affected by progressive dementia, including capacity for self-care and cognitive functions that underlie ADLs (Hindmarch, Lehfled, de Jongh, & Erzigit, 1998). The scale has distinguished patients with dementia from healthy controls and demonstrated high internal consistency and high test-retest reliability. Higher scores indicate increased difficulty performing a task.

**Caregiver Outcome Measures.** The Center for Epidemiologic Studies Depression Scale (Radloff, 1977) is a short (20-item) self-report scale designed to measure depressive symptomatology in the general population. It has been tested in household interview surveys and in psychiatric settings and found to have high internal consistency and adequate test-retest repeatability. Validity was established by correlations with other self-report measures and clinical ratings of depression (Radloff, 1977).

The Revised Memory and Behavior Problems Checklist (Teri et al., 1992) is a 24-item list of behaviors that may be manifested by an individual with AD. Caregivers are asked to rate each one twice: the frequency of the behavior and his or her reaction to the behavior (Teri et al., 1992). Both were measured in this study. Reported Cronbach’s alpha coefficients for the overall scale were 0.84 for behavior and 0.90 for caregiver reaction. Validity was established through comparison with measures of depression and caregiver burden.

Satisfaction with Caregiving (Mutuality) is a 15-item subscale of the Family Caregiving Inventory (Archbold, Stewart, Greenlick, & Harvath, 1990). Mutuality has been found to be predictive of lower levels of caregiver strain, except strain associated with worry or lack of resources, and was found to be consistent (r = 0.79) over extended periods of time. Cronbach’s alpha coefficient was reported to be 0.91.

During the posttest evaluation, caregivers were also asked to comment on their experience and any problems or benefits they perceived for their family member or for themselves. Their comments were recorded by the examiners.

**Data Analysis**

Outcome data were analyzed using analysis of covariance (ANCOVA) with baseline scores as covariates. Group means adjusted for the effect of baseline level were examined for differences on the dependent variables net of the effect of the covariant.

**RESULTS**

Altogether, we enrolled and pretested 83 pairs of individuals with MCI or early-stage AD and their caregivers. Of these, 68 completed the intervention and posttest: 37 in the cognitive training group and 31 in the life review group. Reasons for withdrawal included declining health (2), relocation (3), the intervention was too challenging or too easy (5), inappropriate intervention (i.e., needed speech therapy) (1), or unhappy they were assigned to the life story group (2). Two gave no reason. No significant differences were found in participant age, MMSE score, CDR, sex, years of education, Fuld OME, or depression scores (participant or caregiver) between the 15 who withdrew and the 68 who completed the treatment.
Participant Outcomes

Participants in the cognitive training group evidenced a significant increase in ability to associate names with faces after the 12-week intervention (Table 1). Using ANCOVA controlling for baseline ability, they evidenced a significant improvement at posttest on all three face-name association trials and the three-trial total, \(F(2,66) = 17.67, p < 0.0001\); on delayed recall, \(F(2,66) = 22.52, p < 0.0000\); and on delayed recognition, \(F(2,66) = 13.85, p = 0.004\), over the life story interview group.

Differences between the two treatment groups were also found on the money-related tasks of balancing a checkbook then did life story participants and made fewer errors when balancing the checkbook which then did life story participants but not when making change. They also performed significantly better on the simpler event-related memory task (remembering what tasks to do when a timer goes off) related to taking cash from an envelope, which was in view in the examination room, and sharing it with the examiner, \(F(2,66) = 4.80, p = 0.032\), but not the more complex task of leaving the room, getting a bottle of water from a refrigerator, and drinking some of it from a cup.

Despite the mental stimulation and opportunity to converse about past events, participants in the life review group did not evidence significant improvement in any of the verbal fluency tasks or the picture description task. Neither group evidenced significant change on the Fuld OME (Table 1).

The mean B-ADL scores did not differ across treatment groups. A detailed analysis by individual item was also done. Examination of adjusted means indicates that caregiver-rated difficulty performing each task was higher on 80% of the tasks for the life review group at posttest. For the majority, however, effect sizes are very small, and only one of these (shopping) reached significance at the \(p = 0.05\) level (Table 2).

Caregiver Outcomes

Caregivers of participants in the two treatment groups did not differ at posttest on measures of depression or reported problems (either the frequency or their reaction to them) experienced as a caregiver or their reports of participants’ functional independence, discussed above. Of interest, however, is that there was a significant difference in perceived satisfaction from being a caregiver. Caregivers of individuals who participated in life review reported more satisfaction than did caregivers of individuals in the cognitive training group (Table 3).

Caregivers were also asked to comment on their experience. The following are representative examples of their positive comments by treatment group.

Cognitive training group:
- Stimulating, [he] loves math.
- [Participant] learned how to organize, remember responsibilities, such as taking medications, appointments.
- [Participant] is a little more self-sufficient.
- [Participant] frequently checks the notebook.
- The face-name strategy seemed to be effective.

Life story group:
- Positive effect on activity level and mood.
- [Participant] improved considerably.
- Focus on thinking and reflecting.
- [Participant] liked reviewing the photos and names.

Although there were more positive comments than negative comments, some caregivers did not feel the intervention was helpful. Representative negative comments from caregivers by treatment group were as follows.

Cognitive training group:
- [Participant] didn’t prepare.
- Irritating/repetitive.
- [Participant] became frustrated if didn’t have the answer.
- [Participant] already has a system of reminders that worked as well or better.

Of the 68 who completed the intervention, participants in the cognitive training and life review groups were relatively well balanced in terms of age, male/female mix, and level of cognitive impairment. There were 22 men (59%) and 15 women (41%) in the cognitive training group, and 19 men (61%) and 12 women (39%) in the life review group. There were no significant differences between the treatment groups by age, mean = 80.94, \(SD = 5.46\) in the cognitive training group versus mean = 81.83, \(SD = 5.79\) in the life review group; years of education, mean = 14.25, \(SD = 3.56\) versus mean = 14.14, \(SD = 2.63\); and MMSE scores, mean = 25.54, \(SD = 2.70\) versus mean = 24.22, \(SD = 3.00\). CDR scores were mean = 0.85, \(SD = 0.23\) in the cognitive training group and mean = 0.83, \(SD = 0.23\) in the life review group. The great majority of participants were European American; two were Hispanic. All spoke English as their primary language. The sample reflects the population served by the Memory and Wellness Center through which recruitment was done.
TABLE 1

Comparison of Treatment Group Outcomes:
Analysis of Covariance Using Baseline Levels as Covariate

<table>
<thead>
<tr>
<th></th>
<th>Cognitive Training Adj. Mean</th>
<th>Life Review Adj. Mean</th>
<th>F</th>
<th>p Value</th>
<th>η² Partial</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-name association</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immediate recall trial 1</td>
<td>2.86</td>
<td>1.90</td>
<td>5.56</td>
<td>0.021*</td>
<td>0.078</td>
<td>[0.000, 0.218]</td>
</tr>
<tr>
<td>Immediate recall trial 2</td>
<td>4.23</td>
<td>2.32</td>
<td>15.68</td>
<td>0.000*</td>
<td>0.194</td>
<td>[0.089, 0.348]</td>
</tr>
<tr>
<td>Immediate recall trial 3</td>
<td>4.41</td>
<td>2.92</td>
<td>15.96</td>
<td>0.000*</td>
<td>0.197</td>
<td>[0.051, 0.350]</td>
</tr>
<tr>
<td>Three-trial total</td>
<td>11.48</td>
<td>7.19</td>
<td>17.67</td>
<td>&lt;0.000*</td>
<td>0.214</td>
<td>[0.061, 0.367]</td>
</tr>
<tr>
<td>Delayed recall (out of 10)</td>
<td>4.64</td>
<td>2.35</td>
<td>22.52</td>
<td>&lt;0.000*</td>
<td>0.257</td>
<td>[0.090, 0.408]</td>
</tr>
<tr>
<td>Delayed recognition (out of 20)</td>
<td>16.71</td>
<td>14.31</td>
<td>13.85</td>
<td>0.004*</td>
<td>0.176</td>
<td>[0.038, 0.329]</td>
</tr>
<tr>
<td>Making change</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number correct</td>
<td>6.30</td>
<td>13.61</td>
<td>0.84</td>
<td>0.362</td>
<td>0.013</td>
<td>[0.000, 0.112]</td>
</tr>
<tr>
<td>Time required (seconds)</td>
<td>205.60</td>
<td>272.50</td>
<td>4.03</td>
<td>0.049*</td>
<td>0.062</td>
<td>[0.000, 0.199]</td>
</tr>
<tr>
<td>Balancing checkbook</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With calculator</td>
<td>2.30</td>
<td>1.50</td>
<td>5.02</td>
<td>0.029*</td>
<td>0.074</td>
<td>[0.000, 0.213]</td>
</tr>
<tr>
<td>Without calculator</td>
<td>1.61</td>
<td>1.49</td>
<td>0.11</td>
<td>0.739</td>
<td>0.002</td>
<td>[0.000, 0.069]</td>
</tr>
<tr>
<td>Event-related prospective memory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash from envelope</td>
<td>8.10</td>
<td>4.38</td>
<td>4.80</td>
<td>0.032*</td>
<td>0.068</td>
<td>[0.000, 0.204]</td>
</tr>
<tr>
<td>Water from refrigerator</td>
<td>10.34</td>
<td>10.56</td>
<td>0.01</td>
<td>0.920</td>
<td>0.000</td>
<td>[0.000, 0.040]</td>
</tr>
<tr>
<td>Object memory</td>
<td>4.31</td>
<td>4.15</td>
<td>0.08</td>
<td>0.777</td>
<td>0.001</td>
<td>[0.000, 0.071]</td>
</tr>
<tr>
<td>Verbal fluency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animals</td>
<td>11.16</td>
<td>10.97</td>
<td>0.06</td>
<td>0.804</td>
<td>0.001</td>
<td>[0.000, 0.058]</td>
</tr>
<tr>
<td>F</td>
<td>9.01</td>
<td>9.01</td>
<td>0.00</td>
<td>0.999</td>
<td>0.000</td>
<td>[0.000, 0.000]</td>
</tr>
<tr>
<td>S</td>
<td>8.96</td>
<td>9.85</td>
<td>0.97</td>
<td>0.333</td>
<td>0.015</td>
<td>[0.000, 0.113]</td>
</tr>
<tr>
<td>S</td>
<td>9.02</td>
<td>9.49</td>
<td>0.21</td>
<td>0.647</td>
<td>0.003</td>
<td>[0.000, 0.077]</td>
</tr>
<tr>
<td>S</td>
<td>10.86</td>
<td>11.64</td>
<td>0.74</td>
<td>0.392</td>
<td>0.011</td>
<td>[0.000, 0.105]</td>
</tr>
<tr>
<td>Picture description</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Words</td>
<td>158.12</td>
<td>157.51</td>
<td>0.00</td>
<td>0.965</td>
<td>0.000</td>
<td>[0.000, 0.013]</td>
</tr>
<tr>
<td>Information units</td>
<td>45.88</td>
<td>40.43</td>
<td>1.08</td>
<td>0.303</td>
<td>0.022</td>
<td>[0.000, 0.153]</td>
</tr>
<tr>
<td>Concision</td>
<td>0.29</td>
<td>0.27</td>
<td>0.85</td>
<td>0.363</td>
<td>0.018</td>
<td>[0.000, 0.143]</td>
</tr>
</tbody>
</table>

Note: Adj. = adjusted; CI = confidence interval.
*Significant at p ≤ 0.05.

Life story group:
- Boring, would have preferred the more challenging [cognitive training] program.
- A complete failure—no effect on [participant] memory.
- Positive relationship [with participant but] didn’t see much improvement.

DISCUSSION
The cognitive training appears to have had some beneficial effect related to the cognitive tasks that were the focus of that treatment. The individuals receiving in-home cognitive training demonstrated improved face-name recognition, making change more quickly, greater accuracy
in balancing a checkbook, and remembering the simpler (cued by a visible envelope) of the tasks to do when a timer goes off. Caregivers of individuals who participated in the life story intervention expressed a greater sense of reward from their caregiving role.

There were some limitations in the design of this study. Specific testing was done for face-name, money tasks, and event-related prospective memory, but not for medication management, meal preparation, or object location, which were tested only by caregiver responses to the B-ADL scale. Testing done at the diagnostic center lent objectivity and consistency but may have reduced ecological validity. Testing in the home may have yielded more positive changes in the participants.

Because the face-name association training and balancing a checkbook were done in the same manner as Loewenstein et al. (2004) and evaluated using some of the same measures, it is possible to compare effect sizes between this in-home in-

TABLE 2
Caregiver-Reported Activities of Daily Living:
Analysis of Covariance Using Baseline Levels as Covariate

<table>
<thead>
<tr>
<th>Activity</th>
<th>Cognitive Training Adj. Mean</th>
<th>Life Story Adj. Mean</th>
<th>$F$</th>
<th>$p$ Value</th>
<th>$\eta^2$ Partial</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing his/her everyday activities</td>
<td>3.04</td>
<td>4.15</td>
<td>1.46</td>
<td>0.235</td>
<td>0.038</td>
<td>[0.000, 0.202]</td>
</tr>
<tr>
<td>Taking care of himself/herself</td>
<td>2.96</td>
<td>2.91</td>
<td>0.00</td>
<td>0.950</td>
<td>0.000</td>
<td>[0.000, 0.033]</td>
</tr>
<tr>
<td>Taking medication without supervision</td>
<td>3.79</td>
<td>5.56</td>
<td>2.51</td>
<td>0.121</td>
<td>0.057</td>
<td>[0.000, 0.224]</td>
</tr>
<tr>
<td>Personal hygiene</td>
<td>2.73</td>
<td>1.85</td>
<td>1.52</td>
<td>0.225</td>
<td>0.038</td>
<td>[0.000, 0.196]</td>
</tr>
<tr>
<td>Observing important dates or events</td>
<td>4.07</td>
<td>5.39</td>
<td>1.82</td>
<td>0.184</td>
<td>0.044</td>
<td>[0.000, 0.204]</td>
</tr>
<tr>
<td>Concentrating on reading</td>
<td>4.57</td>
<td>4.47</td>
<td>0.01</td>
<td>0.916</td>
<td>0.000</td>
<td>[0.000, 0.054]</td>
</tr>
<tr>
<td>Describing what he/she has just seen or heard</td>
<td>3.80</td>
<td>4.75</td>
<td>1.19</td>
<td>0.281</td>
<td>0.029</td>
<td>[0.000, 0.182]</td>
</tr>
<tr>
<td>Taking part in a conversation</td>
<td>4.46</td>
<td>4.04</td>
<td>0.21</td>
<td>0.650</td>
<td>0.005</td>
<td>[0.000, 0.114]</td>
</tr>
<tr>
<td>Using the telephone</td>
<td>3.50</td>
<td>4.13</td>
<td>0.44</td>
<td>0.509</td>
<td>0.013</td>
<td>[0.000, 0.137]</td>
</tr>
<tr>
<td>Taking a message for someone else</td>
<td>4.17</td>
<td>5.08</td>
<td>1.01</td>
<td>0.319</td>
<td>0.024</td>
<td>[0.000, 0.167]</td>
</tr>
<tr>
<td>Going for a walk without getting lost</td>
<td>1.99</td>
<td>3.78</td>
<td>3.53</td>
<td>0.071</td>
<td>0.111</td>
<td>[0.000, 0.327]</td>
</tr>
<tr>
<td>Shopping</td>
<td>2.38</td>
<td>4.27</td>
<td>3.99</td>
<td>0.054*</td>
<td>0.117</td>
<td>[0.000, 0.327]</td>
</tr>
<tr>
<td>Preparing food</td>
<td>3.75</td>
<td>4.64</td>
<td>0.60</td>
<td>0.446</td>
<td>0.018</td>
<td>[0.000, 0.179]</td>
</tr>
<tr>
<td>Correctly counting out money</td>
<td>3.15</td>
<td>3.15</td>
<td>0.00</td>
<td>0.993</td>
<td>0.000</td>
<td>[0.000, 0.000]</td>
</tr>
<tr>
<td>Understanding his/her personal financial affairs</td>
<td>4.10</td>
<td>5.95</td>
<td>3.48</td>
<td>0.070</td>
<td>0.086</td>
<td>[0.000, 0.271]</td>
</tr>
<tr>
<td>Giving directions if asked the way</td>
<td>4.56</td>
<td>5.66</td>
<td>0.79</td>
<td>0.381</td>
<td>0.026</td>
<td>[0.000, 0.198]</td>
</tr>
<tr>
<td>Using domestic appliances</td>
<td>3.28</td>
<td>4.23</td>
<td>0.84</td>
<td>0.367</td>
<td>0.023</td>
<td>[0.000, 0.179]</td>
</tr>
<tr>
<td>Finding his/her way in an unfamiliar place</td>
<td>5.16</td>
<td>6.38</td>
<td>1.47</td>
<td>0.235</td>
<td>0.045</td>
<td>[0.000, 0.240]</td>
</tr>
<tr>
<td>Using transportation</td>
<td>2.76</td>
<td>5.55</td>
<td>2.44</td>
<td>0.144</td>
<td>0.169</td>
<td>[0.000, 0.462]</td>
</tr>
<tr>
<td>Participating in his/her leisure activities</td>
<td>2.85</td>
<td>3.20</td>
<td>0.19</td>
<td>0.663</td>
<td>0.005</td>
<td>[0.000, 0.127]</td>
</tr>
<tr>
<td>Continuing with the same task after a brief interruption</td>
<td>4.07</td>
<td>3.64</td>
<td>0.19</td>
<td>0.663</td>
<td>0.005</td>
<td>[0.000, 0.137]</td>
</tr>
<tr>
<td>Doing two things at the same time</td>
<td>5.11</td>
<td>5.92</td>
<td>0.40</td>
<td>0.530</td>
<td>0.014</td>
<td>[0.000, 0.177]</td>
</tr>
<tr>
<td>Coping with unfamiliar situations</td>
<td>5.22</td>
<td>5.39</td>
<td>0.003</td>
<td>0.860</td>
<td>0.001</td>
<td>[0.000, 0.093]</td>
</tr>
<tr>
<td>Doing things safely</td>
<td>2.75</td>
<td>3.76</td>
<td>1.94</td>
<td>0.173</td>
<td>0.054</td>
<td>[0.000, 0.235]</td>
</tr>
<tr>
<td>Performing a task when under pressure</td>
<td>5.22</td>
<td>5.58</td>
<td>0.16</td>
<td>0.691</td>
<td>0.006</td>
<td>[0.000, 0.159]</td>
</tr>
</tbody>
</table>

Note. Adj. = adjusted; CI = confidence interval.
* Significant at $p \leq 0.05$. 
tervention and their in-office intervention on three outcome measures. The partial eta square ($\eta^2$ partial) for the three-trial face-name association total was 0.214 in this study, and our calculation based on published data from Loewenstein et al. (2004) was 0.208. Likewise, the $\eta^2$ partial for delayed recall of names was 0.257 in this study and 0.188 in the Loewenstein et al. study, and the $\eta^2$ partial for balancing a checkbook using a calculator was 0.074 in this study and 0.058 in the Loewenstein et al. study. In each instance, the effect size for the in-home intervention was modestly larger, suggesting that there may be some value in conducting the training in the person's home environment and that a direct comparison of the effect of the two settings is warranted.

The more general measures of function—the Fuld OME and the B-ADL—did not evidence significant change after cognitive training. The significant improvements were found on tasks in which participants in the treatment group were specifically trained. These results suggest that focused, guided practice on relevant tasks can increase independent completion of these tasks by individuals with MCI and early-stage AD. Given the direct effect on specific tasks for which training was given and apparent lack of general effect and the intensity of the training involved, we recommend that cognitive training should be directed to those tasks of significance to the individual.

The considerable improvement in face-name association, money-related tasks, and event-related tasks, but not in overall independent ADLs, suggests that, to be effective, cognitive training must be targeted to the desired task. A more general stimulative intervention, even focused conversation as in the life story interview, did not improve memory or communication skills, although it did appear to have contributed to a more positive feeling toward the relationship on the part of the caregiver.

**CONCLUSION AND RECOMMENDATIONS**

There is continued if not increasing need to discover effective strategies that may help maintain a person's functional independence as long as possible. The findings from this study are modestly encouraging in this regard, suggesting that training on critical tasks can be effective.

Further research should be conducted on the long-term effects of cognitive training and the usefulness of “booster” sessions at intervals following the end of the intervention. Additional research should be done on tasks that are most relevant in everyday life, including remembering appointments and taking medications. Although the purpose of the study was not to explore the emotional impact of the life story interview, the study findings on caregiver satisfaction suggest that participation in life story interviews may influence the caregivers in a positive way, a result that needs further exploration.

**REFERENCES**


