

Benefits of Mindfulness Training for Patients With Progressive Cognitive Decline and Their Caregivers

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Abstract

New strategies are needed to help people cope with the repercussions of neurodegenerative disorders such as Alzheimer's disease. Patients and caregivers face different challenges, but here we investigated an intervention tailored for this combined population. The program focused on training skills such as attending to the present moment nonjudgmentally, which may help reduce maladaptive emotional responses. Patients participated together with caregivers in weekly group sessions over 8 weeks. An assessment battery was individually administered before and after the program. Pre-post analyses revealed several benefits, including increased quality-of-life ratings, fewer depressive symptoms, and better subjective sleep quality. In addition, participants indicated that they were grateful for the opportunity to learn to apply mindfulness skills and that they would recommend the program to others. In conclusion, mindfulness training can be beneficial for patients and their caregivers, it can be delivered at low cost to combined groups, and it is worthy of further investigation.

Keywords

neurodegenerative disorders, mild cognitive impairment, Alzheimer's disease, caregiver stress, mindfulness-based stress reduction (MBSR)

Introduction

Neurodegenerative disorders like Alzheimer's disease (AD) produce many negative consequences. Insidious memory difficulties are often the first sign, followed by a progressive cognitive decline that ultimately robs patients of their independence and their identities. The progression of symptoms combined with a dire outlook for the future entails a heavy burden both for patients and for their families. Neurodegenerative diseases are particularly problematic for caregivers who are often close family members. Caregivers are subject to increased incidence of anxiety, depression, immune dysfunction, and other health concerns as well as an increased mortality rate.¹⁻⁵ Given the increasing prevalence of these age-related diseases, the financial and personal costs constitute a considerable burden on society likely to get worse. Interventions that can help people cope with progressive neurodegenerative disorders more effectively could thus be of substantial value.

Here, we describe a novel application of an intervention known as mindfulness training, in which participants are taught a series of attentional and emotional skills. This training was

designed to decrease levels of stress, improve mood, and lessen tendencies to habitually react in maladaptive ways. The procedures can readily be implemented in various community contexts at a low cost and with low risk of negative consequences. Although the needs of patients and their caregivers differ in important ways, there may be advantages in providing a simultaneous intervention for both parties. For example, some caregivers may find it easier to attend regular sessions when they can bring

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the patient along, participating together may turn out to be an enjoyable group activity, and caregiver support with practicing skills between sessions may increase patient compliance and success. Moreover, psychological benefits may lead to improved patient–caregiver interactions. Accordingly, we tailored a program of mindfulness training to be applicable to the needs and abilities of both patients with early-stage cognitive difficulties and their caregivers.

Mindfulness is a term with multiple possible definitions, but the meaning here is most closely tied to the idea of maintaining awareness to events of the present moment with acceptance. The mindfulness intervention we applied has its roots in Buddhist contemplative traditions and the program of Mindfulness-Based Stress Reduction (MBSR) developed by Jon Kabat-Zinn.⁶ Such programs typically last 8 weeks and consist of weekly group sessions, each with a different learning assignment. The training protocol we adapted similarly emphasizes each individual's ability to deeply experience and enjoy the present moment. This approach may be particularly useful for counteracting worries about the future that are so prevalent in patients and caregivers.

Prior studies have not examined mindfulness training for patients with Alzheimer's disease or for combined groups of patients and caregivers. However, similar psychosocial-educational programs have been applied to a variety of other clinical disorders.⁷⁻¹⁰ A recent review and meta-analysis of research in this area highlighted evidence for improvements in depression, anxiety, and pain.¹¹ Although there is still much to learn about the mechanisms whereby mindfulness training can be beneficial, some research has documented brain changes that might be relevant. For example, one study found increases in measures of regional gray matter density following an MBSR intervention.¹² Although a variety of other findings from recent research on mindfulness could be mentioned in this context, we focus here on the literature most relevant to applications of mindfulness therapies in elder individuals with memory dysfunction and in caregivers of such individuals.

Mindfulness training and related interventions may be particularly beneficial for dementia caregivers.¹³ Such individuals may learn to regard distressing thoughts in a detached and non-judgmental manner, leading to decreased depression and anxiety due to an improved sense of self-efficacy,¹⁴ in keeping with interventions previously found to combat caregiver stress.¹⁵ In caregivers aged 60 to 85 years, McBee^{16(p262)} reported that mindfulness therapy led to a "decrease in stress and somatic complaints as well as an increased satisfaction in the caring role." Several accounts indicate that mindfulness methods can be useful for the well-being of patients and family members during advanced aging and in the progression of AD.¹⁷⁻¹⁹ Although the extant research provides a firm basis for hypothesizing that caregivers have much to gain from a program of mindfulness training, what remains unclear is how valuable such a program would be for patients with memory impairment, and whether an intervention with patients and their caregivers together can be successful.

Although there have been no formal investigations of whether mindfulness interventions can be helpful in the earliest stages of AD, there is evidence that mindfulness training can be implemented with success in other groups of older individuals.²⁰⁻²² In the present study, we targeted patients having mild cognitive symptoms, on the assumption that their capabilities would allow them to be active participants and gain from the instruction. Many types of memory are preserved in early stages of AD, including the skill-learning abilities and other repetition-based capacities that may be necessary for learning mindfulness skills.²³⁻²⁶ Importantly, caregivers can support patients in learning and practicing mindfulness skills.

In our study, we included a broad spectrum of participants. We sought results that would pertain to the type of mindfulness program that might be possible in typical communities, where groups would not be restricted to any one narrowly defined patient or caregiver category. Therefore, patients having various age-related cognitive deficits were included as long as symptoms were not prohibitively advanced.

To characterize the participants and assess effects of the intervention, we administered a broad set of tests once before and again after the intervention. Although we did not contrast pre–post effects with those of any other interventions, in the discussion section we consider possibilities for future research to directly compare mindfulness programs to other potentially useful interventions. The chief purpose of the study was to implement a mindfulness program for patients and caregivers that could be a model for future interventions. Our chief hypothesis was that patients and caregivers who completed the program would experience improvements in well-being and mood. Results are presented that can guide the future application of these sorts of therapeutic strategies and that may also have implications for the more general use of mindfulness training in groups of older individuals, including those who are healthy, those having a disease, and those taking on a caregiver role for someone else.

Methods

Participants

Recruitment efforts emphasized patient–caregiver pairs, but individual caregivers and individual patients were also allowed to participate. None of the procedures required having a partner present. The inclusion criteria were (1) patient or caregiver status, (2) willingness to participate in the intervention and the testing sessions, and (3) the ability to understand instructions and complete the various tasks entailed by the assessment and intervention procedures. Participants were recruited through the university Alzheimer's Disease Center, local advertisements, and word of mouth.

The final sample was comprised of 37 participants. Demographic information is provided in Table 1. The sample included 29 individuals who were part of a patient–caregiver pair (including 2 caregivers who attended with the same patient and 2 caregivers who attended with patients who participated in

Table 1. Participant Demographics.

Type of Participant	Number of Participants	Age Range, years	Mean Age, years	Gender Composition	Mean Years of Education
Patient	17	55-81	72.0	12 males and 5 females	17.1
Caregiver	20	31-98	62.5	4 males and 16 females	16.6

Table 2. Mindfulness Training Sessions.

Week	Lesson	Practices
Week 1	Overview of mindfulness	Mindfulness of breath; mindfulness of body; mindful check-in
Week 2	Mindfulness as remembering; connecting mind and body	Gentle standing yoga; mindfulness of pleasant events
Week 3	Pain and suffering	Gentle floor yoga; mindfulness of pleasant and unpleasant events
Week 4	Integrating mindfulness into everyday life	Mindfulness of breath and body
Week 5	Observing what is happening without getting involved	Mindfulness of thoughts
Week 6	Having compassion when you are in pain; sleep hygiene	Loving-kindness practice
Week 7	Being open to whatever happens	Choiceless awareness; walking meditation
Week 8	How to keep up a meditation practice; outside resources for continuing practice	

the intervention but could not undergo the assessments, and so were not included in the final sample). Patients who participated without a caregiver ($n = 4$) were deemed to be functioning at a level sufficient for learning mindfulness skills on their own. An additional 6 individuals dropped out of the study before completing the procedure. The final sample was mostly caucasian and included 1 African-American and 2 Hispanic participants.

Most of the patients were diagnosed either with dementia likely due to AD neuropathology ($n = 9$) or with mild cognitive impairment (MCI; $n = 2$) based on published research diagnostic criteria.^{27,28} Other patients had memory loss due to multiple strokes ($n = 2$), memory complaints without a clinical diagnosis ($n = 3$), or frontotemporal dementia ($n = 1$). Caregivers for the patients were their spouses ($n = 13$), adult children ($n = 5$), a daughter-in-law ($n = 1$), and a mother-in-law ($n = 1$). Participants gave written informed consent (all participants were able to consent for themselves). Monetary compensation of US\$100 was provided to cover transportation costs.

Procedure

Participants completed an assessment battery within 2 weeks of starting the program (mean 7.7 days prior to start) and again within 2 weeks of completing the program (mean 3.4 days after completion). Testing was conducted individually and lasted 1 to 2 hours. A posttreatment questionnaire to evaluate participants' experiences in the program was completed along with the second assessment battery. The mindfulness program included 8 sessions, scheduled on a weekly basis, and each lasting approximately 90 minutes. Data presented were collapsed across 4 separate 8-week groups, each with 7 to 12 participants. Groups met in a medical school conference room or in a classroom in a local

senior center. The full procedure received approval from the appropriate institutional review board.

Mindfulness Program

Group sessions were designed with a specific orientation to the needs of patients with memory loss due to a terminal illness and to the needs of their caregivers. The pace of instruction was slow, physical exertion requirements were minimal, and the leader was constantly attentive to participants' level of understanding. As outlined in Table 2, sessions included a progression of mindfulness practices, such as attending to breathing, attending to bodily sensations, attending to movement, and attending to thoughts with acceptance. Although the general features resembled that of typical MBSR programs, there were also elements drawn from dialectical behavior therapy and from acceptance and commitment therapy.

To help incorporate mindfulness into daily life, exercises were practiced during group sessions and participants were asked to engage in specific exercises between sessions. These exercises ("homework") related to each week's teaching goals, and participants were asked to spend 30 to 60 minutes each day on these exercises and to keep a written record. Participants were also given a CD, with separate audio tracks that guided participants through the specific exercises for each week.

Weekly group sessions thus included a discussion of the mindfulness practices from the previous week; introduction and discussion of a new mindfulness concept; and assignment of the next week's homework. Meditation periods were shorter than in typical MBSR programs, with less homework and no extended retreat. An example of a session that covered some of the key concepts in a similar way (but was not part of the present program) is available online (<http://pallerlab.psych.northwestern.edu/workshop.html>).

Assessment

Tests were selected to fully characterize cognitive and psychological status at the outset, to cover a range of possible intervention effects, and to be repeatable on 2 testing occasions. However, our primary predictions for intervention effects concerned depression and quality of life. Patients completed these tests in an interview format with an experimenter. Caregivers completed questionnaires at their own pace.

The following tests were included for all patients and caregivers:

- Quality of life in AD (QOL-AD)²⁹: This test was created to be straightforward for people with some cognitive decline. Each participant rated his or her own circumstances. The 13 items pertain to factors often indicative of general feelings about one's life, such as relationships with family and friends, living situation, and mood. Each item was rated on a 4-point scale (poor/fair/good/excellent), yielding a maximum possible score of 52 (excellent on all factors). Scores were prorated for 6 single participants who, understandably, did not complete the item about marital satisfaction. Scores in our sample ranged from 16 to 52 points.
- Geriatric Depression Scale (GDS)³⁰: The GDS was designed to assess depression in geriatric populations. The 30-item scale yields scores indicative of normal mood (0-9), mildly depressed (10-19), or severely depressed (20-30). In the initial session, most participants scored in the normal range (9 patients and 12 caregivers), some scored in the mildly depressed range (7 patients and 4 caregivers), and a few in the severely depressed range (1 patient and 4 caregivers).
- Pittsburgh Sleep Quality Inventory (PSQI)³¹: The PSQI provides a standard measure of subjective sleep quality. Higher scores indicate poorer sleep.
- Beck Anxiety Inventory (BAI)³²: The BAI provides a standard measure of anxiety. Higher scores indicated more symptoms of anxiety.
- Trail-Making Tests A and B³³: These tests assess executive visual attention and task switching, functions often thought to be dependent on the integrity of prefrontal cortex. Scores are tallied as the number of seconds to complete each of the 2 tests. In Part A, participants connect 25 numbered circles in sequential order, which requires minimal executive control. In Part B, the circles contain numbers and letters, so there is a large executive component; participants must alternate in sequence between numbers and letters, numerically and alphabetically, while inhibiting the automatic response of continuing with numbers alone or letters alone.
- Repeatable Battery for the Assessment of Neuropsychological Status (RBANS)³⁴: The RBANS assesses multiple areas of cognitive function and includes different test forms for use across sessions. There is a total score as well as scores from 5 subscales, all age normed.

The following tests were included for caregivers only.

- Revised Memory Problem and Behavior Checklist (RMPBC)³⁵: This test checks for the presence of memory-related problems, depression, and disruptive behaviors in the patients, and assesses the extent to which caregivers are distressed by these behaviors. Higher scores indicate higher prevalence of the behaviors and more distress for the caregiver. All caregivers completed this questionnaire, regardless of whether the patients they cared for participated in the study.
- Short Form Health Survey (SF-36)³⁶: This survey includes 8 separate scales, 6 of which represent the caregiver's health in separate domains (e.g., physical, emotional, and social, with higher scores indicating greater health, maximum possible score 100). The other 2 scales represent the status of the individual's role as a caregiver with regard to physical and emotional issues.
- Activities of Daily Living Questionnaire (ADLQ)³⁷: Caregivers used this questionnaire to rate their patient's abilities to engage in a variety of common activities. Scores were computed as percentages for relevant activities.

The 2 raters who scored test results were blind to patient/caregiver status and to whether the test was completed before or after the program. Occasionally a participant could not complete one or more tests due to factors such as fatigue, poor English comprehension, oversight, poor eyesight, or poor motor control. Test results were included in analyses only when completed on both testing sessions (as shown by the number of participants listed in corresponding tables).

After the final group meeting, participants used a 5-point scale (strongly disagree to strongly agree) to rate whether they felt they benefited from the program; were likely to continue using mindfulness techniques; would recommend the program to someone in their situation; were less stressed; their relationships had improved; their ability to cope with stressful situations improved; and they had better sleep. They also assessed their use of mindfulness over the 8 weeks.

Statistical Analysis

Statistical comparisons focused on determining whether there were reliable changes pre- versus post-intervention. As a secondary concern, differences between patients and caregivers were also of interest. Therefore, statistical comparisons were made using a mixed analysis of variance with 1 between-subjects factor (group) and one within-subjects factor (session, pretreatment vs posttreatment), with α set to .05 (2-tailed tests, SPSS). Significant interactions were followed up with paired-sample *t* tests, which were also used to analyze results from tests given only to caregivers.

Table 3. Participant Comments.

“Mindfulness helped me be more compassionate and thoughtful toward my elderly mother. It also helped me to live in the moment as well as reduce the adverse reaction to stress.” (Caregiver)

“I really appreciated being in a group that encouraged solo detachment from the rat-race and getting in touch with myself. The overload of stressors didn’t ease, but my sense that I’m coping better than I had thought (and as time went on, better than I was coping), gave me more energy and focus to deal with what I must.” (Participant with memory complaints)

“I think of the class when I feel myself getting upset, and it calms me.” (Caregiver)

“A wonderful experience for learning new ways of being—for learning how to become more aware of all aspects of my life, for seeing the value of doing a mindfulness practice. This is such an important piece of living with the stressors of being a caregiver.” (Caregiver)

“The 8-week program was a short period to cause any big change in my life—but as I continue to deal with the stress of my husband’s illness I hope to continue to use some of the mindfulness techniques to find more calmness and deal with my anger and fear of Alzheimer’s.” (Caregiver)

“I am very grateful for having this opportunity to learn new techniques for dealing with stress, which I have begun to incorporate in my life. The presentation, pace, expectations and ambiance were near perfect—I only wish there were a follow-up class available!” (Caregiver)

“The sharing of experiences among the group was very helpful.” (Caregiver)

“It has added a perspective that I have found helpful. Instructive and not a waste of time.” (Patient)

“I think the group interaction was good and it was reassuring to know that others feel stressed by the situation. I think it was interesting to sense the caregivers had much more stress and anxiety than the Alzheimer’s patients. I hope my husband has gained the knowledge and acceptance of his disability to be more open and receptive to help.” (Caregiver)

Table 4. Results for Tests Given to Patients and Caregivers.^{a,b}

Measure	Number of Participants	Combined Group		Patient Group		Caregiver Group	
		Pre	Post	Pre	Post	Pre	Post
QOL-AD	35	37.4 ± 1.3	39.2 ± 1.3*	36.2 ± 1.5	38.4 ± 1.5*	38.6 ± 2.1	40.1 ± 1.9*
GDS	37	9.3 ± 1.2	8.0 ± 1.1*	9.7 ± 1.4	8.1 ± 1.2*	9.0 ± 1.9	7.9 ± 1.9*
PSQI	37	7.0 ± 0.7	6.1 ± 0.7	5.1 ± 0.9	4.3 ± 0.9	8.6 ± 1.0	7.7 ± 1.0
BAI	36	9.1 ± 1.6	8.3 ± 1.8	8.7 ± 2.3	9.2 ± 3.3	9.5 ± 2.2	7.6 ± 1.8
Trails A	31	63.3 ± 1.9	59.0 ± 1.9	88.8 ± 4.7	88.1 ± 4.4	36.0 ± 0.8	28.0 ± 0.5
Trails B	25	124.9 ± 15.6	106.1 ± 12.3*	202.0 ± 24.3	161.9 ± 22.8*	81.6 ± 9.3	74.7 ± 6.2
RBANS							
Total index	29	85.4 ± 3.8	86.2 ± 3.4	69.4 ± 3.8	72.8 ± 4.6	100.3 ± 3.4	98.8 ± 1.7
Immediate memory	31	87.1 ± 4.2	89.8 ± 4.2	71.1 ± 4.8	74.0 ± 5.6	102.1 ± 4.2	104.7 ± 2.7
Visuospatial/constructional	31	83.6 ± 2.5	86.2 ± 2.5	76.1 ± 2.7	81.7 ± 3.9	90.6 ± 3.1	90.4 ± 2.6
Language	31	89.2 ± 3.3	95.2 ± 3.1*	80.7 ± 4.7	85.3 ± 4.3	97.1 ± 3.8	104.6 ± 2.7
Attention	30	95.3 ± 3.9	96.3 ± 3.3	83.0 ± 4.9	86.5 ± 3.9	107.5 ± 4.1	106.1 ± 3.9
Delayed Memory	31	79.5 ± 4.5	81.9 ± 4.3	58.9 ± 5.0	64.4 ± 5.8	98.8 ± 2.1	98.3 ± 2.2

Abbreviations: QOL-AD, quality of life (AD); GDS, Geriatric Depression Scale; PSQI, Pittsburg Sleep Quality Inventory; BAI, Beck Anxiety Inventory; RBANS, Repeatable Battery for the Assessment of Neuropsychological Status; SEM, standard error of the mean.

^aMean scores ± SEM.

^bSignificant pre–post differences indicated by * (see text).

Results

Posttreatment Questionnaires

Although our primary emphasis was on results from the assessment battery, participants also shared their impressions of the program during the posttreatment interview. A rating of agreement or strong agreement (4 or 5) was found for 84% of the participants who felt they benefited from the program, 89% who said they would continue with the mindfulness techniques, and 89% who said they would recommend the program to someone in their situation. Likewise, 69% felt less stressed since starting the program, 50% felt their relationships had improved, and 75% felt their ability to cope with stressful situations had improved. An improvement in sleep was noted by 40%, although many did not have any sleep problems initially.

With respect to use of the mindfulness strategies learned during the program, 71% agreed with the statement that they used mindfulness regularly. Informal evaluations that participants provided were also notable. A sample of specific comments from the participants is shown in Table 3.

Psychological Tests

Test results were useful for characterizing the cognitive and the emotional status in both types of participant and for determining whether there were systematic changes following the intervention. Table 4 shows summary results from tests given to patients and caregivers, and Table 5 shows summary results for tests given only to caregivers. To estimate the effects of the mindfulness program, we first considered change scores from

Table 5. Results for Tests Given to Caregivers Only.^{a,b}

Measure	Number of Participants	Caregiver Group	
		Pre	Post
RMPBC—Patient	20	37.5 ± 4.9	36.2 ± 4.9
RMPBC—Caregiver	19	28.8 ± 7.9	22.3 ± 7.9*
ADLQ, %	17	52.4 ± 4.3	53.2 ± 3.9
Health Survey Well-being Subscales			
Physical	19	77.4 ± 4.9	76.8 ± 4.9
Energy	19	52.6 ± 15.1	60.0 ± 15.1
Emotional	19	66.3 ± 22.3	73.0 ± 22.3
Social	19	73.1 ± 15.2	79.6 ± 15.2
Pain	19	70.7 ± 12.7	68.3 ± 12.7
General	19	69.2 ± 6.2	72.3 ± 6.2
Total	19	66.7 ± 10.1	72.9 ± 10.1
Caring role—	19	68.4 ± 17.8	82.9 ± 17.8*
Physical issues			
Caring role—	19	52.6 ± 27.9	70.2 ± 27.9*
Emotional issues			

Abbreviations: RMPBC, Revised Memory Problem and Behavior Checklist; ADLQ, Activities of Daily Living Questionnaire; SEM, standard error of the mean.

^aMean scores ± SEM.

^bSignificant pre–post differences indicated by * (see text).

the 2 administrations of the test battery. Of secondary interest, we report results as a function of group, although benefits were usually similar in the 2 groups. These results confirmed the indications provided by the posttreatment questionnaire, in that clear improvements were found in measures of quality-of-life and depressive symptoms.

Quality of life. An average increase of 1.8 points (standard error [SE] = 0.5) was observed from the initial session to the subsequent session (main effect of session, $F_{1,33} = 15.06$, $P < .001$). Mean QOL scores did not differ significantly between patients and caregivers (main effect of group, $F_{1,33} = 0.63$, not significant [ns]), and the improvement was similar in the 2 groups (session by group interaction, $F_{1,33} = 0.46$, ns). The improvement amounted to 2.1 points for the patient group and 1.5 points for the caregiver group.

Depression. Participants showed improvement following the intervention, as average scores decreased 1.4 points (SE = .7) from the initial session to the subsequent session. The improvement was significant in the full sample ($F_{1,35} = 4.16$, $P = .049$) but tended to be greater in those who were depressed initially. In particular, of the 16 participants who scored 10 or greater initially, 13 improved and 3 remained stable. Mean scores did not differ significantly between patients and caregivers ($F_{1,35} = 0.05$, ns), and the improvement was similar in the 2 groups ($F_{1,35} = 0.11$, ns).

One participant registered an unusually large pre–post increase in GDS score (8 to 22). In a further analysis with data from this outlier excluded, the average depression score decreased by 1.7 points ($F_{1,34} = 11.28$, $P = .002$). In this analysis, the improvement amounted to 1.6 points for the patient group and 1.9 points for the caregiver group. Although the

absolute magnitude of these effects is small, these values should be interpreted in light of the fact that 70% of the participants started out in the normal range, such that in most participants there was very little room for improvement.

Sleep quality. On average, caregivers indicated poorer sleep quality than did patients ($F_{1,35} = 7.26$, $P = .011$). At initial testing, many participants registered no sleep difficulties. There were 24 participants with scores of 5 or greater, indicating at least a mild sleep problem. Of note, given that successful long-term memory storage likely depends on memory processing during sleep, both subjective measures and electroencephalogram measures of poor sleep in patients with MCI are associated with poor memory retrieval the next day.^{38,39}

Participants tended to show less sleep disturbance after training, with an average improvement of 0.8 points, but this difference was marginal ($F_{1,35} = 2.95$, $P = .095$, ns). Among the 24 participants who registered sleep problems initially, two-thirds improved over the course of the study. In this subset of 24 participants, there was a significant improvement of 1.5 points ($F_{1,22} = 4.72$, $P = .041$). The PSQI improvement amounted to an improvement of 1.9 points for the patient subgroup with sleep problems and 1.2 points for the caregiver subgroup with sleep problems (no difference between groups, $F_{1,22} = 0.20$, ns).

Anxiety. The BAI showed a trend for reduced anxiety after training, particularly in caregivers. This trend was nonsignificant ($F_{1,34} = 0.29$, ns) as was the group effect ($F_{1,34} = 0.02$, ns) and the interaction ($F_{1,34} = 0.81$, ns). Although 36 individuals completed this test, 2 individuals were outliers who showed very large increases in anxiety not caused by the mindfulness training but rather related to other life events. Without these 2 individuals, the decrease in anxiety was significant ($F_{1,32} = 5.32$, $P = .028$) and amounted to a change of 2.2 points from before to after treatment.

Patient behavior and Caregiver distress. No significant changes were found in the patient behaviors subscale of the RMPBC ($t_{19} = 0.64$, ns), but there was a marginal improvement in the caregiver role subscale, as caregivers expressing a trend for a decrease of their own distress with respect to patient problems (mean decrease of 6.5 points, $t_{18} = 1.83$, $P = .08$, ns).

Activities of daily living. No significant change was found in the ADLQ ($t_{16} = 0.73$, ns).

Caregiver health. No significant changes were observed on SF-36 scores except the 2 scales representing the status of the individual's role as a caregiver with regard to physical and emotional issues. These 2 scores showed improvement over the course of the intervention. In an analysis of average scores from these 2 measures, caregivers showed a mean improvement of 16.0 points ($t_{18} = 2.13$, $P = .047$).

Cognitive Tests

Trail making. There was no significant overall change in scores for Part A ($F_{1,29} = 1.7, P = .20$, ns), and the session by group interaction was also nonsignificant ($F_{1,29} = 1.17, P = .29$, ns). Unsurprisingly, patients performed more poorly than caregivers ($F_{1,29} = 9.13, P = .005$). The much more difficult Part B showed a different pattern of results, including a significant overall improvement of 18.8 seconds ($F_{1,23} = 11.11, P = .03$). Again, patients performed more poorly than caregivers ($F_{1,23} = 29.42, P < .001$). Furthermore, the improvement was not equivalent in the 2 groups ($F_{1,23} = 5.56, P = .027$). Indeed, an improvement in the time taken to complete the test was observed in the patient group (40.1 seconds, $t_8 = 2.65, P = .03$) but not in the caregiver group ($t_{15} = 1.08, P = .30$, ns).

The finding that patients improved on Part B but not on Part A may have reflected the fact that different patients were able to complete the 2 parts. Accordingly, an additional analysis for Part A was restricted to the 9 patients who provided results for both parts. We found a nonsignificant change in this subgroup ($t_8 = 1.13, P = .29$), which confirms the prior dissociation and suggests that the selective improvement for Part B may reflect its greater demand on cognitive control.

Additional cognitive measures. For the 5 RBANS subscale scores, caregivers performed significantly better than patients ($F \geq 10.83, P \leq .003$). The corresponding percentile score on the total index, prior to treatment, was 47.0 for the caregiver group (i.e., close to the age-adjusted median) and 7.8 for the patient group. The session by group interaction was nonsignificant in each case ($F \leq 2.46, P \geq .13$, ns). There were no significant effects of session ($F \leq 1.73, P \geq .18$, ns) with one exception, as an improvement was observed for the language subscale ($F_{1,29} = 5.20, P = .03$). This improvement primarily reflects a change in the semantic fluency test. Participants named as many exemplars from a designated semantic category in 60 seconds and they named 2.8 more words after than before training ($t_{31} = 2.35, P = .03$). However, part of this improvement may reflect learning from the first test session. Although the RBANS is repeatable, there may be carryover effects that complicate apparent improvements. Notably, however, there were trends on many subscales for patient improvements, which is remarkable because patients would normally show a cognitive decline, although often not to a noticeable degree across only 2 to 3 months. For example, patients showed improvements after training on various individual tests, including the list recall test (recall improved by 0.5 items, $t_{14} = 2.14, P = .047$) and on the coding test (mean improvement of 3.1 points, $t_{15} = 2.37, p = .03$). Also, caregivers improved on the figure recall test, with a mean improvement of 1.7 points ($t_{15} = 2.97, P = .01$).

Discussion

The present study tested the primary hypothesis that patients and caregivers would experience improvements in well-being and mood after completing a mindfulness-training program.

Results confirmed this hypothesis, both with informal responses provided following the treatment and with pre-post comparisons on various test measures. We can thus conclude that (1) a mindfulness intervention of this sort can be run effectively with mixed groups of patients and caregivers together; (2) this intervention can produce benefits that are deemed valuable by the participants; and (3) such treatments should be offered to other individuals in these circumstances. We discuss each of the specific benefits in turn, along with an analysis of the strength of the inferences that can be drawn from the results.

Participants reported that they were pleased to have participated in the mindfulness program. Given the gravity of a neurodegenerative disorder for both patients and caregivers, it is important to offer them additional ways to cope with the many stressful aspects of this situation. In this case, it was common for patients and caregivers to value the mindfulness techniques they learned and to believe that they had benefited from the program.

In formal tests, clear-cut improvements were found for both patients and caregivers in measures of quality of life and in measures of depression. The corresponding 2 tests (QOL-AD and GDS) were specifically designed for elderly individuals. Although the average improvement in depression was numerically small, this effect must be considered in light of the fact that most participants were not significantly depressed at the initial time point. For many individuals with low scores initially (indicating minimal depressive symptomatology), a large improvement was not possible. Moreover, we did not preferentially recruit individuals with depression for this intervention. An alternative strategy would be to conduct a post-hoc analysis restricted to data from individuals with initial scores showing that they were depressed, but that strategy could lead to a spurious improvement (due to regression to the mean). The significant improvement with the full sample, as found, is thus most convincing. A parallel argument applies for the quality-of-life measure.

An important consideration not addressed in this study is how long these improvements last. A reasonable speculation is that the persistence of these benefits depends on the extent to which people continue to practice the skills that they learned.

The improvements in quality of life and depression observed shortly after the final group session should not be overinterpreted, in that logically they could reflect nonspecific factors rather than mindfulness training per se. That is, test scores might improve (1) due to taking the same assessment battery twice, (2) due to the positive influence of weekly meetings with other participants and with a caring group leader, or (3) from expecting benefits because of the personal effort invested and suggestions from others that such training is beneficial. For these 2 measures of quality of life and depressive symptoms, improvements are unlikely to arise merely from repeated testing. However, the present study did not include comparison groups to determine whether the same benefits would arise from weekly meetings with a group and a group leader but without mindfulness training.

Indeed, the present study provides the groundwork needed to justify randomized control trials to determine whether a program of mindfulness training is superior to other conceivable programs. Such a trial could include a passive control condition for 8 weeks, or an active control condition using a sham therapy with the same nonspecific factors but without specific mindfulness training ingredients thought to be beneficial. However, many aspects of the program might contribute to benefits. Passive control conditions (e.g., waiting list or treatment as usual) would lack social factors and expectations that might contribute to beneficial outcomes. Multiple future studies might thus be needed to determine whether mindfulness training per se was the source of the benefits. What factors should be controlled for in such studies? An active control condition might need some other sort of training presented by a leader conveying equivalent confidence of potential benefits of the procedures. Benefits could conceivably arise from expectations produced during recruitment as well as during the sessions or because of the camaraderie and social support that can develop among members of a group. It may be very difficult to control for all potentially relevant factors in any single study. Furthermore, ethical considerations would argue against subjecting patient and caregiver participants to an 8-week treatment thought to be without any benefit. A randomized control design with 2 beneficial procedures could provide participants with something to gain no matter which random assignment they received, and interpretations could still be useful if mindfulness training was shown to provide distinctive benefits.

We ran a pilot study to test one possible procedure for an active control group, an 8-week program of working-memory training. This training could be predicted to have cognitive benefits but not benefits in quality of life or depression. Participants can generally increase their working-memory span as a function of practice,^{40,41} and the training can be introduced in a way that emphasizes potential benefits of increased working memory in daily life. Such an active control condition could be matched with the mindfulness intervention in many respects, and pilot results suggested that it did not produce pre-post changes in the psychological tests.

Yet, a randomized control design can pose challenges for recruitment. Participants would be randomly assigned to one type of training or the other only after being recruiting for either possible training. In our experience, patients and caregivers struggling with the repercussions of the disease often found the extra unknowns of randomization too much to handle. Many potential participants are already reluctant to make a weekly commitment over the required time period. Although a randomized control design could help determine the degree to which specific factors contribute to beneficial effects, that goal must be balanced against the suffering that might be reduced by treating the full range of those in need of help. Those willing to participate in a study with random assignment to treatment condition might be a biased subset of the larger group of individuals in need. Conclusions from the present results are limited in that the apparent benefits of mindfulness training were not compared to those of any

of the conceivable active control conditions. Nonetheless, other investigators have already reported comparable benefits of mindfulness training using suitable active control procedures.^{7,8,42} Thus, the present results provide a further basis to be optimistic that the mindfulness intervention can be fruitfully applied in groups of patients and caregivers. The overall picture is thus in strong support of the feasibility of such a program, as also suggested by the related approaches used by other investigators.^{19,35,43,44} As argued previously, patients in the earliest stages of AD can probably learn the skills, and their learning can be supported by the assistance of a caregiver who is learning the same skills from the same intervention.

Although improvements in quality of life and depression were robust enough to be evident in our small, diverse sample, other psychological tests did not show significant improvement. There was thus some specificity in the type of benefit achieved. The anxiety measure showed no pre-post change overall, although it did show an improvement in an analysis that excluded 2 outliers who registered high levels of anxiety during the posttreatment test. It is possible that anxiety reduction is another potential benefit of the program, but criteria for outlier exclusion can be ambiguous, and sampling only 2 time points across a 3-month period may be a shortcoming. For example, an individual might be distressed for a particular reason on the testing day, especially in this population. Perhaps future studies could attempt to account for such circumstances by including a life-event stress scale. Also, sampling psychological variables repeatedly over an extended period of time after the intervention might be useful for minimizing the influence of periodic emotional fluctuations and also allow for charting the persistence of any improvement.

The sleep quality measure showed an improvement only after excluding data from individuals who showed high-quality sleep on the initial test. Perhaps sleep quality can be improved if participants in the intervention come to the program with existing sleep problems. Such a conclusion is unwarranted in this case, however, due to the possibility that these data were influenced by regression to the mean; if some participants showed poor sleep quality merely due to random variation, then later it might be the case that those same patients no longer show poor sleep quality, which could contribute to an apparent improvement. Likewise, if we had used a criterion level of impairment as an inclusion requirement for participation, regression to the mean might have been a general problem with other outcome measures. In any event, the magnitude and consistency of the sleep quality improvement, along with the fact that a variety of different measures showed improvement, casts some doubt on a regression-to-the-mean interpretation.

Caregivers appeared to become less distressed about patient problems after the intervention (as specifically examined via the Revised Memory Problem and Behavior Checklist). This kind of change in distress is intriguing, as it fits with the general orientation of mindfulness training toward showing how suffering can be decreased although a patient's behavior shows a

steady decline. This trend is therefore worthy of further investigation. The possibility of a beneficial result in this regard received further support from 2 scales in the Health Survey showing that caregivers experienced less distress in the caregiver role.

Cognitive improvements were seen on the Trail-Making Test in patients, perhaps reflecting improvements in cognitive control, visual attention, and/or task switching. An improvement was also found in semantic fluency, but this improvement may merely reflect repeated testing, as individuals are likely to learn better strategies for producing exemplars during initial testing. Overall, the cognitive improvements found, including those on recall, were not specifically predicted in advance, so conclusions regarding these improvements should await additional evidence. Yet, it is plausible that cognitive improvements could be derived indirectly from mindfulness training, as intrusive emotional responses or anxiety can be detrimental for various cognitive functions.⁴⁵

Alistair Smith²² made a strong case for offering mindfulness training to older people. He argued that they are highly receptive to this training and that there is great need due to the high incidence of depression and anxiety. Mindfulness training offered in small groups could be quite cost effective compared to other therapies, and, as Smith noted, a key advantage is that it “works with people’s abilities rather than focusing on problems,”^{22(p194)} providing an enhanced sense of control and empowering people against the stigma of mental disease and of old age.

Beneficial interventions for caregivers of patients with neurodegenerative disorders are urgently needed.⁴⁶ Such interventions may be especially helpful with respect to their interpersonal interactions with others, including the patient, to the extent that the intervention can enhance compassion in the caregivers.⁴⁷ Indeed, other studies have shown that mindfulness training can lead to an increase in compassionate behavior.⁴⁸

In sum, our results showed that mindfulness training can be helpful both for patients with neurodegenerative disorders (such as early-stage AD) and for family members who act as caregivers. Further tests are needed to determine how this sort of intervention would compare with other possible strategies and how it could be combined with other activities commonly used in caregiver–patient support groups. We also do not know whether the specific benefits described here are long lasting, or whether reduced feelings of distress in caregivers might indirectly benefit the patients, and vice versa. Although an active–control group and random assignment to condition might have allowed stronger conclusions about the active ingredients of the intervention, this concern is lessened due to reports of comparable benefits in controlled studies of similar interventions with other clinical populations,^{42,49–51} although clearly further studies are needed in this regard. Providing mindfulness training to patients and caregivers together may have multiple advantages, including improved interpersonal relationships, which could be tested in various ways. Future

studies could also determine whether there are specific neural changes or other measures that may help in selecting individuals most likely to benefit from mindfulness training. Our conclusion about the benefits that could be expected from mindfulness interventions for quality of life, depression, and other outcome measures must be considered in light of these outstanding questions. Nonetheless, our results show with certainty that a mindfulness intervention can be tailored for patients and caregivers in a way that participants find valuable.

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