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MemAerobics: a Cognitive Intervention to Improve Memory Ability and Reduce Depression in Older Adults

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Abstract

Numerous researchers have shown that older adults who participate in memory enhancement programs can improve their memory abilities. However, previous research has generally focused on "young-old" adults (i.e., under 75 years of age). We replicated these findings with an older assisted living facility population using a new program called MemAerobics™. This program could be used by other long-term care facilities to both improve and maintain residents' overall wellness. Volunteers participated in one of two experimental conditions: either a cognitive enhancement intervention specifically designed to stimulate cognitive activity (known as MemAerobics) or a control group that did not participate in any extra activities. Before the intervention, all participants completed a battery of standardized tests designed to measure memory ability, beliefs in the efficacy in their memory, life satisfaction, and depression. After three-months of MemAerobics exercises, all participants were reassessed with the same measures to determine the magnitude and direction of changes as a function of their intervention group. The results indicated that MemAerobics participants experienced an increase in memory ability as well as a decrease in depressive symptoms.

MemAerobics: A Cognitive Intervention to Improve Memory Ability and Reduce Depression in Older Adults

An increasing number of elderly adults are seeking advice and treatment for memory problems (La Rue, 1992). In fact, the *Diagnostic and Statistical Manual of Mental Disorders* recognizes Age Related Cognitive Decline as a mental health problem (American Psychiatric Association, 2000). However, it appears that various types of memory training programs can improve cognitive functioning (e.g., Fabre, Masse-Biron, Chamari, Varray, Mucci, & Prefaut, 1999; McDougall, 1998a; Mohs et al., 1998; Rasmusson, Rebok, Bylsma, & Brandt, 1999). It may be possible to delay the on-set of dementia through neural and cognitive stimulation. Depression is another problem many older adults experience, especially those with serious or chronic illness (Gatz, 2000). Cognitive impairment and depression can seriously impact the quality and longevity of one's life. We have developed a program that addresses both these problems for people in assisted living facilities (ALFs).

MemAerobics is a multifaceted program designed to help older adults improve their overall well-being. First, we teach residents about memory and give them tri-weekly opportunities to practice their memory skills and increase their self-efficacy with challenging and fun activities. The explicit focus of the program is to improve cognitive performance, but another equally important aspect of the program is to facilitate better social support networks among ALF residents, which may lead to fewer depressive symptoms. Next, we will review previous research on memory training programs for older adults and depression in this population.

Memory Training Programs

Numerous researchers have tried to increase older adults' ability to make new memories by having them participate in memory training programs that primarily teach mnemonic strategies. Meta-analyses of these studies have found that participants experienced a moderate increase in memory ability after being exposed to memory training (Floyd & Scogin, 1997; Verhaeghen, Marcoen, & Goossens, 1992). However, one limitation of these programs is that they generally assess memory for word lists rather than everyday memory tasks (e.g., remembering names, appointments, and where personal items were last put). Regardless of the limitations, these studies suggest that older adults possess some plasticity in their memory ability; some of what has been lost may be regained, at least temporarily.

Verhaeghen et al. (1992) reported that as the age of participants increases the effect of memory training decreases. Will our new memory intervention work with older adults, who might be experiencing greater cognitive impairment? In other words, are these types of programs appropriate for ALF residents? Rapp, Brenes, and Marsh (2002) conducted a study to determine whether older adults with mild cognitive impairment (MCI) would benefit from a cognitive intervention. The participants were at least 1.5 standard deviations below expected performance for their age on neuropsychological tests. Rapp et al. exposed the participants (mean age 75 years) to a multi-faceted intervention that included memory skills training, relaxation training, and information about memory and dementia. Surprisingly, the participants did not demonstrate a reliable increase in memory performance. However, their subjective assessments of their memory ability were significantly higher, indicating a greater degree of confidence in their memory ability. It may be that the tests Rapp et al. used were not sensitive enough to detect subtle changes in memory ability.

Most studies that have attempted to improve older adults' cognitive abilities have simply used memory-training programs, without providing on-going opportunities to exercise their brain and practice their memory skills. Many of these studies have shown positive effects immediately after training; however the gains were often short lived (e.g., Scogin, Storandt, & Lott, 1985; Yesavage, 1983). Researchers have concluded that learning to stay mentally active is a long-term process. One researcher concluded that "It is quite possible that the effective use of strategies and techniques for dealing with memory problems may continue to develop over long periods of time if support and guidance are provided" (Mohs et al., 1998, p. 193). Our cognitive intervention program was developed to be an ongoing and integral part of the retirement community environment. We hypothesized that this approach will yield long-term benefits and improve the overall wellness of the entire community.

Use It or Lose It

Simply teaching older adults how to use mnemonic strategies may be relatively ineffective if they are already experiencing significant cognitive deficits (Rapp et al., 2002). Moreover, researchers have hypothesized that life changes that lead to patterns of cognitive disuse may result in atrophy of cognitive processes and skills (Hultsch, Hertzog, Small, & Dixon, 1999). This problem may be compounded in ALFs, since many everyday activities and chores are done by ALF staff (e.g., cooking, household chores, etc.). ALF residents may be at an even higher risk for developing memory problems without ongoing cognitively stimulating activities. Recently researchers have demonstrated the importance of staying mentally active, in order to ward off memory decline (e.g., Hultsch et al., 1999; Verghese, Lipton, Katz, Hall, Derby, Kuslansky, et al., 2003).

Some researchers have even hypothesized that participating in stimulating activities may reduce the risk of developing Alzheimer's Disease (AD) (e.g., Mortimer, 1997; Verghese et al., 2003). Friedland et al. (2001) conducted a retrospective study on the relationship between amount of intellectual activity and the likelihood of developing AD. They reported that above average levels of cognitive activity during midlife was associated with a decreased chance of developing AD. Verghese et al. (2003) conducted a 21-year longitudinal study and measured the relationship between the amount of cognitively stimulating leisure activities and the likelihood of developing dementia. Verghese et al. found a reliable decrease in the risk of developing dementia as the number of cognitively stimulating activities (e.g., reading, playing board games, and writing) increased. Wilson et al. (2002) found similar results among older adults who participated in a 4.5-year longitudinal study. Wilson et al. reported that a person with activity frequency at the 10^{th} percentile was 28% more likely to develop dementia than someone at the

50th percentile and 47% more likely than someone at the 90th percentile. Wilson et al. hypothesized that cognitive activity might serve a protective function; such that older adults who frequently engage in stimulating activities might strengthen their cognitive skills, thereby making them less vulnerable to atrophy.

The above results are both impressive and encouraging, however the nature of the relationship between cognitive stimulation and mental ability is still unclear. It is possible that engaging in stimulating activities doesn't cause a decrease in cognitive deterioration, but rather good cognitive abilities may lead people to engage in more stimulating activities. Moreover, some researchers have failed to find support for the use it or lose it theory. Salthouse, Berish, and Miles (2002) conducted a cross-sectional study of adults from 20 to 91years of age to determine whether reported activity levels moderated age related declines. They reported that cognitive activity did not moderate age-related declines in cognitive ability (also see Hambrick, Salthouse, and Meinz, 1999). Given the nature of previous studies, Salthouse et al. concluded that "it may be premature to reach a definitive conclusion about the validity the use it or lose it perspective" (p. 556).

Social Environment and Depression

Recent estimates of depression in nursing home facilities are staggering. Some studies have found that as many as 48% of nursing home residents have clinical depression (McDougall, 1998b). It appears that the number of self-reported depressive symptoms progressively increases after middle age (Gatz, Johansson, Pedersen, Berg, & Reynolds, 1993). It is commonly believed that ALF residents also experience clinical depression at rates far above the rest of the population and the depression appears to further compromise their cognitive abilities (La Rue, Swan, & Carmelli, 1995). The depressive symptoms that older adults may be experiencing not only causes emotional suffering, it is also associated with cognitive impairment. Levy-Cusman and Abeles (1998) found that the number of depressive symptoms participants reported explained 15% of the variability in memory. In addition, older adults who are depressed have less confidence in their own memory abilities (Hertzog, Dixon, and Hultsch, 1990).

Schaffer and Poon (1982) hypothesized that many of the benefits seen in cognitive intervention programs are related to enhanced peer interaction. Gattuso (2001) observed that older adults with MCI experienced a reduction in depressive symptoms after participating in a program designed to enhance social, physical, and cognitive well being. Gattuso hypothesized that participants' increased well being (e.g., less depression) was a result of improved social support. According to Gattuso, social isolation is a risk factor for mental health problems. In another study, Murrell and Meeks (1992) found that low social support and loss events are predictive of depression in older adults. ALF residents have often endured significant losses and severe disruptions to their social support network, which may have triggered their need to move to an ALF. It is therefore not surprising that depression rates are high at these facilities.

Ideally, a program to improve memory and cognition should also address issues related to depression, such as social support networks. According to Verhaeghen et al. (1992) group-based training was associated with more improvement in memory ability than one-on-one sessions. Increasing the quality and size of ALF residents' social support networks also gives them more opportunities to engage in social interactions, which in turn can stimulate the brain and help preserve cognitive abilities. In addition to improving cognitive performance, MemAerobics was specifically designed to facilitate social interaction among ALF residents and continually embrace and include new residents.

The present study assessed the effects of a comprehensive cognitive enhancement program (MemAerobics) relative to a control group. We hypothesized that this group-based cognitive intervention would lead to improvement in memory abilities and a reduction in the number of reported depressive symptoms.

Method

Participants

Participants from seven ALFs were assigned to either a MemAerobics or control group. There were between 3 and 11 participants at each facility that were included in the analyses. According to a series of one-way ANOVAs the participants at the seven facilities did not differ at Time 1 in terms of age, Mini-Mental State Exams (MMSE) scores, number of depressive symptoms, RiverMead Behavioural Memory Test (RBMT) scores, or Metamemory in Adulthood scores ($p < .05$). The ALFs were very similar in size (approximately 40-60 residents in each) and provided very similar services (e.g., part time skilled nursing), amenities (e.g., laundry service, housekeeping services were available), and activity programs (i.e., each facility had a full time activity director that organized events such as trips to the grocery store or drove residents to appointments). Each facility that participated in the study either had the MemAerobics program implemented or served as a control group. According to a series of t-tests, participants did not vary at Time 1, as a function of experimental group, in terms of age, MMSE scores, number of depressive symptoms, RBMT scores, or Metamemory in Adulthood scores ($p < .05$).

In order to be included in the study, all participants were required to complete the pretest and posttest measures. Residents who scored less than 10 on the Mini Mental State Examination (MMSE) were not included in the study, the MMSE scores ranged from 10 to 30 ($M = 21.62$, $SD = 4.45$). A t-test indicated that there was not a difference in the MMSE scores at Time 1 as a function of group, t (40) = 1.25, p = .22. At Time 1, the control group had a mean MMSE score of 20.59 (SD = 4.54, ranged from 10-29) and the experimental group had a mean score of 22.32 (SD = 4.33, ranged from 10-30). Participants who had severe uncorrected sensory problems were not included in the study. In addition, the MemAerobics group had to attend at least 50% of the sessions, during the three-month intervention (attendance rate M = 82%).

Seventy-two participants began the study but 30 dropped out due to a number of reasons, including death (2 participants), moving out of the ALF (5 participants), not attending at least 50% of the sessions (16 participants), or not wanting to complete the posttest measures (7 participants). There were no significant differences between those participants who dropped out of the study and those who completed it ($p < .05$). Forty-two participants were included in the following analyses, 25 from the MemAerobics Condition and 17 from the control group. The participants ranged in age from 71-97 years (M = 81.7, SD = 6.01).

Materials

We assessed a number of different aspects of cognitive functioning. First, all participants completed the MMSE; this test is designed to quickly assess possible dementia. The scores range from 0-30, scores of 10 or less are indicative of severe cognitive impairment (Folstein, Folstein, McHugh, and Fanjiang, 2001). Memory performance was assessed using The Rivermead Behavioural Memory Test (RMBT-E) Extended Version. The RBMT-E has two versions, which were counterbalanced across groups and time of testing. The RBMT-E requires participants to engage in numerous everyday memory activities (e.g., remembering names, faces, appointments, and stories). Mohs et al. (1998) suggested using measures of "real-world memory performance" in these types of studies. The RBMT-E may be more appropriate than word list measures in assessing changes in everyday memory functioning. Also, the RBMT-E may be more sensitive to changes than other memory tests. We assessed participants' depression level using the Geriatric Depression Scale. Five aspects of metamemory were measured using the Metamemory in Adulthood Questionnaire, including strategy, capacity, change, achievement, and locus. Finally, we administered the Satisfaction with Life Questionnaire to all participants (Pavot & Diener, 1993).

Procedures

Trained technicians administered the above tests in one-on-one interviews. All participants completed the tests at two times separated by three months. Most participants completed the tests in about 90 minutes. During the three-month interval between testing periods, the participants were either exposed to the intervention or not. The MemAerobics groups were told how the brain works, how memory works, how memory changes as we age, factors affecting memory performance for people of all ages, and ways to improve memory performance. Participants were exposed to information regarding recent research that suggests there is a great deal of plasticity in older adults' cognitive abilities and that neurogenesis is possible in older adults. The presentations were very optimistic and were designed to increase the participants' self-efficacy and motivation. In addition, three times per week the MemAerobics group engaged in fun and social activities designed to stimulate cognitive functioning. The instructor had experience working with older adults as an activity director and took part in an intensive 8-hour memory course. The same instructor conducted all the sessions. The activities were designed to stimulate all the senses. The participants began by exercising their senses individually (e.g., smelling selected fragrant plants or listening to music selections with the goal of focusing on and detecting certain instruments). After participants were comfortable with exercising their senses individually, we began combining senses (e.g., sight and touch) and combining senses with various cognitive activities (e.g., remembering a name of tree when shown or feeling its pinecone).

We concentrated on encoding new memories as opposed to just recalling old episodic memories. MemAerobics participants concentrated hard on making new visual, auditory, tactile, procedural memories, and semantic memories (e.g., flags of the nations, musical instruments, grit of sandpaper, hand and knee galloping exercises, and word games respectively). In order to expand the participants' social networks, they memorized information about other participants (e.g., name, favorite vacation, favorite pet, favorite food, favorite candy bar, and nickname) as well as non-participants who lived at the facility. The information about other residents was generally unknown by the other residents, which leveled the playing field in terms of knowledge and expertise.

Participants also engaged in other activities designed to stimulate their senses and challenge their minds. Each MemAerobics session was designed to be fun, challenging and remain fresh. We also included a degree of surprise and uncertainty in the sessions. After all the data had been collected, the control group was given an opportunity to attend several presentations about the effects of aging on memory and how to improve their own memory.

Results

We performed 2 X 2 (MemAerobics Group X Time) mixed design ANOVAs on all the mental tests that we administered. Our sample size was fairly small, which led to low power. Nevertheless, the analyses revealed several reliable differences. In general, it appears that participating in MemAerobics was associated with increased memory, a decrease in depressive symptoms, and an increase in perceived memory ability. Moreover, the overall trends for most tests were in the predicted direction; it may be that increased sample sizes would have lead to even more statistically significant differences. We will now report the results for the following dependent measures: overall RBMT-E, Geriatric Depression Test, and perceived change in memory functioning scores (a subscale of the MIA).

A 2 X 2 mixed design ANOVA indicated that there was a trend towards an interaction between time of testing (i.e., pre versus post-tests) and experimental condition (i.e., MemAerobics intervention versus control condition) on overall RBMT-E scores, F (1, 36) = 2.88, p = .09. We performed our planned comparisons. A t-test revealed that the MemAerobics group had a significant increase in their memory ability, t (23) = 3.41, p = .002, whereas the control group did not show any change, t (13) = .02, p = .98. See Table 1 to view means and standard deviations.

A 2 X 2 mixed design ANOVA indicated that there was a trend towards an interaction between time of testing and experimental condition on the number of depressive symptoms, F (1, 39) = 2.13, p = .15. We performed our planned comparisons. A t-test revealed that the MemAerobics group had a significant decrease in their depressive symptoms, t (24) = 4.53, p < .001, whereas the control group did not show any change, t (15) = 1.22, p = .24. See Table 1 to view means and standard deviations.

A 2 X 2 mixed design ANOVA indicated that there was a significant interaction between time of testing and experimental condition on perceived memory change, F (1, 38) = 7.77, p < .01. Follow-up tests revealed that the MemAerobics group had a significant increase in perceived improvement, t (23) = 3.59, p = .002, whereas the control group did not, t (15) =0.92, p = .37. See Table 1 to view means and standard deviations.

Discussion

We observed several remarkable changes -- people who participated in MemAerobics had a significant increase in memory ability and a significant reduction in the number of depressive symptoms. In addition, the residents who participated in MemAerobics also had an increase in perceived memory ability. The decrease in depressive symptoms was particularly noteworthy and exciting.

The results of the present study are consistent with several lines of research that have shown it is possible to increase older adults' memory performance (see Verhaeghen et al., 1992) and that adults who are cognitively active tend to have less cognitive decline (Mortimer, 1997; Verghese, 2003; Wilson et al., 2002). One unique aspect of this study was that increased memory performance was achieved by exposing the participants to challenging and stimulating cognitive tasks. Based on the results of this study and others, we conclude that a considerable degree of plasticity exists with respect to older adults' cognitive ability. If they increase their level of cognitive activity they can improve their memory ability. But, the inverse may also be true, such that disuse leads to atrophy -- a problem particularly germane to ALF residents. The results are also consistent with the use it or lose it theory. The cognitive life of ALF residents may not be stimulating enough to maximally protect them from cognitive decline. Previous research has suggested that cognitive stimulation may serve as a buffer or barrier to developing symptoms of dementia (Fritsch et al., 2001; Mortimer, 1997; Wilson et al., 2002).

We believe that these stimulating activities and an enhanced understanding and awareness of memory functioning caused the increase in memory ability. Also, the increased perceived memory ability may have given participants the confidence to engage in other stimulating activities outside of the MemAerobics sessions. Previous researchers have also hypothesized that stimulating activities may increase older adults' cognitive efficiency and reserve.

We believe that the reduction of depressive symptoms was caused, at least in part, by an increase in meaningful social contact, which was facilitated by MemAerobics. Previous research has shown that good social support networks are associated with fewer depressive symptoms. (Murrell & Meeks, 1992). MemAerobics was specifically designed to facilitate social bonds. The sessions were done in groups and most residents quickly learned a great deal of information about other participants. For example, in one exercise, known as the MemAerobics Ladder©, residents are exposed to interesting details about the other participants (e.g., their childhood nickname, favorite vacation). Although we didn’t collect quantitative data on the effects of MemAerobics on the size and quality of social support networks, we observed a significant increase in social interaction among MemAerobics participants. The participants were also observed practicing many of the exercises outside of the actual sessions and testing their grandchildren's memory ability using the MemAerobics stimuli (e.g., flash flags©). Future research should assess the effects of MemAerobics on social networks, depressive symptoms, and loneliness. Future research should also assess the effects of group-based cognitive interventions on longevity and life satisfaction.

MemAerobics and future programs designed to stimulate cognitive activity have the potential to radically change the nature of ALF care. These programs can be used as an ongoing and integral part of the ALF environment. If older adults can maintain their cognitive ability, they will require less care and possibly delay or even eliminate the need to go to a nursing home. Cognitively stimulating activities may also postpone symptoms of dementia, which could also delay the need for more intensive care. Also, residents in ALF facilities who participate in MemAerobics or similar programs will probably experience an increased quality of life, through better moods, more social contacts, and increased cognitive abilities.

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Table 1

Mean and Standard Deviations as a Function of MemAerobics Intervention and Time

	Time 1	Time 2
MemAerobics		
RiverMead Memory Test	59.44 (17.93)	67.21 (17.14)
Geriatric Depression Test	8.68 (6.08)	5.60 (5.06)
Perceived Memory Change (MIA)	42.83 (9.74)	48.88 (10.73)
Control		
RiverMead Memory Test	54.43 (29.22)	54.54 (28.22)
Geriatric Depression Test	5.88 (6.08)	5.18 (5.06)
Perceived Memory Change (MIA)	42.94 (12.57)	40.31 (7.18)