Making Physical Activity Accessible to Older Adults With Memory Loss: A Feasibility Study

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Purpose: For individuals with mild cognitive impairment (MCI), memory loss may prevent successful engagement in exercise, a key factor in preventing additional disability. The Resources and Activities for Life Long Independence (RALLI) program uses behavioral principles to make exercise more accessible for these individuals. Exercises are broken into small steps, sequenced, and linked with cues to help participants remember them. Memory aids, easy-to-follow instructions, and tracking forms to facilitate adherence and proper technique are provided to enhance exercise training and compensate for memory loss. Design and Methods: Thirty-seven individuals (M age = 81.9, SD = 5.8, range 70%–96; 78% women) participated in RALLI pilot groups held in retirement residences. Attendance was excellent, with participants attending 90% of classes. Results: At post-test (12 weeks), 84% of participants had exercised at least once during the prior week, compared with 62% who had exercised at least once during the week prior to baseline (p < .001), mean exercise time increased by 156 min per week (p < .0001), and SF-36 physical components scale significantly improved (p < .002). After 6 months, 76% of participants continued exercising (p < .003) and mean exercise time remained significantly improved (p < .0001). Implications: Persons with MCI can significantly benefit from an exercise program specifically designed to address their cognitive needs. Participants’ ratings indicate improvement in perceived physical health and emotional well-being as a result of the intervention. Thus, RALLI is a promising intervention to promote exercise in individuals with MCI.

Key Words: Mild cognitive impairment, Physical exercise, Health promotion

There is strong evidence from epidemiological studies that a history of exercise or physical activity is associated with delayed onset and progression of dementia in older adults. For example, a longitudinal investigation of community-residing adults aged 55 years and older found that worse cardiorespiratory fitness at baseline was associated with lower cognitive function 6 years later. Controlling for demographic and health-related differences, fitness was strongly associated with measures of global cognitive function, attention, and executive function (such as problem-solving skills and abstract reasoning; Barnes, Yaffe, Satariano, & Tager, 2003). In the Canadian Study of Health and Aging, women who exercised at least three times a week at an intensity more vigorous than walking had a significant reduction in incident cognitive impairment (50%) and incident Alzheimer’s disease (60%) over a 5-year time period (Laurin, Verreault, Lindsay, MacPherson, & Rockwood, 2001). In the Honolulu-Asia Aging Study, physically capable men aged 71–93 years who walked less than 0.25 miles per day had a 1.8-fold increased risk of developing dementia over a 6-year follow-up period than men who reported walking more than 2 miles per day (Abbott et al., 2004). Larson and colleagues (2006) found that people older than 65 years who reported exercising three or more times per week had a significantly decreased risk of developing dementia or Alzheimer’s disease over a 6-year follow-up period (age- and sex-adjusted hazard ratio = 0.63, p = .004). Finally, Colcombe and colleagues (2003) found that brain tissue loss in the frontal, parietal, and temporal cortices was associated with lower cardiovascular fitness, suggesting a

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Results of clinical trials also support the beneficial effects of aerobic exercise on cognitive function, particularly executive function. A recent meta-analysis (Heyn, Abreu, & Ottenbacher, 2004) identified 30 randomized controlled trials of exercise interventions with cognitively impaired older adults, 10 of which included cognitive outcomes. Exercise training had a significant positive effect on measures of health-related physical fitness, as well as behavioral, functional, and cognitive function. In the studies with cognitive outcomes (Mini-Mental State Examination score [MMSE] M = 16.6), exercise produced a moderate positive impact (M effect size = .57, range .28 – 1.92) on cognitive tasks. A separate meta-analysis of exercise interventions with cognitively intact older adults (Colcombe & Kramer, 2003) found that exercise had the greatest effect on executive processes, with exercisers improving more than control participants on time-limited tasks, spatial perception, problem solving, and tests of reaction speed. In Colcombe and Kramer’s meta-analysis, participants in combined strength and aerobic training interventions improved more than those in aerobic training alone, and those in long-term programs of 30 min or greater exercise periods experienced the greatest benefit. Despite these promising results, the ability of exercise interventions to effect clinically relevant cognitive and functional changes for individuals with significant memory problems remains largely unknown.

To date, most research on interventions to promote exercise and physical activity in community-residing older adults has excluded individuals with mild cognitive impairment (MCI) either through explicit criteria or because such individuals are thought to be unable to successfully complete the programs and assessments. However, exercise may be particularly important for older adults with MCI. The conversion rate for those with MCI is 12% annually (Bowen et al., 1997; Petersen et al., 1999) as compared with 1%–6% for those without MCI (Bowen et al.; Petersen et al.), and increases to as high as 100% for a period of 10 years in some studies (Morris et al., 2001). Older adults with MCI also have higher risks for decreased physical function (Marquis et al., 2002), increased chronic physical illness (Lopez et al., 2003), increased levels of affective disturbance (Lopez et al., 2003; Lyketsos et al., 2002), and increased mortality (Bennett et al., 2002). Thus, individuals with MCI may be especially likely to benefit from exercise and health promotion interventions.

Exercise interventions for persons with MCI face many of the same challenges as those targeted to cognitively intact older adults, including participants’ reluctance to start exercise (especially if they have not been physically active in the past), lack of guidance about what exercises are appropriate for them, fear of injury or pain, chronic physical illness, and lack of social support for exercise (Daly et al., 2002; Marcus et al., 2000; Trost, Owen, Bauman, Sallis, & Brown, 2002). These programs must also address the cognitive obstacles that compound these problems for individuals with MCI, particularly difficulties in learning new exercise routines and remembering how to perform them correctly.

Thus, an exercise program for individuals with MCI must address the unique challenges of cognitive impairment while simultaneously addressing the issues common to any exercise program for older adults. This article will describe and provide preliminary data on one such program, Resources and Activities for Life Long Independence (RALLI), an exercise and health promotion program developed specifically for individuals with MCI. RALLI uses behavioral and social learning theory to provide an exercise program that takes advantage of what is known about successful exercise interventions with both cognitively intact older adults and older adults with dementia (Teri, Logsdon, & McCurry, 2008; Teri et al., 1998, 2003) and modifies these interventions to meet the unique needs of individuals with MCI. In this approach, exercise is conceptualized as an observable and modifiable chain of behaviors that can be initiated and maintained using principles of goal setting, self-monitoring, and problem solving, while also providing feedback and reinforcement. RALLI provides close individual supervision and assistance during exercise classes (the instructor to participant ratio is 1:4). Complex exercise behaviors are broken into small steps and practiced repeatedly in class. Simple written materials are provided along with memory aids to support exercise outside of class. Investigating the feasibility and efficacy of this approach will help us better understand the interplay between exercise and cognitive decline to serve a growing population of older adults identified with MCI.

**Methods**

The study was approved by the University of Washington Institutional Review Board, and
all participants provided informed consent. The RALLI program was held in independent living retirement residences and included seven groups of 5–8 participants. Although these residences do not offer “assisted living” services, they do provide optional housekeeping assistance and congregate meals and serve many adults with MCI. Offering the exercise program within each of these residences provided individuals with MCI an opportunity to participate in the program in a familiar environment without requiring transportation to an outside location.

To identify individuals who were interested in the study, a flyer was distributed to all residents of participating retirement communities. Individuals who expressed interest were screened to determine whether they were 70 years of age or older and engaged in less than 150 min a week of moderate-intensity physical activity, as reported by the individual and confirmed by a spouse, other family member, or retirement residence activity staff. Further screening identified those who had MCI, indicated by self-reported memory loss, Clinical Dementia Rating scores of 0.5–1.0, MMSE scores greater than 20, ability to live independently, and no diagnosis of dementia (Petersen et al., 1999). Individuals were excluded if they were unable to walk across a room (assistive devices were allowed), expected to relocate during the study period, had a known terminal illness, had significant psychiatric problems, had severe sensory deficits, or had uncontrolled medical conditions (e.g., uncontrolled hypertension or unstable angina) that would prevent them from participating in a group exercise program.

Thirty-seven individuals (M age = 81.9 years, SD = 5.8, range 70–96 years; 78% women) were enrolled. Average score on the MMSE was 26.1 (SD = 2.5). Nineteen percent of participants were married, 68% widowed, and 13% either divorced or never married. Eight percent had less than a high school education, 70% were high school graduates, 17% were college graduates, and 5% had postgraduate degrees.

Participants were evaluated at baseline and 12 weeks. Cognitive status was assessed on the MMSE, treatment adherence assessed by monitoring attendance and completion of homework assignments, self-rated health status assessed with the SF-36, the physical components scale and general health perceptions subscale improved (p < .002 and p < .09, respectively), and MMSE scores improved by 0.76 points (p < .07). Six-month follow-up assessments were conducted for 33 of the 37 participants. Seventy-six percent were still exercising on their own (performing strength training, walking, or both) at least once per week (p < .003), and the mean weekly exercise time was 152.5 min (SD = 132.5, p < .0001).

Implications

Based on this investigation, we concluded that the RALLI exercise intervention is feasible and potentially beneficial with individuals with MCI. Participants increased their exercise time from an average of about 9 min per day to an average of 31 min per day, thus achieving the amount of physical activity recommended by the American Heart Association (2001) for older adults.
activity recommended for maintaining physical
and cognitive health. Improved scores on the
MMSE as well as participants’ ratings of their
physical function, perceived health, and emotional
well-being suggested that both cognitive and phys-
ical benefits were achieved. Furthermore, 6-month
data were available on 89% of the participants
and indicated participants had maintained a sig-
nificantly higher level of physical activity than they
had at baseline.

During the course of this study, we were able
to test and improve our exercise instructions and
handouts for the participants. For example, our
original exercise instruction handouts included
stick figures to illustrate each exercise. We learned
from our participants that the stick figures were
confusing, and a written description of each exer-
cise was more useful. We developed large-print
versions of the exercise instructions to accommo-
date individuals with visual problems. We modi-
fied some of the exercises to make them simpler
and safer for participants. For example, in our
initial group we used elastic bands for resistance,
but because participants had difficulty using them
correctly and safely, we modified the program to
use body weight only for resistance. We also reor-
dered the exercises so that seated exercises were
done first, followed by exercises done standing
and using the wall for support and balance, and
concluding with exercises done walking around a
large table so that participants could use the table
for support. Doing the exercises in this order
minimized the time and confusion in the transi-
tion from sitting to standing to walking. We re-
duced the initial number of repetitions of
exercises from six to three, to reduce the risk for
soreness or injury to participants who had been
inactive for a long period of time. Once partici-
pants became stronger, we gradually increased
the exercise by one repetition every week.

Table 2. Resources and Activities for Life Long
Independence Feasibility Study Outcome Data

<table>
<thead>
<tr>
<th>Variable</th>
<th>M (SD)</th>
<th>Pre</th>
<th>Post</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any exercise in past week, %</td>
<td></td>
<td>62</td>
<td>84</td>
<td>.001</td>
</tr>
<tr>
<td>Exercise minutes in past week</td>
<td></td>
<td>61.7 (60.7)</td>
<td>218.1 (164.4)</td>
<td>.0001</td>
</tr>
<tr>
<td>SF-36 physical components</td>
<td></td>
<td>40.4 (13.0)</td>
<td>42.9 (13.2)</td>
<td>.02</td>
</tr>
<tr>
<td>SF-36 general health</td>
<td></td>
<td>72.2 (18.6)</td>
<td>75.9 (19.9)</td>
<td>.09</td>
</tr>
<tr>
<td>Mini-Mental State Examination</td>
<td></td>
<td>26.1 (2.5)</td>
<td>26.9 (2.3)</td>
<td>.07</td>
</tr>
</tbody>
</table>

Note: SF-36 = 36-item Short Form Health Survey.
We used pedometers to monitor daily step counts, but we discovered the pedometers often undercounted steps when they were attached in the typical way, at the waist. Because the primary purpose of the pedometers was to provide feedback and motivation to participants about how they were doing (as opposed to measuring true distance walked), we developed a procedure for participants to wear the pedometers on a Velcro strip around their ankle, eliminating the undercounting problem and also making it easier to take the pedometer off and put it on each day. Because many participants had difficulty opening the pedometer off and put it on each day. Because many

It should be noted that apart from minutes of exercise, most findings in this study were modest. Without a control group it is impossible to attribute the findings solely to the RALLI program. A larger randomized trial with a control group, more detailed neuropsychological testing, and more extensive physical assessment is required to evaluate the impact of the program on cognitive and physical status. One limitation of this investigation is the reliance on self-reported assessments of activity level and intensity. More objective assessment of actual physical activity level (e.g., using accelerometry) would strengthen our findings of increased activity. The current results are promising, however, and warrant further investigation.

Future Directions

We are now conducting a randomized clinical trial of the RALLI intervention compared with a social walking group (RO1-AG14777; Linda Teri, principal investigator). The goal of this clinical trial is to investigate RALLI on a larger scale and determine whether the previous study’s outcomes are obtained in a larger sample of more heterogeneous older adults with MCI as well as whether participation in RALLI is more effective than a comparison program of walking and social support. In addition to investigating the efficacy and effectiveness of RALLI, we will obtain information on a number of factors (such as self-rated health, objectively evaluated physical activity, affective and functional status) to investigate their relationship to treatment outcome and the rate of cognitive decline in persons with MCI.

Conclusions

There is no doubt that physical activity promotes physical, cognitive, and emotional health. What is less understood is the level of activity required for adults aged 70 years and older, the kinds of programs that will be effective and appealing for this population, and how to adapt activity and health promotion programs to individuals who have cognitive challenges. We have the ability to examine more fully the impact of physical activity on cognitive and physical function in individuals at high risk for dementia. If preliminary findings are supported by the larger randomized controlled clinical trial, individual and societal benefits will be substantial. For the individual and his or her family, delaying the onset of dementia and physical disability provides additional years of independent healthy functioning and improved quality of life. For society, decreasing hospitalizations and delaying institutionalization would save billions of health care dollars. Achieving these beneficial outcomes must be a priority as we continue to develop, evaluate, and implement community-based exercise programs for older adults.

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References


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