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Exercise Interventions for Dementia and Cognitive Impairment: The Seattle Protocols

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Abstract

Research evidence strongly suggests that increased physical exercise may not only improve physical function in older adults but may also improve mood and slow the progression of cognitive decline. This paper describes a series of evidence-based interventions grounded in social-learning and gerontological theory that were designed to increase physical activity in persons with dementia and mild cognitive impairment. These programs, part of a collective termed the Seattle Protocols, are systematic, evidence-based approaches that are unique 1) in their focus on the importance of making regular exercise a pleasant activity, and 2) in teaching both cognitively impaired participants and their caregivers behavioral and problem-solving strategies for successfully establishing and maintaining realistic and pleasant exercise goals. While additional research is needed, initial findings from randomized controlled clinical trials are quite promising and suggest that the Seattle Protocols are both feasible and beneficial for community-residing individuals with a range of cognitive abilities and impairments.

Keywords

AD; Behavioral Treatment; Caregiver training; Depression; Physical Activity; Behavioral problems; Exercise

Introduction

There is a growing body of evidence from epidemiological studies that a history of exercise or physical activity may delay onset and progression of dementia in older adults. [1–5] Increased activity may also ameliorate some of the negative physical sequelae associated with dementing illnesses, such as risk for falls and fractures, loss of muscular endurance, and cardiopulmonary function, [6] as well as improve ADL function and mood. [7, 8] Thus far, the majority of studies involving exercise training with persons with dementia have been conducted in institutional settings, such as nursing homes and adult day programs, [6, 9, 10] or have been isolated community-based studies with small sample sizes. [7, 11] This paper will provide an overview of a systematic body of research incorporating exercise into targeted behavioral interventions for community-dwelling persons with cognitive impairment. [12–14] These programs, part of a collective referred to as the Seattle Protocols, were designed to decrease physical disability as well as delay disease progression using a standardized approach to care that focuses on 1) identifying, initiating, and maintaining participation in enjoyable physical exercise; 2) teaching behavioral strategies and problem-solving skills for overcoming obstacles to such exercise; 3) engaging interpersonal supports to maintain exercise regimens, and 4) encouraging walking and other easy-to-achieve, accessible, and available physical activities in the community.

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Seattle Protocols

Previous articles have described the theoretical and empirical basis for the Seattle Protocols, a series of evidence-based treatment programs that utilize structured and collaborative behavioral approaches to reduce the physical, social, and behavioral disabilities that are common among persons with AD and related dementias. [15] This article will focus on the application of the Seattle Protocols as a way to increase physical activity and improve health as well as enhance behavioral and affective outcomes. The rationale for increasing physical activity in individuals with dementia is straight-forward. Physical disability compounds the impoverished life experienced by individuals with cognitive decline; it places these individuals at increased risk of physical and functional decline, complicates care, and increases the risk of institutionalization and mortality [16]. Treatment aimed at introducing and increasing physical activity should, if successful, reduce these concomitant risks.

Theory

The Seattle Protocols are based upon social-learning and gerontology theories, and grounded in an understanding of the neuropsychological and behavioral changes that occur in individuals with dementia. The Protocols that include physical activity incorporate findings from evidence-based research on exercise training in older adults with clinical expertise regarding how best to incorporate such training into programs for individuals with cognitive impairment. We use strategies that have been shown to facilitate learning and behavior change without relying heavily on cognitive skills. Exercise is conceptualized as an observable and modifiable chain of behaviors that can be initiated and maintained using principles of goal setting, self-monitoring, provision of feedback, problem solving, and reinforcement. Complex behaviors are broken into small steps, and, as each step is mastered, the next one is added. Visual cues, reminders, and other tools are used to help individuals maintain their exercise program on their own between individual or group sessions and after treatment concludes. For persons with more significant cognitive impairment (and therefore unable to initiate or maintain the program on their own), training includes a caregiving family member, friend, or staff person who can assist them with identifying and remembering how to perform the exercises safely and consistently.

Key components

Each Protocol begins with an orientation that provides participants with a rationale for training and establishes mutually agreed-upon goals. Each concludes with specific recommendations and plans for maintaining and generalizing gains achieved during treatment. The central phase of each protocol focuses on training skills addressing the target behavior of interest, in this case, exercise or increased physical activity. In addition to exercise training, skills that are critical to the successful implementation and maintenance of the exercise program are covered. For example, each protocol addresses systematic ways to increase pleasant events (indeed, making physical activity one of these pleasant events). Participants are assisted in setting appropriate and achievable goals, problem solving potential obstacles and setbacks to continued physical activity, and identifying strategies to maintain motivation and measure progress. Additional health promotion topics may be included as warranted, such as choosing good walking shoes, identifying safe walking routes, maintaining good nutrition, and using relaxation techniques. When caregivers are involved, problem-solving training focuses on ensuring that they understand how cognitive limitations can impact a participant's understanding and cooperation with the exercise program, and helps them learn to use effective communication, pleasant events, and behavioral strategies to guide and motivate the person with dementia.

Exercise training

The exercises included in the Protocols are well-documented as critical to maintaining strength and mobility in older adults. [17, 18] They include activities to promote gentle stretching, strength training, balance, and endurance. Gentle stretching provides a warm up for other exercises, and increases participants' awareness of their muscles and muscle tension. Strength training is designed to help individuals maintain mobility and muscle strength to safely perform daily activities such as standing up from a chair, getting in and out of a car, carrying groceries, and walking. Balance exercises help individuals perform movements necessary for safe mobility, including weight shifting and body awareness. Last but not least, endurance activities help to maintain or improve overall cardiovascular health, physical status, and mood. All exercise activities focus on ease, availability, and pleasantness. For example, walking is the most commonly employed endurance activity – it has the advantage of being a well-learned activity, and it is relatively easy to vary its intensity based on the participant's current level of fitness.

Pleasant Events

Exercise that is not enjoyed will not be sustained. Consequently, we endeavor to help participants select activities that they will enjoy and to modify what they do to maximize their enjoyment. We also provide creative and fun instructions that participants can enjoy and incorporate into their own plans. For example, in a quadriceps strengthening exercise, we instruct participants to stand and sit very slowly, like a mother hen sitting on her eggs, urging everyone to be careful not to break the eggs. Balance training incorporates simple dance steps that shift weight from side to side, or tandem walking on an imaginary tightrope. For endurance, chosen exercises vary depending on the individual's preference: some participants walk, others ride a stationary bike; some walk indoors, others outdoors. In any case, the object is for the person to identify an activity or activities that they can enjoy at their present level of cognitive and physical function and that can be adapted as changes occur. Finally, and importantly, we strive to identify what would make a given exercise more fun for each individual, and therefore more likely to be maintained.

Problem-solving

Engaging in exercise takes effort and planning. Obstacles to initiating a new program and maintaining it when illness, family issues, or travel occurs must be identified and overcome. Using our well-established A-B-C approach to behavior management, [19] we teach participants and their caregivers to problem-solve their way around obstacles to insure they can engage in exercise in a regular and productive manner. In brief, participants are asked to identify and gather information about the behavior (B) that is causing them distress, and to observe and modify the antecedents (A) – actions which precede the behavior and may, therefore be triggering it – and consequences (C) – actions that follow the behavior, and may, therefore be sustaining it.

Since most participants in our studies are sedentary upon enrollment, we work with them to establish reasonable exercise goals, and provide clear instructions to both participants and their exercise partners about how to monitor progress, and problem-solve obstacles that arise. Throughout the process, we emphasize the importance of rewarding successes and having fun. An example of this problem-solving process would be the case of an individual who needs to increase his daily walking (the B - Behavior). The information gathering stage would include identifying how often and how long he walked in the past week, and examining whether he is more or less likely to walk with certain individuals, at certain times of day, in certain locations or weather conditions, or after certain activities (these are the A – or triggering antecedents). In addition, it is helpful to know what happens when he doesn't want to walk: does the exercise partner acquiesce to the refusal, argue, matter-of-factly gather up their coats and head out the

door, or offer to buy a favorite ice cream treat on the way home? Each of these responses (the C or Consequence) may increase or decrease the likelihood that a walk will be pleasant, and will occur. Helping participants find a way to incorporate exercise into a daily routine that is enjoyable and that makes them feel successful is the key to long-term maintenance.

Empirical Basis of the Seattle Protocols for Increasing Physical Activity in Individuals with Cognitive Impairment: RDAD, NITE-AD, and RALLI

RDAD: Reducing Disability in Alzheimer's Disease [14]

The RDAD study was a randomized controlled clinical trial involving 153 AD patients and their family caregivers randomized to a Protocol (exercise and behavior management - ABC/EX) or to routine medical care (RMT). During a 12-week treatment period, caregivers receiving the Protocol were taught to guide their demented care recipient in an individualized program of endurance activities (primarily walking), strength training, balance, and flexibility exercises. In addition, caregivers in this condition were taught behavioral and problem-solving strategies to increase exercise behavior and decrease undesirable agitated or depressed behaviors in their care recipients. [12, 20] Subjects were evaluated at baseline, post-treatment, and 6, 12, 18, and 24-month follow-up. Patient health status was measured with the Medical Outcomes Study Short Form (SF-36), the Sickness Impact Profile, the Cornell Depression Scale for Dementia, and caregiver reports of patients' restricted activity days, bed disability days, falls, and exercise participation.

Study findings indicated that caregivers were able to learn and direct patients to follow scheduled exercise activities. Eighty-one percent of active treatment patients attempted exercise recommendations. Significant differences between active and control conditions were obtained. At post-test, active treatment subjects exercised more (odds ratio [95% CI] 2.82 [1.22, 6.49]), had fewer restricted activity days (odds ratio 3.10 [1.08, 8.95]), and improved significantly more than controls on primary outcomes of physical activity (mean SF-36 Physical Role Functioning difference score 19.29 [8.75, 29.83]) and depression (mean Cornell Depression Scale difference score −1.03 [−0.17, −1.91]). Over 24 months of follow-up, changes in physical activity were maintained and improvements in SIP mobility occurred. For patients entering the study with higher levels of depression, significant improvements in depression were maintained at 24 months. There was also a trend among active treatment patients to have less institutionalization due to behavioral disturbance throughout the 24-month follow-up period. [14]

NITE-AD: Nighttime Insomnia Treatment and Education in Alzheimer Disease [13]

NITE-AD focused on the use of exercise to reduce sleep disturbances in persons with dementia. Participants were randomly assigned to either the Protocol condition (a combination of walking, light exposure, and behavioral problem-solving – NITE-AD) or to an educational contact control. Thirty-six AD patients were evaluated at baseline, 2-month post-treatment, and 6-month follow-up. Objective sleep was measured using an Actillume wrist-movement recorder; caregivers reported patient daytime sleepiness (Epworth Sleepiness Scale), depression (Cornell Depression Scale), and behavioral disturbance (Revised Memory and Behavior Problems Checklist). NITE-AD subjects were assigned a goal of walking daily for 30 continuous minutes. In cases where the AD patient was too frail to walk that duration, he or she started with a shorter time goal, and worked with the interventionist to gradually increase daily walking time over the 2-month treatment period. [21]

At post-test, and 6 month follow up, sleep in NITE-AD subjects had improved significantly, while contact control subjects had declined. NITE-AD subjects' average time awake at night decreased by 36 minutes ($p = .030$) and they had fewer nightly awakenings ($p = .012$). NITE-

AD patients also exercised significantly more days per week (p = .010), and had significantly lower levels of depression (p = .007) than controls. [13] Although the NITE-AD intervention was a combination treatment, compliance with the walking component of the study was high. Active treatment subjects walked 80% of the days exercise was assigned, 56.5% of the days for 30 minutes or more, and walking compliance was maintained over the 6-month follow-up period.

We are currently conducting a follow-up randomized controlled trial to examine the use of the Seattle Protocol for improving sleep in persons with AD. To date, 89 subjects have been randomized into four treatment conditions (walking, light exposure, combination NITE-AD, and education contact control). Among subjects enrolled in the walking only or combination NITE-AD condition, participants walked 81.8% of the assigned days, for an average of 24.6 minutes/walk. In post-treatment evaluation, no caregivers reported that the assigned walking required too much effort. When complete, this ongoing study will allow us to evaluate the direct effects of walking on participants' sleep, mood, and behavioral disturbance, and also to evaluate some of the factors (e.g., season, caregiver variables, and patient health) that may impact the feasibility and efficacy of physical activity interventions in persons with AD.

RALLI: Resources and Activities for Life Long Independence [22]

RALLI (Resources and Activities for Life Long Independence) is geared to enhancing the cognitive supports that individuals with MCI (Mild Cognitive Impairment) may need when engaging in an exercise program. Exercises are designed in a series of easy-to-remember increments that are repeated several times during training sessions in order to help participants' initial learning and facilitate subsequent recall. Each participant has a cognitively intact "study partner" who attends classes and assists them with their exercises throughout the week. Each week, participants receive handouts and tracking forms to help them remember what was covered that week. Written instructions for all exercises are laminated and have small magnets attached to the back of the page, so participants can put them on their refrigerator doors. This provides a visual cue for participants to remember to do the exercises each day, as well as providing a handy reminder of how to do them. These memory aides and cues are incorporated throughout training.

In a pilot study, 34 subjects (mean age=81.5 [SD=5.5], range 70 to 94; 81% female) participated in RALLI groups held in retirement residences [22]. Attendance and compliance with the intervention was excellent, with participants attending 90% of scheduled classes. All subjects completed their 6-month follow-up assessment, with no dropouts or attrition. Preliminary data indicated that at post test (12 weeks), 82% of participants had exercised at least once during the prior week, compared with 59% who had exercised at least once during the week prior to baseline ($p<.0001$), and mean exercise time increased by 172 minutes per week ($p<.0001$). On the SF-36, the Physical Components Scale and General Health Perceptions Subscale significantly improved ($p<.0001$ and $p<.05$, respectively); HDL cholesterol improved by 2.4 points ($p<.05$); and MMSE scores improved by 1.2 points at post test ($p<.06$). Participants' overall ratings of change indicate improvement in perceived physical health and emotional well being as a result of the intervention. Anonymous ratings of class materials and instructor effectiveness also indicated a very high level of satisfaction. Thus, RALLI is a promising intervention to promote exercise in individuals with MCI, and it is currently being evaluated in a larger randomized controlled clinical trial.

Conclusions

The Seattle Protocol was initially developed to treat depression in dementia patients. Since then, it has expanded to address physical activity and exercise enhancement for older adults with dementia and other forms of cognitive impairment, including Mild Cognitive Impairment

(MCI). The Protocols share commonalities of theoretical background, clinical experience, and strategic approaches to participant involvement and caregiver education. They incorporate lessons learned from earlier implementations to insure that exercise is targeted in such a way as to maximize its enjoyability (and thereby insure sustainability) as well as problem-solve obstacles to initiation and maintenance. Each Protocol has been subjected to rigorous randomized controlled clinical trials, employing standardized and multi-factorial methods of assessing outcomes. For each Protocol, detailed trainers' manuals provide all materials necessary to conduct treatment, including session-by-session information, handouts, and assignment forms.

The results of these randomized controlled clinical trials, feasibility and pilot studies demonstrate that physical inactivity is both feasible and beneficial for individuals with cognitive impairment, using a structured behavioral problem solving approach such as the one employed by the Seattle Protocols. Existing empirical evidence indicates that physical disability, depressed mood, and sleep and behavioral disturbances, may be ameliorated by combining an exercise training program with caregiver education and problem solving. In the future, additional prospective research is needed to confirm these promising findings and to clarify the amount and types of activities that are most beneficial for individuals with cognitive challenges, to help maintain or improve their physical, psychological and cognitive wellbeing.

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