4-2018

Development of an Evidence-Based Strength Training Program for Individuals with Dementia Participating in Adult Day Services

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Abstract

Falling and loss of mobility present serious risks for elderly adults, especially those with cognitive impairments such as dementia. These risks are shown to be significantly reduced when elderly adults participate in exercises focusing on strength and balance of sufficient intensity. Despite these potential benefits, many adult day programs do not incorporate exercise in a systematic and progressive fashion to achieve desirable improvements in function.

The purpose of this project was to develop an evidence-based exercise program, later titled *Simply Strong*, for reducing fall risk and improving mobility in elderly adults with dementia participating in Goodwill Easter Seals adult day services. An extensive literature review of current research into the implementation and resulting outcomes of exercise for older adults with dementia was conducted. A supplementary survey of Goodwill Easter Seals program managers regarding barriers and needs was conducted. Barriers to providing such a program were identified through the survey and addressed in the creation of the program so that this program, *Simply Strong*, and other programs of a similar nature, have an increased likelihood of being utilized long-term.

Based on the current literature, an evidence-based training program, titled *Simply Strong*, was developed to meet the needs of older adults with dementia and through the results of the staff survey was specifically tailored for individuals with dementia at Goodwill Easter Seals Adult Day Service. Staff members of Goodwill Easter Seals were instructed in providing the program so that the program remained self-sustaining after the conclusion of this project. Additionally, a training manual, an accompanying video, and an

equipment cart to assist in the implementation of the program was fabricated and then donated to two Goodwill Easter Seals locations.

Acknowledgements

I would like to thank the University of Dayton Honors Department for supporting and organizing this incredible opportunity, as well as the Berry Foundation for providing me with a kick-start to this experience. A special thanks goes to my advisor, Dr. Kurt Jackson, for all his patience and gentle guidance in the navigation of this project. Many thanks for all the family and friends who have provided so much encouragement along the way. Thanks to Peter Tierney, my audience of one. Lastly, I would like to thank the faculty of Goodwill Easter Seals, and most especially, the gracious participants of the GWES adult day center—you are all unforgettable to me.

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Background and Literature Review

Introduction

An increasingly elderly population in the United States, as well as world wide, raises many concerns, one of which is the expected increase in health care costs. Elderly adults incur more medical costs than younger populations. Contributing to the increased cost are injuries resulting from falls and mobility loss. Fall risk is even greater among the population of elderly adults with dementia, which is also expected to increase in coming years. It is therefore imperative that direct action is taken to actively combat fall risk in elderly adults, specifically targeting the cognitively impaired. Current research suggests that one of the most effective means of reducing fall risk and improving independence within this population is the implementation of a strength-training program. Since a large proportion of cognitively impaired adults are attending day service programs, these programs present an opportunity to target this at-risk population in an effective and safe way.

An Increasingly Elderly and Frail Population

America is currently facing a dramatic rise in its population of adults aged 65 and over. By the year 2030 this single population is expected to make up 20% of America's total population; this is a steep growth from the comparative 13% in 2010, or even the 9.8% in 1970. In 2050, this population is expected to encompass nearly 83.7 million people, nearly double of its 43.1 million estimate from 2012[16]. This upsurge of America's elderly population raises several concerns, one of which being the expected toll of health care systems as a result of this populations susceptibility to injury[1,5,11,18]. The high prevalence of injury can be traced to this populations increased fall risk due to muscle reduction.

Sarcopenia and Cognitive Impairment

As people age a reduction in lean muscle mass, called sarcopenia, is often experienced. Sarcopenia is most strongly associated with a reduction in physical activity as part of the aging process[3]. However, it has been noted that adults with cognitive impairment tend to experience more severe weight loss, which can begin before diagnosis and may be a preclinical marker of Alzheimer's disease[3,21]. The key factor in the generalized weight loss experienced is the loss of muscle mass that has been strongly linked to increased severity and progression of cognitive impairment[3,21]. Outside of the physiological impact of muscle loss on mental ability, sarcopenia increases the risk of injury due to falls as a result of instability caused by muscle weakness.

The Cost of Falling

It is expected that one in three seniors will fall each year and of those falls, one in five will result in serious injury[10,24]. A simple fall can result in serious medial trauma, from fractures and broken bones, to extended hospital stays and possible fatality. In the year 2000, America reported 10,300 fatal and 2.6 million non-fatal, but still medically treated, injuries as result of falls in the population of adults aged 65 and over[10]. This is the exact population that is expected to increase considerably in the years to come. While the danger of falls present to the otherwise healthy adult, fall risk can be especially threatening to cognitively impaired adults.

Fall Risk Related to Cognitive Impairment

Up to 5.3 million Americans have Alzheimer's disease, the most common form of dementia, a neurocognitive impairing disorder[1,4,5,8,17]. Worldwide, one new case of dementia is diagnosed every seven seconds[7]. Dementia is now the sixth leading cause of death in the United States, killing more than breast and prostate cancer combined[1,5]. The prevalence of the disease is only set to rise dramatically within the upcoming years due to the aging population[1,4,5,8].

Falling and loss of mobility present serious risks for all elderly adults, but none more so than those with cognitive impairments such as dementia. Elderly adults with dementia are at an increased risk for falls and have much lower mobility than their peers without dementia[1,2,4,15,19,20]. The risk of injury due to falls, including fractures, is greater in people with impaired cognitive function[2,4,9,5,13]. Adults with dementia have a prevalence of falling that is 2-3 times higher than their peers[2,4,9,11]. This loss of mobility, with the related risk of falls and injury, creates a steep burden on immediate family members and society as a whole[1,4,5,18]. It is estimated that in 2016 dementia will cost the United States 236 million dollars in health care, approximately 5,000 per family caring for a loved one with the disease[1,5]. This financial burden can present serious impairments for not only individual families but also the entire health care system.

Reducing Risk Through Targeted Training Programs

Risks associated with falling have been shown to be significantly reduced when elderly adults participate in exercises focusing on strength and balance of sufficient intensity[15,18,22]. Current clinical guidelines indicate that exercises emphasizing lower body strength and balance of sufficient intensity can serve as an effective primary intervention for reducing falls and improving independence in elderly adults, both with and without dementia[4,10,15,18]. Strength training programs are shown to be the most effective and least expensive fall prevention strategy in the elderly community as well as the only intervention that reduces both the number of falls

and fall rate[10]. There is also increasing evidence linking physical fitness and mental health[3,12]. Increasing muscle mass is shown to alleviate negative changes to the brain and body associated with cognitive impairment and general aging[3,12].

It is therefore, imperative that elderly adults commit to strength training to reduce their individual chance of falling and the overarching pressure on societal medical care caused by fall risk. However, the translation of fall prevention programs that were proven effective in elderly adults without cognitive impairment, to adults with dementia can reduce the effectiveness of the program[4, 15]. This finding suggests that a fall prevention program specifically tailored for elderly adults with dementia is required to result in the greatest overall effect of fall risk reduction.

The Prevalence and Importance of Adult Day Services

In response to an increasing elderly population, and resulting pressure on caregivers, adult day service programs are increasing in number. These programs form a crucial aspect of support for families as well as needed social exposure and physical activity for elderly persons[14]. Since many adults, the majority of which are experiencing dementia in some form, participate in day service programs, these programs have a unique opportunity to provide exercise programs that allow elderly adults to engage in strength training in a safe environment without additional strain on the adult's caretakers and families[18]. However, most adult day service programs do not include these types of evidence-based exercises as part of their physical activity sessions.

Despite potential benefits, many adult day programs do not incorporate exercise in a systematic and progressive fashion to achieve desirable improvements in function. Physical activity provided in these day programs typically focus on general movement in a seated position, well-being, and socialization, rather than much needed progressive strength and balance training[14,15]. Barriers such as staffing, safety, cost, time, and training may prevent day programs from implementing these types of exercise programs.

Limitations and Future Research

Many studies into the effects of strength training in cognitively impaired adults tend to exclude certain age ranges or levels of impairment, making it difficult generalize results. Small sample sizes were commonly used so future studies show seek to include a greater number of subjects. As noted in current research, the mechanisms of Alzheimer's and sarcopenia may share underlying mechanisms as both conditions are associated certain physiological abnormalities[3,6]. Future study into prevention and possible cure should seek to understand the connection between

the two conditions through their similar causations. Concerning the implementation of training programs at day service centers, studies have yet to be done on the long-term effectiveness of such programs to see if it is plausible for a center to maintain the programs progression. Future studies into strength training at day services should tailor programs to be maintainable before assessing effectiveness as an effective but unmaintainable program provides no practical help.

Conclusion

The increasing swell of cognitive impairment among an aging population, in America and worldwide, is poised to create significant pressure on the healthcare system. This pressure can be diminished by reducing the medical cost of treating injuries associated with falling, which are more common among adults with cognitive impairment. Since many cognitively impaired adults are enrolled in adult day service programs these programs provide an opportunity to create a significant impact when they employ a strength-training program into their daily routine. The use of strength-training programs should therefore be phased into the focus of adult day centers in order to improve the wellbeing of the individual participant and the world at large.

Program Development

Using current recommendations on strength training for elderly adults the program *Simply Strong* was created to take advantage of the unique opportunity adult day services present in reaching adults vulnerable to falls. Drawing inspiration from the Otago Exercise Program, *Simply Strong* focuses on large, anti-gravity muscle groups of the upper and lower body. Progress made by participants can be tracked to allow for sufficient progression. All the exercises can be performed sitting or standing based on the comfort and strength of the individual.

A functional cart was developed to store all program materials including the *Simply Strong* manual with individual tracking sheets, progression board, exercise equipment, video guide and television monitor. To make the program appropriate for adults with cognitive impairment, the exercises are simple and program materials were designed to ensure the program is easy to follow. Program materials were streamlined for simplicity and to allow for the program's administrator to comfortably lead sessions with minimal training. It is hoped that anyone, given the program materials, would be able to effectively implement *Simply Strong* among whatever population of adult he/she is working with. However, during the duration of this project the focus was placed solely on the population of elderly adults participating in Goodwill Easter Seals programs in Beavercreek and Dayton, Ohio locations.

Methods

Literature Review

Initially, a comprehensive review of the current research was performed. This review focused on falls and mobility impairments in individuals with dementia and the potential benefits of strength and balance exercises for this population.

Needs Assessment

A survey and interview of Goodwill Easter Seals program managers was conducted to identify possible barriers and concerns regarding implementation of an exercise program. These concerns were taken into consideration during the creation of the program so that potential barriers could be tackled before a problem was presented. The survey requested the program managers list experience in leading group exercises and activities in order to gauge the incoming comfort level with leading *Simply Strong*. It was revealed that there was little to no prior experience among program managers so program materials were developed to assist in leading.

Development of the Exercise Program

Based on the research conducted during the extensive literature review and the needs recognized during the assessment stage, a comprehensive and evidence based strength training program was developed so that it is appropriate for individuals with dementia. This program was taught to the Goodwill Easter Seals staff members who will work to implement the program in the Beavercreek location on a trial basis.

Implementation of Mobility Assessments

Prior to participating in the exercise program participants' gait speed, mobility, and lower body strength were tested using the "Timed Up and Go" and "Five Repetition Sit to Stand" assessments. These assessments were used to establish a baseline level for participants and to assess their individual fall risk. The assessments should be re-performed with participants every six to twelve weeks to monitor progress.

Development of Training and Resource Materials

Goodwill Easter Seals staff were educated in the methods of the strength training program so that the staff members may implement the program with minimal guidance. Upon the conclusion of the training the staff member(s) were comfortable with leading the program so that it could be continued independently at Goodwill Easter Seals. Along with the development of the program itself, the materials to be used in the implementation of the program were developed. These materials include a fully equipped cart containing various weights, strength bands, exercise wands, and a television monitor (Figure 1). Supplemental training materials and forms for assessing and tracking participant's balance, mobility and exercise progression were also developed and added to a comprehensive manual detailing the program.

Figure 1. Completed Simply Strong exercise cart and materials. Courtesy of

An exercise video showing step-by-step guiding instructions for the program, specifically tailored to meet the needs of both staff members and participants, was created to be viewed on the cart's monitor during the program's implementation. Upon the completion of the project, two carts created for the implementation of the program were donated to the Goodwill Easter Seals Beavercreek and Dayton locations.

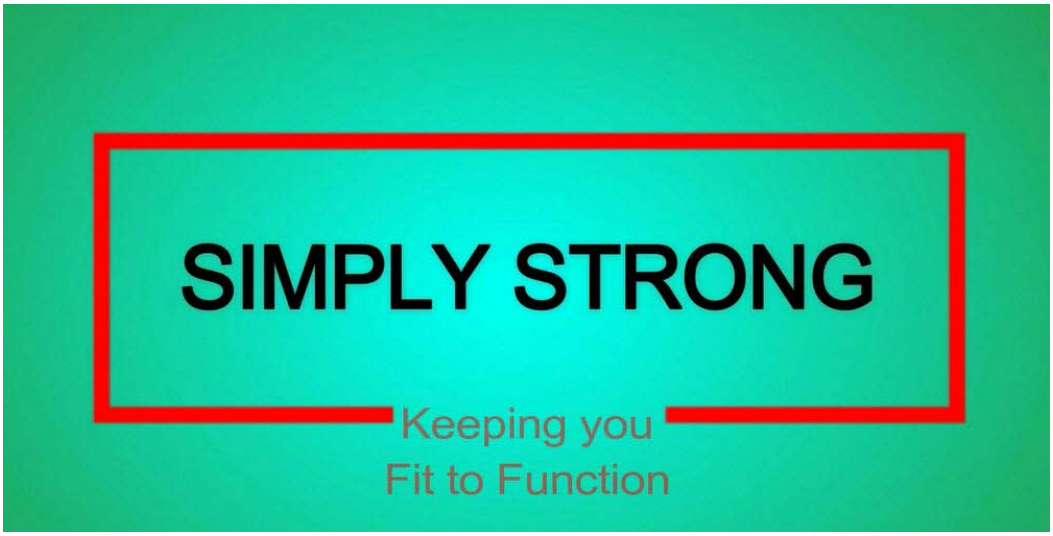

Figure 2. Title slide from the Simply Strong instructional exercise video. Courtesy of Jaclyn Franz and Kurt Jackson, 2016.

The Exercise Program

The Simply Strong exercise program focuses on the large, antigravity muscle groups of the upper and lower body through simple to perform exercises preceded by a short warm-up routine. Upper body muscle groups targeted were the deltoids, triceps, biceps, upper and middle trapezius, and rhomboids. Strengthening these groups should allow for improved posture, reduced thoracic kyphosis, enhanced ability to reach overhead items, and increased arm extension. Lower body muscle groups targeted include the gluteus, quadriceps, and gastrocnemius. Improving muscle quality in these groups should improve balance, mobility, medial-lateral stability, and sit-to-stand performance.

Warm-Up

Forward Rowing (1 set of 10)

Backward Rowing (1 set of 10)

Twists (1 set of 10)

Marching, Seated or Standing (1 set of 10)

Kicks, Seated or Standing (1 set of 10)

Strength Training

Overhead Press (2 sets of 10)

Curls (2 sets of 10)

Band Stretches (2 sets of 10)

Squats and/or Knee Extensions (2 sets of 10)

Hip Abduction, Seated or Standing (2 sets of 10)

Heel Raises, Seated or Standing (2 sets of 10)

Figure 3. Demonstrating an overhead press (standing) as seen in exercise video. Courtesy of Jaclyn Franz and Kurt Jackson, 2016.

Figure 4. Demonstrating a curl (standing) as seen in exercise video. Courtesy of Jaclyn Franz and Kurt Jackson, 2016.

Figure 5. Demonstrating a band stretch (seated) as seen in exercise video. Courtesy of Jaclyn Franz and Kurt Jackson, 2016.

Figure 6. Demonstrating a squat as seen in exercise video. Courtesy of Jaclyn Franz and Kurt Jackson, 2016.

Figure 7. Demonstrating a knee extension as seen in exercise video. Courtesy of Jaclyn Franz and Kurt Jackson, 2016.

Figure 8. Demonstrating a hip abduction (standing) as seen in exercise video. Courtesy of Jaclyn Franz and Kurt Jackson, 2016.

Figure 9. Demonstrating a heel raise (standing) as seen in exercise video. Courtesy of Jaclyn Franz and Kurt Jackson, 2016.

Outcome

At the conclusion of the project, an evidence-based strength training program, specifically targeting adults with dementia, was developed for Goodwill Easter Seals Adult Day Services. During this project the program was implemented with supervision for several weeks at both locations at which point the staff were trained in leading the program and were allowed to assume responsibility for leading. While the program was implemented in such a way that it is able to be independently led by the staff members of Goodwill Easter Seals into future years, current University of Dayton physical therapy students volunteer weekly at the Dayton location to assist in conducting program sessions. This project provided deeper insight into the barriers that prevent adult day centers from taking an active role in decreasing fall risk in adults with dementia and provided a possible model for implementation in adult day centers across the country.

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