

Exercise for Fall Prevention

By Sage Galloway and Graduate Student Mentor, Jeremy Ducharme

Introduction

Exercise is essential to human health and life, yet the World Health Organization has found that “One in three women, and one in four men are insufficiently active” (1). The World Health Organization has also seen no improvement in physical activity levels since 2001 (1). The elderly is one of the population subgroups that is most sedentary; according to the CDC, nearly 25% of adults age 50+ were completely inactive in 2014 (2). Though exercise should be a lifelong habit, it is especially important in the elderly. Individuals begin to lose strength as they age. Research has found that when compared to people in their 20’s, people in their 80’s exhibit 40% less strength. (3) With this decline in strength comes a decline in gait speed, decreased functionality, and ultimately an increase in falls and disability. (3) In a previous review of 121 studies, Liu and Latham (2010) found that resistance training not only helped the elderly improve strength, but they also had improved walking, stairclimbing, sit to stand ability, and activities of daily living. If the elderly are able to remain active, it will help them to avoid falls and associated complications and medical expenses. This article aims to dive deeper into how exercise can be used as a means for falls prevention.

Falls, Mortality, and Associated Health Complications

Falls account for 80% of injury-related hospital admissions yearly for individuals ages 65+ (4). However, fall related injuries are not the only concern, as often times hospitalization leads to social withdrawal, fear of activities, loss of independence, and development of other physical or mental health issues (4). These subsequent developments of fear of activity will further contribute to sedentary behavior. A study following 750 patients admitted to the hospital as a result of a fall indicated that the readmission rate within 30 days was 14% and the mortality rate within 30-days of admission was 6% (5). Some comorbidities commonly resulting in mortality or readmission included heart failure and myocardial infarction, both of which involve risk factors which increase with sedentary behavior (5). Siracuse et al. (5) compiled a list of injuries that occur directly from falls and those that happen as a result of hospitalization. Injuries directly resulting from falls included pelvic fractures, skull fractures, long bone fractures, and intracranial hemorrhage (5). Conditions developing from hospitalization include acquired infection, acquired pneumonia, and pulmonary embolism (5). If the initial fall is avoided or prevented, these injuries and conditions can also be avoided.

The Elderly and Postural Stability

Horlings et al. (6) investigated the effect of muscle weakness on postural instability and subsequent falls. The authors list ankle movement as being essential to balance and gait correction. (6) Furthermore, they cite muscle strength as essential to ankle movement, as muscles act as joint stabilizers. This provides one example of how muscle strength (which can be improved through resistance training and exercise) plays a role in determining risk of falls and instability. Three studies mentioned in this meta-analysis by Horlings et al. (6) demonstrated quadricep and ankle weakness were correlated to instability during quiet stance (stance in which body's mass is supported and regulated by muscles surrounding ankle joint), standing with eyes closed, and standing on foam platform. In addition to static balance, Horlings et al. (6) stated that, knee-extension weakness contributed to 26% of dynamic balance variance. These essential muscle groups surrounding the knee, such as the quadriceps, and ankle can be targeted through exercise protocol to help improve balance and posture, ultimately improving falls incidence.

Financial Burden of Falls

Falls can also be financially costly. A study by Florence et al. (7) analyzed the medical expenses from falls in adults age 65+, and an estimated 50 billion dollars was spent on falls. This number is only expected to rise, as lifespans and years spent living with chronic health conditions are increasing (7). These financial expenses present a large burden on not only the individual, but also their families, caretakers, and the health care system; a burden which might have been avoided through proper exercise intervention.

Exercise as Falls Prevention Interventions

Clearly, falls present many detriments to health, but what role does exercise have in this process? Exercise has become a method for fall prevention intervention. Exercise comes in many forms and can be adapted to many different lifestyles, interests, and preferences. The following studies to be presented provide examples of varieties of interventions all presenting positive outcomes for strength, balance, or incidence of falls. The first type of exercise program to be addressed is home based exercise intervention. Researchers investigated the effects of a home-based exercise program on falls for adults aged 70+ at a Fall Prevention Clinic (8); outcomes evaluated include self-reported falls, balance, and mobility. In this study, subjects were divided into two groups: the first receiving at-home exercise intervention from a physical therapist involving strengthening and balance exercises (knee flexion, knee extension, ankle plantar and dorsi flexion, hip abduction exercises, and backward walking, heel-toe walking, sit-to-stand) and the other group receiving no home-based exercise intervention (8). Patients receiving the home-based exercise experienced 236 falls compared to the significantly higher 366 falls in the non-exercise control group. Incidence of falls in the exercising

group was 1.4 per person-year, compared to 2.1 per person-year in the control group (8). This serves as evidence that exercise helped decrease number of falls, thus decreasing risk of associated injury or mortality.

The next type of exercise intervention to be addressed is an analysis of benefit of wearable exercise technology and “exergaming”. One technological intervention mentioned in a review article by Khanuja et al. (9) was the incorporation of wearable technology to analyze gait, acceleration, and postural sway, which vibrates to provide feedback; leading to decreased postural sway, better balance, and better proprioception. This allowed for improved stability, promoting confident mobility, more frequent exercising, and ultimately less fear of falling (9). Another example of incorporation of technology to exercise is the use of Nintendo Wii: a movement-based gaming console. The review article by Khanuja et al. (9) mentions that exercise gaming results had comparable outcomes for fall incidence to traditional physical therapy. However, the benefit of “exergaming” is that a console might be more accessible to some than physical therapy (9). As technology continues to advance, it provides new opportunity for integration with exercise to encourage physical activity and provide potentially greater, cost-effective outreach to populations in need (including sedentary adults at risk of falling).

Pilates is a type of exercise which focuses on core stability, posture, flexibility, and strength. Pilates is often taught in fitness studios or as group exercise, so it may provide opportunity for a more social or outgoing form of exercise intervention. Josephs et al. (10) compared traditional strengthening exercise regimen to Pilates intervention and found no significant differences between groups in terms of strength, balance, and balance confidence (10). This finding demonstrates that Pilates is yet another option of exercise to prescribe to a person if they do not like traditional resistance training. Pilates may be able to help reduce fall risk, as it produces comparable results to traditional strengthening exercise regimen.

Exercise as Long-Term Intervention

Many of these previous researchers studied the acute responses of exercise on fall risk, but what about the long-term adaptations that come with training? Can these exercise interventions have lasting effects beyond the end of the study? A review by Finnegan et al. conducted an analysis of 24 studies regarding the longer-term outcomes following an exercise intervention for adults age 65+ (11). This study defines long term as one and two years of continued exercise intervention. They found that interventions lasting 6 months resulted in an average of 21% reduction in falls, whereas exercise continued for longer than a year resulted in a 36% reduction in falls (11). It should be recommended that the elderly begin exercise, as this evidence shows that exercise may prevent falls and this effect is improved as the individual continues to exercise.

Specific Healthcare Initiatives for Falls Prevention and Management

An initiative in the health care setting is the CDC's Stopping Elderly Accidents, Deaths, and Incidents (STEADI) program. The three core elements of the STEADI initiative are as follows: screening patients to determine if they are at risk for falls, assessing whether the risks for falls can be modifiable, and intervention to reduce this risk by utilizing effective clinical and community-based strategies (12)". STEADI has been adopted by both New York and Oregon in the geriatric clinics. These two implementations of STEADI in New York and Oregon involved making discussions about falls and history a part of care for every geriatric patient. STEADI provides assigned roles for each member of the care team in caring for and preventing falls (12). It is important that there are assigned roles so that in case of an incident it can be managed properly and will not leave the team of providers unprepared if a fall does occur. The STEADI initiative also ensures providers and families are informed about certain medications and postural hypotension (through informational pamphlets and posters), both of which can increase risk of falls (12). Additionally, some simple chair exercises are provided through the STEADI initiative to help improve safety techniques involving assuming and rising from a seated position amongst at risk populations (12). Though this STEADI initiative is more aimed at clinical populations, everyone must start somewhere with exercise, and for some this start might be the simple chair exercises provided by the CDC through STEADI.

Conclusion

Falls can result in injury and hospitalization and this risk is exacerbated in elderly populations. These sorts of accidents may be avoided completely in some cases with a proper prescription for physical activity. Physical activity, especially when performed regularly, is effective at strengthening muscles (including those essential to posture). By improving strength, this will result in improved balance, gait, and mobility which together decrease an individual's risk for falling. The longer a person can remain mobile, the longer they can maintain their independence. Exercise is essential to general well-being, but also the prevention of falls.

4 Elements

Apply It

Resistance training, when performed safely, can increase strength, thus improving the stabilizing ability of muscles surrounding joints necessary for mobility and balance.

The inclusion of exercises such as Pilates, those that involve reacting to a stimulus (i.e., Exergaming), and chair exercises can be beneficial as they have been shown to decrease the risk of falling by focusing on aspects of fitness that are essential to balance.

Increasing difficulty of simple exercises (such as single leg stand) through the addition of a foam mat or uneven surface can help improve balance and strength, which in turn may lead to further reductions in fall risk.

Bridging the Gap

This article highlights the physical and financial burdens of falls. It also provides potential reasons (decreased strength, balance, and mobility) why the elderly are so at risk for falls and their declining health state following a fall. The ways in which exercise may help prevent falls and improve overall health are explained, as well as how this can be applied to clinical populations or patients.

Summary Statement

This article is about falls and associated health problems within the elderly population. This article explains why exercise is essential for preventing these falls, and how regular physical activity can benefit the elderly.

Pulled Text

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Bio:

Sage Galloway will graduate from The University of New Mexico with her B.S. in Exercise Science in May and has accepted a position at The University of New Mexico's Physical Therapy School, expecting to graduate with her doctorate in the 2024 Cohort. Her interests outside school include hiking, backpacking, soccer, and yoga.

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