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Background and Purpose: Elderly individuals, especially those with dementia, are at an increased risk for falls. These falls can result in extremely serious injuries. However, little is known as to what factors put an Alzheimer's patient most at risk for falls. This study seeks to determine which known fall risk factors are experienced by adults with dementia who attend adult day services. By understanding what risk factors put an individual at an increased likelihood for falls, a specific intervention can be designed to prevent falls in this population.

Participants: To be included in this study, participants had to attend Goodwill Easter Seals Adult Day Service and have a diagnosis of dementia. There were 19 participants in this study (8 male) with an average age of 72 years old (ranged 64-86 years old).

Testing Procedure: Participants were assessed for cognitive function by using the Montreal Cognitive Assessment (MoCA). Testing also included a 6 m gait test, the Timed Up and Go test, a 30 second sit to stand test, and a grip strength test.

Results: The average MoCA score (16 points) is consistent with MoCA scores for cognitively impaired or Alzheimer's population. MoCA scores ranged greatly (0-29 points) signifying a wide range of cognitive abilities among this population. Participants scored significantly worse than the age matched normative values for each measure, signifying an increase in fall risk by each parameter.

Conclusion: In the future, an intervention should be designed that can be easily implemented in the day services and especially target the individual's strength.



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BACKGROUND AND PURPOSE

Dementia is a neurocognitive disorder characterized by a significant impairment in cognitive functioning to the point of decreased independence for the individual.¹ Alzheimer's Disease (AD) is the most common type of dementia, affecting millions of Americans, especially those over the age of 65.² AD significantly impairs an individual's executive functions which control higher level thinking and memory as well as motor planning.³ This causes dementia and AD to be considered as risk factors for falls.⁴

The US is also experiencing an aging population with an expected 1 in 5 Americans being over the age of 65 in 2030.⁵ Moreover, an individual's risk for falls naturally increases as he/she ages with 1 in 3 individuals over the age of 65 reporting a fall in the past year.⁵ Falls can be extremely detrimental to older adults because they often result in broken bones, extended hospital stays, or death.^{6,7} Furthermore, falls can lead to decreased independence and quality of life among the elderly due to a fear of falling.⁸

This increased fall risk for older adults with dementia is concerning not only to individuals and their caretakers but is also concerning on a larger scale for the nation. In 2013, the medical cost of falls suffered from the elderly totaled \$34 billion.⁶ Finding a way to reduce and prevent falls in the elderly is of primary concern for the nation and individuals.

Factors attributed to increased fall risk include balance impairment, gait impairment, lower extremity muscle weakness, medications, and a fear of falling.⁹ Previous research suggests that interventions typically used to address fall risk in individuals without dementia may not be effective in treating patients with dementia or cognitive impairments.¹⁰ Research has also shown fall risk factors in people with cognitive impairment who live in nursing homes but not for those individuals who are community dwelling.¹¹ A better understanding of the physical capabilities and possible risk factors of this population of community dwelling adults with dementia is necessary so that tailored interventions can be designed to address their specific needs. Therefore, the primary purpose of this study was to evaluate balance and functional performance in a population of community dwelling older adults who also participate in Goodwill Easter Seals adult day service programs in the greater

Dayton area. The results of this research may be useful for determining fall risk and developing future interventions for this population. .

METHODS

Participants: Individuals who attended Goodwill Easter Seals adult day services were asked to participate in this study. Additional inclusion criteria included the diagnosis of Alzheimer's Disease or dementia as well as the ability to walk at least 10 m without the use of physical assistance by a research assistant. Participants were excluded from the study if they displayed signs (such as pain, grimacing, etc.) of physical or psychological discomfort. Nineteen participants were included in this study, 8 being male. The average age for participants was 72 years old (Range: 64-86 years). Seven of these participants used an assistive device such as a cane or walker.

Consent: Because of the at risk nature of this population with cognitive impairments, the consent process was extensive. An invitation to participate in the research study was extended to all legally authorized representatives (caregivers) of individuals who attended day services. Once consent was obtained from the representative, assent from each subject was also obtained at the time of testing.

Testing Procedures: Participants were tested on-site at the Goodwill Easter Seals Adult Day Services Center. Participants were first administered the Montreal Cognitive Assessment (MoCA) to determine that individual's cognitive function. The MoCA was chosen for its increased sensitivity in detecting mild cognitive impairments compared to the more widely used Mini Mental Status Exam.^{12, 13}

Participant's vitals were measured including heart rate, blood pressure, respiratory rate, height, and weight. Gait speed was measured by having participants walk 4 m at their self-selected pace. This test has been shown to be good to excellent in reliability for individuals with mild to moderate dementia.^{14, 15} The Timed Up and Go (TUG) test was also administered in which a participant was timed as they rose from a seated position, walked 10 feet, turned around and returned to a seated position in the chair. This test has been

shown to have excellent reliability amongst individuals with mild to moderate dementia.^{14, 16}

Upper body strength was assessed by a grip strength test using a JAMAR dynamometer while seated. Grip strength has been shown to have moderate to excellent reliability in older adults with dementia.^{14, 15} Lower body strength was determined by asking the participants to sit and stand as many times as they could in 30 seconds. This test has been shown to have good reliability in adults with mild to moderate dementia.¹⁴

RESULTS

MoCA: The MoCA is a test scored out of thirty points, with a score of thirty signifying no cognitive impairment. Standardized MoCA values have established scores of 18 or less as being indicative of Alzheimer's Disease.¹³ Our participants had an average score of 16 points (Range: 0-29) indicating a level of dementia consistent with AD.

Gait Speed: Walking speed has been shown to be an excellent predictor of fall risk and has even been considered as a vital sign.¹⁷ Participants' average walking speed was 0.78 m/s (Range: 0.18-1.48 m/s). Age matched normative values for this population were 1.25 m/s.¹⁸ A walking speed below 0.8 m/s is associated with limited ability for community ambulation.¹⁷

Timed Up and Go: The Timed Up and Go is widely used as a functional test that encompasses an individual's ability to stand up, walk, turn, and sit down. Participants' average TUG time was 15.67 seconds (Range: 6.22-28.9 sec). There was one outlier who took a considerably longer time because of his inability to understand the instructions. Age matched normative values for this population is approximately 9 seconds.¹⁹ A TUG time greater than 13.5 seconds signifies an increased fall risk in community dwelling adults.²⁰

Lower Body Strength: The 30-second sit to stand test is traditionally completed with hands crossed across the chest. However, participants were allowed to use their arms while performing the 30-second sit to stand test because it has shown to maintain reliability with

normative values.¹⁵ Participants were able to complete an average of 8.13 repetitions in 30 seconds (Range: 1.5-18 repetitions). According to age matched normative values, females can complete 10 to 15 repetitions while males can complete 12 to 17 repetitions.²¹ Individuals completing less than 10 to 12 repetitions are considered to be at an increased risk for falls.²²

Grip Strength: Grip strength is an easily assessed measure using a hand held dynamometer and can be indicative of overall body strength. Male participants averaged 29 kg (Range: 15.6-37.6 kg). The age matched normative value for males is 42.4 kg.²³ Additionally, a grip strength below 37 kg is predictive of decreased mobility in males.²⁴ Female participants averaged 16.3 kg (Range: 9-22.3 kg). The age matched normative value for females is 23.7 kg.²³ In females, a grip strength below 21 kg is predictive of decreased mobility.²⁴

Table 1: Comparison of Participants Physical Functioning Scores with Aged Matched Normative Values.

	Avg. Participants Scores	Age Matched Normative Values	Decreased Mobility/Function Cut Offs
Gait Speed (m/s)	0.78	1.25	< 0.8
Timed Up and Go (s)	15.67	9	> 13.5
30 s Sit to Stand (repetitions)	8.13	Males: 12-17 Females: 10-15	< 10-12
Male Grip Strength (kg)	29	42.4	< 37
Female Grip Strength (kg)	16.3	23.7	< 21

DISCUSSION

Average MoCA scores were consistent with individuals with Alzheimer's disease. However, there was a wide range of MoCA scores (0-29) demonstrating a large variation in cognitive impairments in the participants. This also indicates that future fitness related interventions should be easily accessible to people of multiple cognitive abilities.

Gait speeds, TUG times, 30-second Sit to Stand Repetitions, and Grip Strength scores all show participants have decreased functional capacity and an increased risk for falls when compared to their age matched peers without dementia. Based on this knowledge participants would likely benefit from a targeted, evidence based exercise program of sufficient intensity and progression to improve strength, balance and functional capacity. A simple strengthening program of large anti-gravity muscle groups is likely to have the greatest chance for benefit and could be administered safely in the Goodwill Easter Seals Adult day center environment.

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