

DEMENTIA AND FALLS

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Dementia is a term for a range of progressive neurological conditions where there is impairment of one or more higher cognitive functions (executive function, learning and memory, language, complex attention, perceptual-motor and social cognition) that cannot be better explained by another medical condition [1]. Dementia encompasses Alzheimer's disease, vascular dementia, dementia with Lewy bodies, LATE (Limbic-predominant age-associated TDP-43 encephalopathy), frontotemporal dementia and mixed pathology. In 2022, over 400,000 Australians were estimated to be living with dementia and the financial burden of dementia was estimated at \$9.8 billion [2]. Although there is some evidence that the incidence of dementia is decreasing, dementia remains a growing public health issue as a result of population ageing [3, 4]. The number of Australians living with dementia is expected to reach 850,000 by 2058 [2] while the financial burden of dementia is predicted to rise to \$24.1 billion in 2056 [5].

Risk factors known to increase falls in people living with dementia

People living with dementia have an increased risk of falls and fall at twice the rate when compared to people without dementia [6]. The risk of multiple falls [7], injurious falls, and poor outcomes following a fall are also increased in people with dementia, compared to those without dementia [8]. While dementia-specific factors such as impulsivity and neuropsychiatric symptoms increase the risk of falls [9], many risk factors for falls in people with dementia are similar to those in the general population.

Balance and Walking

Poor balance is predictive of falls in older people with and without dementia [10]. Balance and walking are complex functions and require coordinated involvement of sensory, motor and the central nervous

system, including vision, proprioception, muscular and cognitive functions [11]. Functionally, older people living with dementia have poorer static and dynamic balance than people without dementia [12], in addition to slower walking speed [13, 14], shorter step length [13, 14], greater walking variability [13, 14] and poorer upper and lower limb coordination [15]. Older people living with dementia also walk slower when performing a secondary task [12, 16] and with more walking variability [14] than people without dementia. Commonly, when undertaking everyday tasks there is a cognitive (e.g. talking, carrying an item, navigating environmental hazards) and motor (e.g. walking) load which we describe as dual tasking. People living with dementia have reduced cognitive reserve which can impact their ability to successfully dual task. Cognitive processes and motor control share common brain networks and these networks can become overloaded when performing cognitive and motor tasks concurrently [17]. These factors have been associated with a higher rate of falls in people with dementia [10] including a recent meta-analysis that found that fallers with cognitive impairment had poorer balance (static and dynamic), mobility (Timed-Up-and-Go Test) and walking speed than non-fallers with cognitive impairment [18]. Dual task walking measures have been shown to discriminate between fallers and non-fallers in people with dementia [15]. However, this discrimination was no better than single task walking in relation to falls.

Inactivity and functional Impairment

A sedentary lifestyle has been associated with executive dysfunction and physical decline and is an independent risk factor contributing to the development of dementia [19]. Inactivity and functional impairment have also been identified as risk factors for falls in older people with and without dementia [10].

Medication Use

Taking multiple medications increases the risk of falls in both healthy older people and older people living with dementia [10]. People with dementia are often prescribed centrally acting medications to manage dementia-related symptoms such as depression, anxiety, sleep disturbances and hallucinations. Medications such as antipsychotics, hypnotics, sedatives, antidepressants and opioids

all contribute to increased falls and fall-related injury in this population [20] due to their negative impact on cognition [21, 22] and arousal [21], with subsequent slowing of reaction time [21, 23] and impairment in balance [24] and functional performance [25].

Cognition

Poorer executive function, processing speed and visuospatial function are all associated with an increased risk of falling for people living with dementia [26]. Judgement error or the difference between perceived and observed physical ability has also been shown to be an independent risk factor for falls in older people with dementia but not cognitively healthy older people [26, 27]. Global cognitive function does not differentiate fallers from non-fallers in people with dementia [18].

Behavioural and psychological symptoms

Behavioural and psychological symptoms such as apathy, depression, anxiety, sleep disturbance, agitation, psychosis, hallucinations and wandering are common in people living with dementia [28]. Increased hyperactivity, restlessness, paranoia, hallucinations and impulsivity have been associated with an increased risk of falls in people living in residential aged care facilities with dementia [26]. For community-dwelling people with dementia, wandering behaviour has been associated with an increased risk of hip fracture [29].

Psychological distress – i.e. low mood, depression and anxiety - are known risk factors for falling in cognitively intact older people and people with dementia [10, 18]. The prevalence of depression and anxiety is higher in older people with dementia with 20-30% experiencing depression and an estimated 70% experiencing anxiety [30]. There is also evidence that anxiety and depression increase the risk of developing dementia [10].

Fall prevention interventions

Community settings

Exercise can improve physical and psychological risk factors for falls [31] and reduce falls by approximately 30% among older people living in the community [32, 33]. These findings are driven by

studies that include 50 hours or more of exercise and include a high dose balance training component [34]. The recent world guidelines for fall prevention strongly recommended that older people living with dementia should undertake an exercise program to prevent falls [33, 35]. While exercise has been shown to reduce the rate at which a person may fall, there is no evidence that exercise can reduce the number of people who fall [33].

One randomised controlled trial that successfully reduced falls in people with dementia living in the community was the FINALEX trial undertaken in Finland [36]. This trial consisted of 1 hour of supervised home or group exercise from a qualified physiotherapist twice a week for 12 months. Exercises included training muscle strength, balance, endurance, and executive function for people with mild to moderate dementia. A subgroup analyses found that for people with mild dementia, exercise was protective against functional deterioration with no significant effect on falls, while those with more advanced dementia had similar functional decline compared to the control group, but a significant reduction in falls [37]. A more recent large randomised controlled trial conducted in Australia (i-FOCIS) [38] examined a fall-prevention intervention of tailored home-based exercise and occupational therapy led home-hazard reduction. This 12-month intervention included 11 home visits combining physiotherapy and occupational therapy. This intervention did not reduce the rate of falls; however, it did reduce the proportion of people who experienced multiple falls, and the rate of falls in participants with better physical function at baseline.

Residential aged care facilities

Dementia is prevalent in residential aged care facilities with up to 70% of this population demonstrating some degree of cognitive impairment [26]. A Cochrane review by Cameron et al. (2018) [39] found conflicting evidence for the benefits of exercise, medication review and multifactorial interventions in reducing the risk of falling (proportion of people who fall). Furthermore, the effect of exercise and multifactorial interventions on the rate of falls in care facilities was found to be uncertain. This review showed that Vitamin D supplementation may reduce the rate of falls but there was no evidence that it reduced the risk of a person falling in a care facility [39, 40]. For residential aged care

facilities it is recommended that all residents should receive vitamin D supplementation due to the high proportion of residents having vitamin D deficiency [35, 41]. This can be achieved through a combination of a diet rich in calcium and protein and vitamin D supplementation [35].

Since the 2018 Cochrane review [39], an exercise intervention delivered within long-term aged care facilities found a significant fall prevention benefit in a subgroup analysis of people with dementia [42]. This 6-month progressive resistance and balance training program conducted twice weekly for 1-hour, followed by a maintenance program (two 30-min sessions/week of nonprogressive exercise for 6 months) significantly reduced the rate of falls, risk of falls, risk of multiple falls, and risk of injurious falls in individuals with dementia [42]. Exercise was prescribed by a physiotherapist, personalised for the individual and reviewed fortnightly.

Another trial of exercise in Sweden investigated the effects of a high-intensity functional exercise program on falls compared to a seated attention control activity conducted over 4 months. This intervention was led by physiotherapists and consisted of five 45-min sessions per fortnight. This trial found no reduction in falls at 6- or 12-months but did prevent moderate to severe fall-related injuries at 12-month follow-up [43]. These results suggest that, similar to community based programs where effectiveness requires at least 50 hours of exercise with a high dose balance training program [34], the program dose and length in care facilities may be important to demonstrate a significant and lasting effect on preventing falls.

A dietary intervention aimed at increasing calcium and protein intake in older adults living in residential care successfully reduced the risk of fractures and the risk of falls [44]. This intervention increased dairy food intake from an average 2.0 to 3.5 servings daily through the use of milk powder to fortify the dairy in foods served and by replacing less nutritious snack foods with dairy based alternatives over 2 years. This intervention was not specific to dementia, however in the subgroup where additional data was collected, over 50% of the participants had cognitive impairment.

The GtACH program was a training package aimed at staff working in care homes within the UK to reduce the rate of falls [45]. This program was co-designed by care home staff, clinicians, researchers and the public with the aim to support care home staff to identify fall risk factors and take action to reduce falls. This allowed for the included care homes and their staff to have a say in developing a program that suited their needs in order to bring about change. The program incorporated staff training through an in-person session conducted by the local NHS falls lead and the provision of educational material, a resource package (including fall incident forms, a medication and falls chart, information on where to seek expert advice or support and GtACH reminder posters to help with implementation) and the appointment of a falls champion identified by the facility to maintain the program. The intervention successfully reduced the rate of falls by around 40%. Again this intervention was not delivered specifically to people with dementia, however 67% of the participants had a diagnosis of dementia.

Hospital settings

It has been estimated that 25% of all hospital inpatients aged over 65 years have some degree of cognitive impairment [46]. The most recent Cochrane review, which was not specific to people with dementia, found multifactorial interventions were effective in preventing falls in subacute settings but not acute or mixed settings [39]. Evidence-based patient education and health professional education about fall prevention prevented falls in a recent systematic review [47]. However, again, this was not specific to cognitive impairment and relied on two study's findings (Hill et al. (2015) [48] and Haines et al. (2011) [49]). Hill et al. (2015) [48] found that fall rates were significantly reduced after a patient and staff education program. However, in a subgroup analysis of people with dementia, while the fall rates were reduced, this difference did not reach statistical significance. Another patient education program conducted by Haines et al. (2011) [49] found a significantly increased rate of injurious falls among participants with dementia, although they suggested this may be due to a greater willingness to report an injury due to a fall after receiving the education and an inability to adhere to safety recommendations.

Delirium is a reversible syndrome characterised by a sudden change in mental status, including attention and concentration, orientation, mood, perceptions, psychomotor activity, and the sleep–wake cycle that often fluctuates in severity during the day [26]. Individuals with dementia have a higher risk of developing delirium during a period of acute illness and hospitalisation. Interventions aimed at preventing falls in hospitals should address risk factors relating to cognition and delirium [50]. However, more research is required to assist in developing clear guidelines for fall prevention for people with dementia in hospitals.

Conclusion

Falls are common in people living with dementia. Physical and cognitive impairments, as well as psychological and behavioural symptoms, contribute to the increased risk of falls in people with dementia. In a community setting there is evidence that exercise can reduce falls in older people with dementia by approximately 30%. In residential care settings, the evidence for exercise has been variable, although a recent Australian trial of exercise shows falls can be prevented in residential care. Although not specific to people with dementia some studies have had a significant proportion of their population living with dementia. These studies suggest that vitamin D supplementation may lower the rate of falls, particularly in individuals who are vitamin D deficient, a diet that is high in calcium and risk assessment with specific action items together with staff education and resources may also reduce falls in this population. More research in hospitals aimed at reducing falls in people with dementia is needed.

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