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Vision and falls: A multidisciplinary review of the contributions of visual impairment to falls among older adults

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ABSTRACT

Falls are a leading cause of mortality among older adults worldwide. With the increasing aging population, falls are rapidly becoming a public health concern. Numerous internal and external factors have been associated with an older adult's increased risk of falling. Most notably visual impairments are gaining recognition for their critical role in fall events, particularly related to trips, slips and falls due to environmental hazards. This review presents the issue of vision and falls from a multidisciplinary health professional perspective. Discussions include the influence of visual impairment on mobility and activities of daily living, the effects of medications on vision, visual cognitive factors on falls risk and visual training interventions. Finally, implications for multidisciplinary health professional practice and suggestions for future research are offered.

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1. Introduction

1.1. Definition of a fall

A fall is an event where a person inadvertently comes to rest on the ground (floor) or other lower level [1]. Globally, adults over the age of 70 years are at higher risk for fall related mortality [1]. Visual impairment is an independent risk factor for falls among older adults, however; older adults typically underreport visual impairment and it is an underrepresented area of research. The aim of this review is to present the issues surrounding vision and falls in older adults through a multidisciplinary health professional lens, providing a comprehensive picture of the problem, and offering recommendations and thoughts for future research and evidence based practice.

1.2. Falls among older adults

Falls among non-institutionalized older adults are growing in epidemic proportions. Given the growth in the elderly population, this represents a major concern for health care providers and health care costs. According to recent census data, 13% of the U.S. population is 65 years of age or older and 1.9% is 85 or older [2]. The growth of older adults has increased at a greater rate (15.1%) than the general population and by 2030, the number of older adults (65 or older) will double to about 71 million [3]. This rapid growth of the elderly has far-reaching implications for public health, placing an unprecedented demand on health care delivery for age-related services.

The data on falls among older adults points to significant issues related to mortality and morbidity. Approximately 35–40% of non-institutionalized adults fall each year, increasing to 50% for those 75 or older [4–6]. Mortality rates for falls among older adults parallels this growth in fall rates. Research has shown that falls are the fifth leading cause of death among the elderly (55+) [5–7], the National Prevention Council (2011) reports that 45.3 deaths per 100,000 older adults are the result of a fall [6].

Falls also contribute to morbidity among the elderly [8]. Non-fatal falls accounts for 1.6 million emergency room visits and 388,200 hospitalizations each year [5,9]. Non-fatal falls have long-term impact on the physical, financial and emotional well-being of older adults accounting for incidence in fractures, internal organ injuries, joint dislocations and closed head injuries [10–13].

Research has identified two major categories of risk factors leading to falls: extrinsic/environmental factors and intrinsic factors

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[7,14–18]. Extrinsic risk factors are factors within the individual's environment. Some examples of extrinsic and environmental risk factors include, use of assistive devices and walking aids, poor flooring, inadequate lighting, area rugs, absence of handrails, and broken or uneven sidewalks and stairs. Intrinsic risks factors relate to characteristics within the individual. Examples of intrinsic risk factors include type and number of medications taken, muscle weakness, age, disease, prior falls history and the number of total risk factors. Another intrinsic risk factor that is gaining increased attention is the area of visual impairment.

Of the risk factors that contribute to increased fall risk, vision is one of the most underestimated contributors, despite the implication of vision in a majority of fall events. Visual impairment reduces a person's ability to detect hazards in the environment. As a predominant number of falls occur due to slips, trips [19,20] and/or interaction with an environmental hazard [21], vision boasts to be a leading issue when evaluating falls risk. In addition, the inclusion of vision in guidelines for fall prevention is limited. Most recommendations for visual health include regular eye evaluations and up to date corrective lenses [22,23], but these do not fully address the complexity of vision and its role in falls. Given the potential importance of vision in events leading to a fall, there is a need for greater awareness of the impact of visual deficits on falls risk.

2. Vision and falls

Vision loss in older adults is the third most common chronic condition next to arthritis and heart disease [24]. Impaired vision has been identified as an independent risk for falls associated with decreased postural stability, the occurrence of two or more falls, and fractures during fall events [25–28]. Vision is essential to a person's ability to plan and coordinate movement in response to environmental hazards as well as assist with balance [29]. Although, visual impairment is a common problem in older adults, it is often an underreported problem [30]. The most prevalent age-related causes of visual impairment include presbyopia, cataracts, glaucoma, and macular degeneration [24,31]. These conditions are described as follows:

- Presbyopia: a problem of seeing objects at close range or small print leads to a need to wear bifocal corrective lenses, a unique problem of aging. Older adults who are required to wear multifocal glasses are twice as likely to fall as older adults who do not wear multifocal glasses [20]. Wearing multifocal glasses increases the risk of falls due to impaired depth perception and edge-contrast sensitivity, which presents a problem when negotiating stairs and settings outside of the home. As such, bifocal lenses may increase risk for injurious outdoor falls in older adults because of greater propensity of tripping and approximation of unexpected objects or barriers [32].
- Cataracts: a cloudiness of the crystalline lens, most commonly occurs as part of the aging process and is one of the significant causes for vision loss with over 50% of older adults 80 years old and older. It is the leading cause of blindness in middle and low-income world countries (WHO [33]).
- Glaucoma: a group of conditions that can potentially damage the optic nerve and lead to blindness. It causes loss of peripheral vision creating a greater risk for falls as visual fields are limited and perception affected. Older age is a major risk factor and approximately 2% of the population is affected [34]. Open-angle glaucoma, the most common type of glaucoma, is estimated to double (reaching nearly 3.6 million people) in 2020 due to the aging population. Older adults with glaucoma have reduced postural instability thus contributing to fall risk [35].
- Age-related macular degeneration: caused by deterioration of the retina. It is the major cause of severe vision loss in older adults, its prevalence due to the aging population with future effect becoming nearly double its current rate. This condition affects central vision causing blurry vision or white spots, distortion of straight lines, and interferes with color perception [36]. The visual impairment is an intrinsic risk factor for falls and injuries, presents an unsafe condition, and creates a potential limitation in activities of daily living.

Some of the conditions listed above may be preventable through early detection; however less than 50% of individuals who are eligible for eye exams access these services [37]. By bypassing these preventive services, persons increase their risk of visual impairments. Aside from the risk of falls, visual impairment and blindness can shortern life expectancy, reduce quality of life through limitation in performance of activities of daily living (Table 1), and is rated among the top ten most common causes for disability in the United States [24].

2.1. Effect of visual impairments on function, quality of life, and psychosocial impact

As vision becomes impaired, older adults experience greater problems with mobility. West et al. found that for every line lost of visual acuity, the odds for limitations to mobility increased 10%, while every 10% change in visual field equaled a 20% increase in the chance for mobility limitations [38].

Reduced mobility affects an older adult's ability to perform Independent Activities of Daily Living (I-ADLs [39]). Disability in one or more I-ADLs occurs in 18% of older adults with minor visual impairment (beginning of glaucoma or ocular hypertensives with normal visual acutity and visual fields). This increases to 25% of older adults diagnosed with moderate visual impairment (glaucoma with visual field deficits and reduction in sensitivity in both eyes), and 43% of older adults diagnosed with advanced macular degeneration (visual acuity loss in both eyes). The top three activities reported to be the most difficult to perform are heavy housework (18.9%), traveling beyond walking distance (14.7%), and grocery shopping (13.6%). Individuals with glaucoma and advanced macular degeneration also report difficulty with preparing meals, managing finances, using the phone, and taking their medications [39]. Reduced ability in these I-ADLs represents significant impact to an older adult's independence and well-being.

Visual deficits also have a significant impact on psychosocial health in older adults. Fear of falling (FOF) is reported more frequently in older individuals with visual acuity impairments than those without [40]. Even after making adjustments for decreased visual acuity, any form of visual deficit produces a greater FOF. Fear of falling limits an older adult's ability to ambulate, impairing ADL function, and leads to difficulty leaving the home and limited participation in physical activities [40]. Therefore, visual impairments have a multifaceted impact on mobility of older adults, not only impeding I-ADLs directly but by also impeding I-ADLs indirectly through significant psychosocial impact. Finally, the types of medications subjects take in unison can affect vision and as a result fall risk.

2.2. Pharmacological considerations for vision and falls

Medication use is a factor associated with falls in older adults [41–43]. Polypharmacy, particularly the use of four or more medications, increases the risk of falling [41]. Additionally, the use of certain classes of medications, including sedatives, hypnotics, anti-psychotics, anti-depressants, and anti-arrhythmics have demonstrated an increased association with falls [43,44]. Although the use of medications may predispose older adults to

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