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Falls in the Elderly: Determinants, Consequences and Prevention Approaches

Paulina Halik

Hospital The Monument of the Baptism of Poland, Gniezno, Poland

https://orcid.org/0009-0008-8660-3481

E-mail: paulinahalik@gmail.com

Justyna Jusiak

Hospital The Monument of the Baptism of Poland, Gniezno, Poland

https://orcid.org/0009-0006-6992-9303

E-mail: justynajusiak98@gmail.com

Lidia Wydeheft

Faculty of Health Sciences, Department and Clinic of Geriatrics, Collegium Medicum Nicolaus Copernicus University, 85-067, Poland

https://orcid.org/0000-0003-0408-9623

E-mail: lidia.wydeheft@gmail.com

Paulina Malon

Faculty of Health Sciences, Department and Clinic of Geriatrics, Collegium Medicum Nicolaus Copernicus University, 85-067, Poland

https://orcid.org/0009-0008-9311-001X

E-mail: malonpaulina@gmail.com

Jakub Lewiński
Faculty of Health Sciences, Department and Clinic of Geriatrics, Collegium Medicum Nicolaus Copernicus University, 85-067, Poland
https://orcid.org/0009-0001-9470-6033,
E-mail: jakublewinski1506@gmail.com

Kornelia Kędziora-Kornatowska
Faculty of Health Sciences, Department and Clinic of Geriatrics, Collegium Medicum Nicolaus Copernicus University, 85-067
https://orcid.org/0000-0003-4777-5252
e-mail: kornelia.kornatowska@cm.umk.pl

Abstract

Introduction:
Falls among older adults constitute a major global public health problem and are a leading cause of injury, disability, loss of independence, and mortality in individuals aged 65 years and older. Due to population aging, the incidence and burden of falls are expected to increase further. Falls result from a complex interaction of intrinsic age-related changes and extrinsic environmental factors, making them a key geriatric syndrome requiring comprehensive management.

Aim:
The aim of this review was to summarize current evidence on the epidemiology, determinants, consequences, and effective prevention strategies for falls in the elderly population.

Materials and Methods:
A narrative review of the literature was conducted using PubMed, Scopus, and Web of Science databases. Peer-reviewed articles, meta-analyses, and clinical guidelines published between 2018 and 2025 were included. The review focused on adults aged ≥65 years and synthesized findings narratively across epidemiology, intrinsic and extrinsic risk factors, consequences of falls, and preventive interventions.

Results:
Approximately one-third of community-dwelling adults aged ≥65 experience at least one fall annually, with substantially higher rates among those aged ≥80 and residents of long-term care

facilities. Key risk factors include advanced age, prior falls, gait and balance disorders, muscle weakness, frailty, multimorbidity, polypharmacy, visual impairment, cognitive decline, and environmental hazards. Falls frequently result in fractures, head injuries, functional decline, psychological consequences such as fear of falling, and increased healthcare utilization. Exercise-based interventions targeting balance and strength are the most effective single preventive strategy, while multifactorial interventions provide additional benefit in high-risk individuals.

Discussion:

The findings confirm the multifactorial nature of falls and highlight the cumulative effect of modifiable and non-modifiable risk factors. Psychological sequelae, particularly fear of falling, play a crucial role in perpetuating recurrent falls and functional decline. Considerable heterogeneity in intervention outcomes suggests that prevention strategies must be individualized and context-specific.

Conclusions:

Falls in older adults represent a complex geriatric syndrome with significant clinical and socioeconomic consequences. Integrated, multifactorial prevention programs based on comprehensive geriatric assessment are essential to reduce fall risk, preserve independence, and limit the growing burden on healthcare systems.

Keywords: Falls; Older adults; Fall-related injuries; Risk factors; Fall prevention; Physical function; Activities of daily living

Materials and methods

The present narrative review was conducted through a comprehensive search of the PubMed, Scopus, and Web of Science databases, covering literature published between 2018 and 2025. The search strategy employed keywords such as "accidental falls," "geriatric population," "risk factors," and "prevention strategies" to identify relevant peer-reviewed articles, meta-analyses, and clinical guidelines. Inclusion was restricted to studies focusing on adults aged 65 and older, while research involving pediatric populations or non-peer-reviewed reports was excluded. The

collected data were synthesized narratively and categorized into thematic domains, including epidemiological trends, intrinsic and extrinsic determinants, and the clinical efficacy of multifactorial intervention programs. This approach allowed for a rigorous integration of current evidence to evaluate the medical and socioeconomic impact of falls in the elderly.

Introduction

Falls among the elderly represent a significant global public health challenge, acting as a leading cause of injury, hospitalization, and loss of independence in adults aged 65 and older [1,2,3]. According to the Global Burden of Disease Study (2021), approximately 45.6 million new falls occurred globally among individuals over 65 years of age in 2021, representing a 182% increase since 1990. These falls contribute substantially to mortality and disability, accounting for nearly 555,000 deaths and 17 million disability-adjusted life years (DALYs) worldwide in 2021 [1].

Falls in older adults arise from a multifactorial etiology involving the interaction of intrinsic and extrinsic determinants. Intrinsic determinants include age-related physiological changes such as impaired balance and gait, reduced muscle strength, chronic medical conditions, sensory impairments, cognitive decline, and polypharmacy. Extrinsic factors consist of environmental hazards within the home and community, including poor lighting, uneven surfaces, inappropriate footwear, and home obstacles [4].

The consequences of falls are severe, ranging from fractures and traumatic brain injuries to psychological effects such as fear of falling, reduced mobility, loss of independence and elevated mortality risk in older adults [5,6]. Moreover psychological concerns about falling are associated with a higher likelihood of subsequent falls, as fear-related activity restriction leads to reduced physical activity, progressive muscle weakness, and impaired physical function that increase susceptibility to future falls [5].

Beyond clinical outcomes, falls in older adults impose substantial economic and healthcare burdens. In the United States, falls result in over 2.3 million emergency department visits and 922,428 hospitalizations annually, generating approximately $19.8 billion in direct medical costs [3]. Similar trends have been observed in Europe. In the Netherlands, direct medical costs of falls among older adults were estimated at €1.5 billion in 2021 and are projected to increase to €2.7 billion by 2040 as the population ages [7]. Overall, fall-related expenditures in high-income countries account for a substantial proportion of healthcare spending, estimated at

0.85%–1.5% of total healthcare costs [8]. Moreover, falls are associated with a 42% increased risk of impairment in activities of daily living - including mobility within the home, eating, dressing, and bathing - with these functional limitations often persisting for prolonged periods among older adults [2].

Future projections suggest that the incidence and absolute burden of falls among older adults will continue to increase in the coming decades as a result of ongoing population aging. This trajectory is likely to place an escalating strain on healthcare systems and long-term care facilities thereby intensifying the urgency of developing effective fall prevention and management strategies worldwide [1].

Considering the complex multifactorial nature of falls among older adults, tailored multifactorial and multicomponent interventions are essential for effective prevention. Evidence from systematic reviews and meta-analyses demonstrates that interventions incorporating exercise, environmental modification, reduction of polypharmacy and individualized risk assessment can significantly reduce both the incidence of falls and recurrent falls among elderly [4, 9, 10]. However, considerable heterogeneity in intervention effects across trials suggests that the effectiveness of multifactorial approaches may be context-dependent and highlights the need for further research to clarify how best to tailor and implement these strategies in diverse care settings [11].

This review aims to examine the determinants, consequences, and effective intervention strategies for falls in older adults, with a focus on geriatric considerations, such as functional decline, multimorbidity and polypharmacy.

Results

Prevalence and Epidemiology of Falls in the Elderly

The World Health Organization defines a fall as an unintended event resulting in a person coming to rest on the ground, floor, or another lower level [12]. Falls represent a significant public health concern in the geriatric population because of their high incidence and substantial effects on mortality, disability, and healthcare burden.

Available epidemiological data indicate that falls are common among older people worldwide. In a meta-analysis of 104 studies involving 1,741,613 older individuals, the incidence of falls was 26.5%, with significant variation across continents. The highest incidence was reported in Oceania (34.4%), while the lowest was in Europe (23.4%) [13].

The likelihood of falling increases with age. It is estimated that in the population aged over 65, at least one fall per year occurs in about one-third of people, in the age group over 70, in 32-42% of the population, while among people aged 80 and older, almost half of the studied population experiences falls [6, 14, 15,]. Importantly, recurrent falls (occurring at least twice per year or over a longer observation period) are common in this population and are associated with an increased risk of hospitalization. In prospective studies, 11.9-14.9% of people aged 70 years experienced 2 or more falls per year, and 33.9% have recurrent falls over a 3-year observation period [16].

European research confirms the high prevalence of falls among older adults living at home. A multicenter study from 17 European countries and Israel using data from the Survey of Health, Ageing, and Retirement in Europe (SHARE, wave 6, 2015), found that 8.2% of individuals aged 55 years or older experienced a fall. This rate was lowest in Greece (3.4%) and highest in Portugal (16.3%), showing significant variation within Europe [17].

A particularly high incidence of falls is observed among older people living in care institutions. In a meta-analysis of 18 studies of older people living in nursing homes, the incidence of falls was estimated at 43%, with the authors noting a gradual decline in subsequent years [18].

A significant proportion of falls among older adults result in serious health consequences. Epidemiological data show that 10% of falls cause injuries necessitating medical intervention, including fractures, traumatic brain injuries, or subdural hematomas [6, 15].

Falls are a leading global cause of death. There are an estimated 684,000 deaths each year from falls, making them the second leading cause of death from unintentional injuries worldwide, after road accidents [19]. In some countries, such as the United States, falls are the most common cause of traumatic deaths in the elderly population [20].

Data on the Polish population indicate a comparable scale of the problem. It is estimated that almost one in four people aged ≥65 in Poland experiences at least one fall, and 3.8% of these events lead to hospitalization [21]. In 2010, the number of hospitalizations due to falls among the population aged ≥65 was 45,762, corresponding to a rate of 883 per 100,000 people. The most common causes of falls resulting in hospitalization were trips and slips (69.4%), followed by falls from stairs and steps (4.3%) and falls on ice and snow (3.6%) [21].

The most significant and frequently identified risk factors for falls in older adults include advanced age, previous falls, gait and balance disorders, muscle weakness, and neurological conditions such as Parkinson's disease and peripheral neuropathy. Modifiable factors, including polypharmacy, visual impairment, and fear of falling, also contribute substantially. These

findings underscore the multifactorial nature of falls and the necessity for comprehensive prevention strategies [6, 15, 20].

Determinants of Falls

Internal risk factors for falls in older adults

Risk factors for falls in older adults are multifactorial and include both internal (personal) and external (environmental) factors. Data from the literature indicate that the accumulation of multiple risk factors is more common among people with multimorbidity and frailty syndrome and is associated with an increased risk of falls compared to the presence of a single factor [21,20,22].

Age and history of falls

Age is one of the strongest predictors of falls. Meta-analyses and population studies show that the incidence of falls increases with age, with people aged 80–85 years particularly vulnerable [21,5,7]. A cross-sectional study conducted by Almada et al. based on data from the Survey of Health, Ageing, and Retirement in Europe (SHARE, wave 6, 2015) showed that people aged 65–74 were 1.2 times more likely to fall, people aged 75–84 were more than 1.7 times more likely, and those over 85 were more than twice as likely to fall compared to those aged 55–64 [5]. In a meta-analysis of 70,868 seniors, prior falls increased the likelihood of another fall by a factor of 3.22 [7].

Demographic and social factors

Demographic and social factors such as gender, living alone, living in a rural environment, and level of education are also risk factors [21,5,22]. Women are more than twice as likely to fall as men [23]. Living alone increases the risk of falls by about 39%, living in a rural area by about 9%, and completing compulsory education reduces the risk by about 7% [21].

Motor function and frailty syndromes

Internal factors related to motor and physical function, such as gait and balance disorders, muscle weakness, and frailty syndromes, limit the ability to maintain a stable posture and respond to sudden environmental changes, increase the risk of falls [20,5,7]. Review studies have shown that frailty syndrome increases the risk of falls by about 2 times, gait disorders by more than 2 times, muscle weakness by 1.5 times, and balance disorders by up to 3 times [20].

Sensory and visual disorders

Peripheral neuropathy more than doubles the risk of falls. Impaired deep and vibratory sensation in the lower limbs is linked to poorer posture control and a higher risk of multiple falls.

Vision disorders increase the risk of falls: visual impairment is associated with a 1.5-fold increase in fall frequency [7], while significant deterioration in visual function can increase the risk by almost 4-fold [24]. Eye diseases such as glaucoma, cataracts, and macular degeneration also increase the risk: glaucoma by 1.38 times, cataracts by 1.25 times, and macular degeneration by 1.36 times [24].

Polypharmacy and pharmacotherapy

Polypharmacy, defined by the WHO as the use of ≥5 drugs simultaneously, is one of the potentially modifiable risk factors for falls [25]. The highest risk of falls is observed in patients using hypnotics and sedatives, antidepressants, antipsychotics, and antiepileptics [20-22,26,27]. Antidepressants increase the risk of multiple falls by 1.5–3 times, sedatives and hypnotics by 1.8–4.5 times, and antiepileptic drugs by 1.22–4.7 times [27]. Among other medications, diuretics (1.8 times) and laxatives (2.1 times) [27].

Findings from the English Longitudinal Study of Ageing reveal that fall-related hospitalizations escalate with medication count: 1.5% in those taking none, 4.7% with 1–4 drugs, 7.9% with 5–9 drugs, and 14.8% with 10 or more; fall risk was increased in every medicated group versus those not on medication [28].

Comorbidities and clinical factors

Comorbidities that increase the risk of falls include hypertension, Parkinson's disease (approximately 3.8 times higher chance of falling), stroke (approximately 2.9 times higher), diabetes (approximately 1–1.5 times higher), osteoporosis (approximately 1.7 times), arthritis (approximately 1.5–2 times), and chronic respiratory diseases [29,20, 7]. Cognitive impairment and dementia increase the risk by approximately 2 times, and depression by 1.1–1.2 times [20,5,7].

Additional factors include excessively high or low BMI, orthostatic hypotension, urinary incontinence, and chronic pain (1.5–2 times) [20]. Functional limitations, such as low physical activity and impaired performance of daily activities, also increase the risk of falls [20,5].

Extrinsic (environmental) factors

Extrinsic factors include elements of the physical environment and the conditions in which an older person functions, and are often the direct trigger for a fall. The most commonly reported factors include uneven, slippery, or unstable surfaces; loose carpets; wet floors; uneven sidewalks; steps; or the presence of pets [20,44,45]. Insufficient lighting, especially at night, and situations where light switches are located far from doors or out of reach of older people are also environmental determinants [20, 30-32].

The presence of obstacles in the immediate environment, such as cables, low-set furniture, or objects left in passageways, as well as the lack of non-slip mats in rooms with an increased risk of slipping, can lead to falls [20,30,31].

The risk of falls is also increased by inappropriate footwear, improperly selected or absent assistive devices, including canes and walkers [20, 3,30,33].

The importance of environmental risk factors is confirmed by Lee et al. [6], among other studies. It has been shown that wet conditions in the bathroom increase the chance of a fall by about 3.7 times, while performing hygiene activities, including bathing, is associated with an even greater risk, increasing the risk of a fall by about 5.7 times [32]. Infrastructure elements beyond an elderly person's reach, such as light switches or alarm bells, increase the likelihood of a fall by a factor of 2 [32].

In the home environment, the lack of appropriate elements that support stability and safety, such as handrails in showers and toilets, increases the risk of slips and falls [20,30,31].

Factors in the outdoor environment increase the risk of falls among older people. These include uneven surfaces, changes in ground level, such as curbs or steps, and the specific characteristics of the surface material — in particular, paving stones, which are uneven and prone to slipping. Environmental factors also include obstacles in public spaces, such as trash cans or billboards, as well as weather conditions, such as wet, icy surfaces or strong winds, especially for people with balance disorders. Inadequate street lighting is also significant, as it limits the perception of obstacles and differences in ground level, thereby increasing the risk of tripping or slipping [34].

In hospital settings, the most commonly reported external factors contributing to falls include dangerous spatial arrangements, lack of individual patient safety measures, wet floors, tripping

and slipping, inappropriate footwear, improperly selected assistive devices (e.g., walkers), and improper placement of wires, drains, and other medical equipment [33]. In addition, in the long-term care environment, inadequate or missing infrastructure, such as handrails and wall handles in passageways, is a significant risk factor for falls, which, in studies of the care facility environment, were among the most common elements of fall risk [35].

Situational factors that can increase the risk of falls are also important, including rushing, multitasking, walking while talking, or getting up at night to use the toilet [30].

Consequences of Falls in the Elderly

Falls in older adults can cause serious physical and psychological problems that affect health, daily functioning, and quality of life. Common physical consequences include bone fractures (especially hip, arms, and spine) and soft tissue injuries like bruises, sprains, and cuts [36]. Falls can also cause head injuries, such as concussions or hematomas, increasing the risk of neurological complications. Severe injuries often reduce mobility, independence in daily activities, and may require hospitalization, long rehabilitation, or even lead to death [2,5].

The *SCOPE Study* showed that most falls happen at home during daily activities, usually due to tripping or loss of balance. The most common results were bruises, cuts, soft tissue injuries, and fractures, including hip and limb fractures. Some falls caused head injuries [37].

Older adults with cognitive impairments experience even more serious consequences. Falls in this group often lead to soft tissue injuries, fractures, head injuries, worse functional ability, higher dependence on caregivers, more hospitalizations, and overall health decline [38].

Falls also have strong psychological effects. Fear of falling (FOF) can limit activity, increase social isolation, and reduce quality of life [29]. People who fall are more likely to develop depression and anxiety, especially if falls are repeated. Recurrent fallers have almost 50% higher risk of depression, and existing anxiety further increases this risk [39,29]. In people with chronic diseases, falls can lower confidence and self-efficacy, further reducing activity and life quality [40,41].

Economically, falls are a major burden. They are a leading cause of hospitalization and long-term care, causing high costs for healthcare systems and families [8,30]. In high-income countries, fall-related costs can reach 0.85–1.5% of annual healthcare spending. Average cost

per fall is around USD 15,212, rising to USD 34,565 for hospital-treated falls. Studies in Europe report similar high costs, confirming the clinical and economic impact of falls [42,43].

Overall, falls in older adults have multidimensional consequences: physical, psychological, and economic, highlighting the need for prevention, comprehensive care, and support.

Prevention of Falls in the Elderly

Scientific evidence shows that preventing falls in older adults living in the community should use a comprehensive approach. This approach combines exercise programs, home modifications, and individual risk assessment. The US Preventive Services Task Force (USPSTF) reported that exercise programs, especially those that improve balance, muscle strength, and motor skills, can significantly reduce falls. Multifactorial interventions, which combine exercise with risk assessment, home adjustments, and medication review, have moderate effectiveness, especially for people at high risk. However, physical activity is the most effective strategy and is recommended in clinical guidelines [44].

A review focused on fall risk mechanisms shows that exercises work because they improve important physical functions. Exercise improves balance, leg strength, coordination, and walking quality, which helps reduce the risk of falling. Balance exercises, functional exercises, and strength training are the most effective, especially when adapted to the person's specific problems and risk factors. Using a mechanism-based approach helps make the interventions more precise and effective [45].

Environmental interventions are also important. They focus on making the home safer by removing loose rugs, improving lighting, installing handrails, and adjusting the bathroom. Research shows that these interventions work best for people at high risk, especially those who have fallen before or have functional limitations. The best results come when changes are tailored individually and done by trained professionals, like occupational therapists. Alone, environmental interventions are moderately effective, but together with exercise, they form an important part of fall prevention strategies [46-49]

Discussion

The present review confirms that falls among older adults constitute a major clinical and public health concern, representing one of the most prevalent causes of injury, functional decline, and mortality in the geriatric population. The available epidemiological evidence demonstrates a

high and age-dependent incidence of falls, with a marked increase among individuals aged ≥80 years and those residing in long-term care facilities. These findings are consistent with global reports and underscore the cumulative effect of age-related physiological changes, multimorbidity, and environmental exposure on fall risk.

Substantial geographic variability in fall prevalence observed across regions and countries suggests that, beyond individual biological factors, healthcare system characteristics, socioeconomic conditions, and environmental safety standards may significantly influence fall incidence. Differences in housing conditions, access to preventive services, and implementation of fall prevention programs likely contribute to this heterogeneity. The epidemiological data from Poland align with broader European trends, confirming that falls represent a significant cause of hospitalization and healthcare utilization among older adults.

The determinants of falls identified in this review highlight their multifactorial pathophysiology. Impairments in balance and gait, reduced muscle strength, neurological disorders, and a history of previous falls remain the most robust predictors of future fall events. Importantly, several modifiable risk factors particularly polypharmacy, visual impairment, and fear of falling play a critical role in fall susceptibility. Polypharmacy, especially the use of psychotropic medications, antihypertensives, and sedatives, has been consistently associated with postural instability and orthostatic hypotension, reinforcing the importance of regular medication review as a core component of geriatric care.

The clinical consequences of falls extend beyond acute injuries and include long-term functional deterioration, increased dependency, and institutionalization. Fractures, most notably hip fractures are associated with substantial morbidity, prolonged rehabilitation, and excess mortality. Head injuries following falls further exacerbate the risk of cognitive decline and neurological complications. Additionally, older adults with pre-existing cognitive impairment experience disproportionately severe outcomes, including accelerated functional decline and increased caregiver burden.

Psychological sequelae, particularly fear of falling (FOF), represent a clinically significant but often underrecognized consequence of falls. FOF contributes to activity restriction, social withdrawal, and progressive deconditioning, thereby perpetuating a vicious cycle that increases the risk of recurrent falls. The association between recurrent falls, depression, and anxiety highlights the necessity of incorporating mental health assessment and interventions into fall prevention strategies, particularly in individuals with chronic disease or prior fall history.

From a health economics perspective, falls impose a substantial burden on healthcare systems, driven by emergency department visits, hospital admissions, surgical interventions, and long-

term care needs. The proportion of healthcare expenditures attributable to fall-related injuries is considerable in high-income countries and is expected to rise further in parallel with demographic aging. These findings emphasize the cost-effectiveness potential of preventive interventions and support prioritizing fall prevention within public health and healthcare policy frameworks.

The evidence reviewed indicates that multifactorial fall prevention interventions are superior to single-component strategies, particularly in high-risk populations. Exercise-based interventions, especially those targeting balance, lower-limb strength, and functional mobility, demonstrate the strongest and most consistent effectiveness in reducing fall incidence. Environmental modifications and medication optimization enhance intervention efficacy when tailored to individual risk profiles and implemented within an interdisciplinary care model. Nonetheless, heterogeneity in study designs, intervention components, and outcome measures limits direct comparability across trials and complicates the translation of evidence into standardized clinical practice.

Conclusion

The findings of this review demonstrate that falls in the elderly are not isolated incidents but a complex geriatric syndrome resulting from the synergistic interaction of intrinsic physiological decline and extrinsic environmental hazards. The most critical determinant of future falls is the accumulation of multiple risk factors, particularly in patients with frailty and multimorbidity, which necessitates a shift from managing individual symptoms to a comprehensive geriatric assessment.

A key psychological conclusion is the identification of the "fear of falling" cycle, where psychological anxiety leads to activity restriction, subsequent physical deconditioning, and an increased objective risk of injury. This highlights the necessity of incorporating mental health support and self-efficacy training into standard prevention protocols.

Furthermore, while exercise-based interventions targeting balance and strength remain the most effective single strategy, their success depends on individualized tailoring to the patient’s specific functional status and environmental context. To address the escalating healthcare burden, public health policies must prioritize integrated, multifactorial programs that combine medication optimization, home safety modifications, and long-term physical activity to preserve independence and reduce mortality in the aging population.

Author's contribution

Conceptualization: **Lidia Wydeheft**
Methodology: Justyna Jusiak, Jakub Lewiński
Software: not applicable;
Verification: Paulina Halik
Formal analysis: Paulina Malon
Research:Paulina Malon, Jakub Lewiński
Resources: Lidia Wydeheft
Writing- rough preparation: Justyna Jusiak
Writing- review and editing: Kornelia Kędziora-Kornatowska
Visualization: Paulina Halik
Project administration:Kornelia Kędziora-Kornatowska
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