



Diminishing returns of fall reduction for hip fracture prevention in older age

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Abstract

Summary Using data from a meta-analysis including 606,715 women, we found that the predictive value of a fall the past year for future hip fractures in women significantly decreases with age, resulting in a diminishing population attributable risk with increasing age.

Purpose In a recent meta-analysis of 40 cohorts, we demonstrated that a fall history in the past year was associated with an increased risk of hip fracture. An interaction between fall history and age was observed in women, with lower hazard ratios (HR) for older women. This study aimed to determine the population-attributable risk (PAR) for hip fracture due to increased fall risk in women of different ages.

Methods Fall history associated attributable risk (AR, %) for hip fracture was calculated $[100 \cdot (1 - 1/\text{relative risk (HR)})]$ for women per age stratum, using previously calculated HRs. PAR (%) of hip fractures in the female population (≥ 50 years) that could be prevented if the fall history-mediated risk increase could be eliminated was calculated as $100 \cdot P_{\text{exp}} \cdot (\text{HR} - 1) / [1 + P_{\text{exp}} \cdot (\text{HR} - 1)]$ where P_{exp} was the exposed proportion of the population (i.e. the proportion with past falls).

Results A total of 606,715 women included from 40 cohorts, with fall risk documented in the past year (fall history yes/no or 2 or more falls) and prospective information about hip fracture and death, were analysed. The proportion of fallers increased progressively with age from 24.6% at age 50–54 years to 45.5% at age 90–94 years. In contrast, the AR due to falls decreased, from 54.8% at age 50–54 years to 8.3% at age 90–94 years, and the PAR diminished with age, from 23.9% in women 50–54 years old to 3.9% in women 90–94 years old.

Conclusions As falls become more common with age, their predictive value for future hip fractures in women significantly decreases. This suggests that the effectiveness of fall prevention strategies in reducing hip fractures is lower in older women, who are at higher risk for serious falls and hip fractures.

Keywords Falls · Hip fracture · Older age

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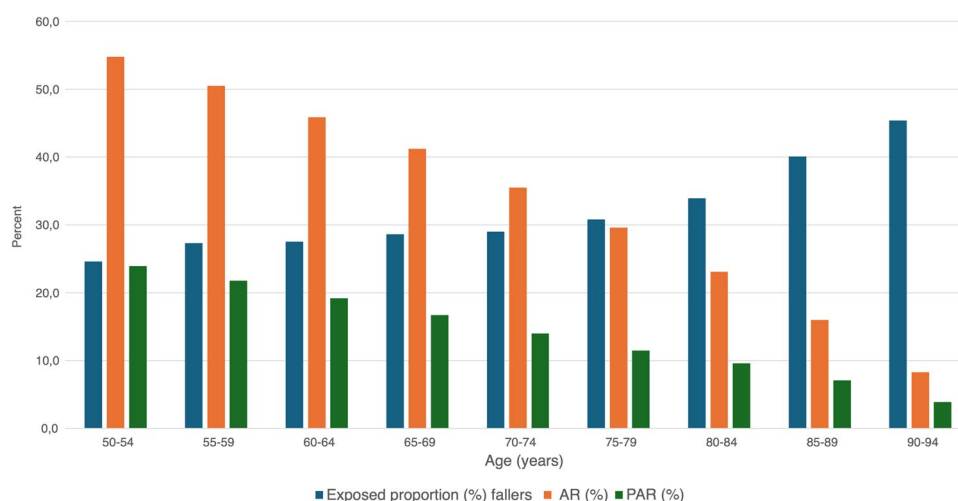
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Fig. 1 Hip fractures attributable to the risk of falls history according to age band



As reviewed recently in *JAMA*, falls are among the most significant and common causes of morbidity and mortality in older adults [1]. Each year, up to 27.5% of community-dwelling adults aged 65 years and older experience a fall [2]. However, only one in five falls results in injuries such as bone fractures or head trauma, with hip fractures—arguably the most severe type of fracture—occurring in less than 1% of falls [2]. Hip fractures account for a large proportion of the disability, medical costs, and mortality associated with falls [3]. Osteoporosis medications have demonstrated efficacy in reducing the risk of hip fracture and other fall-related fractures in postmenopausal women with osteoporosis, whilst no effect on injurious falls or fractures has been observed in well-powered randomized trials using falls prevention as the intervention [1, 4].

The incidence of injurious falls, including hip fractures, increases with age, and consequently the burden of injurious falls and hip fractures is the highest within the oldest population [2]. Most clinical guidelines recommend fall preventive measures in those with a fall history, typically limited to whether an individual has experienced a fall (yes/no) in the past 12 months [5].

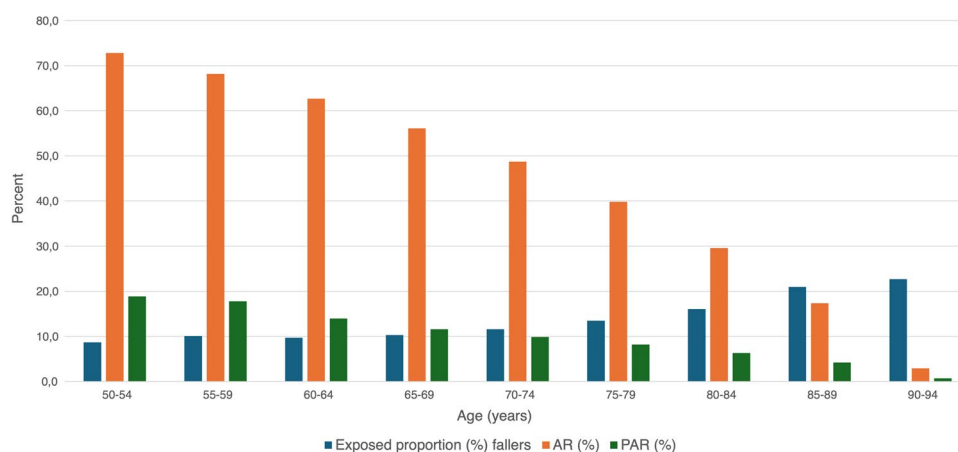
In a recent meta-analysis of 40 cohorts, we demonstrated that a fall history in the past year was associated with an increased risk of fracture (any, hip, osteoporotic, and major osteoporotic). Notably, an interaction between fall history and age was observed in women—but not in men—with more pronounced differences in hip fracture risk ratios between age groups. For instance, the hazard ratio (HR; 95% confidence interval) for hip fracture in an 80-year-old woman with a fall history was 1.30 (1.23–1.38), compared to 2.21 (1.68–2.90) in a 50-year-old woman [6]. Thus, fall history was of lesser importance for hip fracture risk in the population with the highest hip fracture incidence.

This study aimed to determine the population-attributable risk (PAR) for hip fracture due to increased fall risk in women of different ages.

Methods

A total of 606,715 women included from 40 cohorts, with fall risk documented in the past year (fall history yes/no or 2 or more falls) and prospective information about hip fracture

Fig. 2 Hip fractures attributable to the risk of history of multiple falls according to age band



and death, were analysed [6]. Fall history associated attributable risk (AR, %) for hip fracture was calculated [$100 \cdot (1 - 1/\text{relative risk (HR)})$] for women per age stratum, using previously calculated HRs [6]. PAR (%) of hip fractures in the female population (≥ 50 years) that could be prevented if the fall history-mediated risk increase could be eliminated was calculated as $100 \cdot P_{\text{exp}} \cdot (\text{HR} - 1) / [1 + P_{\text{exp}} \cdot (\text{HR} - 1)]$ where P_{exp} was the exposed proportion of the population (i.e. the proportion with past falls).

Results

The proportion of fallers increased progressively with age from 24.6% at age 50–54 years to 45.5% at age 90–94 years. In contrast, the AR due to falls decreased, from 54.8% at age 50–54 years to 8.3% at age 90–94 years, and the PAR diminished with age, from 23.9% in women 50–54 years old to 3.9% in women 90–94 years old (Fig. 1). The proportions with 2 or more falls the last year ranged from 8.7% at age 50–54 years to 22.7% at age 90–94 years. For multiple fallers, the AR ranged from 72.8% to 2.9% and PAR from 18.9% to 0.7% in these age groups (Fig. 2).

Discussion

As falls become more common with age, their predictive value for future hip fractures in women significantly decreases. It is important to acknowledge that recall bias presents a substantial limitation in retrospective assessments of falls, particularly among the oldest study participants [7]. Moreover, our study assessed PAR and AR of hip fracture based on falls risk as identified through fall recall, rather than through measures of physical function—which have been shown to have a stronger association with fracture risk than fall history [8]. Nevertheless, our recall-based data suggest that the effectiveness of fall prevention strategies in reducing hip fractures is lower in older women, who are at higher risk for hip fractures. In light of the well-established efficacy of osteoporosis medications and the limited impact of fall prevention interventions, our findings indicate that future clinical guidelines may benefit from prioritizing osteoporosis treatment over fall history to improve hip fracture prevention.

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Declarations

Conflict of interest M. Lorentzon has received lecture fees from Amgen, Astellas, Meda, Medison Pharma, Gedeon Richter, UCB Pharma, and consulting fees from Amgen, UCB Pharma, Gedeon Richter, Parexel International, Medac AB, and Pharmacosmos. J. A. Kanis is a director of Osteoporosis Research Ltd. N. Harvey has received consultancy, lecture fees, and honoraria from the Alliance for Better Bone Health, Amgen, MSD, Eli Lilly, Servier, Shire, UCB, Kyowa Kirin, Consilient Healthcare, Theramex, Radius Health, and Internis Pharma. E. McCloskey has received research funding, consultancy, lecture fees, and/or honoraria from Amgen, AstraZeneca, Consilient Healthcare, Fresenius Kabi, GSK, Hologic, Internis, Lilly, Merck, Novartis, Pfizer, Roche, Sanofi-Aventis, Servier, Synexus, UCB, Unilever, and Warner Chilcott. All other authors have no conflicts of interest.

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