Acta Scientific Orthopaedics (ISSN: 2581-8635)

Volume 7 Issue 1 January 2024

Review Article

Hip Fracture and Falls Etiological Observations and Control Implications 2023: What is Needed and Why

Ray Marks*

Department of Clinical Research and Education, Osteoarthritis Research Center, Canada

***Corresponding Author:** José Tomás Bravo, Department of Orthopedic Surgery, Hospital Juán Noé Crevani, Arica, Chile.

DOI: 10.31080/ASOR.2024.07.0884

Received: December 01, 2023

Published: December 14, 2023

Abstract

Background: Hip fracture injuries, surgery, preventive and rehabilitation efforts over the years have not yielded commensurate returns despite their laudable goals and great need.

Aim: This mini review aimed to examine 2023 data focusing on falls and recurrent falls as a possible and remediable key hip fracture determinant.

Methods: Available English language related papers published in 2023 and housed in key data bases were sought and examined for cohesive themes and their clinical implications.

Results: Although highly diverse, cumulative findings appear to support a need for more careful routine evaluation of falls risk factors among the elderly, plus efforts to reduce modifiable falls risks that induce hip fracture injuries. But what is distinctive or inseparable in this regard is hard to discern.

Conclusion: More carefully conceived preclinical as well as longitudinal studies of the possible mechanisms underpinning falls risk among larger more diverse samples of older adults of various ages plus commensurate societal investments in home and community based falls prevention efforts are strongly indicated.

Keywords: Aging; Falls; Falls Injuries; Hip Fractures; Prevention; Recurrent Falls

Introduction

Even though many years of research have been enacted in efforts to prevent or minimize hip bone fractures in the elderly, these injuries persist in producing immense levels of devastating disability among survivors no matter where they reside [1-4]. In particular, although Dong., *et al*. [3] report that falls are the strongest hip fracture predictor and can significantly influence post operative survival rates [5], efforts to avert falls in the older population remain suboptimal at best [5].

However, falls-induced injuries among older adults which can not only stem from aging associated bone mass and muscle mass declines, but from frailty as well as concurrent problems of diabetes and its correlates, among other conditions, may continue to prevail if timely well-chosen insightful preventive efforts are not forthcoming [5-10]. Moreover, if unaddressed early on, many older adults who sustain an injurious fall may fall multiple times especially if they are weak, depressed or anxious thus compounding the extent of any adverse fatal as well as non-fatal health outcome [11]

Moreover, based on what we do know, even though operative interventions used to treat falls associated hip fractures are reasonably successful, many hip fracture surgery survivors may continue to incur declines in functional ability, self-sufficiency and independence [12] plus high mortality rates [13,14], and a diminished life quality. A fair proportion of community dwelling adults who thus desire to live independently in the community rather than in an institutional setting, may yet need to be housed in nursing homes or in long term care facilities as a result.

Aims

This mini review strove to examine if there are any novel findings as of 2023 that can advance our understanding of how to prevent hip fracture injuries due to falls among older age adults living

in the community, a topic that has received less attention than that focused on bone and muscle health as well as nutrition, and where little objective progress has been made to date despite numerous public health efforts and others.

Rationale

Older adults who wish to reside in the community as well as those who desire a high life quality may be unexpectedly disabled by one or more falls incidents especially those that may induce a fracture of the hip bone. Yet, despite years of endeavor and efforts to reduce the chances of this prevalent cycle of negative events, there is no current universal antidote that has proven successful. By contrast, it is possible that more concerted and dedicated efforts to examine the nature of the most likely falls determinants and their preventive potential may have multiple applied and beneficial health ramifications and resource demands consequences.

Significance

In view of the severe individual and cumulative personal as well as economic consequences of falls in their own right, especially those that result in fostering hip fractures the ability to pinpoint remediable factors and mechanism underpinning falls may have considerable clinical as well as public health merit including potential reductions in a) Hospital costs and utilization; b) Physical costs; c) Psychological costs; d) Social isolation costs; e) Financial and liability costs; f) Hip fracture injuries.

Moreover, since the risk of falling increases incrementally with the number of prevailing risk factors, reducing one or more preventable falls-related correlates could yield proportionate reductions in fall frequency and injury risk [14].

Strategies to reduce potentially modifiable risk factors that appear to hold promise are screening for falls risk and thereafter efforts to improve strength, balance and movement coordination as indicated [14]. Others include the use of hip protectors, the use of specific shoe types, dietary amendments, and supplementation.

Methods

To examine current viewpoints and implications as related to the comprehension of the factors that appear to drive the persistently high falls and hip fracture rates prevailing and reported among most aging populations, most existing 2023 peer reviewed articles were scanned accordingly. For purposes of budgetary and social planning directives in the future, it was assumed that currently posted publications would point to those key issues that have emerged over time in this sphere as well as any relevant post-COVID-19 implications. To this end, data mapping the topical themes of interest and located in PUBMED, PubMed Central, Science Direct, and GOOGLE SCHOLAR repositories were scanned and examined using the key words, *falls, falls injuries, elderly. older adults, recurrent falls, etiology, and hip fractures*. With an obvious lack of any focused themes within this body of data, it appeared only a narrative descriptive review approach was possible, and thus strove to focus on what current authors have found recently and analysed and what they have concluded. Studies based on young adults or youths, those with distinctive health conditions, plus televised or virtual reality interventions, as well as those examining surgical procedures and various prevention approaches in nursing homes were omitted. As well, organizational, climatic and environmental factors underpinning falls and hip fractures were omitted. All forms of publication were deemed eligible if they were full reports written in English. Hip fractures, rather than other bone fractures were studied because they are the most common fracture injury in older populations and their key determinant is a falls injury rather than pathology.

Results

Among the current research findings on falls and hip fractures among older adults in the context of the community, data show that these two health challenges will likely continue to pose immense public health concerns and immense social costs. Indeed, as identified by a scan of the prevailing data bases and their many associated articles listed in 2023, falls-cited consistently as a major cause of bone fractures-including hip fractures, plus falls in their own right- consistently result in high degrees of disability, and oftentimes premature mortality among older adults [15,16]. In addition those hip fracture cases who have fallen previously and return to the community may suffer accelerated declines in cognitive and physical function, plus mortality [17].

Falls in their own right may also prove potentially costly because they may be indicators of future dementia problems [18] and excess mortality as well as hip fractures. Those older adults who use psychotropic medications regularly [19] may be especially vulnerable in this regard to multiple falls [20].

However, very few actual clinical studies focusing on this topic are currently posted to validate these findings.

Additionally, the varied types of falls examined, the varied study settings, non random samples, plus the use of instruments with unknown properties is problematic to aggregate and renders it challenging to separate out what is valid or not. Moreover, despite all postings having undergone peer review, when viewed as a whole, the highly diverse study designs and research questions posted in 2023 do not seem to permit any common general emergent trend [19] or consensus or common ground.

Nonetheless, in accord with persistently high rates of actual annual falls and predicted falls in the future, and almost no sound current framework that has a strong evidence base, almost all current authors advocate for more extensive well designed research in this regard. As outlined by Biswas., *et al*. [21] despite their careful meta analytic efforts the data they downloaded, reviewed and examined were largely non-conclusive because many factors of possible falls risk relevance were either not studied or included in the available study reports or were not assessed or analyzed in a standardized manner. Additionally, even in a specific realm, the temporal associations between variables such as dementia, physical frailty, and falls contexts, as well as differences in what is concluded based on instrument selection for example [22,23] are potential further barriers to arriving at any definitive precise actionable preventive solutions [24]. Other possible falls determinants that are not well studied currently, but may warrant attention are 'lifestyle', plus health status including pain status, and possible excess alcohol usage [25-28].

As well, efforts to examine the clinical relevance of visual deficits [29], various cardiovascular impairments [30], mobility and/or stepping reactionary impairments in isolation remains uncertain at best [31], as do those that point to- but cannot affirm- conclusively the combined or distinctive influence of cognitive impairments, physical frailty, malnutrition and loneliness [32-35]. The potential impact and relevance of multiple social factors, neighborhood context plus frailty [36,37] is also hard to discern at present. Also alluded to but warranting added attention are various muscle-based deficits and impairments [16,19,38-42], depression [43], obesity [44], disability, certain medications [45] and sleep challenges. In addition, a past history of knee or hip joint replacement surgery, and fears of stumbling or slipping in those with a falls history cannot be ruled out readily as a secondary falls risk indicator or predictor [46-48]. Alternately, understudied predictors such as discrimination in various forms, homes that are unsafe, outdoor safety issues, social isolation, and pain cannot be excluded as being highly salient independent or collective falls injury analogues warranting examination alongside those that appear of high salience to obviate [27,49-51].

In short, adding to many gaps that prevail, and despite mounting evidence in multiple spheres that currently implicate the social and economic environment, including a combination of public-policy, community, and institutional/organizational factors as having a profound and lasting effect on health, and the incidence, prevalence and severity of disease, injury and sickness are rarely discussed, especially in the context of falls and recurrent falls injury prevention.

To assist in attaining more predictive models that can yield desirable and more advanced understandings and outcomes, it appears studying a broad array of carefully chosen correlates among those discussed above and summarized below in Table 1 will help validate what has been observed and will also possibly yield substantive novel insights. Samples with one or more traits listed in table 2 may also prove highly insightful especially if examined among large diverse samples using agreed upon frameworks and with uniform validated instrumentation. Examining indoor falls features versus those occurring outdoors is also advocated [52].

Alcohol usage [28]
Balance and gait deficits [39,53,54]
Cognitions, cognitive frailty, depression [23,43,54]
Environmental risk factors/home hazards
Degree of psychotropic, sedative, analgesic medication usage [45]
Falls beliefs, history, and fears
Muscle structure/function [11,14].
Muscle and joint pain [54]
Poor nutrition, abnormal fat distribution, physical frailty [23,59,60]
Sleep problems [26,48,56,57]
Social circumstances [36]
Visual and hearing impairments [29]

Table 1: Key falls injury associated attributes that appear to be promising to examine.

Chronic disease cases [52]
Chronic pain sufferers [54]
Depressed or confused elders [34,61,62]
Frequent and/or fearful fallers [52,69]
High age adults
Hip fracture surgical recovery cases [63, 69]
Malnourished frail older adults [37,59]
Those living alone/under poor conditions [58]
Visually impaired [29]

Table 2: Possible priority populations wanting study as well as falls counter solutions.

Discussion

Among the many problems faced by aging nations, one of persistent concern is the high rate of hip fractures, which are commonly highly debilitating injuries affecting many older adults in all parts of the world, despite years of study and efforts to avert this injury. Unlike many health conditions affecting older adults, and where treatment can help to restore wellbeing to some degree, once a hip fracture has occurred multiple challenges remain, including functional disability, and loss of independence [64], a second or third hip fracture, almost always preceded by a fall. However, even though falls are a significant hip fracture risk attribute [14], and

despite overall agreement that falls in general, are hazardous to an older person's health, and often generate an ongoing need for health services and resources, efforts to categorize the most salient falls risk factors and who is or is not at risk is likely to remain challenging to unravel unless concerted thought is applied to their assessment [52]. However, even after decades of study, many current 2023 authors such as Kelsey., *et al*. [52] support assertions by others that more research is needed in this regard for multiple reasons [11,65]. In particular, the ability to identify and control falls injuries risk factors is seen as especially relevant in efforts to reduce the growing falls injury induced health costs [10,53,66].

Indeed, most current articles strongly imply that rather than viewing falls as inevitable, there is potentially much value in pursuing and uncovering the sources or etiology of falls affecting older adults more intently. As well it may be helpful to consider delineating falls risk according to environmental factors. Using more adequately powered approaches with more focused study questions and robust design elements is also warranted. More 'face to face' data collection approaches and analysis, rather than those based on isolated secondary data sets [11,14] are also indicated as are studies to isolate the role of age distinct falls factors and needs [64].

As well, to further our current understandings, it could help if the time lag for publication of any new data is minimized as most contemporary studies clearly have to rely on historical data that may not be sufficiently representative of 2023 needs and trends [11,14,70]. Even in the case with no respondent attrition [70], a multi-year time lag with almost no data beyond 2020 must surely preclude assurances that all salient influences on falls and injury recovery are detailed. For example, what the impact of COVID-19 and its long term effects have-if any-on falls in*jury* and recovery risk is basically unknown. Other population wide issues such as climate change, systematic disparities in social conditions, and cultural factors, among older populations may have affected and are still affecting falls risk and injury trends in some way in more recent times and their general omission from evidence based studies may hence leave us with more unknowns than answers. Further gaps in our knowledge base as well as elaboration studies that employ advanced technologies also warrant attention. In the interim, until some of the shortcomings are addressed, the possible application of solutions derived from artificial intelligence will likely be tentative a best and fail to offer universal falls risk solutions due to: a) the possible exclusion of salient falls injury data from unfunded organizations; b) data where disease terms used do not comport with adopted or accepted PRISM recommendations; c) observational and retrospective use of secondary data rather than prospective clinical studies [10,53] study approaches that omit a role for the influence of environment and the orientation of health services, policies and systems; f) follow up studies conducted in the community but often not easily reached by elderly clients-thus high possible attrition rates [69].

Finally, publications discussing various protocols for future study, but no actual data, along with completed studies and those that do not consider falls fears or falls self-efficacy, but focus solely on other variables of physical or emotional dysfunction may induce further potential barriers or delays of immense relevance in efforts towards arriving at a sound set of conclusions and applied implications, for example in advancing screening efforts advocated by several current groups for reducing the falls burden [14,53,67] and fostering a life of high rather than low functional quality [48] even if the older adult has fallen and fractured a hip [68,70].

In sum, while much progress has been forthcoming to date, it appears more insightful future studies can help to unravel the complex temporal sequence of possible health status and muscle factors, and their sensori-motor pathways, plus possible genetic and gender influences more readily [48,63]. The study of larger samples of adults of various ages and health status prospectively using validated instruments, including those with possible economic and social resource limitations also appears promising. Areas where research might also focus include validation of preventive approaches such as

- Regular screening and health assessments of high risk individuals
- Individualized tailored collaborative falls abatement intervention plans as needed
- Exercise and balance training as indicated
- Education [older adults, patients, families, trainees, providers, economists, policy makers]
- Provision of resources as required
- Home inspections and modifications
- Discouraging use of excess alcohol, psychotropic medications
- Encouraging sound nutritional practices

In addition, it is undoubtedly still useful to draw on the prevailing evidence base in efforts to inform and to promote healthy aging, including optimal bone and muscle health that may help to reduce the severity of the falls and highly disabling costly hip fracture injuries should they occur. To this end, careful community wide surveillance of possible public safety concern, home environmental hazard reduction, and systematic data collection and analysis of electronic medical records using agreed upon end points and modes of inquiry of at risk older populations, plus the inclusion of artificial intelligence to tailor the implications of this may advance this effort immensely.

In particular, to foster clinical and public health investments in falls prevention, the high relevance of reducing their immense costs must become more mainstream. As well, research efforts to not only validate what is known, but especially to combat inconsistencies and oversights in previous etiological studies including the use of single and varied measures without defined properties is imperative. Moreover, concerted efforts are needed to overcome the limited upper age ranges studied to date, the collective analysis of cases with varying falls histories, and isolated rather than comprehensive inclusive domains of falls inquiry despite a wealth of recent knowledge of its multi-factorial socio ecologically sensitive nature.

Conclusion

Within the constraints of this limited 2023 overview and available clinical studies examining falls etiology, and consequences among older adults who sustain a hip fracture as a result, it appears reasonable in our view to conclude

- Hip fractures remain persistent devastating injuries common among older populations and are greatly impacted by falls.
- To mitigate hip fracture injuries, there are numerous modifiable determinants of falls that can be targeted.
- The costs of failing to reduce the incidence of falls and fall-related injuries impactfully among older adults are immeasurable.
- Misconceptions that falls are inevitable and do not warrant care must be addressed and replaced by well designed research endeavors that clearly outline linkages between fall, and their consequences, and points for targeted mitigation.
- Until more robust data and expanded attention to both charted as well as uncharted falls risk factors are forthcoming, the etiology and consequences of falls will remain hard to unravel.
- Incorporating environmental factors, as well as personal deterministic factors such as risk-taking behaviors, physiological and physical status is paramount.

In the field, it may also be necessary to train personnel who can implement preventive interventions against falls, and conduct risk assessment processes, as well as counsel individual clients is required. Moreover, legislation to optimize safety in the home and its environment and adequate medical coverage and funding for counseling appear desirable and may require education of the policy maker and health economist as well as medical trainees and family, orthopedic, and geriatric medicine specialists and generalists.

Bibliography

1. Sing Chor-Wing., *et al.* "Global epidemiology of hip fractures: secular trends in incidence rate, post-fracture treatment, and all-cause mortality". *Journal of Bone and Mineral Research* (2023).

2. Johansen Antony., *et al.* "Standardization of global hip fracture audit could facilitate learning, improve quality, and guide evidence-based practice: an international study of hip fracture registries in 20 countries using the Fragility Fracture Network 2022 Minimum Common Dataset". *The Bone and Joint Journal* 105.9 (2023): 1013-1019.

3. Dong Yimin., *et al.* "What was the epidemiology and global burden of disease of hip fractures from 1990 to 2019? Results from and additional analysis of the Global Burden of Disease Study 2019". *Clinical Orthopaedics and Related Research* 481.6 (2023): 1209-1220.

4. Viganò Marco., *et al.* "Proximal hip fractures in 71,920 elderly patients: incidence, epidemiology, mortality and costs from a retrospective observational study". *BMC Public Health* 23.1 (2023): 1-10.

5. Alsayed Hassan D., *et al.* "Risk factors associated with falls among older adults with diabetes". *The European Journal of Public Health* 33, S2 (2023): ckad160.1718.

6. Ge Yufeng., *et al.* "Association between hip bone mineral density and mortality risk after hip fracture: a prospective cohort study". *Calcified Tissue International* (2023): 1-9.

7. Shankar Kalpana N and Angel Li. "Older adult falls in emergency medicine, 2023 update". *Clinics in Geriatric Medicine* 39.4 (2023): 503-518.

8. Kakara Ramakrishna. "Nonfatal and fatal falls among adults aged ≥ 65 years-United States, 2020-2021". *MMWR. Morbidity and Mortality Weekly Report* 72 (2023).

9. Yang ZC., *et al.* "Frailty Is a risk factor for falls in the older adults: a systematic review and meta-analysis". *The Journal of Nutrition, Health and Aging* (2023): 1-9.

10. Ilic Irena., *et al.* "Epidemiology of hip fractures due to falls". *Medicina* 59.9 (2023): 1528.

11. Choi Namkee G., *et al.* "Recurrent falls over three years among older adults age 70+: associations with physical and mental health status, exercise, and hospital stay". *Journal of Applied Gerontology* 42.5 (2023): 1089-1100.

12. Shehu Enron., *et al.* "Sex differences in the burden of hip fractures on functional status in older age". *Journal of Women's Health* 32.1 (2023): 57-62.

13. Meyer Anna C., *et al.* "The impact of hip fracture on geriatric care and mortality among older Swedes: mapping care trajectories and their determinants". *American Journal of Epidemiology* 192.1 (2023): 41-50.

14. Moreland Briana L., *et al.* "Hip fracture-related emergency department visits, hospitalizations and deaths by mechanism of injury among adults aged 65 and older, United States 2019". *Journal of Aging and Health* 35.5-6 (2023): 345-355.

15. Ardaneh Mahdieh., *et al.* "Falls leading to fracture and nutrition among older adults: a case-control study". *Journal of Health, Population and Nutrition* 42.1 (2023): 1-6.

16. Appeadu Michael K and Bruno Bordoni. "Falls and fall prevention in the elderly". *StatPearls* (2023).

17. Deulle Min Hye., *et al.* "Consequences of fall-induced hip fractures on cognitive function, physical activity, and mortality". Korean Longitudinal Study of Aging 2006-2016". *Injury* 52.4 (2021): 993-940.

18. Liang Haixu and Ya Fang. "Longitudinal association between falls and motoric cognitive risk syndrome among community-dwelling older adults". *Geriatric Nursing* 49 (2023): 1-7.

19. Gallagher Eleanor., *et al.* "Psychotropic medication use and future unexplained and injurious falls and fracture amongst community-dwelling older people: data from TILDA". *European Geriatric Medicine* 14.3 (2023): 455-463.

20. Barceló Montserrat., *et al.* "Indoor falls and number of previous falls are independent risk factors for long-term mortality after a hip fracture". *Aging Clinical and Experimental Research* 35.11 (2023): 2483-2490.

21. Biswas Isha., *et al.* "Health consequences of falls among older adults in India: a systematic review and meta-analysis". *Geriatrics* 8.2 (2023): 43.

22. Kirk Ben., *et al.* "Diagnostic power of relative sit-to-stand muscle power, grip strength, and gait speed for identifying a history of recurrent falls and fractures in older adults". *European Geriatric Medicine* (2023): 1-8.

23. Ge Mei-Ling., *et al.* "Order of onset of physical frailty and cognitive impairment and risk of repeated falls in community-dwelling older adults". *Journal of the American Medical Directors Association* 24.4 (2023): 482-488.

24. Leroy Victoire., *et al.* "The nebulous association between cognitive impairment and falls in older adults: a systematic review of the literature". *International Journal of Environmental Research and Public Health* 20.3 (2023): 2628.

25. Lin Wei-Quan., *et al.* "Prevalence of falls, injury from falls and associations with chronic diseases among community-dwelling older adults in Guangzhou, China: a cross-sectional study". *Frontiers in Public Health* 11 (2023).

26. Muhammad T., *et al.* "Mediation of pain in the association of sleep problems with falls among older adults in India". *Scientific Reports* 13.1 (2023).

27. Donnell Desmond O., *et al.* "The 'Bermuda Triangle' of orthostatic hypotension, cognitive impairment and reduced mobility: prospective associations with falls and fractures in The Irish Longitudinal Study on Ageing". *Age and Ageing* 52.2 (2023).

28. Yuan Keming., *et al.* "Emergency department visits for alcohol-associated falls among older adults in the United States, 2011 to 2020". *Annals of Emergency Medicine* (2023).

29. Ouyang Shuyi., *et al.* "Cataract, glaucoma, and diabetic retinopathy are independent risk factors affecting falls in the older adult with eye diseases". *Geriatric Nursing* 53 (2023): 170-174.

30. Bourke Robbie., *et al.* "Cardiovascular disorders and falls among older adults: a systematic review and meta-analysis". *The Journals of Gerontology: Series A* (2023): glad221.

31. You Liuqing., *et al.* "Association between multimorbidity and falls and fear of falling among older adults in eastern China: a cross-sectional study". *Frontiers in Public Health* 11. 1146899 (2023).

32. Wang Shanshan., *et al.* "The association of cognitive frailty and the risk of falls among older adults: a systematic review and meta-analysis". *International Journal of Nursing Practice* 29.4 (2023): e13181.

33. Davies Katie., *et al.* "A prospective analysis examining frailty remission and the association with future falls risk in older adults in England". *Age and Ageing* 52.2 (2023): afad003.

34. Guo Xiaojing., *et al.* "Cognitive frailty as a predictor of future falls in older adults: a systematic review and meta-analysis". *Journal of the American Medical Directors Association* 24.1 (2023): 38-47.

35. Bally Esmée LS., *et al.* "Factors associated with falls among hospitalized and community-dwelling older adults: the AP-PCARE study". *Frontiers in Public Health* 11 (2023): 1180914.

36. Lohman Matthew C., *et al.* "Social mediators of the association between depression and falls among older adults". *Journal of Aging and Health* 35.7-8 (2023): 593-603.

37. Yang ZC., *et al.* "Frailty is a risk factor for falls in the older adults: a systematic review and meta-analysis". *The Journal of Nutrition, Health and Aging* 27.6 (2023): 487-595.

38. Zhou Jian., *et al.* "A prospective cohort study on the association between new falls and balancing ability among older adults over 80 years who are independent". *Experimental Gerontology* 180 (2023): 112259.

39. Hsieh Katherine L., *et al.* "Factors associated with falls in older adults: A secondary analysis of a 12-month randomized controlled trial". *Archives of Gerontology and Geriatrics* 108 (2023): 104940.

40. Rodrigues Renata G., *et al.* "Calf circumference predicts falls in older adults on hemodialysis". *Journal of Renal Nutrition* 33.2 (2023): 363-367.

41. Liu Xiao., *et al.* "Association of motor index scores with fall incidence among community-dwelling older people". *BMC Geriatrics* 22.1 (2022): 1008.

42. Cavusoglu Cagatay., *et al.* "Elasticity of leg muscles and incidence of falls in older adults: a prospective cohort analysis". *European Geriatric Medicine* 14.1 (2023): 79-87.

43. Feng Zhiqiang., *et al.* "The association between falls and depressive symptoms among older adults: evidence from the China Health and Retirement Longitudinal Study". *Frontiers in Public Health* 11.1248551 (2023).

44. Monteiro Elma Lúcia de Freitas., *et al.* "Use of structural models to elucidate the occurrence of falls among older adults according to abdominal obesity: a cross-sectional study". *Sao Paulo Medical Journal* 141.1 (2023): 51-59.

45. Júnior Nelson Machado do Carmo., *et al.* "Sedative use and incidence of falls and hip fractures among older adults in an outpatient geriatric clinic". *Geriatrics, Gerontology and Aging* 17 (2023): 1-7.

46. Pantong Uraiwan., *et al.* "Analysis and prevention of falls among community-dwelling older adults in southern Thailand". *Journal of Advanced Nursing* (2023).

47. Alamri Sultan H., *et al.* "Falls and correlations among community-dwelling older adults: A Cross-sectional study in Jeddah, Saudi Arabia". *Pakistan Journal of Medical Sciences* 39.1 (2023): 109.

48. Wu Jia-Xin., *et al.* "The casual association inference for the chain of falls risk factors-falls-falls outcomes: a Mendelian randomization study". *Healthcare (Basel, Switzerland)* 11.13 1889. (2023).

49. Williams Carla T., *et al.* "Managing geriatric patients with falls and fractures". *The Orthopedic Clinics of North America* 54.3S (2023): e1-e12.

50. Soomar Salman Muhammad and Zeyanna Dhalla. "Injuries and outcomes resulting due to falls in elderly patients presenting to the Emergency Department of a tertiary care hospital - a cohort study". *BMC Emergency Medicine* 23.1 14.

51. Kim Kyoung Min., *et al.* "Cummings. "Recent fall and high imminent risk of fracture in older men and women". *Age and Ageing* 51.6 (2022): afac141.

52. Kelsey Jennifer L., *et al.* "Reevaluating the implications of recurrent falls in older adults: location changes the inference". *Journal of the American Geriatrics Society* 60.3 (2012): 517-524.

53. Peng Junyi., *et al.* "Characteristics of falls among older hip fracture patients from six Chinese hospitals: a post-hoc descriptive analysis". *BMC Geriatrics* 23.1 (2023): 284.

54. Hirase Tatsuya., *et al.* "Risk factors for falls and fall-related fractures in community-living older people with pain: a prospective cohort study". *International Journal of Environmental Research and Public Health* 20.11 (2023): 6040.

55. Nagashima Yuko., *et al.* "Chronic pain in the lower extremities and low back is associated with recurrent falls in community-dwelling Japanese people aged 40-74 years". *Archives of Physical Medicine and Rehabilitation* (2023).

56. Zhang Yuan-Wei., *et al.* "Short report: relationship between self-reported sleep characteristics and falls-associated fractures in elderly individuals: a population-based study". *Psychology, Health and Medicine* 28.4 (2023): 946-954.

57. Aparecida Damasceno Daiane., *et al.* "Factors related to recurrent falls among older adults attending primary health care: a biopsychosocial perspective". *Experimental Aging Research* (2023): 1-12.

58. Escosura Alegre Irene., *et al.* "Living conditions and the incidence and risk of falls in community-dwelling older adults: a multifactorial study". *International Journal of Environmental Research and Public Health* 20.6 (2023): 4921.

59. Mai Ha., *et al.* "Frailty and risk of subsequent fracture among older adults presenting to hospital with a minimal trauma fracture". *Osteoporosis International* 34.2 (2023): 399-404.

60. Webster James., *et al.* "Nutritional strategies to optimise musculoskeletal health for fall and fracture prevention: looking beyond calcium, vitamin D and protein". *Bone Reports* (2023): 101684.

61. Okoye Safiyyah M., *et al.* "Predictors of falls in older adults with and without dementia". *Alzheimer's and Dementia* (2023).

62. Smith Cindi., *et al.* "Executive function and prospective falls: a 6-year longitudinal study in community-dwelling older adults". *BMC Geriatrics* 23.1 (2023): 140.

63. Qian Xing Xing., *et al.* "Post-hospital falls among the older population: the temporal pattern in risk and healthcare burden". *Journal of the American Medical Directors Association* 24.10 (2023): 1478-1483.

64. Armstrong Elizabeth., *et al.* "Do we understand each other when we develop and implement hip fracture models of care? A systematic review with narrative synthesis". *BMJ Open Quality* 12.S2 (2023): e002273.

65. Pantouvaki Anna., *et al.* "The effect of an exercise-based rehabilitation programme in functional recovery and prevention of secondary falls after a hip fracture in older adults: a systematic review". *Journal of Frailty, Sarcopenia and Falls* 8.2 (2023): 118.

66. Trinh Vincent Quoc-Nam., *et al.* "Falls and fractures in the acute care setting: A retrospective cohort study". *Australasian Journal on Ageing* 42.3 (2023): 598-602.

67. Montero Odasso Manuel., *et al.* "World guidelines for falls prevention and management for older adults: a global initiative". *Age and Aging* 51.9 (2022): afac205.

68. Rocha Paula., *et al.* "Safety-promoting interventions for the older person with hip fracture on returning home: a systematic review". *International Journal of Orthopaedic and Trauma Nursing* (2023): 101063.

69. Scheffers Barnhoorn Maaike N., *et al.* "Course of fear of falling after hip fracture: findings from a 12-month inception cohort". *BMJ Open* 13.3 (2023): e068625.

70. Kawaji Hiroyuki., *et al.* "Decennial trends in hip fractures over 20 years in Yamagata Prefecture, Japan". *Journal of Orthopaedic Science* 28.3 (2023): 621-626.