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Osteoarthritis Falls Origins, Risks, and Prevention: Do we Need an Ecological Guiding Explanatory Framework?

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Abstract

Lower limb osteoarthritis, a widespread age related chronic condition is often accompanied by an increased tendency to fall and thereby various degrees of intrinsic and extrinsic injury. Falls, in turn may provoke the disease alone and in turn a high falls risk and cycle of recurrent falls and heightened disability. This report which updates what is known about falls in the context of disabling osteoarthritis argues for a possible future ecological orientation rather than a focal uni dimensional approach to addressing this costly health problem. It examines osteoarthritis falls risk factors, falls injury prevention attempts, and recommendations to advance research and practice using an ecological analytic approach in this regard. Using the **PUBMED** data base and others, lower limb osteoarthritis linkages and falls interaction studies were sought and examined. The data revealed osteoarthritis can lead to the chances of incurring one or more falls and further health and disability challenges, while falling can provoke the onset of osteoarthritis in its own right. Although many factors appear to be involved, these are rarely viewed through a broad multi dimensional ecological perspective, thus are confusing or overwhelming to apply to the active community dwelling elderly subject.

Background

Osteoarthritis, the most common form of arthritis, is a progressive disabling disease commonly affecting joints such as the hip and knee. A disease largely affecting older adult populations, a group prone to falling, the condition remains an ever increasing public health concern, but one with few remedial opportunities [1-4]. At the same time, although a wealth of data attests to many possible reasons for incurring any unwanted and often life changing falls risk, there is no unifying consensus in this regard. This failure attributable to some degree due to a limited data base, may also reflect the fact that most available studies have viewed the topic through a one-dimensional deterministic lens rather than through a multidimensional social ecological lens [5-7].

Adding to the confusion is the frequent omission or isolation of emotional and cognitive factors, as well as a role for unknown albeit salient environmental factors [1, 7, 8].

Unfortunately, in the face of the increasing numbers of aging adults worldwide expected to suffer from lower limb osteoarthritis by 2050 and knowledge that this group may suffer from joint instability and pain that may well increase their falls risk [9, 10], very few conclusive studies aimed at averting this situation prevail [5].

Moreover, whether mitigation should focus on a possible suboptimal relationship between desirable spinal proprioceptive input patterns and alterations in neuromuscular control strategies that potentially impair gait control, or whether obesity induces joint instability and excess pain and should be targeted is unclear. Similarly, whether muscle fat mass that impairs muscle reactively or the presence of cardiovascular disease, along with unsafe medication usage and type of medications, affect falling is uncertain [7, 10, 11].

In our view, this aforementioned scenario can:

- Potentially impair the ability of the clinician to:
- Understand +
- Appreciate the larger picture as well as the contribution of the many factors that
- may be involved in explaining the health behaviors and health status and falls risks of individuals and communities.
- Limit the adoption of the most salient strategies needed to promote optimal individual, group or community health.

To overcome these limitations we argue in favor of obtaining a better understanding of the topic and its solutions by employing an ecological or multi layered factorial perspective.

Key Points Examined

- If there is currently agreement on osteoarthritis falls risk factors that could be harnessed towards more effective falls prevention and osteoarthritis mitigation efforts.
- Whether the association between falls and osteoarthritis is likely to be a uni- or a multi dimensional one.

Since falls associated with osteoarthritis can magnify or induce a life time of suffering, as well as significantly increased health costs even in the face of surgery [8], we sought to establish if there are specific preventive strategies indicated for community dwellers who wish to age ‘in place’.

Hypothesis

We anticipated there would be a consistent cyclical linkage between the onset and progression of disabling lower limb osteoarthritis and falls risk and falls events in the older adult population that can be mediated by neuromuscular factors and others that may be remediable.

However, most studies tend to emphasize only individual mediating or moderating factors, while paying little attention to the vast array of socio-cultural and physical environmental influences that can impact both osteoarthritis and falls injury risk and severity and are potentially key. to advancing our understanding of these issues [10].

Rationale for overview

Osteoarthritis as well as falls where 1/4 may sustain serious injuries such bone fractures [https://www.cdc.gov/falls/data-research/facts-stats/index.html] currently pose an enormous challenge to many aging individuals, as well health providers, and economists. At the same time even if a key cause is deemed to be injury rather than age, there is a pervasive lack of clarity in our view as to whether falling is a relevant pathogenic factor and whether a fall can initiate a cycle of suffering, as well as the onset of increasing osteoarthritis damage despite a host of possible clinical features that include the following, but where some may be remediable.

1. Pain/joint stiffness/locking
2. Joint movement speed and range limitations
3. Muscle weakness/sarcopenia/being sedentary
4. Joint instability/degraded balance control
5. Limited walking endurance
6. Depression/anxiety/fear
7. Faulty posture/gait biomechanics
8. Deficient proprioception
9. Sleep deprivation
10. Obesity

As well, research shows 400 risk factors linked to a heightened falls risk and a high potential for injury in the older adult population, especially in the presence of frailty and muscle weakness [https://www.cdc.gov/falls/data-research/facts-stats/index.html]

What emerges from the above in our view is that the etiology of falls is sufficiently complex in its own right and warrants study using an appropriate framework including the role of environmental factors, as well as other deterministic factors such as risk-taking behaviors, biology, physiological, physical and mental health status, disease classification status, and the role of policies that govern community safety and health resource allocation [12, 16-18].

In this regard, as opposed to the more traditional 'biomedical model', the ecological explanatory model of inquiry is one that considers the connections between the target audience behaviors and manifestations and their environments and tries to account for possible psychological, environmental and sociological factors that determine health status. Its usage appears to provide a possible alternative and sound tool for uncovering the complex web of causation underpinning a health issue such as osteoarthritis, and falling risk and outcomes. Its multidimensional approach to examining a complex issue can create an

enriched, rather than a limited perspective in all likelihood and one able to offer sound predictions, plus the ability to prioritize and direct intervention planning and desired management and implementation strategies accordingly in our view, even though not commonly applied in general, in any population wide osteoarthritis or falls risk research efforts among community dwelling older adults.

Since outcomes for knee osteoarthritis sufferers' alone who incur a falls event are found to be significantly worse over time than those outcomes of cases who do not fall, and surgery to replace a diseased end stage knee joint does not always prevent falls post surgery, it appears a better understanding of what specific variables might underpin this cycle of unwanted events is highly desirable [2]. Moreover, since falling can markedly exacerbate osteoarthritis pain and disability – it appears it may be beneficial to examine this topic in a broad sense to ascertain if there is a consistent interactive linkage between the onset and progression of disabling osteoarthritis in the older population and certain variables that can arguably lead to and be exacerbated by falls injuries, but are potentially remediable.

In this mini report, we largely explored the **PUBMED** electronic data base using the key terms: "*osteoarthritis and falls*", "*osteoarthritis and falls risk/injury*" and "*falls prevention programs*" as catalogued from January 1 2020 - December 25 2025. As well, the **PubMed Central**, and **Google Scholar** data bases were reviewed, as were some past salient documents. Accepted were articles published in the English language as full reports and pertinent to the current theme, with the exception of falls relative to older adults in nursing homes, intervention studies other than those falls prevention efforts currently documented, and articles that did not discuss osteoarthritis per se. Data were carefully reviewed for relevance and those articles deemed potentially informative in the author's view were downloaded and analyzed. PUBMED was selected as the key electronic data source of information given its widespread data repository and effective method of organizing recent as well as relevant data. Prior data can be gleaned from those citations denoted as systematic reviews [eg., 1, 3. 6, 10, 18, 34, 65]

We begin with an overview of the importance of osteoarthritis and falls injuries and prevention and then follow with a general overview and research findings and limitations, and the potential use of the ecological model to influence more favorable outcomes in both spheres, in particular. We discuss key examples from the current literature and notes from the author who is a skilled behavior theorist and osteoarthritis expert.

Results

As of December 20, 2025, it is clear osteoarthritis remains a topic of immense interest and one to mitigate sooner rather than later. Related strongly to injury, its uni- and bidirectional falls associations that have been specifically studied since 1987 remain relevant but without any consensus. While this has been attributed to the emergence of weak atheoretical stand alone studies of varying dimensions and attributes it may also be due to a failure to examine the context where osteoarthritis and falls occur most readily [eg., 13-20]. These contextual levels of influence include intrapersonal factors, interpersonal impacts, institutional, community and public policy factors.

At the same time, very few prospective analyses have been forthcoming for examining any factor and that may help inform on the relative importance of biology, behaviors, health status, demographics, and mental health intrapersonal status attributes and intervention priorities. Generalizability of the data, currently limited because almost all studies focus on the osteoarthritis knee joint, common observations at other joints as well as possible diverse conclusions must await further study. In the interim, the presence of knee pain identified as a risk factor for falls; may not be trustworthy as the strength of evidence in

this regard has been rated as "conflicting" [18]. As well, limited evidence was found for knee instability, impaired proprioception, and the use of walking aids.

Hence, the ability to discern trends via attempts at systematic study aggregation must remain in question. Most articles not only fail to use theory based frameworks but are found to test one or more factors in isolation without a sound foundation. Alternately, they may use differing small size diverse samples, differing assessment approaches, and differing falls definitions and attributes, with common omissions of the degree to which deficits in cognition, psychological status, and factors such as anxiety and fatigue are influential [14].

Rosado et al. [8] who point out that older adults with higher degrees of dysfunction or other related osteoarthritis symptoms, such as a persistent fear of falls, low back pain, diabetes mellitus, and an increased body mass index may be at risk for falls did not assess the possible role of factors such as food security and physical safety environments. Ample data shows that simply focusing on the detail of individual injury risk within a single cognitive or behavioral framework leaves us less able to perceive the larger picture-and hence at risk of failing to improve injury death and morbidity rates as desired.

Moreover, intense scientific scrutiny of individual risk factors for injury shows the individual is metaphorically speaking, embedded in many overlapping health related dimensions of being and surviving. Ignoring the interaction of these possible factors may fail to produce efficacious programs and solutions that drive the injury rates and costs down [19-21, 24].

According to Iijima et al. [22] cases with sarcopenic knee osteoarthritis do tend to have a 4.17 times higher odds of incurring two or more falls than controls after adjustment for age, sex, and body mass index, but whether this is due to pain, biological factors or factors such as poverty is uncertain at best. Additionally, results of falls over time may vary depending on what is assessed or not in our view, plus the role of pain medications, particularly the use of opioids.

While other studies show that having a falls risk appears to be more likely in cases experiencing challenges in carrying out dual tasks when walking or trying to balance [24-27], others imply falls risk is increased in those osteoarthritis cases exhibiting symptoms of anxiety and excess stress [28]. Yet others imply muscle weakness and early pathological changes in the neuromuscular system are salient risk factors [13] in addition to opioids or paracetamol [23, 29-33], as are depression and/or a fear of falling [31, 35, 36]. Moreover the combined role of physical as well as psychological correlates that may be implicated are rarely studied together [7, 18, 19], and even then may yet omit the potential role of legislative policies, the absence of trustworthy public health educational messages, limited health care access and quality, poor housing, and behavioral influences in the physical, communication, and community environment.

As well, disease severity or grade of disease is another possibly highly salient falls predictor in addition to stability and balance dysfunction and level of pain and may be impacted by restrictions on health coverage rather than biological alterations [39]. It is also increasingly apparent personal belief factors as well as multiple environmental factors may be salient contributory causes of excess osteoarthritis disability, but these variables are rarely studied in tandem [39]. Another view is that compared with older disease free adults, those with osteoarthritis may exhibit a significantly reduced walking ability plus inadequate joint flexion and extension range of motion that could predispose the older adult with osteoarthritis to injurious falls, but unless sought and screened for may fail to enlighten [40]. However, until more strategic studies that incorporate an ecological stance are forthcoming, what the relative significance of any isolated osteoarthritis falls risk factor is, is impossible to unravel [41-44] as this may de-

pend on the circumstances in which the older adult falls as well as their cognitive and mental health state [45].

In short, while many laudable studies focusing on examining the damaging nature of the osteoarthritis-falls linkage prevail, almost all are hard to validate conclusively. As well as a failure to examine the role of environmental factors that influence health, a failure to examine multiple affected joints, the role of nutrition, and health services impacts [47-53] where noteworthy, are themes not studied in depth, objectively or prospectively to any degree over time. In our view, this situation predicts there will be little respite from this dual costly health negating association for some time to come [54, 55-61]. Maintaining the status quo also predicts a high rate of recurrent falls [2 or more falls per year] [65]. Yet, it is probable single and multiple falls events and their often incrementally dire outcomes can be averted to a high degree in our estimation if more efforts to address this issue in a preemptive manner are forthcoming. As well, careful future multi level mimed method study approaches can potentially uncover novel risk as well as protective factors for both osteoarthritis and various falling occurrences and their implications.

Moreover, as per the premises embedded in the social ecological model [87], attention to uncovering the predisposing, enabling, and reinforcing factors underpinning osteoarthritis disability and falls risk may prove insightful as may a focus on certain health beliefs, attitudes, behaviors, biological and environmental variables including salient administration and policy factors [88].

Discussion

Osteoarthritis, a progressively disabling joint disease and one increasing in prevalence despite years of study is a costly health concern that reduces independence among many older adults in all parts of the world. At the same time, the prevalence of falls among older populations and that can be attributed in part to osteoarthritis disease features is an understudied topic even though it may have a bearing on the disease progression as well as its costs [42]. Moreover, when studied, the key importance of identifying remediable disease outcomes and pathogenic factors remains confusing to apply uniformly even though most current authors support the view that falls are inextricably linked to osteoarthritis of the knee joint among other determinants and that more should be done to revert this link. This may be because few groups have sought to examine if falls, a major health determinant of the elderly in its own right, can lead to the onset of knee or other forms of osteoarthritis, a hypothesis that cannot be ruled out. Moreover, even if it appears those with more severe disease may fall to the same degree as those with less joint damage, this appears mostly true for radiological not the clinical disease features.

At the same time, even when the data sources examined in cumulative reviews are known to be reputable and give the impression they house a reasonable number of relevant papers on the present topic of interest, most do not appear to be based on any sound theoretical premise or framework and thus a high number either examine many possible falls osteoarthritis correlates simultaneously, while others only examine a small number. Some data drawn from specific data repositories and not others, and analyses that employ secondary data sets captured in the previous decade using surveys and medical charts, may also fail to represent the entirety of the situation as this occurs globally in 2025. Data represented largely by knee osteoarthritis cases with various clinical features often ignore the interaction between these and those extrinsic falls risk factors that may be salient. As well, terms such as falls, falling, and recurrent falls are not uniformly defined, nor captured in a standardized manner across available studies, and subjective reports and measures that could be flawed prevail widely.

In contrast, data pertaining to possible confounding factors such as differing osteoarthritis phenotypes,

frailty, medications, sociodemographics, types of falls, fall locations, disease duration and extent, plus the role of prior surgery, overall health status, corticosteroid injections and others is also unclear and a profound limitation to progress in this realm in our view.

Further confusion arises because it has been possible to argue that osteoarthritis may actually be protective against falls rather than a risk factor, especially if severe enough to limit weight bearing activities. However, frailty or muscle status alone can raise the risk for falling in knee osteoarthritis cases whether severe or not [46, 63-68], as well as after joint replacement surgery [14]. There is also evidence that a persistent preoccupation related to an incident fall, termed the '*fear of falling*' may be related to the risk of falling as well as subsequent osteoarthritis morbidity outcomes whether osteoarthritis is severe or not [36].

However, even though the topic of falls and osteoarthritis discussed intermittently for decades [72] shows a possible salient linkage to balance control, sensory deficits and poor proprioception in addition to pain, as well as comorbid health conditions, gait challenges, obesity and cognitively derived challenges, the relative risk of any of these factors is far from evident [9]. Similarly, a role for assistive devices, footwear issues, sedatives, sleep impairments, social and medical factors, unsafe environments, and erroneous health beliefs about falling and nutritional factors add to the current inability to unravel what is needed and why.

Research implications

In light of what has been achieved, and to advance this line of inquiry more impactfully it is evident in our estimation that it is desirable to conduct more carefully designed and executed inclusive comprehensive theory based studies including multiple risk factors and mixed methods so as to broaden our understandings of the falls risk linkages between current high age elders and:

- Nutrition intake, cognitive, and health status factors [44, 47, 63].
- Medication type and intake, environmental, and mental health factors [11].
- Specific osteoarthritis correlates, such as pain, joint instability, poor dynamic balance during gait, poor proprioceptive sensitivity, muscle fatigue, contractures, muscle weakness [34, 48] and atrophy, plus falls fears, falls self-efficacy [38, 41, 46-50, 61], and obesity [9].

In the interim, although promising [77, 78], the evidence base remains fragmented [51], and is one that does not uniformly employ agreed upon multidimensional falls questionnaires, careful subgroup analyses, longitudinal assessments of high-and low risk individuals and diverse ages [34, 48, 64, 67], thus maybe flawed. Identifying and targeting those expressing a fear of falling is also indicated [69, 77].

However, as outlined more than 10 years ago [71], this topic remains of high import and continues to be one meriting careful ongoing attention in light of a highly relevant need to reduce osteoarthritis suffering and the widespread costs of suffering. These costs, including the costs of falls in their own right, can extend to the family, friends, and employers, as well as heightening a possible need for more intense costly health and human services and resources and accessibility. In particular, for any tangible progress to be evidenced it appears high age lower limb osteoarthritis cases as well as healthy older adults with a high falls risk profile, which can implicate psychosocial, demographic, medical, medication, behavioral, social, and environmental factors must be identified and examined sooner rather than later using valid assessment tools [24]. As well, efforts to ascertain whether a community wide falls prevention program for the osteoarthritis sufferer or high risk faller or both is likely to prove as effective as a targeted personalized program or more effective are strongly encouraged.

To this end, a comprehensive needs assessment study approach that embraces salient physical, cognitive and sociological situational factors across time and diverse population-wide domains of possible influence may prove enlightening as well as highly informative [56. 65, 68, 69].

Clinical implications

Even in older age groups, it is generally accepted that good health enables elders to lead personally meaningful and productive lives and to contribute to the prosperity and overall social fabric and stability of a country or community. However, designing effective health promoting interventions for averting late life health risk factors and adverse outcomes is not a simplistic task, because health is not only a product of individual factors (namely: genes, health practices and coping skills), it is the sum of collective conditions including the environment, and the health care system itself. Thus, simply knowing the pathological causes of a disease, injury or disability may not ensure an intervention will achieve its goal.

Indeed, mounting evidence suggests that the social and economic environment, including a combination of public-policy, community, and institutional/organizational factors can have a profound and lasting effect on health, as well as the incidence, prevalence and severity of disease, injury and sickness, such as osteoarthritis as well as unintentional falling events. Yet, this knowledge has not been a major focus of the health community in the past in the context of lower limb osteoarthritis and falls injury prevention to any meaningful degree.

As per Ling [72] until more compelling deterministic data concerning the cause effect osteoarthritis falls linkage emerge, applying what we do know may yet have a profound array of health benefits, as well as favorable longevity implications and must not be ignored in the hope a 'magic bullet' will soon emerge [64]. The degree of prevailing falls fears and its underpinnings [69], plus the relative role of type and usage of prescribed medications, pain location and extent, walking and balance facility, and environmental safety issues require specific clarification [13, 37] as do personal beliefs and concerns about osteoarthritis and falls, anxiety, functional mobility and mental health status [74-80].

In the meantime, we believe attempts to modify falls injury or health risks among older adults, by continuing to examine only one level of possible disabling underpinnings in isolation may fail to address those not studied, as well as one or more potentially relevant extrinsic determinants that are known to heighten falls as well as osteoarthritis injury risk.

It is also concluded that as with standard care approaches, osteoarthritis cases should be screened for their falls risk periodically at their annual or regular visits as this may change over time, as ,may their social situation, thus warranting a situational assessment at each visit as well.

Clinicians can help by directing clients accordingly and being mindful of offering affordable health care solutions, as well as opportunities to be made aware of their falls risk and that their help in averting falls events as far as possible.

Concluding remarks

Despite a lack of unity, a strong reliance on data already collected, plus data largely focused on the diseased knee joint alone, it is clear falls, which are serious injuries now prevail in sizeable numbers of osteoarthritis cases and aging adults and can account for their oftentimes substantive independence losses and magnification of any concurrent disability in multiple ways, even after surgery [70].

As in 2019 when Mat et al. [75] implied the negative impact of falls in older persons has been attributed to the presence of mild, moderate, and severe pain, pain may have an indirect rather than a direct effect

on falls risk and thus establishing its determinants such as anxiety, fear of falling, and poor function are imperative to rule out erroneous treatment targets including narcotics and sedatives, social factors, and impersonal medical treatments and disadvantageous health policies and paradigms.

By contrast, a failure to consider the above idea may perpetuate a host of adverse preventable degrees of disability and suffering [18, 79, 82], rather than possible benefits of community wide falls prevention programs and others [83-86]. Research to overcome the equivocal or weak fragmented single level evidence base deficits captured to date at the individual level, should be updated, extended, and expanded to address major ecological, environmental and epidemiological influences, rather than failing to do this.

Indeed, it appears imperative to ensure older adults living in the community are able to remain mobile and offset injurious falls, as well as a high degree of excess disability and associated fiscal costs due to falls as well as lower limb osteoarthritis presence and onset.

To this end, more comprehensive stand alone or multi level longitudinal studies of large representative samples, plus efforts to capture and identify the magnitude of any cognitive, emotional, lifestyle, health beliefs, extrinsic, and general health factors known to heighten falls risk and that can be acted on with confidence are imperative [7, 53, 55, 63, 74-76]. In addition, in planning to avert excess falls occurrences and thereby associated osteoarthritis disability, efforts to employ the past and validated emergent evidence towards prevention should follow without delay [77-79, 81, 82].

To specifically avert high degrees of osteoarthritis disability and pain, as well as recurrent falls and a low life quality, those in the higher age ranges, those who exhibit sarcopenia, those with symptomatic hip or knee osteoarthritis, those with radiographic osteoarthritis who have undergone total joint replacements, those suffering possible walking impairments, frailty, visual impairments, sleep challenges or heart disease, deficient motor control and exercise as well as social opportunities, and those requiring multiple medications to quell pain should be specifically studied [88].

Take home message

Although there is no cure for osteoarthritis, careful timely management that includes falls safety interventions and prevention may foster a viable rather than a debilitating life course. Those older adults exhibiting risk factors for osteoarthritis, as well as falling, plus hip and knee osteoarthritis symptoms, should be targeted early on as the chance of falling increases with numbers of risk factors [https://www.cdc.gov/falls/data-research/facts-stats/index.html]

In the interim-

- To change the risk profile of the individual it is becoming increasingly necessary to address the environmental and sociological issues that can determine or impact on individual health behaviors and disease manifestations.
- Modifying the risk profile of the whole system in which the individual is embedded, may be more likely to be successful and with sustained outcomes than not.
- Because of the complexity of factors that influence health—multi-level interventions [plus multi-sectoral strategies] may be much more effective as well as less costly than single level interventions in many cases and are strongly encouraged [87, 88].

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Conflicts of Interest

The author declares no conflict of interest.

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