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Review Article

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Secondary and Incident Hip Fracture Epidemiology and Physical Activity Participation: Is there a Clinically Relevant Mediating Connection?

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Abstract

Hip fractures, an important costly health concern in aging populations, commonly lead to disabling hip osteoarthritis, functional disability, and/or premature death, especially among those sustaining recurrent hip fractures. But are hip fractures and their consequences such as increasing the risk for a second hip fracture inevitable among aging adults or can these or a proportion of these subsequent hip fractures, commonly attributed to a combination of age, incident and recurrent falls, low bone and muscle mass be prevented? This review examines pertinent literature sources published in the peer reviewed English language between 1975 and June 2026 concerning hip fractures. The aim was to highlight potential intervention points to offset the risk of incurring an incident as well as a subsequent hip fracture and its attendant disability. Relevant data showed hip fractures remain an important, but potentially preventable public health problem partially attributable to several remediable factors, including low physical activity levels, suboptimal neuromuscular function, and sedentary lifestyles.

Keywords: Aging; Falls; Hip Fractures; Morbidity; Mortality; Muscle Weakness; Older Adults; Physical Activity; Recurrent/Second Hip Fractures; Prevention.

Background to the Problem

In spite of much research, hip fractures continue to pose a serious health care problem as far as aging, health policy, and public health care costs are concerned. Indeed, despite some evidence of declining hip fracture rates in some spheres in past and current years in some locations [1-4], it appears hip fractures continue to pose one of the most serious health care challenges facing policy makers, health care organizations, and older adults desiring to live independently in the community, rather than in the nursing home or institution. In reality, even in the face of so many technological advances, a hip fracture injury remains an ever present and potentially unwarranted cause of severe disability, excess morbidity, reduced life quality, post surgical hospital complications, and premature mortality among many older adults [4-8], especially those of higher ages [9]. Moreover, according to some, it is just as likely that the annual incidence of hip fractures could increase, rather than decrease over the next several decades [10], even though certain pharmacologic drugs may limit hip fracture risk. In addition, due to an increase in the numbers of adults living to higher ages [9], a group where frailty, muscle atrophy, sedentary behaviours and bone fragility prevalence rates continue to rise [11, 12], data projections, may yet be underestimates or inaccurate, In particular, high age adults are often excluded from research or unable to complete surveys or clinical exams, data may not include actual hip fracture incidents occurring in isolated communities, where some adults may well fall but are unable to access help, or too fearful or ill to be admitted to a hospital. As well, even in areas where hip fracture rates have reportedly remained stable over 10 years, other data show hip fracture rates have not fallen in all locations [13] and recently appeared to be increasing among: Asian older women [5], older adults in China [10], Taiwan [14], Saudi Arabia [15], United States [16], and Costa Rica [17] and where the individuals are living to high ages [25]. Hip secondary or refracture rates may also vary depending on multiple intrinsic as well as extrinsic factors including the sample demographics, size, and bone status, location or region studied, the assessment and analytic approach and cut-off risk indicator levels, the availability of services, surgical methods and degree of delay and whether data are systematically collected, accurate and up to date [18, 20]. Nonetheless, it appears the observed reversal of the hip fracture secular trend may not apply universally [8], and it is more likely the annual incidence of hip fractures as well as recurrent hip fractures will increase, rather than decrease, over the next few decades [7-10, 20, 21]. Further, in addition to well established hip fracture determinants, it is possible this scenario may prevail in the face of poor rehabilitation or oversight on remediating the causes of the initial fall or predisposing

factors. According to Shroder *et al*. [24] it appears the risk of incurring a third hip fracture cannot be overlooked and may occur at rates as high as 8.6 in men 9.8 per 1000 for women, per year, or even higher, for example those with severe fragility signs.

This specific state of fracture recurrence that may well prevail in the face of untreated or sub optimally treated bone and muscle underpinnings, even though surgery is the current treatment choice for dealing with an acute hip fracture, is associated with excess mortality as well as morbidity rates, with low numbers attaining the ability to walk independently. Although the pattern here though is unpredictable in that additional research reveals same side second hip fractures or opposite side fractures involving the same or differing bone sites, speak to similar underlying causative factors, such as muscle weakness or poor bone health that impacts surgical recovery potential as well as repair methods. For example, in the study conducted by Shroder *et al*. [24] only 8 percent of second hip fractures occurred on the same side as the orginal fracture, while 92 percent occurred on the opposite side, suggesting factors other than surgery may be implicated. Other data show differences in hip fracture location, and often contralateral fractures of the same type within 3.3 years (range 5 days-14 years); although 20 percent suffered a subsequent fracture within one year following the initial fracture. Yamanashi *et al*. [25] who followed 714 hip fracture cases found a second fracture, if it occurred, took place in general within eight months of the initial fracture, and was generally of the same type.

According to Nymark *et al*. [26] if it occurred, the time frame from a first to a second hip fracture was highest within the first 12 months following a first hip fracture, implying a narrow window of preventive opportunity and one strongly indicated [26. 27]. However, the high recurrent fracture rate occurring in the second year thereafter, suggests long term vigilance is crucial, possibly for up to five years after the initial injury [27-29].

However, to date, despite the implementation of many community wide falls risk intervention programs in recent years, as well as the administration of bone mass building anti-osteoporisis medications, no strategy to date has proved widely successful in any sphere in averting either a first or recurrent hip fracture. Because the data span many decades and we only previously surveyed a possible role for physical activity in the hip fracture disability cycle as of 2010, and that this approach presented some aspect of promise in this regard, we specifically sought to ascertain if indeed this is an area of current as well as future promise, and if so, what is its possible value for averting hip fractures, or for fostering or restoring functional recovery post-hip fracture surgery.

The topic of second hip fractures that may involve a fracture recurrence or 'new' fracture and their known determinants were specifically sought, including past as well as current trends or potential intervention and prevention insights. We were interested as to examine whether these 'additional' fractures that may account for up to 15% of all hip fractures and commonly induce immense suffering for many are potentially preventable to some degree, for example if efforts to mitigate bone density losses are forthcoming sooner rather than later [30, 31].

Aim

We currently aimed to examine possible trends in hip fracture occurrences both primary and secondary as of 2026 and to uncover possible modifiable attributes, such as inactivity.

Question

Can early life physical activity participation have a bearing on late life hip fracture occurrences and recurrences?

Hypothesis

Muscle factors such as regular bouts of moderate exercise or activity participation are beneficial to aging adults with and without a falls or hip fracture history in multiple interactive ways.

Implications

Costs of care for aging adults, especially hip fracture sufferers continue to raise, despite years of research and reliance of pharmacologic and surgical intervention strategies to limit its many disability impacts. Indeed, the aforementioned likelihood of an increase, rather than a universal decrease in global hip fracture prevalence rates, along with their immense social, physical, and economic costs endorses the idea that continued vigilance plus the implementation of effective preventive strategies against hip fracture are essential.

Below we try to address these guiding themes and specifically the importance of physical activity participation through a qualitative oriented overview.

Rationale

Many factors may be involved in the pathogenesis of hip fractures, of which one, namely physical activity, defined as "any bodily movement produced by skeletal muscles that results in energy expenditure" may be key to reducing the risk of falls and premature bone density losses that lead to osteoporotic hip fracture. At the same time, sedentary lifestyles are rising rapidly across the lifespan, and their presence may have a strong bearing on late life health status and risk of injuries such as hip fractures and this state may thus be of paramount importance to effectively mitigate [18].

Methods

We began the above exploratory project goals by seeking and exploring pertinent full length published studies in the English language detailing primary and recurrent or secondary hip fractures and their epidemiology and impacts as housed primarily in the **PUBMED, GOOGLE SCHOLAR,** plus **PubMed Central** data bases over the time periods January 1 1970-June 15 2026, and employing the key words: '*Hip fracture(s)*', '*Older adults*', '*Muscle*', '*Physical Activity*', '*Recurrent/Second Hip Fractures*'. Summarized were selected findings we believed to be insightful as regards first and second hip fractures and their ramifications and determinants or well founded parallel studies related to this topic area so as to discern trends and imperatives in this regard. Mitigation efforts offered in the context of first and second hip fractures were specifically sought in the desire to conceptualize how to effectively reduce the immense hip fracture burden and its projected increase in incidence and prevalence in the near future. Those articles listed, but failing to discuss first or recurrent/second hip fractures or in the older adult (> 65 years of age), as well as those discussing fractures in the context of specific diseases, new or refractures of other joint sites, cancer related or peri-prosthetic fractures, were excluded. Gender and actual high age and body mass features or ethnicity issues were surveyed only superficially, as we sought consensus on a modifiable factor, rather than non modifiable traits. No specific hip fracture sub groupings or post surgery rehabilitation efforts were reported on. However, we are aware these may elicit differential findings given the possibility of etiologic differences in the two key hip fracture types, intracapsular hip fractures being related to bone mineral density and extracapsular hip fractures to older age and falls, in addition to the possible influence of gender, health status and/or race among other factors.

Key observations

Among the many studies published to date in the reviewed data bases on the topic of secondary as well as incident hip fractures, despite over 2423 postings since 1974 with 126 articles listed since 1997 on PUBMED], it is clear these as a whole do not allow for any universal or optimally relevant conclusion as regards their prevention. Many, however, agree this is an immensely important health condition to mitigate wherever it occurs even if variations in hip fracture incidence rates prevail. Most also agree upon the most salient risk factors for first and second hip fractures wherever they are occur, other than age, such as bone mass declines [32].

However, most, while affirming the hip fracture is a highly disabling condition, with several modifiable underpinnings such as those affecting the hip and leg muscles, commonly fail to place any emphasis on their prevention, other than via pharmacologic efforts to build bone [eg., 31]. That is, currently, even if a fair number of modifiable risk factors have been identified and that could be addressed successfully in principal without medication or invasive reliance, it is striking that most hip fracture reports discuss surgical repair as the treatment strategy of preference and advocate possible best practices for doing this, but do not stress other options. This approach however, may prove suboptimal in averting hip fracture prevalence as well as surgical outcomes in our view, especially secondary fractures of the same hip joint or that of the opposite side as discussed for more than 60 years [32]. This includes a persistent senile osteoporotic state, and related ongoing systemic weakening of the skeletal system as well as falls and recurrent falls [33, 34], especially among those using psychotropic drugs [25, 27, 28], those who are frail or obese, or have a cardiovascular conditions that encourage inactivity [19, 28, 35]. As well, those with a chronic disease history, including dizziness, impaired depth perception and mobility, bone and muscle density losses plus any cognitive impairment, gait impairments and signs of instability when walking, a falls history and fair self-[as opposed to robust perceived health status, and respiratory disease may be at risk [35-37].

As a result, some who have studied this realm of complexity have suggested more emphasis be placed on early community based falls and fracture prevention programmatic efforts to reduce hip fracture risk, plus ongoing support for extended time periods post surgery to allow for optimal post hip fracture rehabilitation outcomes [38-40], especially for those who have not received pharmaceutical bone building or muscle oriented treatments pre injury [41-43]. Bynum *et al*. [44] concluded secondary fracture prevention strategies that take a population perspective are indeed strongly indicated to avert the possible impact of a second hip fracture that accounts for an increasing proportion of hip fracture surgeries, more demand on shrinking health care resources, poor outcomes and excess mortality rates [30, 38]. As per Sheik *et al.* [45] it appears efforts to improve screening for older adults at risk for an acute hip fracture or a subsequent hip fracture may likewise prove helpful.

What is clear is that the disabling nature of the incident and second hip fracture may be difficult to avert in the event bone protection medication regimens or others have not been implemented in the past or in the context of the peri operative state to any degree [46, 47]. Indeed, of cases deemed to have sustained a fragility fracture, 12.4% were shown to have sustained a second hip fracture [48]. The predisposing factors in this regard were identified by several others as: being female, having a high bone fragility score, and a low physical capacity level. Vitamin D recommended for treating osteoporosis at safe levels was observed as having been implemented in only 24% of cases and 42% had ionized calcium levels below the reference range. The risk of death is higher after the second hip fracture [34], and may stem from the impacts of high age [cases who have a 6.57 fold increase in second hip fracture risk], neurological or comorbid health conditions [50], and the lack of adequate post-surgical anti-osteoporosis medication recommendations or similar approaches at any time prior to the index hip fracture incident.

Zidrou *et al*. [49] who confirmed a second hip fracture can indeed occur quite commonly among older adults who have already suffered an initial hip fracture, indicated the key determinants in this regard were indeed advanced age, as well as being female, living alone, being demented, having a chest and/or urinary tract infection, chronic heart failure, and peripheral vascular disease. Other determinants of debilitating second hip fractures are cardiovascular conditions and signs of dementia.

However, while high age adults who sustain a first hip fracture and often exhibit one or more hip fracture risk factors are at high risk of fracturing a secondary hip fracture on the same side or on the other hip or another hip site [50-52], preventive therapy is often not forthcoming or advocated [53] even though many risk factors for a second as well as primary hip fracture are similar and quite well and consistently documented. These include the persistent role of declines in bone mineral density, muscle size and density, and a possible lack of strategies other than anti osteoporosis interventions to meet these oftentimes progressive health challenges [54].

In addition, Ren *et al*. [61] who examined 19 studies showed several risk factors appear to underpin a secondary hip fracture including a reduced hip muscle density, as well as a reduced hip bone mineral density, plus definitive osteoporosis. In addition, signs of muscle degeneration, cognitive impairments, and calcium/vitamin D deficiencies were significant cross-cutting hip fracture risk factors. Among these factors, muscle morphology impairments, and calcium/vitamin D deficiency were deemed to be key, albeit possibly under- recognized or undertreated, even though possibly remediable. As such, it can be argued their collective impacts may well explain long-term post hip fracture/recurrent fracture mobility challenges, independence losses, and decreased post hip surgery survival times, poor functional outcomes, and a heightened premature post hip fracture mortality risk in one out of every ten hip fracture injuries in older adult populations [64].

In this regard, and in addition to more intense long term, rehabilitation, Tao *et al*. [77] propose that since the level of fall risk perception among elderly hip fracture patients may only be moderate, clinical nursing staff may need to incorporate intervention goals and plans as based on the patient's intrinsic perceptions. Also of import are possible case-specific health profiles, and stage based personalized care that take muscle degeneration and the need for adequate calcium and vitamin D into account [64].

In sum, after many decades of research, including multiple efforts to identify upstream risk factors for incident as well as second hip fracture injuries, these injuries remain sufficiently common and continue to cause sizeable percentages of older ambulatory adults, excess disability if they survive surgery [6, 55]. This finding is not spurious, but remarkably consistent across multiple venues housing the most advanced orthopedic facilities in multiple regions of the globe renowned for their advanced health care and surgical practices. What is apparent is that among the reasons examined to explain this possible incident as well as second hip fracture risk, is not the surgical processes per se or the associated pain or role of prosthetic infections/loosening requiring re-surgery, but the possible failure to provide comprehensive multi dimensional preventive care approaches pre as well as post-hip fracture surgery, along with efforts to maximize the patients' functional and nutrition status, along with their ability to understand the important role of their behaviors during the recovery process and beyond [6, 55, 56, 58, 77, 78].

As such, and among possible secondary preventive strategies at the time of the first hip fracture is intense rehabilitation [26] that appears warranted for periods of up to 12 months in the case of men and 19 months in the case of women. In this regard efforts to heighten activities of daily living, optimal nutrition and gait [78] are especially indicated among, other approaches as outlined in Table 1.

Table 1: Possible approaches that might be harnessed to foster the prevention of incident as well as subsequent hip fractures among older adults living in the context of a community setting.

POSSIBLE HIP FRACTURE MEDIATORS	POSSIBLE PREVENTIVE APPROACHES
Balance capacity	Foster balance/ambulation training
Bone mineral density attrition/fragility	Optimize bone health, prevent trauma
Cardiovascular disease history	Monitor cardiac status periodically
Cognitive status	Foster self- and coping efficacy, personal agency
Dietary factors	Assess, provide access to desirable nutritional foods
Falls history/risk profile	Vigilance, education, control comorbid illnesses
Fear, depression	Counseling
Health status	Foster stress control, mobilize social support
Medication usage/polypharmacology	Careful medication usage
Muscle degenerating/fat infiltration	Exercise, muscle stimulation
Lifestyle	Avoid alcohol, unsafe outdoor/indoor activities
*Overall weakness/mobility losses	Muscle strengthening/weight bearing exercises
Post operative sarcopenua	Monitor, intervene accordin;gy
Relative cortisol insufficiency	Stress management
Vision status	Eyewear reviews/referrals/lighting attributes
Vitamin D status	Assure safe levels
Sleep challenges	Avoid sleep/hypnotic medications, naps
Smoking	Encourage non smoking
Poor understandings of risks/solutions	Health education
Weight status	Avoid excess/suboptimal weight
Zinc status	Ensure especially post opertatively

* Weak muscles may decrease the force required to fracture a hip + may imply a slower than normal reflex response and less protection of the underlying bone. Adapted from: [8, 12, 27, 36, 53, 56-60, 64, 78, 80, 82-84, 86, 87, 91-94]

In addition to annual health reviews, older adults might undergo bone density assessments, and be evaluated periodically for any excess falls or possible fracture risk, progressive muscle mass and strength declines. They might also be monitored for any regression in health status, especially if the older adult is undernourished, and of low body weight, and receiving drugs to counter depression or sleep challenges [20]. Despite gaps in the literature, it appears that where applicable, the 'at risk' older adult should also be strongly encouraged to avoid tobacco or excess alcohol usage, and to engage in regular exercise and recommended fall prevention programs, regardless of extent of probable falls risk [20]. In addition, referrals to endocrinologists or other osteoporosis specialists should be advanced, as well as orthopedic therapists, if warranted.

In the interim, it appears timely persistent primary prevention efforts are potentially the most important tools in efforts to minimize the overall burden of hip fractures among older members of society, and especially their oftentimes devastating impacts and need to return to surgery within one year, as well as possible recurrent or subsequent hip fracture occurrences [61-67, 89]. To this end, in addition to more widespread falls prevention programs, prompt emergency, surgery, and comprehensive post operative care, including prevention approaches delivered both at the bedside as well as the home or community are indicated now more than ever, especially among the frail or pre frail [68], prior fallers, and older underweight tall women [89, 90].

Selected attributes of muscle that might require special attention include but are not limited to:

- Muscle atrophy
- Muscle density declines
- Muscle degeneration
- Muscle endurance
- Muscle inflammation and pain
- Muscle responsiveness
- Muscle strength
- Muscle strength asymmetries

Discussion

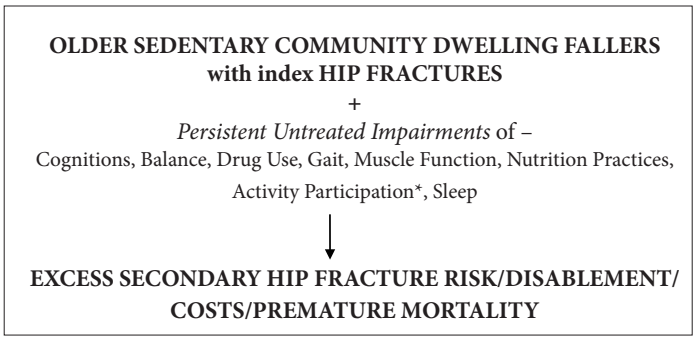
Although the topic of hip fracture injuries among the older adult population has been studied for several decades in an effort to prevent these oftentimes devastating injuries, a fair percentage of current reports indicate this condition remains a highly prevalent one, as well as a severely debilitating one, if indeed the older adult survives surgery. Especially problematic are multiple negative post operative health outcomes including the risk of secondary hip fractures. However, even if hip fractures as a whole are the most costly forms of fracture occurrences [79], very little progress in averting their incidence prevails. Well designed targeted primary, tertiary as well as secondary preventive efforts are however, likely to offset the risk of an older adult incurring this unwanted debilitating injury and its attendant immense social and personal costs [79].

The possibilities are quite numerous here in our view as conceptualized in Table 1. For example, those older adults with multiple co existing health conditions who appear at greater risk for long term disability in the face of one or more hip fractures may benefit from a protective health promotion program starting in early adulthood as well as comprehensive falls prevention efforts. Moreover, loneliness and depression determinants can be treated as indicated, as can malnutrition, frailty, bone fragility, sleep disturbances, and cognitive challenges that can underpin first as well as second hip fractures. Indeed, as discussed above, several current studies have shown older adults with fractures may also present with medical comorbidities such as diabetes, stroke, and hypertension that warrant control where present> As well, those with weakened muscular and bone systems should not go untreated or be ignored [67, 68, 72]. Here, participating regularly in weight beating physical activities may hold the key here to preventing chronic disease flares, as well as fall injuries attributable to poor motor control.

Alternately, it seems safe to say global trends in hip fracture prevalence will persist or worsen unless the need for widespread insightful preventive and intervention approaches is recognized in a timely manner, regardless of country of origin. At present, the available data indicate little change over documented second hip fracture occurrences and their severity, although these vary from eight to fifteen percentage points over time, they may occur more readily in high age adults whose population is rapidly rising. In particular, waiting too long is likely to be harmful to many, because almost all reports are largely in agreement that mortality rates are increased in the presence of a second hip fracture, regardless of fracture site. In addition the role of malnutrition, social isolation factors, pain, and possible multiple cognitive, alongside muscle and bone mass is rarely discussed in the context of those factors potentially amenable to alteration, regardless of fracture type.

Indeed, there are several frequently observed and reported factors impacting hip fracture epidemiological trends, including poor health status, poor vision, muscle weakness, stress, and falls injuries, with almost all being somewhat preventable or modifiable [69, 80]. As well, the impact of psychotropic drug usage, and its reduction may prove of further benefit in multiple ways. In this respect, recent data have indicated those older adults who are deemed fragile should be closely monitored post surgery to counter a high risk of incurring subtrochanteric or related site hip fracture [64, 66, 70], that can occur within five years [71]. As well, ensuring their homes are safe and bone building resources are forthcoming appears strongly indicated as well [10] alongside routine muscle assessments [72]. Limiting excessive drug use and monitoring postoperative cortisol levels is also of potential salience to avert any possible adverse albeit modifiable outcome [80] [See Figure 1].

Figure 1: Schematic representation of possible interlocking cascading adverse effects of poorly treated falls-related hip fractures on secondary hip fracture risk and burden among vulnerable older community dwelling older adults.



Extracted from sources 20-25, 50, 85, 87, 88, 92-94, 95, 98

Notea:

*Adults who do not pursue adequate levels of physical activity participation across the lifespan may negatively influence: 1) bone and muscle structure; 2) balance capacity; 3) muscle emchanis, and the effectiveness of protective reflexes; 4) the ability to walk and effectively attenuate impact at the hip joint; 5) general mobility 6) the **proclivity to falls and falling mechanisms** [18, 36].

Based on the Global Health Burden 2021 study, more than 90% of the age-standardized hip fracture incidence, prevalence, and years-lived-with-disability rates in older adults were attributable to **falls.

***Pharmacologic treatments do not protect against second hip fracture occurrences [101]

***Figure 2**: Possible hip fracture preventive benefits of weight bearing physical activity participation to counter inactivity and falls risks*

Source: Author; [18]

In the broader context, in light of projected upward epidemiological trends in the future, fall-related hip fractures may continue to lead to an even more severe disease burden [8], pending the absence of timely continued vigilance in encouraging physical activity is the realms of healthy aging and across primary, secondary and tertiary falls and bone fragility prevention efforts. The additional attribute of paramount importance in the context of averting an immense unwanted health burden and low life quality in later years, namely the potential influence of physical activity on cognitions as well as motor control and balance mechanisms should not be ignored [73-75]. Alternately, because the presence of muscle density declines along with muscle weakness can inadvertently diminish coverage as well as protection of the underlying bone if compromised, suboptimal related attempts to offset hip fractures that fail to include efforts to overcome inactivity tendencies at any stage may fail to offset possible injurious falls and fragility fractures as envisioned in Figure 2 [32, 84, 92-94].

In particular, a sole reliance on passive strategies to avert hip fractures may have little to no benefit on either the prevention of one or more hip fractures as well as falls [81]. For example, if the older adult is deemed a recurrent faller due to dementia [89], suffers from malnourishment [94], has obvious muscle strength asymmetries of the lower leg, is depressed or anxious and consistently exposed to polyphamacology [82, 93], or suffers from untreated osteoporosis [76] or cardiovascular disease [73]. In addition, the failure to institute timely rehabilitation post hip fracture surgery, especially in cases exhibiting a sedentary behavior and sarcopenia history, pain, poor balance and proprioception, changes in muscle density may hasten the onset and perpetuation of a state of recurrent falls. In turn, this scenario may 'open the door' towards advancing secondary hip fracture occurrences, and a life of great suffering among non frail as well as frail vulnerable high age adults [65, 73, 91-93, 100].

On the other hand, in addition to heightened geriatric care, much needed efforts to minimize the multiple possible burgeoning hip fracture societal costs, public health organizations and personnel can potentially help enormously in our estimation. For example to counter inactivity, local municipalities can help by sponsoring safe forms of physical activity participation, safe recreation spaces, community oriented walking Tai Chi, and aquatic exercise programs, that aim to promote muscle strength, regardless of health status and to do this through moderate rather than high activity impactful exercises [85-88, 97, 102]. Older adults at risk for frailty, who may seek to avoid exercising due to pain and falls fears, and those admitted to and operated on in a hospital setting and exhibiting vitamin D and calcium deficiencies, who use walking aids should be targeted comprehensively as well [75, 76, 84, 86, 96, 99, 100, 101]. Also advocated as key post hip fracture surgery outcome mediators, concerted efforts to ensure optimization of bone health, prevention of falls, nutritional supplementation as indicated, and a comprehensive rehabilitation program aimed at achieving optimal functional outcomes, goal setting for recovery and counseling and education of the older adult and family are imperative [86].

Indeed, pending the more universal adoption and implementation of these aforementioned ideas, we predict no far reaching changes in hip fracture prevalence and suffering for years to come and thus marked demands for nursing home and hospital care and immeasurable medical and human costs.

By contrast, concerted efforts to offer comprehensive screening opportunities that can examine lifestyle factors, along with the presence of muscle-related deficits among vulnerable adults as they age, including muscle strength and responsiveness, proprioception, joint range of motion, and balance capacity are likely to minimize most modifiable hip fracture risk factors or prevent these, including excess comorbidity, obesity, poor muscle sensibility and force generating and balance capacity.

Summary and key conclusions

Despite the limitations of this report, we believe this overview spanning a 50 year+ time period supports the view that surgery alone for repairing an index hip fracture among older adults, is often necessary, but not sufficient to offset future excess debility and mortality rates attributable to subsequent fractures found to occur in sizeable numbers of cases.

In this regard and in line with the expressed consensus on the gravity of incurring a hip fracture by many, if not all researchers, we conclude:

1. This situation may yet be compounded as adults live to higher ages, but with high levels of associated chronic health challenges, both physical and emotional, as well as frailty.
2. Until more research prevails, along with routine screenings to identify modifiable hip fracture risk factors, such as progressive bone density and muscle mass losses, followed by concerted multi pronged carefully construed personalized action-oriented preventive efforts, it will be challenging to obviate hip fracture risk rates and extent to any degree.
3. Carefully construed long term post index fracture targeted muscle, gait, and balance control, will prove valuable in averting secondary hip fractures, as well as excess hip fracture disability.
4. High risk older adults living alone in the community, especially those with multiple chronic diseases and/or a low bone, muscle, and body mass, plus those with and without cognitive challenges who are frail and inactive or using psychotropic drugs should be specifically targeted.

To achieve success, however, it appears safe to conclude, many ideas about hip fractures may need to be modified, expanded, or upgraded to align with what we know and what is needed and why and how to best proceed or what to avoid. Here, no shortage of data implying a favourable role for regular physical activity participation conceivably offers a highly beneficial preventive hip fracture mitigating effect and preventive path at all stages of aging and occurrences consistent with the documented role of multiple muscle and bone attrition related changes that may fail to avert falls injuries in this regard. In particular, role for the impact of age related muscle spindle sense changes, usually essential for safe efficient gait and postural maintenance, and its link to the risk of falling among older adults warrants more dedicated attention in the hip fracture disability cycle, along with the recently observed potential of exercise to mediate muscle reinnervation, and possibly thereby, preserving muscle structure and function in elderly people [103, 104].

Closing remarks

Among the many related remediable hip fracture risk factors, low physical activity levels appear especially important to counteract. By contrast, encouraging physical activity participation, especially modest weight-bearing activities it may be possible to reduce the prevalence and excess disability of hip fractures occurrences markedly and effectively across the spectrum of aging, as well as among 'high risk' and/or actual hip fracture populations, no matter where they reside.

Indeed, it is increasingly apparent that efforts to promote physical activity across the lifespan, in addition to the identification and remediation of adults with deficient muscle function and bone mass is likely to be of paramount importance in continuing efforts to effectively reduce hip fractures incidence rates and their enormous fiscal costs, while helping many aging adults to attain a high rate of self-care, independence, and successful aging, rather than despair and suffering.

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