IJCIM
International Journal of Complementary and Internal Medicine

RESEARCH ARTICLE

# Type 2 Diabetes and Hip Fracture Risk and Disability: Is More Physical Activity Participation Indicated or Not?

**Ray Marks**
OARC Clinical Research and Education Director, Ontario

**Corresponding Author:** Dr. Ray Marks, OARC Clinical Research and Education Director, Ontario L3T 5H3, Canada.
E-mail: doctorraymarks75@gmail.com

**Received:** August 29, 2026 **Published:** September 14, 2026

**Citation**: Marks R. Frailty, Type 2 Diabetes and Hip Fracture Risk and Disability: Is More Physical Activity Participation Indicated or Not?. Int J Complement Intern Med. 2026;7(1):535–546. DOI: 10.58349/IJCIM.1.7.2026.00174



## Abstract

Type 2 diabetes, a predominantly adult form of this disabling health condition, is one that appears increasingly present among many older adults, who are also at high risk for falls and osteoporotic as well as non-osteoporotic disabling or life threatening primary as well as secondary fractures. This article summarizes pertinent findings regarding a role for physical activity in this regard and with respect to fractures that prevail at the hip joint. We conclude moderate lifelong physical activity participation holds promise as one of several lifestyle factors that can possibly reduce type 2 diabetes risk and severity, as well as falls and hip fracture risks. Public health messaging and opportunities to counter the sedentary, passive lifestyles of many, should prove helpful in multiple tangible respects.

**Keywords:** Falls, Hip Fractures, Physical Activity, Older adults, Prevention, Type 2 Diabetes

## Background

Pre diabetes and the onset of Type 2 diabetes/mellitus, conditions highly impervious to sublimation, arrest, or reversal, are increasingly observed to affect high numbers of aging adults especially in societies that follow Western lifestyles, of which sedentary behaviors and high sugar intakes are rife. This situation remains problematic given that type 2 diabetes in its own right, is a well established prominent cause of premature and excessive morbidity, as well as mortality among a sizeable percentage of the aging population.[1,2] This may be because the condition commonly affects multiple organs and body systems of the older adult, and may do so more profoundly at the higher ages, as opposed to type 1 genetic or autoimmune diabetes that may be longstanding and less impacted by the added disadvantage of age, and possible overall declines in multiple body systems.

In addition to adversely impacting the systemic wellbeing of an older adult, the costs of the disease may be heightened by its impact on falls risk and bone fractures often unanticipated injuries that may arise among the frail as well as the obese. Its specific impact on hip fracture risk and severity, and the subsequent possible adverse influence of a hip fracture injury on diabetes status alone must surely represent an unwanted costly public health burden that requires urgent timely primary as well as secondary preventive efforts as outlined by many.[3-8]

This brief summarizes what has emerged in this regard as far as the topic of hip fractures is concerned and whether there is any magnified cause for concern in the case of the older type 2 diabetic who may be more inactive than not for various modifiable reasons. For example, as far as being fearful of falls, or increasing the risk of hypoglycemia in the case of an insulin dependent adult in the face of excess exercise.[3] Older adults and others who have already experienced multiple fractures are also at increased risk for diabetes, possibly due to their diminished physical abilities.[9] Based on the most recent data in the literature, here we specifically strove to examine hip fractures and their relationship to type 2 diabetes. In particular, why they are of import, who is affected, what are some reasons for their persistence, and what are potential prevention strategies that can offset hip fracture prevalence and severity among the older adult type 2 diabetes population.

This effort was undertaken given the immense numbers of hip fracture cases we have encountered in a high quality setting where income is not a factor, but where survivors rarely returned to their former lives. Rather, they consistently incurred further often progressive health challenges, including secondary hip fractures and worsening health including the onset of hip joint osteoarthritis requiring surgery. Many had been quite weak for prolonged periods post hip fracture surgery even in terms of their muscle strength of unaffected hip joint sites, and a sizeable number who survived surgery did not improve their walking or balance ability to any meaningful degree, a possible indicator of their poor pre injury status. We also sought to examine if more attention is needed here as far as physical wellbeing influences go, rather than glycemic control issues alone. Given the rise of the disease in previously healthy young adults[6] we hypothesized that older adults with type 2 diabetes who remain at higher risk for falls including non-injurious skeletal falls[10] would continue to incur hip fractures at a rate greater than those who remain disease free, especially if insulin dependent, and despite an immense data base and many medical advancements that have accrued.[10] Moreover, with few signs that type 2 diabetes correlates are being addressed in primary care, we anticipated researchers would continue to observe cases with type 2 diabetes to exhibit poorer health outcomes even in the face of advanced hip fracture repair surgical solutions, especially when differentiated by physical fitness measures and attributes. Moreover, this adverse series of events would persist as of 2026 despite a well articulated prior need for more vigilance against this debilitating health condition that was raised previously by us and many others.[11-13] and an obvious role for non medical insights into diabetes type 2 prevention and intervention that continues to be overwhelmed and largely overshadowed by medically-oriented uni-dimensional interventions rather than not.

Indeed, on this regard**,** hip fractures, an important costly health concern in aging populations, and one that commonly leads to disabling hip osteoarthritis, functional disability, and/or premature death can be induced in the presence of chromic type 2 diabetes. In our view therefore, at least some hip fractures and their consequences may not be inevitable among aging adults but can be mitigated or arrested by addressing the dual underlying determinants of one or both of these conditions.

In this regard, the present mini review revisits and examines pertinent literature sources published in the peer reviewed English language between 1980 and August 2026 concerning hip fractures, type 2 diabetes associations and physical activity. The aim was to highlight potential intervention points to offset the risk of incurring a hip fracture and its attendant disability in the presence of type 2 diabetes as observed in the older adult population.

The specific questions of current interest addressed herein were:

- Is there a consistent relationship between the presence of a type 2 diabetes diagnosis and the risk of incurring a hip fracture in later life?

- Is physical inactivity a risk factor for hip fractures as well as type 2 diabetics and can this information be beneficial if applied clinically?

We have not focused on the many other potentially remediable underpinnings of type 2 diabetes or hip fracture incidence here, such as the presence of lifelong excess body weight and muscle fat infiltration, but assumed the diabetic condition disease manifests in part, due to early or persistent limited bouts of regular physical activity participation.

## Methods and Procedures

Data sources sought were those that might provide topical information and interrelated data on type 2 diabetes origins, type 2 diabetes and hip fractures, the possible causes of hip fractures in general, as well as among type 2 older diabetics, and the implications of this specific health condition for preventing hip fracture occurrences and severity. Data sources used were those published in the English language and covering the years 1980-2026, and located in PubMed, Academic Search Complete, Google Scholar, PubMed Central, and Science Direct which yielded many articles when applying the key words *Hip Fractures, Type 2 Diabetes [Mellitus], Type 2 Diabetes, Physical Activity, Physical Inactivity*, as applied to older adults [> 65 years]. Due to the diversity of the literature and its lack of focus with the exception of anti-diabetic or bone building pharmacologic strategies, a meta-analysis of one or more preventive efforts to obviate type 2 diabetes in its own right or as a falls correlate that commonly predates hip fracture incidents was not possible. Rather, a narrative overview of the data as derived from clinical studies, and systematic reviews as to the causes, consequences, and possible control of the hip fracture risk in type 2 diabetics was conducted. We chose to focus on type 2 diabetes as many of its underpinnings appear preventable, rather than not, such as inactivity and its association with age related falls and fractures as well as type 2 diabetes bone attrition severity. Data on fractures in general were excluded, as were hip fracture surgical studies and all types of hip fracture were surveyed collectively. The focus was on physical activity rather than environmental determinants of hip fractures and type 2 diabetes and the term type 2 diabetes was used rather than type 2 diabetes mellitus, and which are analogous terms. The data were supplemented by the author's research base detailing the disability associated with selected hip fracture cases. All articles that dealt with these key topics were eligible for review, and relevant data were tabulated and analyzed qualitatively for any trends. Hip fractures were not classified according to sub groupings, but treated as a composite entity, as were gender and age range dimensions.

Rather than a composite overview, the current commentary centers on the overlapping factors of poor physical fitness or activity participation relative to the morbid health condition type 2 diabetes and osteoporosis and their possible underlying modifiable falls and fracture risk links, such as declines in muscle and bone mass that can ensue readily if ignored. The discourse is specifically limited to understanding these linkages among community dwelling older adults rather than young adults and does not examine these topics in venues such as nursing homes or the hospital post hip fracture surgery and its observed impacts on future sedentary behaviour adoption.

## Key Observations

***Type 2 diabetes***

Type 2 diabetes representing a growing diabetes sub-grouping and one often believed to be non-insulin dependent, is a chronic progressively destructive metabolic health condition affecting the ability of the individual to utilize glucose effectively, with dire health implications. A health condition that constitutes a burgeoning problem among the older adult population, it is one often increasingly traceable to behaviors adopted in early life in the West in particular, rather than genetics, or age, and a state that may be adopted in adult life even if they pursued early activity.

Although this finding alone seems to offer a ready-made preventive strategy, as indicated by 9844 related citations on this topic alone since 1983, as posted on **PUBMED** as of August 19, 2026, type 2 diabetes remains a potentially potent functional disabler of many older adults no matter where they reside, and remains a condition negatively influenced by physical inactivity.[14] This fact seems hard to accept, but clearly persists in spite of volumes of research and strong indications of a role for physical activity participation in preventing both diabetes type 2 as well as falls that lead to fractures, that are especially disabling if this results in a fractured hip.[15] Yet it seems, type 2 diabetes remains relatively impervious to mitigation or reversal or prevention in an era where many advanced pharmacologic methods remain the sole treatment option in this regard despite the urgency here to do something much more profound and far reaching.[2,15-18]

***Hip fractures***

For more than 50 years, ample research has shown hip fractures that commonly involve damage to one of three predominant local bone sites of the proximal thigh bone, tend to occur largely in older adult populations, where they may yet lead to premature death,

high rates of morbidity, independence losses, or reductions in life quality. In recent years, hip fractures have not only been identified as one of the most serious health care problems facing health policy makers and public health care organizations, but this form of unintentional injury remains highly problematic despite being the target of a voluminous amount of research that has extended for many many years alongside multiple public health endeavors and others to reduce its occurrence and/or severity. Yet, with the exception of a few regions where bone building treatments have been employed, the lifetime risk of incurring a hip fracture has not decreased sufficiently over the last few decades and high numbers of incident cases continue to prevail, despite a large body of knowledge and a variety of contemporary preventive and refined surgical approaches plus clear indications that those worse off, are older adults in poor health.

***Type 2 diabetes and its adverse mobility impacts***

In many respects, especially given its disabling impact on the sufferer incurred directly by a deficit in glucose control, the aging type 2 diabetes case may predictably experience serious progressive nerve damage and pain, blood vessel, and organ related damage, that commonly involve the eyes, kidneys, heart and other vital body structures such as bone and that may well converge additively and progressively to negatively influence mobility and thereby the risk of hip fractures.[19-28] As well as impacting the ability of the affected older adult to function painlessly, safely and independently, the condition may foster multiple adverse cognitive alterations that are often injurious in their own right, such as depression. A disease often linked to an exaggerated risk of falls and falls mediated injuries, as well as bone mass density abnormalities and fractures its remediation is unfortunately often delayed until it is 'too late' and even then is marred by ongoing deficient proprioception, vision impairments, hypoglycemia or hyperglycemia, frailty, signs of painful peripheral and centrally derived neuropathy, feelings of anxiety and distress, as well as fears of falling that engenders sedentary behaviors.[29-36]

Additionally, obesity often thought of a bone protective state can yet accompany or induce unwanted osteoporotic bone features in the case of a type 2 diabetes sufferer, as may possible entrenched sedentary behaviors, alcohol usage, malnutrition, certain medications, and smoking. In addition, although type 2 diabetes predictably proves to be a highly pertinent disabling determinant of poor health outcomes in general, as well as injurious falls, most treatment protocols continue to focus on the pharmacological, rather than on other modalities such as exercise.

Due possibly to erroneous beliefs of the idea prevention is better than cure as this applies to aging care in general, and despite an array of possible type 2 diabetes pathways that might be reversible and not inevitable, very little progress in the preventive realm to counter type 2 diabetes linked hip fracture occurrences has been forthcoming, and with no cure in sight, and remediation that is often suboptimal at best, many older adults continue to suffer a possible excess health cost and premature mortality at rates unchanged over literally decades. In addition, it is increasingly apparent the presence of a type 2 diabetic condition is often underestimated in its own right until it is severe rather than not, and especially as a highly probable hip fracture risk factor. Its role as a fracture determinant in particular, especially its falls related underpinnings are thus often undiagnosed, or ignored, even though falls may ensue readily in the type 2 diabetic as a result of declines in perception with respect to vision, proprioception and/or transient circulatory insufficiencies, impaired sensory integration or motor functioning, and the inability to counter unexpected perturbation. The same lack of due attention may prevail in the case of the older type 2 adult suffering from obesity and who may have osteoporosis, as well the frail type 2 diabetes adult case who may be more likely to experience worse outcomes if they fall on the hip when compared to disease free similar age adults as well as premature mortality, including all-cause mortality rate increases.[16-18]

Additional research reveals that older people with type 2 diabetes especially those with measureable muscle strength declines, postural dyscontrol, and functional impairments are likely to have up to a 2.5 fold increased risk of incurring a future injury, as well as having a higher fracture, impaired mobility and health-related functional risk,[20-22] plus ensuing bone related changes, such as accelerated bone mass losses or actual bone mineral density increases, as well as muscle mass declines.[22-25]

***Physical Activity***

Physical activity, vitally important for the health and well-being of all, is defined as any body movement that uses the muscles and requires the consumption of more calories than the consumption when the muscles are not moving. Some examples of common everyday physical activities are walking, jogging, biking, dancing, swimming, tennis, and gardening. Physical activity can also be carried out as part of one's recreational activities, work activities, and house chore activities, and does not have to be formally structured.

Exercise is however, a form of physical activity that is often adhered to more readily when structured.

Physical activity appears quite notable in this regard because ample research shows physical inactivity, or too little physical activity, is a leading risk factor for chronic diseases, such as type 2 diabetes, as well as for premature death and excess disability. In addition to being the key cause of many common diseases, people who partake in very little physical activity may also find it hard to regulate their weight, muscle mass needs and bone mass.

On the other hand, both adults and children who regularly participate in physical activity can potentially:

- Reduce the risk of incurring insulin resistance, high blood pressure, heart attacks, stroke, depression, anxiety, and the risk of falls and fracturing a hip;
- Improve their bone, muscle, and joint health, as well as their ability to function physically and cognitively.
- Increase their energy supply, and reduce fatigue, as well as excess weight, and body fat.
- Increase their chances of living longer.
- Lower health care costs and numbers of doctor visits.
- Promote their psychological well-being, sleep quality, and quality of life.
- Promote their self-esteem, stress control, body image, and general confidence.
- Improve their self-discipline, and socialization opportunities.
- Reduce the need for toxic or risky medications [Class notes 2020].

The lifelong pursuit of a physically active life also appears to help older adults maintain their mobility, physical functioning ability, bone mineral density levels, joint flexibility, muscle strength, mass, and balance and thereby reduces the risk of falls and fractures and a life of low quality and suffering among the elderly, especially those with sarcopenia of inactivity origin that can affect cognition.[75]

***Low Levels of Physical Activity and Hip Fractures***

Several studies over the past 40-50 years have supported the view that inactivity, which can foster muscle weakness and atrophy, increases the hip fracture risk of elderly people. Some of these studies found a low degree of physical activity participation doubled the risk of fracturing a hip. Similarly subjects who did not weight-bear regularly, or perform muscle loading activities such as climbing stairs, were all more than twice as likely to sustain a hip fracture, when compared with subjects at the higher end of the activity spectrum. These increases in risk tend to remain after adjusting for body mass index, smoking, alcohol consumption, and dependence in daily activities.[11, 38-42]

Low physical activity along with a vitamin D deficiency, which significantly increases hip fracture risk, may similarly reflect inadequate outdoor as well as indoor activity, possible severe fast twitch muscle fiber atrophy, a neuromuscular change that may weaken protection of the hip joint and raise the tendency of a type 2 diabetic towards sustaining a hip fracture as a result of a fall. Low physical activity levels, particularly the lack of optimal load-bearing activities and related muscle mass declines may be the most salient explanatory factors for the poor bone health increasingly seen in the type 2 and hip fracture cases in our increasingly sedentary societies.[42-45]

The importance of being a physically fit adult across the lifespan may likewise help secure an optimal ambulatory or mobility status for the type 2 at risk diabetic prone to falling, especially falling sideways on a vulnerable hip bone. Moreover, a lack of sufficient physical activity and its impact on aging declines in muscle strength may well decrease the force required to fracture a hip especially if its bone composition is compromised. As well, poor physical fitness may render a hip fracture occurrence more likely due to its impact on slowing the normal reflex response rate alongside possible bone demineralization and progressive attrition impacts.

Added to this cycle of adverse events, is a probable decline in balance control, gait speed, and, and possible worsening diabetic signs that raise the risk of hip fracture markedly among cases with a diabetes history compared to those without the disease,[15] even when controlled for by stratifying the data according to body mass index and in the face of tight glycemic control.[15,19,21] Outcomes after a hip fracture in the face of all its possible cumulative health correlates[16-30] and possible secondary lethal hip fractures risk[31] in those with a history of hypoglycemia or neuropathy[32] may also be traceable to one or more physical activity determinants, as well as muscle strength declines,[33,34] bone losses[8] and possible micro vascular neuropathic complications,[35] as well as an increased degree of muscle fat mass.[36,37]

Indeed, although the data stem from vastly differing samples or populations, research designs, questions, and themes they largely present a unified voice in advocate for more activity based strategies to counter the type 2 diabetes and hip fracture epidemics and costs, and to reduce the often negative vascular and bone health influences of excessively stringent or suboptimal glucose control efforts. In the interim it appears:

- A lack of lifelong physical activity is not only an immense public health problem nationwide, but a risk factor for several potentially preventable adult onset diseases such as type 2 diabetes[46] and one where reportedly, 27.5% of adults aged ≥50 years reported no physical activity outside of work in the United States.[46,47]

- Physical activity interventions may also foster cognitive health regardless of health status.

Investments to encourage improved physical fitness across the lifespan may also help avert diabetic neuropathic ramifications, including fracture risk and that may otherwise impair life quality and functional ability. By contrast older adults with an established type 2 diabetes diagnosis who refrain from physical activity are likely to be worse off at all stages of the disease as in rates and extent of recovery if they do fracture a hip[6] and have not been encouraged to overcome sedentary health practices, but to rely solely on glucose monitoring.[48] They may have to stay in hospital for longer periods than desired, and experience longer surgeries than those with no health condition. Insulin users are also more likely to be readmitted more regularly post hip fracture hospital discharge[49] as well as incurring high premature mortality rates, and hospital costs due to the frequent need for hospital readmissions, as well as basic care costs.[50,51]

Those with deficient bone quality profiles or subnormal body weights and a changing ratio of muscle mass to visceral fat[52] may be at an especially high risk, especially if painful diabetic foot ulcers preside.[53-55] Compounding this series of adverse events may be a parallel declining disease induced ability to not only enact rapid favorable reflexive shock absorbing neural responses on demand in any falls related situation, but poor impact control in those with low muscle mass. In our estimation muscle dysfunction, rather than bone attrition alone, is a key factor in mediating hip fracture risk in type 2 diabetic situations and may stem from

i. Low physical activity levels[14,56,57]
ii. Poor walking endurance[58]
iii. Muscle density declines[59]
iv. Muscle fat ratio is altered[43,52]
v. Muscle performance deficits[9]

Indeed, it appears regular participation in physical activity clearly has a strong cumulative bearing on multiple muscular determinants such as muscle strength that can impact falls risks significantly if unaddressed early. In addition, as per prior research among 51, 300 cases, moderate levels of activity, including walking is associated with a substantially lower risk of sustaining a hip fracture in women[39] and in men, especially those among those who routinely walk for longer rather than shorter distances.[41]

Repeated among multiple at risk populations this simple remedy could have far reaching favorable impacts at low or no cost for the aging adult at risk including a substantially lower hip fracture risk in general, plus their frequent post surgical complications, and extended hospital stays and heightened resource needs,[4] plus the risk of a secondary hip fracture or a fracture at a another site[61] alongside recurrent falls, and a possibly declining cognitive health status.[48]

Indeed, despite advances in glucose control approaches and community based falls prevention efforts these efforts may prove suboptimal in an inactive subject.

## Discussion

As outlined above, type 2 diabetes, a chronic health condition, and one increasing rapidly among the older populations is a group also at high risk for hip fractures, a major health concern and one where vulnerable older adults may not be receiving optimal protective care or are encountering a worsening of their situation. This is hard to fully comprehend given at least 80 years of related study, but one that has yielded little in the way of advancing outcome expectations or improvements, despite a plethora of documented or envisioned possible preventive options to offset their combined dire public health and personal implications. Because these intertwined problems seem pervasive, modifying their determinants appears essential.

Indeed, we believe quite forcefully that improvements in this realm of any degree would have immense current as well as future public health ramifications and may help to diminish untold human costs while reducing this projected dual health burden. We elected to examine the key intrinsic risk factors for incurring a hip fracture in the presence of type 2 diabetes, rather than age or

gender alone, plus the degree to which any additionally enumerated deterministic factors are likely to be strongly indicated, preventable, remediable, or reversible targets.

From our very extensive search we affirm that what emerges here, which is basically an unchanging landscape, is indeed one where despite a great need to reduce the older adult's falls risk and an immense hip fracture burden and great deal of suffering very few non medical preventive efforts here have been forthcoming. That is, multiple data analyses point to minimal reductions in hip fracture occurrences and severity over time, and especially premature mortality rates, and that the outcome here is less desirable in the presence of type 2 diabetes in general.[11,15,59-63]

However, there is no consensus here about what might be done, and no unique mode of prevention or intervention that appears to prevail to date. Nonetheless, it is increasingly apparent efforts to advance muscle optimization regardless of method seems of high promise, as does the parallel role of physical activity participation[64] and the degree to which rehabilitation is needed post hip fracture.[65]

Over time however, the link between type 2 diabetes and hip fractures that continues to prevail could rise markedly in the face of the increasing incidence and prevalence rates of both type 2 diabetes as well as falls injuries in high age populations and a life style that is often highly sedentary. In addition to causing much distress and disability, rehabilitation in these dual conditions, even if possible is slow, and often predictive of long-term costly institutional care, especially in the frail. Adding to the importance of preventing a single hip fracture, is the data showing hip fracture cases are commonly susceptible to multiple hip fractures and within a four-year period following an initial hip fracture, and more so in the presence of type 2 diabetes that may deteriorate health in its own right more markedly.

***Proposed countermeasures***

To counter these aforementioned unwanted health events, possible promising strategies include efforts to encourage physical activity, alongside glucose monitoring and weight control.[14,66]

In particular, opportunities for varied low or no cost enjoyable weight bearing albeit moderate impact activities, balance training and possible exposure to vitamin D at its source appear of high potential value whether the bones are already brittle or not.[67]

Linked to diabetes education interventions encouraging physical activity among newly diagnosed diabetic cases would likely be helpful in the long run as well in the context of both type 2 diabetes as well as falls and fracture prevention. Particularly indicated are efforts to discourage inactivity influences such as the prolonged use of smart phones. Exposure to positive media messages rather than those directed at elders that encourage passive behaviors and a negative outlook should be challenged as well, for example exercise advocated via machines applied to the adult foot in a seated position and those that encourage the use of stair lifts that may not protect against either physical or disease associated cognitive declines[64] and possible muscle attrition, bone erosion and a state of bone fragility and immense disablement.[68-70] Countering sedentary behaviors appears of high import in countering type 2 diabetes among community-dwelling middle-aged and older adults, as it is shown to be associated with sarcopenic obesity, a high ranking hip fracture determinant.[71]

In addition it appears those high age adults exhibiting limited physical endurance may need special encouragement, as may those with gait impairments and poor balance, neuropathic foot ulcers and pain, plus muscle structural and functional reductions. Embracing functional mobility strategies and limiting sitting time, as indicated, rather than the pursuit of passive behaviors and strategies alone is also strongly advised.[69,72]

Moreover, overweight individuals who would be expected to have a relatively higher proportion of body fat than average to dissipate a fall should receive counseling, even if their bone mass is within normal limits, particularly in those treated with insulin or presenting with a high degrees of insulin resistance, sarcopenic diabetes, bone mass abnormalities, and/or weakened arm and leg muscles.

Encouraging safe day to day mildly impactful activities rather than high impact fatiguing activities is also especially recommended for those exhibiting one or more type 2 diabetes emergent manifestations as outlined below

**Figure 1**. Factors exacerbating type 2 diabetes and hip fracture risk.

| |
|---|
| Adverse neurological profiles |
| Cardiovascular compromises |
| Bone fragility/frailty[67] |
| Defective gait/balance |
| Depression[64] |
| Dizziness/confusion |
| Emotional distress |
| Falls |
| Falls fears |
| Mental health deficits |
| Muscle weakness/atrophy/sarcopenia |
| Musculoskeletal/neuropathic pain[20] |
| Polypharmacology usage |
| **SEDENTARY** inactive lifestyles[14,57,64,69,71,73*] |

*According to a 2016 study among U.S. adults 50 years old and older. As of 2014 it was reported:

- 28% were physically inactive.
- Inactivity was 30% higher among those with a chronic disease[47]

In the meantime, although negative studies that do not align may not be published, we perceived almost all the studies we have encountered and that focus on physical activity as a health determinant appear to conclude a favorable protective role for this if applied moderately rather than forcefully with regard to hip fractures as well as type 2 diabetes mitigation and favor its day to day adoption sooner rather than later. Moreover, this association is strong and consistent in general and applies not only to its influence in childhood, but increasingly to young adults and aging populations, including those with chronic diseases, in spite of the obvious very great differences in these populations. Indeed, when compared to other counter measures or failure to act, one group has implied[40] being physically active seems to reduce the risk of incurring a later life hip fracture by up to 50% and this benefit alone may increase further if diabetes type 2 and/or its cardiometabolic manifestations are similarly avoided or prevented.[73]

This approach is promising because it appears it can be applied universally quite consistently and does not have to entail or depend on formal exercise, but its effects can ensue even as a result of carrying out daily chores, activities such as climbing stairs exercise,[70] as well as a life of poor quality, dependence and declining health and socially motivated and walking and even efforts to reduce sitting or screen time.

Additionally, this approach may well help to avert an injurious fall in the face of sarcopenic muscle mass declines, sensory impairments, bone losses, among other intrinsically generated factors such as poor reaction time that may be accelerated adversely in cases suffering from type 2 diabetes who feel dizzy or confused who do not exercise,[70] as well as a life of poor quality, dependence and declining health and socially motivated interactions.

## Key conclusions

Despite the limitations of this report, we feel confident in concluding aging adults with type 2 diabetes may be at high risk for a single or secondary hip fracture especially if inactive. In particular, it appears the decline in muscle function and balance as well as gait that arise with aging will likely be exaggerated in the presence of uncontrolled diabetes and any unwanted injurious falls event.

We further conclude that since the parameters that may play the largest role in this regard are likely to include a combination of muscle strength declines, muscle composition alterations, poor muscle coordination and endurance that can stem from a sedentary lifestyle rather than age alone, inactivity is a potent type 2 diabetes as

well as hip fracture risk determinant.

Moreover, this idea leads us to believe that to combat their rising incidence, hip fracture researchers and others can:

- Possibly advance this field by showing how type 2 diabetes and hip fractures can be influenced markedly by human behaviors, such as inactivity.
- Narrow down the above exploration according to age category, socio economic status, health literacy extent, and gender.
- Examine the degree of support for a combination of low impact enjoyable practical activities such as yoga and walking in nature as routine preventive as well as treatment practices for countering falls risk and hip fractures, especially in type 2 diabetes contexts.
- Be encouraged to examine the role of physical fitness in allaying, arresting, obviating or reversing an otherwise negative type 2 diabetes diagnosis, plus its impact on falls and the hip fracture risk cycle.

Until then, modifiable deterministic factors and others should be minimized accordingly and pro actively and the role played by factors other than blood glucose levels such as activity participation should not escape attention.

In particular, empowering all citizens, including youth to engage in lifelong daily or regular physical exercise, appears essential to prevent or avert a life of immense late life suffering and at risk cases should receive regular screening[73-76] whether obese or not. Those cases found to suffer with high bouts of neuropathic pain or vascular impairments, poor balance and gait, muscle and bone mass losses, and/or heightened feelings of stress and anxiety and persistent hypo or hyperglycemia will likely warrant special attention for some time to come and should not be ignored.[75,76]

In this regard, efforts by providers towards combating the adoption of excess sedentary behaviors inadvertently appears vital in efforts to help the older diabetes sufferer who has sustained a hip fracture to offset possible post operative complications and a life of relentless suffering and diminishing function among survivors. In particular, long term, insightful, personalized, modest low impact non-fatiguing activity oriented approaches rather than generic, intense, or passive approaches appear increasingly indicated and should be duly supported and strongly encouraged.

Composite anticipated benefits of fostering physical activity as a key tertiary as well as primary type 2 diabetes–hip fracture prevention strategy that may lower their collective social burden include:

- ✓ Improved weight/glucose control status.
- ✓ Reductions in cardiovascular disease manifestations.
- ✓ Reduced secondary fractures and overall falls risks.
- ✓ **More favorable bone, muscle mass, strength, and endurance status.**
- ✓ Better mental health, stress control, and cognitive function.
- ✓ Decreased drug dependency.
- ✓ Heightened functional ability to carry out daily self-care and desired activities.
- ✓ Increased longevity and life quality.

In essence, it appears beyond dispute that a sizeable number of hip fracture injuries among older adults stem from associated declines in active living that occurs readily in today's' societies and that have enormous late life ramifications in most elderly populations due to the interaction of multiple intrinsic factors, especially in the presence of diverse type 2 diabetes associations, sarcopenia and bone fragility, or as a result of tripping or a slip incident that is not counteracted readily in this specific elderly population and in itself may promote intractable sedentary behaviors.

## Acknowledgement

None

## Funding

None

## Competing Interests

Author has declared that no competing interests exist.

## References

1. Ahmad E, Lim S, Lamptey R, et al. Type 2 diabetes. The Lancet. 2022;400(10365):1803-1820.
2. Linares PA, Shenoy R, Kwarteng MA, et al. Country-specific burden of type 2 diabetes mellitus in the Caribbean, 1990-2023: insights from the global burden of disease study. Diabetes Res Clin Pract. 2026;239:113482.
3. Hidayat K, Fang QL, Shi BM, et al. Influence of glycemic control and hypoglycemia on the risk of fracture in patients with diabetes mellitus: a systematic review and meta-analysis of observational studies. Osteoporos Int. 2021;32(9):1693-1704.
4. Cortes-Sancho R, Perez-Castrillon JL, Martin-Escudero JC, et al. Type 2 diabetes mellitus as a risk factor for hip fracture. J Am Geriatr Soc. 2004;52(10):1778-1779.

5. Nicodemus KK, Folsom AR. Type 1 and type 2 diabetes and incident hip fractures in postmenopausal women. Diabetes Care. 2001;24(7):1192-1197.
6. Janghorbani M, Feskanich D, Willett WC, et al. Prospective study of diabetes and risk of hip fracture: the Nurses' Health Study. Diabetes Care. 2006;29(7):1573-1578.
7. Zou X, Chandran M, Xiong X, et al. Type 2 diabetes is associated with increased complications and mortality after hip fracture in older adults aged 60 years or older. Diabetes Obes Metab. 2026;28(9):8084-8093.
8. Mohsin S, Kaimala S, Sunny JJ, Adeghate E, et al. Type 2 Diabetes mellitus increases the risk to hip fracture in postmenopausal osteoporosis by deteriorating the trabecular bone microarchitecture and bone mass. J Diabetes Res. 2019;2019:3876957.
9. Zhang C, Li Y, Wang G, Sun J. Fracture severity dependence of bone and muscle performance in patients following single or multiple vertebral fractures. Front Endocrinol (Lausanne). 2024;15:1423650.
10. Wallander M, Axelsson KF, Nilsson AG, et al. Type 2 diabetes and risk of hip fractures and non-skeletal fall injuries in the elderly: a study from the Fractures and Fall Injuries in the Elderly Cohort (FRAILCO). J Bone Miner Res. 2017;32(3):449-460.
11. Marks R. Hip fracture epidemiological trends, outcomes, and risk factors, 1970-2009. Int J Gen Med. 2010;3:1-17.
12. Johannesdottir F, Roberts JE, Kiel DP, et al. Hip fractures: a review. JAMA. 2026;336(6):496-507.
13. Jiang Y, Luo Y, Lyu H, et al. Trends in comorbidities and postoperative complications of geriatric hip fracture patients from 2000 to 2019: results from a hip fracture cohort in a tertiary hospital. Orthop Surg. 2021;13(6):1890-1898.
14. Han Y, Choi Y, Yoon S, et al. Associations between physical activity trajectories, hypertension, and type 2 diabetes among adults: a systematic review and meta-analysis. Nutr Metab Cardiovasc Dis. 2026;36(8):104674.
15. Koh WP, Wang R, Ang LW, et al. Diabetes and risk of hip fracture in the Singapore Chinese Health Study. Diabetes Care. 2010;33(8):1766-1770.
16. Madsen CM, Jantzen C, Norring-Agerskov D, et al. Excess mortality following hip fracture in patients with diabetes according to age: a nationwide population-based cohort study of 154,047 hip fracture patients. Age Ageing. 2019;48(4):559-563.
17. Tebé C, Martinez-Laguna D, Moreno V, et al. Differential mortality and the excess rates of hip fracture associated with type 2 diabetes: accounting for competing risks in fracture prediction matters. J Bone Miner Res. 2018;33(8):1417-1421.
18. Komorita Y, Iwase M, Idewaki Y, et al. Impact of hip fracture on all-cause mortality in Japanese patients with type 2 diabetes mellitus: the Fukuoka Diabetes Registry. J Diabetes Investig. 2020;11(1):62-69.
19. Hung YC, Lin CC, Chen HJ, et al. Severe hypoglycemia and hip fracture in patients with type 2 diabetes: a nationwide population-based cohort study. Osteoporos Int. 2017;28(7):2053-2060.
20. Mei F, Li JJ, Lin J, et al. Multidimensional characteristics of musculoskeletal pain and risk of hip fractures among elderly adults: the first longitudinal evidence from CHARLS. BMC Musculoskelet Disord. 2024;25(1):4.
21. Puar TH, Khoo JJ, Cho LW, et al. Association between glycemic control and hip fracture. J Am Geriatr Soc. 2012;60(8):1493-1497.
22. Vestergaard P. Discrepancies in bone mineral density and fracture risk in patients with type 1 and type 2 diabetes—a meta-analysis. Osteoporosis Int. 2007;18(4):427-444.
23. Martiniakova M, Biro R, Penzes N, et al. Links among obesity, type 2 diabetes mellitus, and osteoporosis: bone as a target. Int J Mol Sci. 2024;25(9):4827.
24. Cobuz C, Ungureanu-Iuga M, Costescu I, et al. Exploring multidimensional diabetes self-management and health-related functioning in relation to vascular complications. J Clin Med. 2026;15(15):6125.
25. Graversen JL, Kvist AV, Rasmussen NH, et al. Diabetic neuropathy and fracture risk - a nation-wide case/control study. Bone. 2026;207:117860.
26. Hawkins Carranza F, Martín-Arriscado Arroba C, et al. Hip fractures and type 2 diabetes in the elderly: risk factors analysis of the Nedices cohort. Diabetes Metab. 2025;51(4):101656.
27. Cirovic A, Vujacic M, Petrovic B, et al. Vascular complications in individuals with type 2 diabetes mellitus additionally increase the risk of femoral neck fractures due to deteriorated trabecular microarchitecture. Calcif Tissue Int. 2022;110(1):65-73.
28. Donnelly E, Moseley KF. Pathophysiology of bone fragility in type 2 diabetes mellitus. Curr Osteoporos Rep. 2025 30;23(1):39.
29. Tramontana F, Napoli N, Litwack-Harrison S, et al. More rapid bone mineral density loss in older men with diabetes: the osteoporotic fractures in men (MrOS) Study. J Clin Endocrinol Metab. 2024;109(12):e2283-e2290.
30. Wang K, Fu W, Pan H, et al. Determinants and predictive performance of reduced muscle mass in elderly patients with type 2 diabetes: a retrospective study. Front Endocrinol (Lausanne). 2026;17:1746797.
31. Lu J, Wei F, Sun Rong K, et al. Increasing level of leisure physical activity could reduce the risk of hip fracture in older women: a dose-response meta-analysis of prospective cohort studies. Medicine (Baltimore). 2016;95(11):e2984.
32. Lee KM, Chung CY, Kwon SS, et al. Factors associated with bone mineral density and risk of fall in Korean adults with type 2 diabetes mellitus aged 50 years and older. J Clin Endocrinol Metab. 2014;99(11):4206-4213.
33. Lund A, Bendtsen MAF, Andersen H, et al. Postural instability and fall risk in type 2 diabetes: a cross-sectional study using posturography and video head impulse test. Arch Phys Med Rehabil. 2026:S0003-9993(26)00858-0.
34. Vinther D, Thomsen RW, Furnes O, et al. Impact of diabetes on the risk of subsequent fractures in 92,600 patients with an incident hip fracture: a Danish nationwide cohort study 2004-2018. Bone. 2024;184:117104.
35. Yin H, Ma Y, Liu X, et al. Diabetes-related foot disease and sarcopenia-related traits: evidence from US and Chinese cohorts and Mendelian randomization. Aging Clin Exp Res. 2026;38(1):92.
36. de Araújo IM, Salmon CEG, de Paula FJA. Ectopic fat in muscle and poor glycemic control are negatively associated with trabecular bone score in type 2 diabetes. Clinics (Sao Paulo). 2024;79:100430.
37. Olamoyegun MA, Alare K, Afolabi SA, et al. A systematic review and meta-analysis of the prevalence and risk factors of type 2 diabetes mellitus in Nigeria. Clin Diabetes Endocrinol. 2024;10(1):43.
38. Coupland C, Wood D, Cooper C. Physical inactivity is an independent risk factor for hip fracture in the elderly. J Epidemiol Community Health. 1993;47(6):441-443.
39. Feskanich D, Willett W, Colditz G. Walking and leisure-time activity and risk of hip fracture in postmenopausal women. JAMA 2002;288(18):2300-2306.
40. Joakimsen RM, Magnus JH, Fønnebø V. Physical activity and predisposition for hip fractures: a review. Osteoporos Int. 1997;7(6):503-513.

41. Feskanich D, Flint AJ, Willett WC. Physical activity and inactivity and risk of hip fractures in men. Am J Public Health. 2014;104(4):e75-81.
42. Marks R. Physical activity and hip fracture disability: a review. J Aging Res. 2011;2011:741918.
43. Lu N, Liu BL, Zhang W, et al. Muscle mass and function in patients with type 2 diabetes mellitus:a characteristic analysis based on sex, age, and BMI. Front Endocrinol (Lausanne). 2026L17:1888206.
44. Kim KM, Kim KJ, Han K, et al. Associations between physical activity and the risk of hip fracture depending on glycemic status: a nationwide cohort study. J Clin Endocrinol Metab. 2024;109(3):e1194-e1203.
45. Xu L, Yuan R, Yue H, et al. Sulfonylureas and fracture risk in patients with type 2 diabetes mellitus: a systematic review and meta-analysis. Rev Clin Esp (Barc). 2026:502596.
46. Deatrick JA, Klusaritz H, Atkins R, et al. Engaging with the community to promote physical activity in urban neighborhoods. Am J Hlth Promotion. 2018:33(5), 718–726.
47. Watson KB, Carlson SA, Gunn JP, et al. Physical inactivity among adults aged 50 years and older - United States, 2014. MMWR Morb Mortal Wkly Rep. 2016;65(36):954-958.
48. Zhang D, Huang J, Zhang Y, et al. Effects of continuous glucose monitoring on dietary behavior and physical activity: a systematic review and meta-analysis. Diabetes Res Clin Pract. 2025;229:112907.
49. Matas RQ, Álvarez MN, Cerezo JG. Association between type 2 diabetes and 30-day clinical outcomes following hospital discharge for hip fracture in older adults. Ann Geriatr Med Res. 2026;30(2):199-207.
50. Zou X, Chandran M, Xiong X, et al. Type 2 diabetes is associated with increased complications and mortality after hip fracture in older adults aged 60 years or older. Diabetes Obes Metab. 2026;28(9):8084-8093.
51. Baji P, Gregson CL, Patel R, et al; REDUCE Clinical and Methodological Team; Marques EMR; REDUCE clinical and methodological team; Griffin J, Javaid MK. Hospital costs attributable to further fracture, reoperation, and death during the first year following hip fracture in England : a nationwide cohort study. Bone Joint J. 2026;108-B(7):952-960.
52. Guo Y, Li R, Xu N, et al. The associations between skeletal muscle mass to visceral fat area ratio (SVR) with bone mineral density (BMD) and 10-year probability of fracture risk in Chinese patients with type 2 diabetes mellitus (T2DM): a cross-sectional study. Endokrynol Pol. 2025;76(2):202-211.
53. Mori Y, Tarasawa K, Tanaka H, et al. Postoperative risks of type 2 diabetes in elderly hip fracture patients: a propensity score-matched study. J Bone Miner Metab. 2025;43(5):553-563.
54. Zhang Y, Lin L, Zheng L, et al. Waist-to-body mass index ratio and risk of musculoskeletal disease in type 2 diabetes: a cohort and PhIP-Seq analysis. J Cachexia Sarcopenia Muscle. 2026;17(4):e70336.
55. Kim B, Lee KN, Han K, et al. Diabetes progression and its association with fracture risk in type 2 diabetes. Osteoporos Int. 2026 May 20.
56. He Z, Li H, Luo Y, et al. Shared mechanisms of musculoskeletal dysfunction in type 2 diabetes mellitus: insights into future therapeutic directions (Review). Int J Mol Med. 2026;58(4):284.
57. Landgraff IK, Myrstad M, Ranhoff AH, et al. Midlife physical activity, BMI, and hip fracture risk five decades later in men: a NOREPOS study. Arch Osteoporos. 2026;21(1):28.
58. Strotmeyer ES, Kamineni A, Cauley JA, et al. Potential explanatory factors for higher incident hip fracture risk in older diabetic adults. Curr Gerontol Geriatr Res. 2011;2011:979270.
59. Ge Y, Li R, Tao X, et al. Gluteal muscle density, but not size, is independently associated with fall risk in older adults with hip fractures: a cross-sectional study using opportunistic CT imaging. Maturitas. 2026;211:108975.
60. Ekström W, Al-Ani AN, Sääf M, et al. Health related quality of life, reoperation rate and function in patients with diabetes mellitus and hip fracture--a 2 year follow-up study. Injury. 2013;44(6):769-75.
61. García-Tercero E, Villalon Rubio D, Belenguer-Varea Á, et al. Impact of sarcopenic diabetes on outcomes and mortality in older adults hospitalized for hip fracture: a nested case-control study within a real-world evidence cohort. Nutrients. 2025;17(16):2616.
62. Christodoulou NA, Dretakis EK. Significance of muscular disturbances in the localization of fracturesof the proximal femur. Clin Orthop Relat Res. 1984;(187):215-217.
63. Choe H, Yoneda T, Oba M, et al. Muscle atrophy around the hip joint in patients with femoral neck fracture is associated with postoperative walking ability. Geriatr Orthop Surg Rehabil. 2025;16:21514593251336626.
64. Mao S, Wang Y. Risk factors for cognitive decline in type 2 diabetes mellitus adults: a systematic review and meta-analysis. Mol Cell Biochem. 2025;480(9):4961-4972.
65. Shimizu T, Kanai C, Asakawa Y. Relationship between independence in activities of daily living at discharge and physical activity at admission of older postoperative hip fracture rehabilitation inpatients: a retrospective case-control study. Physiother Res Int. 2024;29(1):e2070.
66. Rong K, Liu XY, Wu XH, et al. Increasing level of leisure physical activity could reduce the risk of hip fracture in older women: a dose-response meta-analysis of prospective cohort studies. Medicine (Baltimore). 2016;95(11):e2984.
67. Dent E, Daly RM, Hoogendijk EO, et al. Exercise to prevent and manage frailty and fragility fractures. Curr Osteoporos Rep. 2023;21(2):205-215.
68. Ren J, Liu M, Wang B, et al. Secondary fracture risk after hip fracture in older patients: an updated sex-specific systematic review and meta analysis with GRADE and PAF assessment. Osteoporos Int. 2026 Mar 12.
69. Nguyen S, Crandall CJ, Bellettiere J, et al. Associations of accelerometer-measured physical activity and sedentary behavior with incident clinical osteoporotic fractures among older women: the Objective Physical Activity and Cardiovascular Health Study. J Aging Phys Act. 2026:1-13.
70. Guerado E, Gómez-Palomo JM, et al. Prevention of hip fractures in the elderly. a public health problem. I. Basic science. Rev Esp Cir Ortop Traumatol. 2026:S1888-4415(26)00120-7.
71. Zhao W, Meng M, Geng Y, et al. Sedentary behavior and type 2 diabetes in community-dwelling middle-aged and older adults: indirect cross-sectional correlation of sarcopenic obesity. Front Endocrinol (Lausanne). 2026;17:1813608.
72. Zusman EZ, Dawes MG, Edwards N, et al. A systematic review of evidence for older adults' sedentary behavior and physical activity after hip fracture. Clin Rehabil. 2018;32(5):679-691.
73. Esht V, Sharma A, Alshehri MM, et al. Therapeutic and preventive role of integrated moderate-to -vigorous recreational activity programs in type 2 diabetes care: a systematic review and meta-analysis. Adv Ther. 2026 Feb;43(2):650-665.
74. Gates M, Pillay J, Nuspl M, et al. Screening for the primary prevention of fragility fractures among adults aged 40 years and older in primary care: systematic reviews of the effects and acceptability of screening and treatment, and the accuracy of risk prediction tools. Syst Rev. 2023;12(1):51.
75. Sha T, Zhang Y, Wei J, et al. Sarcopenia and risk of cognitive impairment: cohort study and Mendelian randomization analysis. JMIR Aging. 2025 Jun 11;8:e66031.
76. LaMonte MJ, Wactawski-Wende J, rt sl; Women's Health Initiative (WHI). association of physical activity and fracture risk among postmenopausal women. JAMA Netw Open. 2019;2(10):e1914084.