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Frailty, Frailty Progression, Falls Fears and Injuries among the Elderly: Possible Protective Role of a Stepped Stage Theory Approach to Active Tai Chi Therapy Adoption

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

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Abstract

Increasing numbers of older adults vulnerable to becoming frail are also often at risk for serious falls injuries and poor health outcomes that can include frailty. In this report we aimed to examine the correlate of frailty, and its association with falls and their outcomes among older adults and the possible protective efficacy of Tai Chi therapy in this regard. Employed were articles of relevance published up to May 31 2026 in three major electronic data bases that address these topics. Key findings regarding the syndromes of frailty, falls and falls fears, plus their Tai Chi related impacts showed a high proportion of older adults can be expected to exhibit less frailty and falls in response to Tai Chi practice if addressed in a timely and stage matched manner. Indeed it appears comprehensive timely assessments of at risk older adults, and encouraging Tai Chi adoption in the pre frail adult who does not exercise or wish to do so may avert frailty onset, falls and their progression, serious injury plus long term disability costs including excess frailty, recurrent falls injuries, concerns about falling, poor falls self-efficacy, and depression.

Keywords: Falls, Falls Fears, Frailty, Fractures, Intervention, Older Adults, Prevention, Stages of Change, Tai Chi

Introduction

Aging, a generally accepted biological phenomenon often implicating an inevitable declining state of organ and tissue homeostasis is frequently associated with a variety of chronic health conditions, including frailty and an enhanced proclivity to falling, alongside pain, functional limitations, multiple physical injuries, and high health costs.[1-3] Also often associated with various degrees of cognitive and psychosocial challenges, immobilizing falls fears, as well as possible accelerating overall declines in well-being, many older community dwelling adults may sustain a hip fracture and thereby premature disability and possibly mortality.[4] However, even though frailty is a condition expected to increase in prevalence in future years,[3,4] and may predict falls, a high degree of functional challenges including active mobility and movement problems that can underpin low energy falls and others falls may hasten the magnitude and onset of excess disability, and premature mortality states.[3,5] This is not a well studied topic by any means however, despite its immense social costs and ramifications[6] and failure of bone building drugs to remediate this situation substantively and safely.[7] As well, preventive efforts are commonly implemented only after their actual adverse impacts on the individual are evidenced, rather than before, for example failing to reduce an osteoporosis risk for averting a hip fracture in the frail older adult.[8]

However, in light of the growing high age populations that are increasing rapidly in all parts of the globe, the need for health providers and others to not only assist older adults to avoid preventable illnesses or disability states such as frailty and falls is greater than ever. In this regard, we propose there may indeed be some merit to examining if there are possible intervention options other than drugs that build bone, or offset other adverse fracture determinants, among the elderly.[9] For example, will encouraging physical activity participation address the apparent decrease in the aging adult's ability to function physically, and if so, avert muscle weakness and wasting, gait disturbances, depression, and falls fears?[10,11] In particular, and in light of the severe impact of frailty on falls risk especially where bone mass is compromised, we elected to focus on Tai Chi, an ancient form of movement therapy known to have multiple bone, muscle and cognitive located benefits and that could arguably help to prevent or mitigate the rate and degree of downward spiraling of the older adults' health as well as their frailty status- and possible tendency to fall and fracture a bone such as the hip that characteristically fosters immense disability among survivors.[5,11]

Indeed, this idea, although possibly not novel, may yet prove to have considerable far reaching value insofar as prevention of these states, if we consider these frailty and falls factors alone may not only jeopardize overall health, longevity, and life quality, but underpin a high risk for one or more trauma related bodily injuries, future or recurrent injuries,[6] such as bone and soft tissue injuries, and these health attributes alone that increase in severity with age are expected to show an immense increase in prevalence among the elderly by 2050.[5]

Aim

To establish whether there is a role for improvements in frailty prevention and its possible link to excess falls risk, injury and fears of falling among older adult community dwelling populations.

A parallel aim was to establish if more should be done in this regard, if desirable, and in what respect?

Hypothesis

It was hypothesized that a carefully tailored Tai Chi program of therapy could help reduce frailty and its falls related consequences among a proportion of older community dwelling adults who may be at risk or unmotivated towards self help. Moreover, we theorized Tai Chi practice may help to negate the link for both frailty and falls fears to hip fracture risk and its costly disabling pathway.

Relevance

Frailty, a potentially preventable serious health state and undisputed impediment to well-being among many older populations, not only impacts bone fragility, but overall energy levels, muscle strength capacity, and gait. Frailty also commonly engenders various degrees of anxiety, and depression[12] that alone or in combination with one or more of these factors can be expected to not only exacerbate frailty, but also associated levels of serious morbidity and excess rates of premature mortality, as well as possible parallel increases in falls risk, as well as fears of falling.

As such, the excess human as well as fiscal costs of frailty are currently immeasurable, and are likely to increase, rather than decrease, as societies age unless actions are taken to offset this possible cycle of highly adverse events. In particular, falls that often cause severe injury, anxiety and loss of confidence, as well as activity avoidance, depression, and social isolation due to 'fears of falling' among older adults who have experienced prior falls, this cycle of adverse events undoubtedly tends to increase frailty or provoke its multiple manifestations.[13] In particular, falls injuries commonly

require medical attention[2] and those falls leading to hip fractures that occur frequently among the frail elderly not only predict less than desirable outcomes of survivors post hip fracture surgery,[14] but the persistence of falls fears, anxiety, and osteosarcopenia (concomitant bone and muscle mass losses) if present, plus low functional self-efficacy and outcome expectations of exercise interventions and readiness for exercise adoption.[15,16]

Rationale

Frailty, an age associated syndrome attributed to under nutrition among other factors, appears strongly associated with a progressive decline in several physiological systems that can collectively heighten the older adult's vulnerability to the risk of multiple adverse health events and outcomes, such as injurious falls, disability or death.[16] In this regard, both frailty itself, as well as falls injuries often attributable in part to frailty features such as muscle and bone mass declines,[15] can clearly be expected to lower the ability of the aging adult to adapt to undesirable stresses as well as the chances of successful aging and a high life of quality. Moreover, the cost of treatment of secondary injuries related to falls is high in terms of bone fractures and several other comorbidities.[3]

Pre frailty representing a critical transitional phase in age-related functional decline among older adults, and characterized by reduced muscle strength and impaired balance may however be amenable to exercise interventions known to ameliorate these symptoms[17] and help vulnerable adults to maintain a high level of wellness and one free from excess fears and preventable health issues, while possibly lowering the immense and profound social costs of failing to intervene.[16,18-21] For example, Crehan et al.[22] found a quarter of 47 elderly fallers who appeared to exhibit falls fears were also largely frail [75% cases], while in a study of older adults located in four Indian villages, among several associated factors mentioned as salient frailty determinants, were low physical activity status, as well as age.[15]

Prevention is indicated here because as well as falls, various fear perceptions, which have been studied for some time, and that may evoke the specific 'fear of falling', may in turn lead to the onset or perpetuation of a state of inactivity, muscle and bone mass losses, motor control response deficits, depression and anxiety, and a heightened falls risk and incidence of falls.[24] Indeed, a fear of falling and/or low falls efficacy appears to be a key risk factor for frailty in older adults,[20,25] and is one suggesting this linkage may have a possible profound role to play in terms of clarifying those frailty determinants that might be modifiable, and studied further in the future.[26-28]

In particular it appears adopting a more active lifestyle is critical for reducing frailty[10] as well as the number of fall related episodes and their consequences and for mitigating age associated muscle mass and bone mass declines. However, due to gaps in the literature it appears essential to continue to examine if one or more physical exercise methods can reduce the presence of sarcopenia as well as falls and adverse fall-related health effects.

This narrative review aimed to examine current evidence on existing Tai Chi findings3 and how these exercises may be helpful in attenuating late life falls and frailty It does not discuss nutrition or supplements, medication, and psychological interventions, but whether a movement approach is of possible adjunctive benefits or not. It does not discuss long term care or similar work in the context of assisted living environments.

Assumptions

Aging is characterized by fundamental cellular and molecular hallmarks that result in a physiologic decline of most body systems. This may culminate in frailty, a state of decreased reserve, and subsequent multisystem dysregulation, requiring multimodal interventions to mitigate and prevent their impacts. To this end, movement-based mind–body therapies, such as Tai Chi and yoga, are promising because they may foster improvements in key falls indicators such as the speed of information processing, the timely generation of protective motor reactions, overall health status, sleep, balance, bone health, and the ability to undertake and pursue health behaviors that reduce rather than provoke falls risks[5,29-32] and are safe and easy to apply.[33] Their direct and measureable influence on physical ability, physical and cognitive vitality, psychological status, bone and soft tissue injury susceptibility, disability, and disease onset, has enormous promise for fostering optimal aging goals in our view.

Moreover, since the risk of frailty and falling increases with numbers of risk factors, it seems reasonable to propose

that reducing the numbers of falls risk factors through increases in physical activity participation may carry with it a proportionate reduction in severe falls, as well as their frequency and injury risk.

In this respect, we believe health promotion efforts that are safe as opposed to main stream pharmacologic approaches or possibly high impact or stressful exercise may hence present a powerful tool for averting excess late life disability and for encouraging self directed life affirming behaviors and readiness to change especially in cases where there is potential resistance to integrating exercise into self-care identity, and limited motivation to do this unless more personalized, sustainable, encouraging physical activity prescriptions prevail.[35]

Herein we assume some older adults may be either reluctant or unmotivated or lack the inherent cognitive capacity to independently pursue Tai Chi or believe a mind-body program of regular activity is not applicable to them, nor one they feel confident to pursue.[36] They may have a low degree of falls injury risk perception and belief in the benefits of exercise. We thus propose a staged approach towards planning for this mode of behavior change that would be delivered and planned by a skilled health professional and in line with a comprehensive falls risk assessment procedure. The approach advocated here is based on years of research pertaining to the formulation of the *Transtheoretical Model* of behavior change, a cross cutting psychological theory – and one often used to secure more active adoption and adherence to novel behaviors and/or their possible substitution for negative behavior practices such inactivity. We specifically propose a staged approach may be especially helpful when applied to raise the intention of older frail adults to self-care activities such as physical activity participation.[37-39]

Based on many meta analyses over the years, we are confident encouraging motivational readiness and favorable thoughts about whether a tailored Tai Chi program will secure its adoption and adherence successfully will heighten readiness to do this, especially among those older adults with low beliefs in non-traditional medicine, low health literacy, or physical activity outcome expectations. We anticipate too that through a carefully designed stepped and personalized staged approach to Tai Chi the adult involved will not feel overwhelmed or intimidated to adopt an unfamiliar exercise mode and will resonate to the provision of face to face efforts towards their goals that is duly applied in a gradual staged manner and is tailored accordingly rather than not.[39-41]

Methods and Procedures

Accordingly, the **PUBMED**, **PUBMED CENTRAL**, and **GOOGLE SCHOLAR** depositaries believed to house salient topical peer reviewed articles on the aforementioned issues were carefully searched. Key terms used alone or in combination included, '*exercise adherence*', '*frailty*', '*falls*', '*interventions*', '*older adults*' '*Tai Chi*', '*trantheoretical model*'. No yearly restrictions were applied, and after an extensive scan of the available data, all pertinent reports addressing the current topics were scrutinized in detail, regardless of research design, and those deemed of substantive relevance were selected to provide an overview of this topic. The method of reporting in this instance was limited solely to a narrative descriptive format, given the low numbers of topical papers, or any substantive numbers of prospective studies on this topic. Excluded were foreign articles, proposals for future studies, nursing home studies, and issues related to frailty other than falls fears and exercise combinations rather than Tai Chi alone. Moreover, the review excluded reports on digital intervention applications, AI, behavioral models other than the Stages of Change [specifically precontemplation and contemplation conceptualized stages only], or exercise forms other than Tai Chi or applied in parallel with this.

Key Findings

The study of frailty as well as falls among the older adult that has been pursued for more than four decades remains an unresolved topic and one of great public health import. This is because among these data, there is clearly strong support for the view that many older adults –a group projected to increase markedly by 2050-are likely to be frail or in a pre frailty state, as well as likely to fall. If not intervened upon early enough they may develop a state of disability attributable to both physical injury as well as disabling fears of falling again. Many may experience functional declines warranting high health care costs, institutionalization, and hospitalization, as well as possible premature mortality[41-44] in the face of significant muscle, bone mass, reactive and static balance declines

that predispose to recurrent falls, injuries and disability,[45,46] pain, depression, and often a heightened medication need, plus insomnia.[42] Additionally, even though those who have studied this commonly use differing outcome measures and samples, most tend to agree that frailty and falls as overlapping events can be expected to foster a high risk state for costly adverse health outcomes including secondary falls,[3,4] as well as possible subsequent increments in frailty[19] cognitive, psychological and functional health domains.[47] These associations are further worthy of attention due to their observed predictably in fostering a cycle of excess suffering, including multi-morbidity, injury, and disability, especially if the individual is depressed, exhibits low muscle and bone mass and fragility, is a previous faller, or shows falls fear signs.[9,13,16,48-52] Other data reveal the fear of falling can contribute to the onset or exacerbation of psychological conditions such as depression, while adversely impacting the health-related life quality of the frail older adult.[53]

In short, although the literature on the current topic of interest implies intervention strategies to prevent or reduce frailty as well as falls risks among older vulnerable adults are imperative for reducing the chances of a severe falls injury or recurrent falls injuries[54] few solutions prevail. Explicit attention to identifying and intervening upon multiple attributes that underpin excess frailty and falls, such as malnutrition, immobilizing falls fear beliefs and sleep disturbances[42] where they prevail, seems imperative. Herein we focus on Tai Chi. a holistic mind-body therapeutic exercise approach that may interact safely and with low joint impact in a cross cutting manner across several key determinants of frailty, falls risk, falls injuries and their potential independent or cumulative debilitating outcomes.

Tai Chi

For more than 2000 years, Tai Chi, an ancient form of mind-body therapy has been a fundamental tool shown to have a significant influence on balance, motor function and fear of falling among older adults[55-58] as well as on:

- Bone health
- Cognitions
- Drug usage
- Muscle health
- Neural control
- Pain
- Psychosocial perceptions
- Range of joint motion
- Self efficacy
- Stiffness
- Stress
- Sleep

As well, Tai Chi, when applied as a therapeutic exercise intervention is found more effective than stretching or multimodal exercises in reducing the incidence of falls.[58] In this regard, Liang et al.[59] claim maintaining physical function is important for independence and frailty prevention in later life, but unfortunately very few older adults meet exercise recommendations. However numerous previous studies have proved Tai Chi therapy, often accepted by older adults, has immense potential when practiced for 4-weeks alongside a Tai-chi snacking component. Its practice is indeed a mode of therapy that is not only safe but can enhance muscle strength, balance, and mobility in pre-frail and frail elders with associated improvements in cognitive and functional wellbeing and possibly fewer falls.[60-65,67]

Additionally reported long-term benefits of regular Tai Chi exercise are: enhancements in dynamic stability during gait initiation, more optimal foot placement strategies during gait initiation, and a reduced risk of falls[63] and fear of falling.[33,64] Others are improvements in motor function,[17,56] possible declines in falls incidents or extent, and magnitude of frailty among older adults[62,63] in those deemed to be pre frail or suffering from a persistent fear of falling.[45,66]

Supported by decades of empirical study, Tai Chi studies are able to consistently show its effectiveness is not spurious and its impacts are comparable to-or even greater than-that of mainstream multi pronged exercise methods for reducing falls.[67] As such, Tai Chi practice can indeed be projected to help prevent the source of much late life suffering. It may retard the onset of excess age related muscle mass and bone strength losses[3] as well as enhancing lower limb cortico-muscular balance and postural stability, gait coherence, gait adaptability under challenging sensory perturbations, and control attributes.[68-70] In terms of the current social and economic frailty and falls burden alone these above outcomes and observations of a post Tai Chi improved ability to generate more rapid or desirous and flexible sensory reweighting responses as well as improved self-motion perceptions that mediate safe walking in the face of perturbations or obstacles[70] may prove enormously beneficial for high numbers of older adults living to higher ages and wishing to reside in the community in our view.

Even more impressive is Tai Chi research that points to its promise for enhancing wellbeing even among high age vulnerable adults, especially if applied through insightful and carefully tailored, structured and staged Tai Chi based preventive approaches.[70-74] As explained above, these include, but are not limited to possible improvements in muscle and bone mass and sensory motor function plus a sizeable decline in falls risk and injurious falls.[72-75] Further efforts in this regard may also decrease harmful medication usage.[72]

To achieve success, it appears efforts to provide preemptive screening and a person-centered and goal setting approach that encourages hope and projects success, rather than despair, as well as self-care and self protection actions are strongly indicated here, however.[65,76] In particular, screening programs and tailored Tai Chi interventions that are supported by and delivered in an encouraging manner by a provider, in spite of aging or distress, appear essential as well.[77-80]

Stage theory

Ample behavioral research shows, however that simply recommending exercise as a falls or frailty deterrent is often more confusing than not given the myths about aging and the common lack of any tangible provider directive to do this. Moreover, adherence is poor and often not well targeted or staged. Behavioral research further shows that change is a non linear process rather than a liner one and according to the Transtheoretical [Stages of Change] Model of Behavior Change, exercise adoption decisions and others must be appropriately encouraged and supported accordingly because-

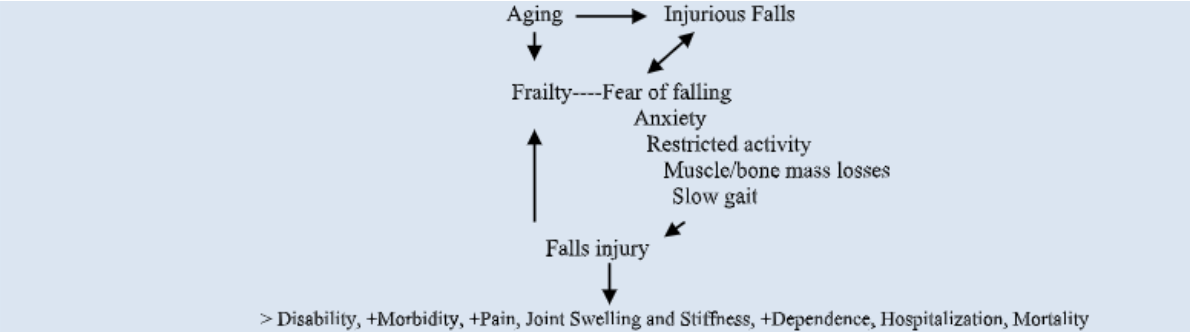
- People may differ in terms of their exercise and self-efficacy beliefs.
- They may be at different *stages of change* or motivation or ability to actively initiate or change their current sedentary or excessive exercise behaviors in this regard and do this independently, willingly, and consistently.
- They may need to be prepared in small steps and a temporally relevant staged approach if they cannot initiate program requirements immediately.
- To be adopted and adhered to, Tai Chi programs may need to be appropriately matched to each person's *stage of change and motivation level* as well as their frailty and health status.
- Successful change and adherence practices may require the client and provider to work thoughtfully and collaboratively over extended periods of time.

In this respect, the 6 key behavioral change stages often identified in behavior analyses as systematic guiding steps that can be applied to foster a desirable goal are fluid however, and although often non linear - their temporally based conceptual categories and support principles are portrayed as representing cognitive as well as action based phases that may be selectively enacted to foster behavioral change and its adherence as per below:

Key Stages Of Behavioral Change

Precontemplation, Contemplation, Preparation, Action, Maintenance, Relapse (common)

[https://www.healthlinkbc.ca/living-well/physical-activity/being-active/overcoming-barriers-physical-activity/stages-changing]



Extracted from references: [11,14,16,18,19,42,44,45,48,75,81-84]

Figure 1. Conceptual Model of Multiple Interrelated Factors Potentially Impacting Frailty and Falls Cumulatively and that Can Potentially be Mitigated at all Ages via Tai Chi

Accordingly, and to highlight the principles of this theoretical approach, if a client is in the '**precontemplation'** stage (unaware or not intending to change in the near future) for example, the clinician can use empirically tested strategies to raise awareness of the need for and benefits of change in the hope this will enhance adoption of the new behavior such as the idea of exercising regularly using a non mainstream approach, rather than pharmacology alone. Here they can aim to heighten motivation to act by:

- Providing information
- Using reflective listening
- Acting as a collaborator
- Acknowledging perceived threats

To support '**contemplation'** and help a client clarify their intent to act

- The clinician can work with the client to articulate the pros and cons of the recommended activity/the personalized risks of failing to do this
- Discuss pros and cons of changing/not changing
- Foster perceived self-efficacy, plus benefits of exercise
- Explore options for change
- Identify perceived change facilitators and barriers.[40,86-88]

If according to this series of cognitive derived intervention efforts the client is 'ready' to pursue the recommended Tai Chi intervention program, the action phases of the Stages Model are likely to be useful and successful guides towards desired life-long maintenance goals. Those at risk older adults who appear eligible to undertake Tai Chi, as a central physical activity option, but remain intent on not doing this may not be amenable at that point to undertake a potentially beneficial program and may need time and/or cognitive assessments and follow up intervention, as may those who 'relapse' periodically.[89,90]

Discussion

While aging is inevitable, increasing evidence suggests aging does not have to be a foregone ordained experience of downward spiraling events and perceptions. This review explored the possible contribution of frailty development and its exacerbation, along with a related frequently observed injurious falls risk and its mitigation via Tai Chi practices.

It further outlined a role for a stage based exercise recommendation approach to prevent the risk of poor health status and outcomes attributable to frailty in elderly populations, and poor adherence, among those elderly who exhibit persistent fears of falling and/or have fallen as a result of frailty. As well, the review examined the potential for a stage matched process to encourage its long term usage to combat the interactions outlined below.

The specific premise for exploring some new intervention delivery routine for addressing the above was based on existing evidence that mitigating these associations is not only an urgent public and social health concern as a whole that requires long term adoption, but is often an immense challenge given the frailty state is a complex one that can engender much personal suffering and misunderstandings and reluctance towards self-care. For example, those aging adults who are more frail than others and have fallen at least once are less likely to be highly motivated or ready to undertake exercising spontaneously, especially if fearful and depressed,[39,49] and thus more subject to falls injuries and a sedentary rather than active existence.[77]

At the same time, bearing in mind, insights, answers and optimal solutions are not yet agreed upon, or widely enacted, or the same for all, what is clear is that untreated frailty plus unidentified depression, and client beliefs and behaviors that view weakness, disability or falls fatalistically as a part of aging[3,81,84] along with low injury or health risk perceptions plus poor nutrition, although remediable, or modifiable, rather than inevitable or irreversible. will likely foster progressive weakness and bone fragility and a highly vulnerable rather than robust state of wellbeing.[14,29,85] For example, the failure to encourage a pre frail adult to partake in any form of carefully graded physical activity may heighten the onset or extent of frailty, bone fragility, muscle mass losses, joint inflammation, poor balance, pain, and/or severe falls injuries[38,67] plus their disabling ramifications.[29,30]

In light of the independent as well as collective impact of both frailty and falls fears on multiple personal dimensions of health, as well as the broader social and political dimensions of 'wellbeing',[77] we thus encourage more public health vigilance, and effective screening procedures, followed by an integrated rather than a fragmented action plan, including physical activity.[9,24,53,80] Moreover, efforts to employ exercises that can offset falling and fear of falling to a high degree as well as bone losses and muscle weakness safely and effectively are essential..

To this end, we believe ample evidence implies slow paced Tai Chi exercises can meet an apparent urgent need for a cost effective safe far reaching collective effort to keep the aging adult mobile and alert, especially if frail or pre frail. It may help those who employ psychoactive drugs, and are malnourished to have a lower fracture risk and better gait mobility in the face of a frailty risk or unanticipated falls event.[63] Guided by the stages of change model as applied to Tai Chi exercise adoption and adherence, much success can be anticipated here in our view even among the chronically ill.[86]

In sum, it appears personalized comprehensive risk assessments and supervised carefully staged and progressed appropriate modes of Tai Chi may help avert excess frailty, injury and debility risks, plus movement fears and muscular and bone derived attrition in the high age adult population. However, in the case where the adult is not 'ready' to do this, we advocate the use of the concepts of the transtheoretical model and others to build the older adult's motivation to adopt and participate regularly and with confidence in a carefully articulated personalized and practical Tai Chi action plan.

Key conclusions

Based on the prevailing data, and within the limitation of our methods of inquiry and scope, we conclude that:

1. With advancing age, many older adults may experience an accelerated decline in physical function, overall well-being plus the increased likelihood of falls and bone injuries if they are frail.
2. This cycle of events can possibly be partially mitigated by reducing certain falls risk factors such as physical inactivity, but will likely prove costly in untold ways if ignored.
3. The practice of slow paced low-impact Tai Chi type exercises holds much promise for many in this regard although the adult's readiness for its adoption may need to be fostered by the application of the transtheoretical model of behavior change goal oriented counseling framework and principles or others that employ cognitive approaches aimed at encouraging activity rather than inactivity among those who do not readily initiate or desire to undertake this form of intervention.

Indeed, if expectations of success are forthcoming and Tai Chi attributes are carefully explained to a reluctant or unaware client, many frail older adults who have fallen and sustained a fear of falling again may likely be motivated to practice this form of therapy if they can gain hope as well as actual meaningful health improvements that are likely to benefit their lives immensely both mentally and physically for years to come.

Anticipated in particular are declines in overall physical disability and frailty extent, falls injury rates and extent, medication usage, underlying cognitive and sensory impairments, dependence and poor self-confidence. Favored however, is a raised degree of cognitive and motor competence, bone and muscle mass benefits, personal control, and a lowered social and overall economic burden:

Older adults who should be specifically targeted are those who are a) underweight, b) have poor mobility, c) are previous fallers, d) have mild cognitive impairment, e) are weak or depressed high age adults [>80 yrs], and f) those with pain and low exercise self-efficacy and outcome expectations who have one or more chronic health conditions, low bone mass, muscle atrophy, sleep and stiffness challenges, and use selected medications that can impair bone mass and/or cognition.

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Competing Interests

Author has declared that no competing interests exist.

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