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The Risk Factors and Preventive Measures Regarding Fall-Related Injuries at Home Among Older Adults: A Literature Review

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The Risk Factors and Preventive Measures Regarding Fall-Related Injuries at Home Among Older Adults: A Literature Review

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Abstract

The purpose of this study was to identify the risk factors, among older adults, that play a role in causing fall-related injuries in the home as well as to investigate the various preventive measures via a literature review. 14 articles were identified to have met the inclusion/exclusion criteria for this review. The results showed that there were potentially modifiable risk factors (for example, musculoskeletal factors like balance and gait impairment), several available preventive measures (for example, home modifications and medication review), and effective multifactorial programs in preventing falls among older adults. This study also sought to locate gaps in the current literature regarding fall risk prevention in the older adult demographic. Additionally, selected articles were found to neglect the role of occupational therapy in fall prevention.

Keywords*:* older adults, independent living, fall-related injuries, risk factors, fall prevention

Introduction

Throughout the aging process, there is a decrease in bone density, muscle mass and strength, an anterior bend of the spinal structures, and an increase in joint stiffness and resistance. Older adults must therefore begin to consider how these physical changes will affect their daily living activities and how to adapt their living environment to suit their age-related needs. One of the greatest risks of injury to the aging adult population, within the home, is a fall. Fall-related injuries, such as fractures and traumatic brain injuries, account for 2.8 million emergency department visits each year (Moncada & Mire, 2017).

One of the most common preventive measures recommended against fall-related injuries, among adults aged 65 and older, is the use of home modifications. Home modifications are changes to a home's interior and/or exterior structural design with the goal of increasing independence, reducing fall-related injury, and increasing quality of life (Carnemolla & Bridge, 2019).

Other types of preventive measures include balance and strength training, frequent medication reviews with care providers, and fall prediction assessments. A combination of these measures has been shown to be more effective in reducing overall fall risk than implementing just one modification (Palvanen et al., 2014). This study also sought to identify barriers to implementing preventive measures.

This literature review sought to identify the various types of risk factors that contribute to older people falling in the home, such as environmental hazards and musculoskeletal factors, and the current variations of preventive measures available in literature to prevent against or decrease the instances of falling. The goal of this study was to answer the research question, *"In aging adults, 65 and older, what are the risk factors that contribute to fall-related injuries, in the home, and the associated preventive measures currently available?"* by creating a cohesive summary of the current literature on fall prevention in aging adults and to investigate if there are areas for needed revisions in the current interventions utilized by professionals.

Method

To complete this research paper, inclusion/exclusion criteria were used for article selection, and the matrix method was utilized for data management and illustration (Garrard, 2015). An advanced search was conducted using the PubMed, JSTOR, and ScienceDirect databases with the key term '65 and older/older adults' being combined with 'home/independent living' as well as one or more of the following topics: 'accessibility,' 'accidental falls,' 'risk factors,' and 'fall prevention' to further specify the articles needed for this study (see Figure 1).

The results were analyzed, and the keywords were modified to further specify the research articles needed to answer the research question. Articles that mentioned 'cancer,' 'migration,' 'mistreatment,' or 'surgery' were filtered out. Articles that were available in English, published from 2014 to 2020, had full-text availability, and were journal articles were included. 5,841 articles were retrieved from PubMed, 97 articles were retrieved from JSTOR, and 2,797 articles from ScienceDirect.

The titles of the articles were examined and were considered pertinent to the literature review on the basis that the article title demonstrated that it could answer the research question concisely and would be necessary to include in a summary of the current literature. After these inclusion/exclusion criteria were applied, the results (101 articles) were recorded on a list of potentially eligible articles to be included in the literature review. There were 22 duplicate articles present on this list. After removing the duplicates, 79 articles remained. The researchers analyzed the abstracts of these 79 articles by (a) reading the objectives of the studies to see if the goal of the articles aimed to answer the questions presented in this paper's research question, (b) making a prediction that based on the information presented in the abstract, the article would provide vital information needed to answer the research question, and (c) questioning the

intended use of the articles in this paper to concisely present a summary of currently available literature.

A total of 27 articles were found to fall under the scope of this literature review. The topics and subtopics intended to be expounded on in this paper were utilized as headings and subheadings. A manuscript backbone was drafted using the headers, as well as the 27 articles and their intended use. After careful consideration, some sections appeared to have repetitive information and unnecessary secondary points. The correlating articles were omitted because they were not needed in a concise summary of the available literature. Therefore, an additional 13 articles were removed.

Results

In total, 14 of the 27 articles were chosen to summarize the available literature using the inclusion criteria (see Figure 1). These 14 articles encapsulated the range of the research question as they expounded on three major points: (1) the modifiable risk factors that may prevent fall-related injuries, (2) the types of preventative measures currently available, (3) the effectiveness of a multifactorial approach in the reduction of fall-related injuries. As shown in Table 1, the articles consisted of studies that utilized before and after surveys, controlled trials, literature reviews, and systematic reviews. The articles also consisted of studies done in several countries such as Brazil, Thailand, New Zealand, and Finland.

Review of Literature

Risk Factors in Falling

Falls are the leading cause of injury in the aging adult population and after one instance of a fall, the risk of falling again is an imminent danger (Moncada & Mire, 2017). Moncada and Mire (2017) found that potentially modifiable risk factors in falling could be categorized into eight terms, which include cardiac factors (e.g., arrhythmia), environmental hazards (e.g., polypharmacy), metabolic factors (e.g., diabetes mellitus), musculoskeletal factors (e.g., balance and gait impairment), neurologic factors (e.g., Parkinson's disease), psychological factors (e.g., depression and the fear of falling) and sensory impairment factors (mainly visual and auditory). The strongest modifiable risk factors were identified as balance and gait impairment, the simultaneous use of multiple medications, and a lack of awareness of falls.

Balance and Gait Impairment. Dunsky et al. (2017) discussed balance as one of the most important aspects of carrying out activities of daily living (ADLs). They stated that balance is imperative and both types of balance, static and dynamic, were tested in the aging adult population to ensure functionality and reduce the risk of falling. Static standing balance refers to the ability to stand still without wavering while dynamic standing balance refers to the ability to shift your body's weight from one leg to another, much like walking; therefore, balance impairment plays a large role in gait impairment. Balance and mobility were affected by factors that included cognitive impairments, a decline in vision, and musculoskeletal deterioration (Dunsky et al., 2017).

Polypharmacy. Due to a relative decline of musculoskeletal functionality, sensory performance, and other areas of health, older adults may be prescribed a plethora of medications to increase function, reduce pain, and/or help cope with the demands of the aging body. There are several medications that have been linked to increased risk of falls such as antidepressants, opioids, sedatives, and hypnotics (Moncada & Mire, 2017). Hypnotics have been shown to impair body balance and standing steadiness (Mets et al., 2010, as cited in Bell et al., 2017), and there is suggestive evidence that statins may potentially reduce muscle strength (Krishnan & Thompson, 2010, as cited in Bell et al., 2017). There is also a possible correlation between fall-risk-increasing drugs and dizziness that may contribute to falls in the older population (Bell et al., 2017).

Fall Awareness. A Brazilian study aimed at testing older adults on their awareness/knowledge of falls

found that most older adults have little knowledge on falls and that more knowledge regarding falls correlated to having less in-home risk factors (Chehuen Neto et al., 2018). Russell et al. (2017) used surveys to reflect how Canadian older adults perceived six national fall prevention guidelines. 76% were aware of the risk of falling but percentages varied with respect to the number of respondents that implemented/adhered to each guideline. Therefore, their study demonstrated that there needs to be more awareness and more emphasis on adhering to each factor presented in a multifactorial approach.

Preventive Measures

Home Modifications. Findings from Carnemolla and Bridge (2019) suggested home modifications currently on the market aimed to make ADLs easier, created more accessibility in and around the home, and reduced injuries that came about while doing regular tasks. These modifications included major structural changes (such as widening doors, adding ramps, and step modifications) and minor structural changes (such as installing grab bars in the shower, handheld showers, and handrails throughout the home). Most home modifications were located in bathrooms, kitchens, and access areas (for instance, doorways and front entrances). Home modifications were deemed a crucial component of aging in place (Carnemolla & Bridge, 2019). Among those most at risk for falls in the home, home modifications were most effective when delivered by an occupational therapist (Moncada & Mire, 2017).

Based on the findings of a New Zealand study conducted by Keall et al. (2015), there were few effective home modifications on the market currently. The study aimed to test those that were available, such as handrails for stairs, grab rails for bathrooms, repairs to stairs and window catches, improved lighting, and slip-resistant surfacing throughout the home.

Keall's methodology consisted of a single-blind, cluster-randomized controlled trial of single dwelling homes. The study concluded that of the 436 households assigned as the treatment group, there was a 26% reduction in the rate of fall-related injuries in the home per year in the treatment group when compared to the control group (Keall et al., 2015).

Bailey et al. (2019) found that older people often do not implement the necessary home modifications because they consider these adaptations "for old people." The United Kingdom-based study found that some modifications are often delayed because of the stigma that associates growing older with frailty, vulnerability, and overall decline.

Balance and Strength Training. The promotion of engaging in physical activity to the aging adult population was identified as an excellent tool in the reduction of fall risk associated with balance and the improvement of muscle strength. There were several activities (such as, ballroom dancing, Tai Chi and Thai boxing) in which older adults can participate that significantly reduced their likelihood of falling. A study carried out by da Silva Borges et al. (2014) showed an improvement in balance ($p = 0.002$) and reduction of falls ($p < 0.0001$) with the use of a ballroom dance program in which older Brazilian adults in the experimental group took part in three 50-minute dance sessions each week, for 12 weeks.

Huang et al. (2017) conducted a systematic review with the goal of evaluating the effectiveness of a Chinese calisthenics exercise, known as Tai Chi, in preventing falls in older adults. Their findings indicated that Tai Chi was effective, and that effectiveness increased based on exercise frequency. A more recent study was done by Areeudomwong et al. (2019). Their study demonstrated that a four-week Thai boxing program was beneficial in improving static and dynamic (standing or overall) balance, as well as lower limb muscle strength, body flexibility, and agility when compared to the control group ($p < 0.05$). The improvements in balance, strength, and agility were found to have been retained at a four-month follow-up ($p < 0.05$).

Medication Review. Several physical changes such as decreased vision and sensory loss occur as

older adults go through the aging process. These changes, as well as the medication used to manage them, may contribute to dizziness, which may then lead to increased risk of falls. The more fall-risk-inducing-drugs (FRIDs), such as psychotropics, an older adult uses, the greater their risk of experiencing a fall (Bell et al., 2017). It is recommended that physicians limit the prescription of high-risk medications as well as the number of medications used (Moncada & Mire, 2017). A Norwegian study, Bell et al. (2017), aimed to understand older adults' perception of fall risks and its relation to drug use with the utilization of interviews. Their study found that several participants decided to adapt their lifestyle to their dizziness rather than "bother" their physicians (for example, the decision to stop participating in sporting activities) and that several informants suspected their drug use may influence the occurrence of dizziness and falls. The study concluded that "physicians should regularly inform, monitor, and assess," the use of FRIDs among the older adult population in the hope that doing so would reduce falls in this demographic.

A Multifactorial Approach. A Finland-based study conducted by Palvanen et al. (2014) focused on the effectiveness of a 12-month fall prevention plan known as the "Chaos Falls Clinic Prevention Programme" to prevent fall-related injuries in the home. Their study aimed to investigate the use of a multifactorial approach, which includes home modifications, strength and balance training, medical review and referrals, medication review, and proper nutrition (e.g., calcium and vitamin D), delivered in a clinical setting.

The study was a randomized controlled trial that focused on aging adults above 70 years of age and utilized 1,314 participants. The participants had a high risk of falling and were placed into two groups of intervention and control. The study concluded that there was roughly a 30% reduction in falls (Palvanen et al., 2014). Therefore, utilizing multiple factors in fall prevention is more effective than utilizing one factor at a time.

According to Avin et al., 2015, "The American and British Geriatrics Societies and several international sources strongly recommend a multi-factorial approach to fall risk screening in older adults" (as cited in Nithman & Vincenzo, 2019, p. 185). In 2012, the CDC decided to implement a fall screening algorithm/toolkit called STEADI (Stopping Elderly Accidents, Death and Injuries) for the use of primary care providers in predicting future fall-risks. The algorithm places older adults under one of 3 categories: *low* , *moderate*, or *high risk* and provides interventions based on the respective risk category.

The categorization of patients begins with the *Stay Independent* brochure that asks a variety of questions that aim to screen for fall risk. After the patient completes the brochure, the clinician uses the score as a starting point towards determining fall risk. If patient A had a low score for fall risk, then they would be placed in the *low-risk* category. If patient B scored high on the screen for fall risk, the next step involves physical activity that aims to evaluate gait, strength, and balance. If patient B had no issues with these then they would be categorized as low risk as well but if patient B had issues with these factors, they would be considered for the *moderate-risk* category. If patient C scored high for fall risk, had issues with gait, strength, and balance, and a history of both falls and fall-related injuries, they would be categorized as *high-risk* individuals (CDC, 2020).

Low-risk individuals would be educated on fall risk, encouraged to take vitamin D and calcium, and referred to a community exercise program. Individuals placed in the *moderate-risk* category would receive the same but would instead be referred to a physical therapist. *High-risk* individuals would be encouraged to do all of the previous recommendations as well as hypotension management, vision and foot health prioritization, and home safety optimization (CDC, 2020). The CDC reported that the algorithm may be able to reduce fall risk factors and prevent future falls by 25% (Stevens & Phelan, 2013, as cited in Nithman & Vincenzo, 2019).

The study conducted by Nithman & Vincenzo (2019) sought to find evidence of the effectiveness of the CDC's STEADI algorithm. Results indicated

that while there are limitations with the sensitivity of the test in predicting fall-risk, STEADI is an important step in the integration of the multifactorial approach, regarding fall-risk prevention, into discussions being held between primary care providers and older adult patients.

Fall Education and Awareness. Kiami et al. (2019) stated that based on available literature, a majority of seniors are not receiving information regarding fall risks and fall prevention from their healthcare providers. This indicates the need for another source for fall prevention education. A community-based fall clinic would be the ideal place to disseminate these concepts to older adults. To ensure that older adults participate in a community-based fall prevention/education program, there must be a clear understanding of the barriers and facilitators to registering for such a program. Kiami et al. (2019) found that there are seven facilitators with statistically significant association to older adult interest in a community-based fall prevention program. The facilitators are distance from home, free of cost, a friendly group leader, free vision examination, group exercise class, socialization opportunity after class, and a safe environment. A multifactorial fall prevention program could incorporate education-based fall prevention methods as well as the facilitators listed to create a more well-rounded approach.

Discussion

While there may have been great strides made in the development of preventive measures against fall-related injuries in adults aged 65 and older, there is still room for improvement as shown by the available literature. We argue that a multifactorial approach is appropriate to address fall prevention. Specifically, we discuss how components of a fall prevention program (e.g., community-based programs, home modifications, strength and balance training) are effective and how together they may address multiple risk factors that contribute to falls. Additionally, we argue that occupational therapists (OTs) have a greater role in fall prevention than indicated in the included articles.

A Multifactorial Approach

Moncada & Mire (2017) stated that the U.S Preventive Services Task Force (USPSTF) and the American Academy of Family Physicians do not recommend routine multifactorial intervention in all older adults. It is instead recommended that multifactorial assessment and management only be utilized for individual cases that are deemed high-risk. However, given the benefits of the multifactorial intervention in preventing falls and related fall injuries, as indicated in their study, perhaps all older adult patients regardless of risk should receive a multifactorial intervention.

The Person-Environment-Occupation-Performance (PEOP) model recognizes that there are multiple factors (person, environment, occupation, and performance) that interact and ultimately impact an individual's ability to achieve optimal occupational performance (Baum et al., 2015). The person component refers to internal factors that affect the individual and focuses on wellbeing (e.g., neurological factors like balance coordination) while the environment component refers to external factors and focuses on quality of life (e.g., social support and built environment). The occupation component involves the structure of tasks, and the performance component refers to the physical act of doing or engaging in an occupation. Based on the PEOP model, a multifactorial fall prevention approach would be the best option in regard to targeting the multiple components of fall risk (Baum et al., 2015).

Based on Palvanen et al. (2014), a multifactorial approach includes home modifications, strength and balance training, medical review and referrals, medication review, and proper nutrition (e.g., calcium and vitamin D) while a multifactorial intervention, typically used in patients determined by the CDC's guidelines to be high-risk, includes all these factors as well as hypotension management, and vision and foot health prioritization (CDC, 2020).

Community-Based Programs. Community-based programs, such as the Chaos Falls Clinic, incorporates the multifactorial approach in

preventing falls among older adults by delivering assessment, intervention, and treatment in an outpatient clinic (Palvanen et al., 2014), could be beneficial to the older adult population. Short-term benefits include a potential increase in the participation of older adult members of a community in a fall prevention program since the highest odds of enrollment in such a program is associated with "offered close to home," (Kiami et al., 2019). Long-term benefits include a lower incidence of falls and fall-related injuries in the population (Palvanen et al., 2014). These community-based programs have been proven to operate efficiently with a physician (general practitioner), a physiotherapist and a nurse at each clinical site (Palvanen et al., 2014).

Home Modifications. With the use of home modifications, older adults could maintain a greater level of independence as these structural changes in the home have shown a reduction in caregiving hours with informal care reduced by 46% and formal care reduced by 16% (Carnemolla & Bridge, 2019). There is also a relationship between home modifications and improved function, wellbeing, and quality of life. The lack of suitable home designs for the aging population is one of the reasons that older adults often end up transitioning to an assisted living facility. Home modifications are often used in the multifactorial approach to reducing falls in the older adult population therefore there is a gap in knowledge as to the success of this individual intervention (Carnemolla & Bridge, 2019).

Keall et al. (2014) helped to shed a light on the safety aspects of a few home modifications with the aim to determine if a package of low-cost home modifications could decrease the annual rate of injuries in the general population. The study made structural modifications that would benefit all age groups thus creating a home design that would be suitable throughout one's lifetime. Given the fact that there is a stigma around the implementation of home modifications by older adults (Bailey et al., 2019), perhaps intervention must start at a much earlier age. If all homes were designed to be homes that one could safely grow older in, there would be less of a need to implement these changes in later years. This would combat the associated stigma and many home modifications would no longer be associated with decline but rather with safety and longevity.

Strength and Balance Training. Exercise has been proven to be a very useful tool in the multifactorial approach since it can significantly decrease the risk factors associated with fall-related injuries, such as issues with balance, muscle strength, agility, and body flexibility (Areeudomwong et al., 2019; da Silva Borges et al., 2014; Huang et al., 2017). To encourage older adults to implement an exercise regimen, they need to be educated on the variety of benefits of engaging in community exercise programs such as the increase in body awareness and control, mental and emotional wellbeing, and social opportunities (da Silva Borges et al., 2014).

Awareness of the Multifactorial Approach. Regarding the education of older adults, health care providers should regularly educate and promote the implementation of the various factors of the multifactorial approach. Russell et al. (2017) discussed the way that the Public Health Agency of Canada recommended dealing with fall prevention in a community setting. It includes the promotion of an annual medication review, an annual medical examination, an annual vision examination, nutritional support, home modifications, and a minimum of 150 minutes of moderate to vigorous level weekly exercise. In the U.S, these factors would only be considered for high-risk patients based on the CDC's STEADI algorithm. The study also found that 56% of participants were not aware that polypharmacy could increase fall risk and that awareness increased with higher levels of education. As age increased and education levels decreased, awareness also decreased in several categories, such as home safety devices and physical activity. This indicated that there are glaring inconsistencies in the older adult population's awareness of implementing and adhering to national guidelines. More studies should be attempted to fully address these inconsistencies.

The Role of OT. Occupational therapy appears to be an underutilized field when discussing and/or implementing fall prevention methods. Based on the included articles, there is an emphasis placed on physicians' role in reducing risk of falls in the older adult population by means of intervention (e.g., increasing fall awareness and performing routine medication reviews; Bell et al., 2017; Chehuen Neto et al., 2018). However, the specifics remain unclear as there is a lack of a detailed plan that discusses what various health professionals can do at various levels. More specifically, the included articles (14) seemed to limit the role of OTs to only revolve around home safety modifications which is just one aspect of their multifactorial approach. Therefore, while there are several preventative measures available in the prevention of falls among the older population, there may be a bias to discuss the role of other health professionals' roles in fall prevention (e.g., physicians and physical therapists), rather than OTs who bring a unique and client-centered perspective to this issue.

Since multifactorial based approaches tend to be more effective for fall prevention, OTs may be the most suitable healthcare providers to successfully tackle various fall risk factors. Occupational therapists review home environments for hazards, make recommendations to implement changes to ADLs and instrumental activities of daily living (IADLs), and consult with the family members and care team members of clients (AOTA, 2020).

The current study provides an overview of available interventions to prevent fall-related injuries in the home among older adults. However, the selection process purposefully excluded articles with repeated information regarding each topic and subtopic. For instance, if an article provided an example of a community-based fall program that expounded on the importance of utilizing a multifactorial approach, another study that discussed community-based fall programs was then excluded. Therefore, the included articles reflect a scoping overview of interventions available rather than the weight of work in specific intervention areas, which is consistent with the aim of this review. To further enhance this review, more databases could be searched.

Overall, OTs have the capability to focus on the intrinsic and extrinsic factors involved in a multifactorial intervention. Therefore, OTs can create more tailored fall prevention plans that incorporate all the aspects of a multifactorial approach but is also specific to an individual client's needs. OTs can address fall risk factors such as impaired balance, lower extremity weakness, side effects of medications, and home safety hazards (AOTA, 2020).

Conclusion

The purpose of this literature review was to examine the risk factors that contribute to the occurrence of fall-related injuries as well as identify the preventive measures currently available in literature that aim to reduce the risk of fall-related injuries in the home among the aging adult population.

In summary, the factors of balance impairment, gait impairment, polypharmacy, and fall awareness are the most modifiable aspects of the risk of falling in the home. The preventive measures commonly utilized include home modifications, balance and strength training, and medication review. A multifactorial approach is slightly more effective but as shown by Nithman et al. (2019), improvements can be made on how it is utilized in the healthcare setting. There are gaps in knowledge on how to successfully encourage older adults to implement and adhere to fall prevention guidelines. By increasing older adults' awareness of falls, it is possible that they will become more interested in implementing these precautions.

Based on the information summarized above, there is an opportunity to create and test an updated multifactorial approach that incorporates more factors of intervention (essentially treating all older adults as *high-risk* cases based on STEADI standards), more educational outreach, and smart devices that could improve upon the benefits achieved by utilizing the multifactorial approach (home modifications, strength and balance

training, medical review and referrals, medication review, and proper nutrition).

Increased education regarding fall prevention measures should increase the inclination of the aging population to implement and adhere to those measures but with the stigma associated with aging it will prove quite difficult to do so therefore, the issue of internalized ageism must first be tackled. Public outreach, when discussing interventions to prevent fall-related injuries in the home, should focus on more positive terms like longevity, independence, and "active aging" rather than negative terms like decline and frailty (Bailey et al., 2019).

Incorporating smart devices into the multifactorial approach could potentially make ADLs much easier such as, turning on/off the lights at night with a simple voice command, without the need to fumble around in the dark, or even reminders of what pills or supplements, like calcium or vitamin D, to take at the appropriate times. This could be a potential game-changer since one of the most evident household risk factors for falls as discussed in a study done by Chehuen Neto et al. (2018), was the habit of leaving the light off during the night. Other risk factors included in that study could be improved upon by structural design therefore, this needs to be a collaborative effort with other job sectors like architecture, engineering, and information technology.

Based on the included articles, occupational therapy appears to be an underutilized field in the implementation of a multifactorial fall prevention approach. Since the multifactorial approach encompasses the interconnected factors of person, environment, occupation, and performance (PEOP model), the most suitable healthcare provider to help older adults implement and adhere to these interventions may be OTs. These professionals have a history of developing interventions with multifaceted strategies that are client-based (AOTA, 2020). In the future, more solutions centering around the role of OTs in a fall prevention plan should be attempted.

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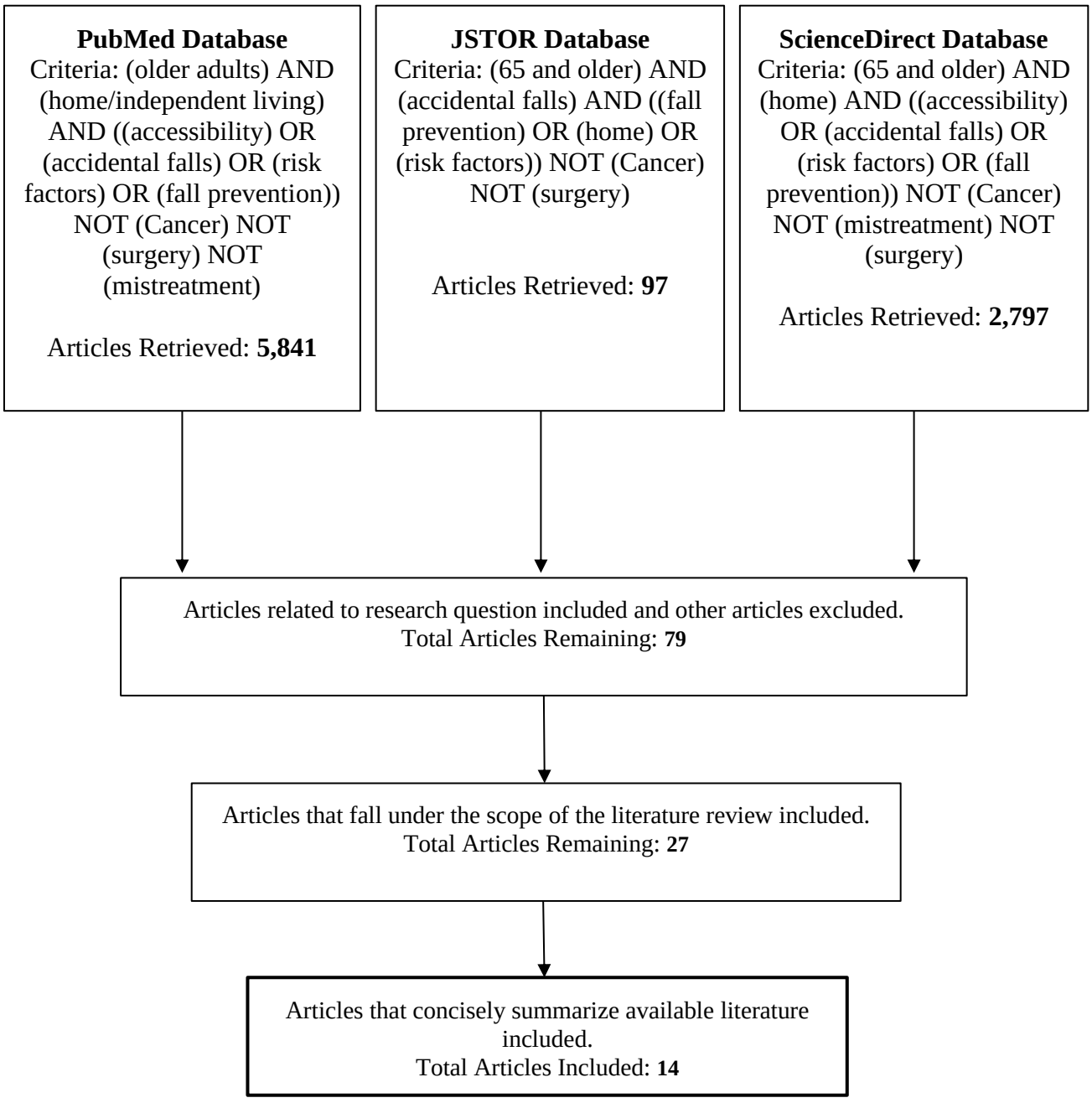
Nithman, R. W., & Vincenzo, J. L. (2019). How steady is the STEADI? Inferential analysis of the CDC fall risk toolkit. *Archives of Gerontology and Geriatrics, 83*, 185-194. https://doi.org/10.1016/j.archger.2019.02.018

Palvanen, M., Kannus, P., Piirtola, M., Niemi, S., Parkkari, J., & Järvinen, M. (2014). Effectiveness of the Chaos Falls Clinic in preventing falls and injuries of home-dwelling older adults: A randomised controlled trial. *International Journal of the Care of the Injured*, *45* (1), 265–271. https://doi.org/10.1016/j.injury.2013.03.010

Russell, K., Taing, D., & Roy, J. (2017). Measurement of fall prevention awareness and behaviours among older adults at home. *Canadian Journal on Aging, 36*(4), 522-535. https://doi.org/10.1017/s0714980817000332

Figure 1

Matrix Method for Selecting Articles for Literature Review



Note. Figure adapted from The Matrix Method (Garrard, 2015).

Table 1

Review Matrix for Literature on Risk Factors and Preventive Measures for Falls in Older Adults

Author, Title	Year	Study Design	Purpose	Key Terms/Concepts
Areeudomwong P, Saysalum S, Phuttanurattana N, Sripoom P, Buttagat V, Keawduangdee P. Balance and functional fitness benefits of a Thai boxing dance program among community-dwelling older adults at risk of falling.	2019	A randomized controlled study.	To investigate if the implementation of Thai boxing could reduce falls among older adults by improving balance and overall functional fitness.	Thai boxing in relation to fall-related injury preventive measures.
Bailey C, Aitken D, Wilson G, Hodgson P, Douglas B, Docking R. "What? that's for old people, that." Home adaptations, ageing and stigmatisation.	2019	A qualitative inquiry.	To understand older people's perceptions of the acquirement of home modifications.	The article addresses a possible challenge in the implementation of fall prevention measures.
Bell HT, Steinsbekk A, Granas AG. Elderly users of fall-risk-increasing drug perceptions of fall risk and the relation to their drug use.	2017	A qualitative study.	To explore the perception of older adults in regard to fall risk and the relationship it may have to FRIDs.	The definition of fall-risk-related-drugs (FRIDs) and its correlation with possible fall risk prevention.
Carnemolla, P., & Bridge, C. Housing Design and Community Care: How Home Modifications Reduce Care Needs of Older People and People with Disability.	2019	A single-arm study that utilizes a cross-sectional data capture of participants' pre- and post-survey responses.	To investigate if the implementation of home modifications has the potential to reduce the number of hours of care given by caregivers of older people and people with disabilities.	The definition and purpose of home modifications.
Chehuen Neto JA, Braga NAC, Brum IV, et al. Awareness about falls and elderly people's exposure to household risk factors.	2018	A transversal study.	To understand the awareness of falls among the older adult population.	The identification of a correlation between older adult fall risk perception and a lower chance of having household fall risk factors.
da Silva Borges EG, de Souza Vale RG, Cader SA, et al. Postural balance and falls in elderly nursing home residents enrolled in a ballroom dancing program.	2014	A randomized control trial.	To investigate if the implementation of a ballroom dance program could reduce falls among older adults by improving postural balance.	Ballroom dancing in relation to fall-related injury preventive measures.
Dunsky, A., Zeev, A., & Netz, Y. Balance Performance Is Task Specific in Older Adults.	2017	A collection of surveys was utilized and compared.	The association between static balance measures and two dynamic balance field tests are examined.	The study stressed the importance of balance, listed the two types of balance, and discussed factors related to balance impairments.
Huang ZG, Feng YH, Li YH, Lv CS. Tai Chi for preventing falls in older adults.	2017	Systematic review and meta-analysis.	To investigate if the implementation of Tai Chi could reduce falls among older adults.	Tai Chi in relation to fall-related injury preventive measures.

Keall, M. D., Pierse, N., Howden-Chapman, P., Cunningham, C., Cunningham, M., Guria, J., & Baker, M. G. Home modifications to reduce injuries from falls in the Home Injury Prevention Intervention (HIPI) study: a cluster-randomised controlled trial.	2015	A single-blind, cluster-randomized controlled trial.	The study aimed to investigate the effectiveness of home modifications in the reduction of fall-related injuries using households from the Taranaki region of New Zealand.	The study also sheds light on the lack of variety in the home modifications currently available on the market.
Kiami, S. R., Sky, R., & Goodgold, S. Facilitators and barriers to enrolling in falls prevention programming among community dwelling older adults.	2019	A cross-sectional survey study.	To investigate the potential barriers and facilitators to enrolling older adults in fall prevention programs.	Listed the 7 facilitators associated with increasing older adult interest in registering for a fall prevention program.
Moncada, L. V. V., & Mire, L. G. Preventing Falls in Older Persons.	2017	A literature review.	To analyze the prevention of falls in older persons by investigating risk factors and key recommendations for its prevention.	Listed the 8 eight categories of potentially modifiable risk factors in falling and gave examples of each.
Nithman RW, Vincenzo JL. How steady is the STEADI? An inferential analysis of the CDC fall risk toolkit.	2019	A quantitative cross-sectional cohort and prospective design.	To analyze the strengths and weaknesses of the CDC fall-risk prevention algorithm-STEADI.	The meaning of the concept STEADI and how the CDC utilizes this multifactorial approach.
Palvanen, M., Kannus, P., Piirtola, M., Niemi, S., Parkkari, J., & Järvinen, M. Effectiveness of the Chaos Falls Clinic in preventing falls and injuries of home-dwelling older adults.	2014	A randomised controlled trial.	To compare the use of only home modifications and the use of a multifaceted approach using home modifications and other factors.	The concept of a 'Multifactorial Approach' is introduced.
Russell, K., Taing, D., & Roy, J. Measurement of fall prevention awareness and behaviours among older adults at home.	2017	A survey-based study.	To analyze the awareness of, and adherence to, six national fall prevention recommendations among community-dwelling older adults.	The study discussed fall awareness among the older adult population, as well as an awareness of the multifactorial approach.

Note. Figure adapted from The Matrix Method (Garrard, 2015).