

## Community-Based Programs to Prevent the Risk of Elderly Falls: Mini Review

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### Abstract

Falls and fall-related injuries are common in older adults, including those with cardiac and pulmonary conditions, but thankfully falls are preventable. Despite national guidelines recommending using community-based fall prevention programs to help reduce falls, little is known about their availability at senior centers. This review summarizes pertinent evidence on community-based fall prevention programs that can be deployed for cardiac and pulmonary rehabilitation patients. A novel algorithm for health care workers is proposed based on the available data to help decide how to refer older adults to the appropriate community-based fall prevention programs.

**Keywords:** Fall prevention; Falls; Geriatrics; Senior; Cardiac rehab; Pulmonary rehab; Fall risk; COPD; CHF; Coronary artery disease; Atrial fibrillation; Acute myocardial infarction; Congestive heart failure

### Introduction

One in three older adults (65 years old and older) in the United States experiences falls [1]. Falls are the number one cause of non-fatal injury leading to emergency room visits as well as number one cause of unintentional death in older adults [2]. Falls account for 2.99 million emergency visits a year as of 2018 in 65+ year's old age group [2].

### Mini Review

There is evidence that pulmonary and cardiac conditions are considered risk factors for falls and fall-related sequelae. Atrial fibrillation, acute myocardial infarction and congestive heart failure, for example, were shown to be risk factors for mortality in older adults aged 75 and over admitted for falls [3]. Frailty, a geriatric syndrome associated with falls, was found to be prevalent in 50% to 54% of older adults with severe coronary artery disease or heart failure [4]. Sarcopenia, another risk factor for falls [5], was found 20% more frequently in heart failure patients vs. healthy individuals [6]. Furthermore, chronic obstructive pulmonary disease (COPD) has shown to be associated with impaired postural control and gait speed, contributing to balance deficits in patients affected with COPD [7].

It appears that addressing risk of falls may be an appropriate goal for professionals working in the field of pulmonary and cardiac rehabilitation. The Centers for Disease Control and Prevention (CDC) had created a general algorithm for medical providers: Stopping Elderly Accidents, Deaths and Injuries (STEADI), which recommends using evidence-based community (e.g. at a senior center) fall prevention programs (EBCFPPs), together with other fall risk reduction strategies for older adults at risk of falls [8]. Unfortunately, there is little known about the prevalence of these programs or how to decide which program to recommend for a given patient. We will review here some of the most common EBCFPPs and suggest a simple algorithm to guide healthcare providers on EBCFPP utilization in clinical practice. We limit this review to EBCFPPs that can be implemented at a senior center (SC) and have at least one randomized controlled study with primary outcome of reducing falls or fall rate.

A national study on EBCFPP prevalence across the US showed that although 35% of SCs offered no EBCFPPs, 54% offered at least one [9]. Tai Chi of any type was offered in 59.9%, A Matter of Balance (MO) in 8.9% [10], Stepping On (SO) [11] in 7.7% of SCs sampled. A different study, focusing on delivery of EBCFPP in rural areas, showed that most of EBCFPPs are delivered at SCs, and that MO, SO and Tai Ji Quan (TJQ), a type of Tai Chi [12], were the most common EBCFPPs implemented [13]. We believe that relatively high prevalence of Tai Chi found by Hamel et al. [9] should be differentiated from the relatively low prevalence of TJQ found by Smith et al. [13], since Hamel et al. [9] did not differentiate between the different types of Tai Chi as was acknowledged as a study limitation [9]. Overall, both prevalence studies agree that MO, SO and Tai Chi are the top three most prevalent EBCFPPs nationally.

In Table 1 we provide a short description of MO, SO and TJQ as well as some other salient EBCFPPs. It appears that both SO and MO offer cognitive-behavioral approach for providing fall-reduction education together with balance and strengthening exercise regimen. It appears that all of the EBCFPPs that show efficacy in randomized controlled studies include at least balance and strengthening components, and some of the most common ones also include general mobility training and/or education on environmental modification (e.g. installing grab-bars, removing throw rugs, etc...). Since programs at large offered physical or general medical fall prevention related education, it makes sense that most of the programs listed minimum cognitive capacity criteria for participation to exclude patients who may have difficulty with "carry-over," learning and/or retaining new information [11,12,14-16]. Overall, patients in these studies were able to independently ambulate: though Otago program was acceptable even for patients able to ambulate at least house-hold distances [14], most of the programs required community ambulation as a functional mobility requirement (Table 1). Otago, a physical therapist driven intervention which includes four home visits with physical therapist, followed by phone follow-up for reminders and to help progress the exercise, is shown to be effective even for the oldest of the old and with least exclusion criteria [14]. Additionally, TJQ [12] intervention requires at least a 6-month commitment [12], which may enrich for more compliant patients by automatically screening out those that have difficulty committing to their health care related goals.

It appears that duration of these interventions varies from 2-6 months overall (Table 1).

It should be noted that none of the studies listed in Table 1 had any cardiac or pulmonary conditions listed as exclusion criteria, except perhaps for TJQ which excluded participants who on one hand participated in “daily or structured vigorous physical activity or walking for exercise that lasted 15 minutes or longer or muscle-strengthening activities on 2 or more days a week in the previous 3 months” or on the other hand had “major medical or physical conditions determined

by their health care practitioner to preclude exercise” [12], which may by inference exclude patients currently participating in or eligible for cardiac or pulmonary rehabilitation programs.

As of today, there is no peer-reviewed publication advising how to prescribe EBCFPPs for patients at risk of falls, even though current national guidelines e.g. (STEADI) recommend implementing them as part a comprehensive fall prevention regimen [9]. We focused on EBCFPPs offered at SCs in this study, since more than half of SCs sampled nationally did offer at least one EBCFPP [9]. We generated a

Name of Program	Participant Characteristics						Prevalence at Senior Centers		
	Age			Falls Risk	Ambulation	Cognitive Criteria	Exclusion	Hamel et al [9]	Smith* et al. [13]
	65+	70+	80+						
A Matter of Balance [10]		✓		Are you concerned about falling? Do you avoid certain activities due to concerns about falling?	Not confined to bed or wheelchair			8.9%	60.13%
The Otago Exercise Program [14]			✓		household ambulator	MSQ [17] <7/10		N/A	0.13%
Stay Active and Independent for Life [15]	✓			No exercise in previous 3 months, 10 ft TUG [18] <30 sec		<5 errors PSPMSQ [19]	Excluded transportation, hearing and vision impairments	1.2%	0
Stepping On [11]		✓		concerned about falling or have fallen in the last year	not homebound	<3 errors PSPMSQ [19]		7.7%	18.25%
Tai Chi for Arthritis [16]	✓				can move independently without assistance	Impairment of mental functioning	Excluded if have serious medical condition or impairment of mental or physical functioning	N/A	6.04%
Tai Ji Quan: Moving for Better Balance [12]		✓		1 fall in 12 months. TUG [18] >13.5 s	Able to walk 1-2 blocks and exercise	MMSE [20], ≥20 range of 0 to 30	Excluded patients participating in structured physical Activity or walking >15min or muscle activities. Major medical or physical conditions.	N/A	15.4%

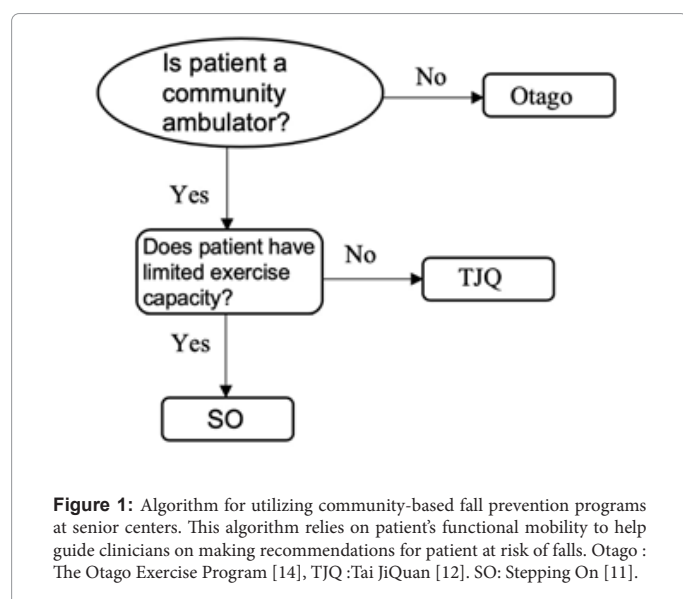
**Table 1:** Summary of most common evidence-based community fall prevention programs. Abbreviations: TUG: Timed Up and Go test shown to help predict falls [17]; PSPMSQ: Pfeiffer Short Portable Mental Status Questionnaire for assessing cognitive ability [18]; MSQ: Mental Status Questionnaire for assessing cognitive ability [19]. MMSE: Mini Mental State Examination for Assessing Cognitive Ability [20]. \*It should be noted that Smith et al. [13] do not specifically report prevalence of these programs at senior centers, they report an aggregate number offered across different types of community venues. They also tend to focus on prevalence of the programs at rural areas. We refer to their study to provide estimate of prevalence of the community-based programs as no other study we are aware of has assessed for prevalence at senior centers besides Hamel et al. [9]. Prevalence percentage in Smith et al. [13] is calculated by adding non-metro adjacent workshops and non-metro non-adjacent workshops for each program and dividing each of them by the sum of the total programs listed as enumerated in the original article [13].

	Intervention									Duration	Control group	Fall Reduction	Study Outcome	
	ED	BM	S	B	F	ENV	V	M	MO				Falls Rate	Other Outcome
A Matter of Balance [10]		✓	✓	✓						8 weekly sessions, a booster session 6 months after	usual care	reduction of falls, but not as a primary outcome		self-efficacy, sense of control, risk perception and expectancies regarding falls
The Otago Exercise Program [14]			✓	✓						4 home visits in the first 2 months. Then the rest over the phone. Program over 2 years	usual care and social visits at home		0.83 vs 1.19 falls per person year at 2 years	
Stay Active and Independent for Life [15]	✓		✓	✓						3 times a week 12 months			25% less than in the control group	Leg strength, Balance, Mobility
Stepping On [11]	✓	✓	✓	✓		✓	✓	✓		7-week follow-up home visit within 6 weeks of the final session	two social visits from an occupational therapy student	31%		
Tai Chi for Arthritis [16]			✓	✓						1 hour twice a week for eight weeks.	maintain their usual care and activities			pain, mobility, stiffness, fatigue, strength, and balance.
Tai Ji Quan: Moving for Better Balance [12]			✓	✓	✓		✓			two 60-minute classes weekly for 24 weeks	multimodal exercise or stretching exercise	58%		physical performance measures, walking assessment, standing balance tasks

**Table 1:** Continued. Abbreviations: ED: Education Intervention; BM: Behavior Modification Intervention; S: Strengthening Exercise; B: Balance Exercise; F: Flexibility Exercise; Env: Environmental Modification; V: Vision Screening; M: Medication Review; MO: Mobility Training.

short algorithm (Figure 1) that recommends EBCFPs based on two criteria: their national prevalence to make it more likely to be present near one’s local practice and fall reduction efficacy. National prevalence at SCs was estimated directly from data from SCs when such data was available [9] or inferred based on their approximate relative national prevalence [13] (Table 1). Fall reduction efficacy was deemed to be appropriate only if study demonstrated reduction in falls, recurrent falls or falls rate as a primary outcome in a randomized controlled study. MO, though significantly prevalent nationally and supported by

several randomized controlled studies, does not show fall reduction as a primary outcome [10]. We provide a simple to use algorithm based on patient functional mobility criteria (Figure 1). Those that are not community ambulators probably would do best with OTAGO [14] which was proven effective even for patients who are only household distance ambulators. Those with limited exercise capacity, e.g. early on in cardiac and pulmonary rehabilitation can probably start with SO [11], and not TJQ which excluded patients based on exercise tolerance limitations [12].



## Conclusion

We believe that cardiac and pulmonary rehabilitation practitioners can include reducing risk of falls as a goal for their clients. To accomplish the goal of fall risk reduction, we recommend utilizing EBCFPPs offered at SCs as per by national guidelines suggesting community based fall prevention program use [8]. We hope that our summary of some of the most prevalent EBCFPPs at SCs and their efficacy, as well as the mobility-based algorithm can help inform clinical decision for reducing falls in older adults.

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