After the Fall: Consequences and Psychosocial Determinants when an Older Person Falls

A Continuing Education Module for the Academy of Geriatric Physical Therapy

MODULE CHAPTERS

1. Looking Beyond the Episode
2. Movement Perspective
3. Cardiopulmonary Considerations
4. Concussive Syndrome
5. Fear of Falling
6. Home Modifications
7. NCOA

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REFERENCE LIST

References can be found at the end of each chapter in the module.

OBJECTIVES

1. Explain the investigation process for fall determination.
2. Discuss falls from a movement systems vs event perspective.
3. Address and discuss cardiopulmonary ramifications of fall effects on individuals with/without known cardiac disease.
4. Discuss signs and symptoms of TBI/concussion in older people and physical therapy assessments.
5. Understand the determinants of balance confidence with respect to fall events.
6. Discuss methods for determining home modifications appropriate to prevent falls.

TARGET AUDIENCE

Physical Therapists and Physical Therapist Assistants

CONTACT HOURS/CONTINUING EDUCATION UNITS

Completion of this CE Module is equivalent to 4 contact hours (0.4 CEU units).

CONTINUING EDUCATION CERTIFICATE OF COMPLETION

A Continuing Education certificate will be provided to each participant after successful completion of the course requirements (post-test and module evaluation) and payment of a processing fee. The Academy of Geriatric Physical Therapy is a recognized component of the American Physical Therapy Association. The Academy has not applied to any state licensure agency for prior approval of this course. The module has all the components (content, objectives, qualified instructors, reference lists, and post-test) that will allow participants to submit the certificate of completion to meet CE requirements in some states. Participants are urged to check with their state licensure board to see if this course counts towards continuing education credit.

HOW TO OBTAIN CEUS

To obtain CEUs for this unit, participants must complete the ONLINE post-test AND the ONLINE evaluation form. Go to http://geriatricspt.org/exams.

A processing fee of $40.00 for Academy of Geriatric Physical Therapy members and $80.00 for non-members is required for all physical therapist and non-member Physical Therapist Assistants**. The processing fee is WAIVED for all Physical Therapist Assistant Academy Members** – Congratulations on 50 years and many thanks for all that you do for older adults and the profession! **Test and evaluations forms must be completed online no later than December 31, 2022.** Upon submission of materials and a passing score of 80% or higher on the post-test, the Academy will email you a continuing education certificate for 0.4 CEUs. Those with incomplete submissions will be notified via email and given the opportunity to re-take the exam. There is only ONE correct answer for each question. NOTE: This is to be performed ONLINE ONLY at http://geriatricspt.org/exams/

Looking Beyond the Episode: What Really Caused the Fall?

Cathy Ciolek, DPT, FAPTA

According to the US Centers for Disease Control and Prevention, an estimated 28.7% of Americans over the age of 65 fall each year.[1] This results in nearly 2.8 million emergency room visits annually and many more injuries that do not get reported.[1] Falls in older adults are now being recognized as a public health issue with greater resources becoming available to address the issue.[1] As physical therapists, we recognize that falls are multifactorial[2] and have a wide range of assessment tools at our disposal to screen for fall risk and components of balance issues that may predispose a person to falling.[3,4]caregivers, and health care providers. Identification of fall risk is crucial for appropriate referral to preventive interventions. Falls are multifactorial; no single measure is an accurate diagnostic tool. There is limited information on which history question, self-report measure, or performance-based measure, or combination of measures, best predicts future falls. PURPOSE First, to evaluate the predictive ability of history questions, self-report measures, and performance-based measures for assessing fall risk of community-dwelling older adults by calculating and comparing posttest probability (PoTP But how good are we at really determining the cause of a fall and addressing risk?

Whether you are in outpatient, acute care, or a post-acute setting (Skilled Nursing Facility, Home Health, etc), getting to the root cause of the fall is key for determining the next steps for further examination, intervention, environmental, or behavior change. As physical therapists, we are problem solvers. We like quick answers. Often determining what contributed to a fall is like peeling away the layers of an onion, each new layer giving us more information and further details to explore. If we stop examining when we first think we have a quick answer, we may stop too soon. Our interventions are then limited and may be a contributing factor for why solutions do not "fix" the problem.

Over the last 3 years, I have been privileged to help facilities problem solve with their most complicated situations that impact people who fall…a lot. Initially as part of a grant to improve well-being for residents in skilled nursing facilities and now as an independent consultant, I have the opportunity to dig deep into these cases. I try to combine the art and science of fall assessment. The science gives us some known tools. The art is filling in the blanks with suppositions based on learning about the person, the environment, and the situations. Hopefully these concepts from long term care facilities will prompt some thoughts on applying the art in your practice.

FALLS INVESTIGATION

The Oregon Patient Safety Commission created a Long Term Care Falls Investigation Toolkit[5] that is a wonderful guide with resources for nursing home staff. The concepts included can be applied to any institution or setting where a team response is needed to assess falls. The steps would also apply to interviewing someone after a fall who presents to outpatient or home health.

When investigating circumstances around a fall, it is helpful if there are eyewitness reports and/or the person who fell can relate the event. If the person has a cognitive impairment or becomes concussed as a result of the fall, this becomes more challenging. Additionally, most falls in a long term care facility are not observed[6] and an examination of video footage of falls in a common area of a long term care facility showed more than 50% of incident report descriptions were inaccurate compared to the video recording.[7] One facility I worked with had a policy to interview every nursing assistant on the residents' unit if a fall occurred. This resulted in many reports that contributed no useful information (for example, I was on break when it occurred). The facility felt they had met the need to have documentation and it seemed to end there. They did not analyze the data for what was useful information to help draw conclusions, to discover the root case. Doing interviews is not a checkbox for compliance, instead the point is to get information to help identify the problem, determine interventions specific to the problem, and assess if it worked. Some key information that is critical for "filling in the blanks" of un-witnessed falls is listed in Table 1. The toolkit includes links to drill down

Table 1. Key Information in Un-witnessed Falls in the Skilled Nursing Facility (if applicable)

Last time observed and what the person was doing.	Create a diagram of the scene.
Any recent changes in medications or medical status?	Were care-planned interventions in place?
Any known environmental factors (noise, light, flooring)?	Was all equipment in working order?
Any recent changes in behavioral expressions?	Last time they were assisted to bathroom?
Did they appear sad, bored, overwhelmed, in pain?	How has their sleep been?

in medications, environmental factors, and communication factors, as well as 3 different falls investigation checklists.[5]

The next stage is to fill in the gaps of information of the history along with findings from the physical therapy examination. Let's assume the person has a history of some balance impairments that previously were not amenable to physical therapy intervention and that the last time she was assisted to the bathroom before the fall was 4 hours prior. We still need more information. In this case the reports indicate she was found on the floor near the bathroom and was incontinent. From here, using the concept of the 5 Why's is essential to getting to the root cause of the issue.[8]Lowry, and Smith (2012 This is the "dig" discussed earlier. As you come to a possible answer, again ask a ***why*** question. It may need more than 5 levels to drill down and there may be more than one cause at any level. In the example shown in Figure 1, stopping at the first questions may have identified the need for a better schedule for voiding, however, it would have failed to identify the many staff errors, and a failed care planned intervention (ie, remind resident to use call light for assistance) that ultimately contributed to the fall. Failing to put new systems in place to fix these errors will likely see a repeat of the problem with potentially worse results for an individual and the community.

RISK REDUCTION

Developing interventions to address fall risk is a team effort in long term care. Beyond traditional physical therapy interventions of exercise, addressing fear of falling, gait, and balance training, one must address additional factors.

First, many agencies may disagree, but not all falls are preventable. Humans make decisions, perform actions, and show failures of insight that increase risk daily. It is human nature. Add in cognitive or physical impairments, and the risks increase.[9] Trying to create a care-plan that states a resident will not have any falls will set up a facility for failure. We want to reduce risk and minimize events and injury.[10] Let's aim for safest possible environment, recognizing that safety is a relative term, and do our best to reduce preventable falls.

Second, my experience is that physical therapists are highly risk averse. Evidence demonstrates that health professionals are more risk averse than the general population[11] and that nurses (who provide care) are more risk averse than social workers (who are more likely to promote autonomy).[12] We can't walk by a spill without getting a caution sign or cleaning it up because someone MIGHT fall. We live in the world of potential negative risks, seeing things many others never see. We live in the lower left quadrant (negative risk associated with doing nothing) of Figure 2 and assume only upper right (positive) expectations with intervention. The truth is all 4 quadrants exist and if we are trying to improve the care of a humans, we need to explore 4 quadrants as a team based on their risk aversion and capability/interest in change.. The Department of Health and Social Care in England uses the phrase "Positive Risk Management" or "Risk Enablement."[13] This person-centered approach encourages a review of the 4 quadrants and promotes creating shared understanding to minimize negative risk and promote positive risk.

For example, if someone with dementia experiences a fall in a skilled nursing facility, the staff may review the incident and add a new intervention to the care-plan. The intervention is often chosen from a drop-down menu in the electronic medical record (EMR) and may read "the resident will spend free time by the nurse's station for observation." The rationale is that if the staff is observing the resident more, they will be able to intervene before a fall occurs. However, the family has shared that they believe the resident enjoys quiet time alone. Let's look at some of the potentials with the quadrants here. Potential negative with this intervention--will she stay; does she enjoy being out with others; will it overstimulate her and cause agitation; will she try to get up and get away from this; will she walk less because the staff try to keep her there, a known risk factor for deconditioning and a decline in well-being? Potential negative with no change--she could fall again and injure herself. Potential positive of placing by the nursing station--she may surprise everyone and enjoy the social interaction; get more exposure to light; there may be intervened falls. Potential Status Quo--she is content spending time in her room; family understands risk and wishes her to be happy.

The team needs to expand their thinking and review all the possible implications of an intervention and come to a shared understanding. Person-centered care practices place the individual at the center of the decision, with input from selected care partners/ family members, staff, and leadership.[14] It requires the team to learn the person's preferences and priorities and act on

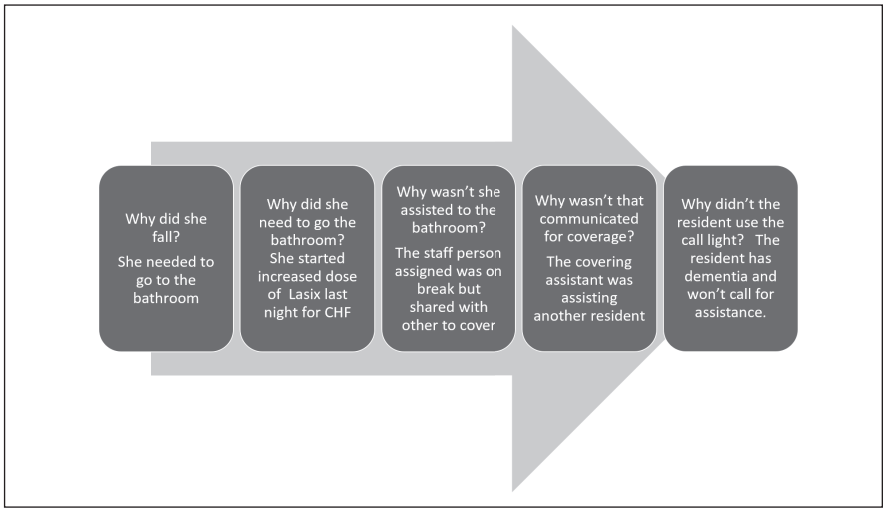

Figure 1. Example of 5 why's.

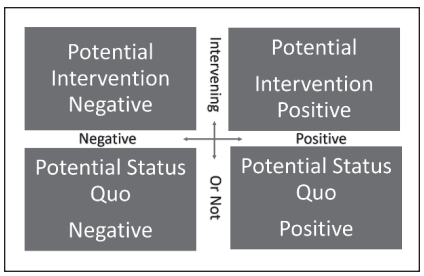

Figure 2. Positive and negative risk.

them even if it is not what any one discipline or staff member thinks is best. As shared understanding is reached, it should be documented including the risks discussed and options considered and can be revisited as preferences change or new factors are unearthed.

A similar application could be used for someone presenting to outpatient physical therapy. The person presents s/p fall of unknown etiology. He does not recall any precipitating event. As you review the case, his balance measures do not show a fall risk, however, you note that he started on amiodarone for atrial fibrillation in the last week before the fall. A recent study showed that anti-arrythmia medication is associated with a 29% higher rate of injurious falls, particularly in the first 14 days of initiation.[15] As the physical therapist, you need to follow-up with the physician to discuss your findings and to discuss all 4 quadrants of the risks to see if, based on the individual's preferences for care, there are better options for him.[16] Ultimately, a shared understanding of the risk of continuing/discontinuing should occur with the physician and physical therapist contributing to the ultimate decision made by the patient.

CONCLUSION

Beyond traditional physical therapy examination and evaluation, assessing fall risk and risk reduction may require an investigation. This level of exploration of cause may not be needed for everyone, but for people with multiple falls or when a facility has "tried everything," spending time to look deeper is well within the scope of physical therapy practice and helps drive our profession forward to transform society and improve the human experience.

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Fall Risk from a Movement System Perspective: An Event or an Experience?

Lise McCarthy, PT, DPT; Jean Miles, PT, DPT

Peter, an 89-year-old retired tree-trimmer, is attending his first physical therapy appointment. He wants to know what his fall risk is because he lives alone and recently fell while walking on the sidewalk. He denies any injury; however, he has a small bruise on his left knee with a noticeable limp. He reports the cause of his fall was inattention. He loves spending hours in his backyard tending to his garden. He is well dressed except he is wearing loose fitting tennis shoes that are badly worn down at both heels. Except for taking a recommended vitamin D supplement, Peter takes no medications. He reports having no significant medical conditions or comorbidities. He recently saw his ophthalmologist, which resulted in a recommendation for prescription reading glasses in lieu of drugstore readers. Peter reports his home has good lighting with secure railings and two grab bars in the shower. He reports no prior history of falling or fear of falling, but his son who accompanies him thinks he may be at risk for falling and wants an expert's opinion. Peter agreed to come to see a physical therapist at his family's insistence because they have observed some lapses in his judgment regarding driving and safety issues. Many of his friends have fallen; however, he denies any concerns about himself.

The physical therapist performs a STEADI evaluation.[1] Peter's STEADI questionnaire score is 3/14 giving his physical therapist the initial impression that Peter has a low fall risk (Table 1.) His performance test measures for orthostatic hypotension screen, Snellen eye test, and STEADI are all normal (see Table 2 for Peter's STEADI performance scores and norms.[2]). His foot wear is not appropriate so his physical therapist could simply recommend alternate supportive shoes and inform Peter that based on the Centers of Disease Control and Injury Prevention STEADI criteria his fall risk is low. But is Peter's fall risk really low?

A universal definition of a fall does not exist.[3] The CMS refers to a fall as "…unintentionally coming to rest on the ground, floor, or other lower level, but not as a result of an overwhelming external force...."[4] The operational definitions of falls have been classified and codified into the International Classification of Diseases, Tenth Revision (ICD-10) mostly in terms of external causes or events (eg, fall from a bed, fall from a chair, fall from a ladder, fall off a boat, and fall due to ice or snow).[5] This viewpoint superficially makes sense when the primary reason a health care professional examines a person injured by a fall is because something happened (ie, an event) causing an injury or concern that results in people seeking health care evaluation and management services.

As more people enter the Medicare system, records and projections of fall-related Medicare costs show an exponential rise is well underway. Yet multifactorial interventions and strategies for reducing fall risks, especially in older people, are insufficiently effective[3] despite multiple global, national, state, and local stakeholders working hard to improve the fidelity of fall prevention and early detection programs. Why?

Part of the answer may be that the operational definition of "fallers" based on ICD-10 language is limited. At present, ICD-10 language and codes do not adequately codify elements of falls as described by people who are actually experiencing falling, and by health care professionals who are movement experts. For example, people who fall, and health care professionals who examine people who fall, report different reasons for the fall event[8] (Table 3). Unfortunately, these descriptions and phrases describing the reasons for falling are not codified into ICD-10 language. For example, "Loss of balance" (no ICD-10 code) is not equivalent to "unsteadiness on feet" (codified R26.81). In addition, "inattention" is not necessarily the same as "neglect" (codified in a variety of ways)

Table 1. Peter's "Yes" Answers on the STEADI Questionnaire

Points	Statement	Why it matters
2	"I have fallen in the past year."	People who have fallen once are likely to fall again.
1	"I am worried about falling."	People who are worried about falling are more likely to fall.
3	14 total points are possible.	A score =/> 4 points indicates possible risk for falling.

Table 2. Peter's STEADI Performance Scores and Norms

Test	Score	Norms[2]
4-Stage Balance	4	Achieving < all aspects of position 3 indicates a high fall risk.
30-second Chair	12	Normal: 85 - 89 years >/= 8 male and 8 female.
Timed-Up and	10	Normal: 80 – 99 years = 10.0-12.7 seconds.

or "attention and concentration deficit" (codified R41.840). Furthermore, coming changes related to PDPM and PDGM will have significant impact on home care and skilled nursing facility reimbursements payments and will require a specific diagnosis that explains the underlying causation for the falls.

Applying the biopsychosocial model to better understand how a fall is experienced requires greater inclusion of perspectives that are meaningful to more stakeholders (eg, people who fall and experts in fall risk evaluation and management). A fall perceived as an experience is viewed differently from a fall considered to be an event. Falls codified as having external causes are different from falls with internal elements outwardly expressed as "…a type of abnormal movement defined as the unexpected and complete loss of balance due to dysfunction within the brain-body system and/or due to inadequacies in adapting to challenges or barriers within the environment."[9]

Peter's age puts him at higher risk for falling and fall-related injury regardless of his STEADI results indicating his fall risk is low.[10-12] Peter has fallen once, which doubles his chance of falling again.[13] Peter's physical therapist is aware of these statistics and so she expands her fall risk examination to include proprioception and reflex testing, and measuring oxygen saturation while walking 2 minutes. These tests are also negative.

His physical therapist knows that people with cognitive impairment have a two-fold increased risk of falling compared to people who are cognitively intact.[14] She includes two cognitive-based functional assessment screening tools (ie, GDS/FAST Staging System and the Behavioral Dyscontrol Scale). Administration and interpretation of these 2 cognitive screening tools are skills particularly well-suited for physical therapy practice.

The GDS/FAST Staging System screens 20 specific cognitive-based functions, many of which are important for movement control (Box 1).[15] This tool grossly assesses 5 brain functions (ie, concentration, recent and long-term memory, orientation, and IADL/ADL function) as a means for staging people (specifically Alzheimer's dementia and vascular dementia) on a 7-stage dementia spectrum. Interventions for each of the 7 stages has been previously described in *GeriNotes*.[16]

However, the GDS/FAST Staging System, like all cognitive tests, is limited. From a movement system perspective, unintended falls can be considered movements that the brain-body system cannot control. A good fall risk assessment must therefore include tests that help rule in/out functional deficits in the brain-body system that are contributing to a fall. A good fall risk care management plan must subsequently include strategies and interventions that target treatable deficits within the brain-body system.

Peter's total score is 2.4 (Table 4) and places him in GDS Stage 2. Collectively, his score indicates that his limbic system, temporal, parietal, and frontal lobes are working well enough together that he does not meet the threshold for having characteristics of cognitive impairment (GDS Stage 3). Why would a fall risk expert want to include further cognitive screening? If a cognitive impairment was noted based on test results, what would be appropriate goals, and what could the physical therapist offer as part of a care management treatment plan?

Peter described his experience of falling as due to inattention. His son verbalized concerns about Peter's judgment. A tool that assesses insight and inattention from a movement system perspective is necessary to understand Peter's particular fall risk. The Behavioral Dyscontrol Scale (BDS) is such a screening tool. The BDS uses motor responses and motor sequences to determine the capacity of a person to engage in purposeful and goal-directed activity, to inhibit inappropriate or irrelevant behavior, and to monitor their performance accuracy. The BDS is unique among executive function tests, in that it selectively assesses movement-related aspects of executive function involving insight and judgment, and is correlated with ADL performance ability in older adults.[17-19] Further, the BDS is valid and reliable, can identify people with executive dysfunction with high MMSE scores, and correlates with low MMSE scores.[17] (The BDS manual and video demonstrations are available by contacting Dr. Jim Grigsby at University of Colorado in Denver, jim.grigsby@ucdenver.edu.)

Peter's score on the BDS is 18 indicating he has characteristics of mild to moderate cognitive impairment. (See

Table 3. Comparison of Perspectives and the Top 3 Reasons for Falling Reported by Seniors and Healthcare Professionals[8]

Reporting Source	#1 Reason for falling	#2 Reason for falling	#3 Reason for falling
Seniors	**Loss of balance**	**Weather**	**Inattention**
	No ICD-10 code	ICD-10 Code W00.0XXA Fall on same level due to ice or snow	No ICD-10 code
Health Professionals	**Medical conditions**	**Loss of balance**	**Medications**
	No ICD-10 code	No ICD-10 code	No ICD-10 code

Box 1. Twenty Specific Domains Screened by the GDS/FAST Staging Tool[15]

Abstraction	Affect	Attention span	Concentration
Consciousness	Constructional Ability	Functional Ability	General Knowledge
Intelligence	Judgment	Language	Learning Ability
Memory	Orientation	Perception	Problem-solving
Psychomotor Ability	Self-care	Social Interactions	Thought Content

Table 4. Peter's Scores on the GDS/FAST Staging System

Category	Points
Concentration	3
Recent Memory	3
Long-term Memory	2
Orientation	2
IADL/ADL Self-care Function	2
Total score / 5 categories	12 / 5 = 2.4

Table 5. Peter's Scores on the Behavioral Dyscontrol Scale

Test Category	Points	Comments
1	3	
2	1	Impaired
3	2	
4	2	
5	3	
6	1	Impaired
7	2	
8	1	Impaired
9	3	
Total score	18	

Table 5 for details about Peter's BDS score, Box 2 to interpret his score, and Box 3 to view BDS.)

Peter's fall risk profile and the reason(s) for his fall change when his fall is viewed, not as a medical event, but rather as an experience. He fell because he experienced a period of inattention. His subjective report can be corroborated by his physical therapist through objective cognitive-based functional testing using the GDS/FAST Staging System and the BDS. His report of inattention can be teased out by testing his motor responses and movement control using the BDS. Peter's collective test scores on the BDS indicate he has characteristics of a mild to moderate cognitive impairment likely in one or both frontal lobes his brain. And yet the ICD-10 language needed to describe his fall experience (as being due to inattention) is, at best inadequate, and mostly non-existent.

From a movement system science perspective, how would you clinically describe Peter's fall risk? Regardless of Peter's STEADI score, Peter fits the profile of a person with a high fall risk because of his age and fall history. His self-report that inattention caused his fall adds to his fall risk. Peter's test results on the BDS indicate he has MCI in the frontal lobe area(s) of his brain that is likely impairing his body's motor responses and movement control, and further contributing to his fall risk. Looking at his fall risk profile (Table 6), is Peter's fall risk low or is it high? What percentage risk for falling again would you give Peter (Table 7)?

How would you treat Peter's fall risk using the biopsychosocial model? Two of the three reasons for falling as listed by the physical therapist are potentially treatable. Following this model of care, physical therapy efforts should be focused on developing with Peter a fall risk management plan that promotes his well-being, and incorporates good brain health practices, and exercises to improve motor responses, movement control, and attention. For more information about ideas for treating brain-based fall risk factors, please review the November 2016 *GeriNotes* articles.

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Box 2. Behavioral Dyscontrol Scale[19]

INTERPRETATION:
- 20-27 Normal
- 13-19 Mild to moderate impairment
- 7-12 Moderately severe impairment
- 0-6 Severe impairment

Box 3. Behavioral Dyscontrol Scale[19]

1. Tap twice with the right hand and once with the left in a series (10 reps after allowing practice).
   - Score of 3 - No errors. Task learned quickly and performed rapidly, smoothly, automatically, with little effort.
   - Score of 2 - Generally smooth performance, but with 1 or 2 errors.
   - Score of 1 - Three or 4 perseverative errors, or poor timing and slow, effortful performance with fewer errors.
   - Score of 0 - Poor performance, 5 or more errors, or unable to perform the task despite recalling instructions.
2. Tap twice with the left hand and once with the right in a series (10 reps after allowing practice).
   - Score of 3 - No errors. Task learned quickly and performed rapidly, smoothly, automatically, with little effort.
   - Score of 2 - Generally smooth performance, but with 1 or 2 errors.
   - Score of 1 - Three or 4 perseverative errors, or poor timing and slow, effortful performance with fewer errors.
   - Score of 0 - Poor performance, 5 or more errors, or unable to perform the task despite recalling instructions.
3. If I say "red," squeeze my hand. If I say "green," do nothing (15 repetitions).
   - Score of 3 - No errors, and rapid responses to verbal stimuli.
   - Score of 2 - Rapid responses to stimuli and no more than 1 error, or slow responses (~ 1-1.5 sec) and no errors.
   - Score of 1 - Two to 4 errors, including errors on which patient catches him/herself, or response time > 2 sec.
   - Score of 0 - More than 4 errors of either inhibition or initiation.
4. If I tap twice, you tap once. If I tap once, you tap twice (10 repetitions).
   - Score of 3 - No errors, and rapid responses to stimuli.
   - Score of 2 - Rapid responses to stimuli and no more than 1 error, or slow responses (~ 1-1.5 sec) and no errors.
   - Score of 1 - Two or 3 errors, or fewer errors and response time > 2 seconds.
   - Score of 0 - More than 3 errors.

Box 3. *Continued*

5. Alternate touching of thumb and fingers (5 full repetitions after allowing practice).
   - Score of 3 - No errors. Task learned quickly and performed rapidly, relatively automatically, with little effort.
   - Score of 2 - Learns task with at most a few errors. Movements become relatively automatic with practice.
   - Score of 1 - Difficulty learning task. Patient makes many errors, or best performance remains deliberate and effortful. Improvement observed, but performance is never really automatic even after practice.
   - Score of 0 - Failure to learn the task, or no improvement with practice unless examiner models task constantly.
6. Fist - Edge - Palm
   - Score of 3 - No errors. Task learned quickly and performed rapidly, relatively automatically, with little effort.
   - Score of 2 - Learns task with at most a few errors. Movements become relatively automatic with practice.
   - Score of 1 - Difficulty learning task. Patient makes many errors, or best performance remains deliberate and effortful. Improvement observed, but performance is never really automatic even after practice.
   - Score of 0 - Failure to learn the task, or no improvement with practice unless examiner models task constantly.
7. Head's Test (Correct first mirroring error, but count it as an error. Examiner and subject should return their hands to their laps and pause 2-3 seconds after copying each hand position to avoid mimicry.) ¨ Left fist beside head ¨ Right index finger points to right eye ¨ Left hand vertical, right hand horizontal, forming a "T" ¨ Right hand with bent fingers under chin ¨ Left hand to left ear
   - Score of 3 - No errors.
   - Score of 2 - One error.
   - Score of 1 - Two or 3 errors.
   - Score of 0 - More than 3 errors.
8. Alphanumeric Sequencing: 1 a 2 b 3 c 4 d 5 e 6 f 7 g 8 h 9 i 10 j 11 k 12 l
   - Score of 3 - Completes task with no errors in 20 seconds or less.
   - Score of 2 - Completes task with no errors in more than 20 seconds.
   - Score of 1 - One to 3 errors. Time: ____
   - Score of 0 - More than 3 errors, or complete failure to finish the task.
9. Insight rating
   - Score of 3 - Awareness of inaccuracy of performance, and of its severity and significance, if performance is deficient.
   - Score of 2 - Awareness of errors, but limited understanding of their severity or significance.
   - Score of 1 - Partial and/or inconsistent awareness of deficient aspects of performance.
   - Score of 0 - Completely lacking in ability to assess performance accurately and critically.

Questions to consider in assessing the patient's capacity for insight (for rating Item 9)
- Was the patient aware of making errors?
- Was this awareness consistent?
- Did the patient spontaneously express awareness of his/her errors (eg, comments, nonverbal reactions)?
- Did the patient express awareness of his/her errors in response to the examiner's comments or questioning?
- Was the patient's awareness of his/her errors consistent across items?
- Did the patient accurately describe the nature and severity of his/her errors?
- Did the patient demonstrate awareness of the severity and/or significance of his/her errors?
- Did the patient become understandably emotionally upset over his/her errors?

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Table 6. Peter's Fall Risk Profile and Risk Status

Fall Risk Factors	Risk Status
• History of falling	• High
• Self-report of inattention causing his fall	• High
• 89 years of age	• High
• 3/14 on STEADI questionnaire indicated	• Low
• 2.4/7 score on GDS/FAST Staging System	• Low
• 18/27 score on BDS	• High

Table 7. Fall Risk Percentage Ranges[20]

Number of Fall Risk Factors	Percentage Risk of Falling
0	8%
1	19%
2	32%
3	60%
4+	78%

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—A Continuing Education Module—

Considerations of Cardiopulmonary System Ramifications for a Fall Event

Kenneth L. Miller, PT, DPT; Leslie D. Ayres, PT, DPT

INTRODUCTION

Physical therapists demonstrate strong understanding of the musculoskeletal and neurological effects falls have on individuals. The cardiopulmonary ramifications may be less defined in practice. This article aims to address and discuss these implications in order to develop a further understanding of falls and possible impacts on the cardiovascular system.

CARDIOPULMONARY FALL ETIOLOGY

Particularly in the acute setting, physical therapy referral may be initiated prior to complete understanding of the fall event, especially in patients who present without a mechanical reason for the fall. Several cardiopulmonary factors should be considered. The side effects of many arrhythmias include symptoms of decreased cardiac output which in turn may cause decreased cerebral blood flow.

This decreased flow may manifest itself as dizziness or a syncopal event that can lead to a fall. These arrhythmias include bradycardia, prolonged sinus block or pauses, second degree atrioventricular (AV) block –type II, third degree AV block, ventricular tachycardia, torsades de pointes, and ventricular fibrillation.[1] Often once the arrhythmia is corrected, the necessity for physical therapy may be diminished as the cause of the event has been mitigated. It is important to note that the decrease in cardiovascular stability caused by arrhythmia could present a sequela of decreased function and mobility, which would warrant physical therapy intervention.

Syncope and fall due to orthostatic hypotension can also be a referral trigger for physical therapy. An understanding of the nature and cause of the hypotension event leading to fall can help guide clinicians regarding appropriate treatment. In patients with cardiopulmonary comorbidities such as heart failure changes in fluid balance, salt and water intake, and medications should be considered when assessing patients after a hypotensive event.[2] Patients on multiple medications to control heart rate and blood pressure should be monitored during physical therapy treatment.

The Cardiopulmonary Section of the American Physical Therapy Association (APTA) has published several videos that are freely available through the #VitalsAreVITAL campaign to raise awareness of cardiovascular risk screening in physical therapy practice. Patients in all settings should be screened and monitored for cardiovascular sources of falls. Often blood pressure is screened in a medical office setting at rest, by incorporating vital sign assessment with mobility, clinicians may identify risk factors for fall events.[3]

ANTICOAGULATION

The American Heart Association estimates that at least 2.7 million Americans are living with atrial fibrillation (AFib). Venous thromboembolism (VTE) is estimated to affect 300,000 – 600,000 Americans each year. Anticoagulants are the mainstay of treatment for these types of thromboembolic disorders.[4] As the elderly population increases in America, it is important that physical therapists have an understanding of these medications and the consequences related to falls, injury, and physical therapy treatment. In 2016 the APTA and Cardiopulmonary Section developed a guideline for therapist practice when treating patients at risk for or diagnosed with deep vein thrombosis (DVT).[5] The guideline recommends: "when a patient has a recently diagnosed lower extremity (LE) DVT, physical therapists should verify whether the patient is taking an anticoagulant medication, what type of anticoagulant medication, and when the anticoagulant medication was initiated." It is important to be aware of all types of medications a patient is taking, including newly initiated medications or those that have been stopped. The physical therapy practitioner should be aware of monitoring PT/INR in the acute setting, when these medications have been initiated. In 2017, the Acute Care Section of the APTA published a lab values reference guide that can help guide the clinician in decision-making regarding the treatment of patients undergoing treatment on anticoagulants.[6] It is important for the clinician to remember lab values are a snapshot of the patient as a whole. As physical therapy clinicians, we can use these values to help assess the anticipated benefit of therapeutic intervention versus potential risk to the patient.

As therapists, we are uniquely placed to assess benefit versus risk of anticoagulant usage on patients at risk for falls. With the unique education to address strength, flexibility, balance, and ambulation as part of the multidisciplinary health team, our input can provide important information for decision-making regarding anticoagulant usage. The previously mentioned guideline recommends that "physical therapists should screen for fall risks whenever a patient is taking an anticoagulant medication."[5] Chiu et al report that among patients admitted to the hospital for a fall, 4.7% will be re-admitted for a recurrent fall within 6 months.[7] The evidence suggests that with subsequent falls the rate of bleeding injury remains the same regardless of anticoagulant use; however, if patients remain on anticoagulation, the odds of death are nearly doubled. This reinforces the importance of fall screening and places these patients at a high priority for focused intervention to prevent future falls. In 2015, Boltz et al reported that 30-day mortality after falls demonstrate markedly different injuries between the elderly who die and those who do not.[8] They suggest injury patterns including fractures of the skull, injuries to the duodenum, stomach, intestines, pancreas, liver, spleen, and intracranial hemorrhage demonstrate highest mortality. This information may allow caregivers to develop improved criteria

Bleeding Ratio/Viscosity

International Normalized Ratio (INR)	
Normal Range	0.8- 1.2
Therapeutic range (VTE, PE, AFib)	2.0 – 3.0
Patient at higher risk for bleeding	>3.6
Activated Partial Thromboplastin Time (Heparin)	
Normal Range	21-35 sec (>70 seconds signifies spontaneous bleeding)
Therapeutic for effectiveness of anticoagulant	2-2.5 times normal range (variability in reagents)
Prothrombin Time (Coumadin)	
Normal Range	11-13 sec
High risk for bleeding into tissue	>25 sec
Anti-Factor Xa Assay (unfractionated Heparin and Low Molecular Weight Heparin (LMWH)	
Therapeutic ranges of: LMWH UH	 0.5-1.2 IU/mL 0.3-0.7 IU/mL

Adapted from the Academy of Acute Care Physical Therapy 2017 Laboratory Values Interpretation Resource.[6]

for identifying patients with a propensity for experiencing poor outcomes.

Although falls place a patient at risk for further injury, it is also important to consider the risks of discontinuation of oral anticoagulation. Hagerty and Rich present a case discussion regarding the delicate balance of fall risk and anticoagulation.[9] The most common reason that physicians site withholding anticoagulation in older patients with AFib is the perception of a high risk of falling; however, they propose for most patients in this category the benefits of anticoagulation outweigh the risks.[9] As mentioned above, as physical therapy practitioners, we are uniquely situated to provide assessment of risk, as well as intervention to help mitigate the risk of falls and subsequent bleeding injury.

As valuable members to the interdisciplinary team, physical therapists can provide unique insight into patient function and fall risk to allow the medical team and patient to make informed decisions. We can provide education to our patients regarding their fall risk. The rate of recurrent falls and related complications provide a baseline for clinicians to present to patients and families when considering disposition planning, including the need for continued rehabilitation, home care, and the continuation of anticoagulation.[7]

SEQUELAE FROM FALLS

Physical therapists can use fall categorizations in the decision-making process. Current trending is to classify fall events into two broad categories—falls with and without injury. For example, the Centers for Medicare and Medicaid Services (CMS) in the most recent home health assessment tool - Outcome and Assessment Information Set (OASIS-D) has added section J – Health Conditions. This section captures specific falls within 3 categories (Figure 1). Categorizing falls in this way allows clinicians to triage resources for care provision may be based on level of risk of injury. Additionally, the need for specific interventions based on this risk may be obtained.

While major injury is a large focus of immediate concern among health care providers, all falls regardless of category have the potential for negative consequences, disability, and mortality. Older adults that fall without major injury as defined above are still at risk for adverse health events. A fall is the most frequent cause of the development of rhabdomyolysis (56.9%), a condition resulting in muscle necrosis and leakage of intracellular muscle contents into the circulation. Other causes of rhabdomyolysis include statin use (2.4%), sepsis (4.8%), post cardiac arrest (0.6%), infection (0.6%), and immobilization (5.4%).[11,12] The hallmark signs of rhabdomyolysis is significantly elevated Creatinine kinase levels, muscle pain/weakness, and dark colored urine.[11,12] Physical therapist practice should include questions regarding genitourinary system in the review of system, specifically asking probing questions about urine color following a fall especially when other causative factors are present such as muscle pain/weakness, use of statins, or immobilization.

The inability to get up from the floor after a fall and the time spent on the floor significantly increases the risk of complications. Complications such as pressure injury, carpet burn, dehydration, hypothermia, pneumonia, and even death could result from extended time spent on the floor following a fall.[13] Fleming reports that the only characteristic to predict lying on the floor for a long period of time was cognitive impairment.[13] It is important for physical therapists to assess a person's ability to get up from the floor to help determine appropriate interventions to reduce or minimize floor time. The takeaway message regarding reducing floor time is that the medic alert devices may not work due to the cognitive status of a person who falls. Newer technologies, such as the Apple watch, that has fall detection could be an alert system to call emergency medical services and emergency contacts.[14]

The risk of fall-related injuries, such as bleeding, increase with use of oral anticoagulant agents. People with cardiovascular health conditions having undergone cardiac surgery have a risk of developing postsurgical arrythmias, such as atrial fibrillation, that increases the risk of forming thromboembolism.[15] Medical treatment for the prevention of thromboemboli is often with an anticoagulant medication.[16] Warfarin is commonly prescribed, but for those with a history of fall or at risk for fall, there is risk for major bleeding, including intracranial, and death should a fall occur. A newer anticoagulant, Apixaban has been shown to reduce stroke risk and bleeding risk as compared to Warfarin.[76] Therapists working with patients taking anticoagulants should be aware that the level of risk for bleeding should a fall occur varies by the drug. The use of Apixaban has not been approved for patients with prosthetic heart valves as the risk of clot formation may actually increase.[17]

In a study by Reddy, et al overall frequency of intracranial hemorrhage (ICH) following a ground level fall was 15% and there was no difference in ICH rates, type of ICH, need for craniotomy, mortality, or intensive care unit or hospital length of stay between Warfarin, clopidrogrel, and aspirin groups.[18] A clinical question one may ask, "Is a single CT scan following a fall with head trauma when a person is taking a direct acting oral anticoagulant sufficient?" Smith et al instituted a 12-hour follow up CT scan and identified delayed onset ICH via repeat CT scan.[19] Therapists need to be mindful of the potential for delayed onset ICH and monitor for CNS signs/symptoms to report back to the medical team, regardless of initial CT findings. However, according to Mann et al, the incidence of delayed ICH in the older adult population is very low, 0% to 6%.[20]

It is important for physical therapists working with patients having had coronary artery bypass graft surgery (CABG) to understand that postoperative atrial fibrillation (AF) is the most common complication affecting between 16% and 30% in the

J1900.	**Number of Falls Since SOC/ROC,** whichever is more recent	
CODING: 0. None 1. One 2. Two or more	↓ **Enter Codes in Boxes**	
	☐	**A. No injury:** No evidence of any injury is noted on physical assessment by the nurse or primary care clinician; no complaints of pain or injury by the patient; no change in the patient's behavior is noted after the fall
	☐	**B. Injury (except major):** Skin tears, abrasions, lacerations, superficial bruises, hematomas and sprains; or any fall-related injury that causes the patient to complain of pain
	☐	**C. Major injury:** Bone **fractures**, joint dislocations, closed head injuries with altered consciousness, subdural hematoma

Figure 1. Excerpt from the CMS OASIS-D guidance manual.[10]

postoperative period.[21] The discharge medication regime for post CABG without AF and CABG with AF were similarly matched with the exception of antiarrhythmic medications used with the AF group. See Table 1 for details.

Many people with cardiac disease, or at risk for the development of cardiac disease are treated for hypertension with a variety of medication classes (several of which are listed in Table 1). Those that were considered healthy taking antihypertensive medications had a lower risk of fall with injury than those with multiple chronic conditions, but a linear-dose response relationship was not found for any single drug class or intensity.[22] This study was limited to hypertension medications including renin-angiotensin system blockers, beta blockers, calcium channel blockers, and diuretics. Medications for angina were not included.

Other considerations with regards to falling for those with cardiovascular or pulmonary disorders are immobilization from length of stay (ICU/Step down), prolonged ventilation, and subsequent disuse atrophy sequelae from the disease process itself.

In conclusion, the cardiopulmonary system greatly impacts fall risk for falls with or without injury. Arrhythmias, other heart impairments, and lung pathology may lead to a fall event, the medications used to treat heart and pulmonary dysfunction may lead to a fall event, or any combinations of disease and medications may lead to a fall event. It is crucial for physical therapists to understand that fall-related injury may occur at the time of the fall or may be delayed as may be the case with the development of rhabdomyolysis and intracranial hemorrhage. With this knowledge, physical therapists need to monitor for muscle weakness, and/or neurological signs in ongoing fashion for older adults with any fall history.

Table 1. Comparison of Hospital Discharge Medications Post-Coronary Artery Bypass Graft Surgery[21]

Medication Class	CABG without AF	CABG with AF	P value
Beta Blocker	55%	54.7%	0.691
Calcium Channel Blocker	22.1%	22.9%	0.366
ACE Inhibitor	25.2%	24.9%	0.201
Aspirin	89.3%	88.5%	0.725
Statin	22.8%	22.2%	0.521
Warfarin	4.2%	6.1%	0.059
Antiarrhythmic	10.4%	33.7%	0.001

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(Continued on page 20)

Physical Therapist Assessment for Concussive Syndrome in the Geriatric Population

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SCOPE OF THE PROBLEM

A concussion is defined as a mild traumatic brain injury (TBI) induced by traumatic biomechanical forces causing a neurometabolic cascade initiated with the shearing of vasculature contributing to intracerebral swelling and decreased nerve conduction.[1-5] A concussion will not show structural injury to the nerves, rather a diffuse axonal injury due to the metabolic processes affected. Additionally, the diffuse axonal injury event decreases blood supply to the brain leaving neuronal tissues vulnerable to further damage.[1-5] Those 65 years and older have the highest TBI-related deaths with an additional increase in those over 75 years.[6] While likely underestimated due to lack of recognition or lack of seeking medical care, there are approximately 200,000 mild TBIs reported each year.[6] Physical therapists have a professional responsibility to increase knowledge and recognition of a mild TBI in order to best serve and optimize functional outcomes in the geriatric population following a concussion.

RISK FOR OLDER ADULTS

Age-related physiologic changes to the neurological and musculoskeletal systems in the geriatric population both increase the susceptibility of concussion and increase functional impairment following concussion contributing to the likelihood of not returning to prior level of function. In the geriatric population, a mild TBI most commonly occurs as a result of a fall.[6] One out of three people over 65 will experience a fall each year, with risk for falling and fall-related complications increasing with each decade.[7] Age-related changes to musculoskeletal and neuromuscular systems impair functional abilities and balance reaction times contributing to higher incidence of falls in the geriatric population and increasing susceptibility for a mild TBI.[8] Physiological age-related changes increase the susceptibility of an older adult having a mild TBI with even a low-mechanism fall in which they did not strike their head or lose consciousness.

In conjunction with physiological age-related factors contributing to a fall, comorbid diseases and polypharmacy contribute to likelihood of falling, therefore increasing the risk for sustaining a mild TBI.[2,8] The high rate of polypharmacy, anticoagulant use, safety issues in the living environment, and alcohol consumption further increases an older adult's risk for falling.[4,5,8] Falls in the adult population over 65 are largely multifactorial with age-related changes, environmental factors, and comorbid conditions contributing to the rise in falls among the geriatric population. Of those screened, 73% of participants reported having one or more comorbid conditions prior to sustaining a mild TBI compared to 32% of all Medicare beneficiaries having one or more comorbid conditions.[2,9] Of those comorbid conditions reported, there was a clinically significant increase in risk for mild TBI in those who reported dementia, depression, or Parkinson's disease.[2,5] The use of anticoagulation therapy to manage comorbid conditions greatly increases the risk for intracranial bleeding with low-energy trauma.[5,8] Physiological age-related changes, comorbid conditions, and environmental factors significantly increase risk of falls and concussion in the geriatric population.

PATIENT PRESENTATION: ESSENTIAL SIGNS AND SYMPTOMS

Among all ages, patients are likely to present with varying acute signs and symptoms of a concussion. Common cognitive symptoms present after suffering a concussion include confusion, amnesia to the event, and delayed or slowed thinking. Somatic symptoms include a presence of a headache, dizziness, blurred vision, and impaired balance and coordination. A person who sustained a concussion may report a disruption in sleeping pattern with either increased sleep or decreased sleep following the injury. Commonly reported symptoms affecting mood include feeling depressed or anxious, emotional lability, or ongoing fatigue.[1,4,6,8,10] Specific to the geriatric population, the potential for imbalance, gait instability, or mental status change predisposes this population to risk for additional falls and further injury to the brain.[11] Signs and symptoms of a concussion may appear hours to days following injury in the geriatric population, hindering definitive diagnosis in the acute stage.

As neuroimaging techniques are limited in the diagnosis of an acute concussion due to lack of structural change, the current diagnostic process includes account of injury, symptom reporting, and examination results including neurocognitive, balance, vestibular, and exertional testing.[1,4] It is more common for the person to be seeking medical attention for other fall related injuries often leaving a concussion undiagnosed due to the lack of symptoms on initial presentation. Those over the age of 65 presenting to the emergency department (ED) with a minor head injury will receive a computed tomography (CT) scan to rule out red flag conditions such as a subdural or subarachnoid hemorrhage and acute cerebrovascular accident, though a CT scan is not sensitive to

detecting a concussion.[3,11] Diagnosing a concussion in the geriatric population is often hindered by limited knowledge of patients' baseline cognitive function and functional abilities prior to admission or screening.[5,8]

Screening for acute concussion in the geriatric population poses many concerns and challenges due to age-related physiological changes, the presence of comorbid conditions, and premorbid cognitive and physical functional deficits. Many tools including the Standardized Assessment of Concussion (SAC), Sport Concussion Assessment Tool 2, and Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) exams are not validated in older adults, though each exam highlights the recognition of signs and symptoms through balance, oculomotor, and cognitive testing.[10] For all ages, the literature suggests a multimodal approach to acute screening in which physical therapists play a vital role.

A SYSTEM-BASED SCREENING APPROACH

A physical therapist should consider performing a thorough evaluation including these 5 recommended systems: cognition, cervical spine, autonomics system, vestibular system, and falls assessment. As a concussion could present with varying signs and symptoms in the geriatric population, literature suggests screening all systems listed in order to accurately capture all deficits to incorporate in a thorough plan of care. The algorithm provided (Figures 1 and 2) depicts a screening method for patients suspected to have sustained a concussion with suggested progressions to evaluative tools validated in the geriatric population. With the results of this screening measure and further evaluative tools, physical therapists can aid in recognition and treatment of a concussion in the geriatric population.

Current literature lacks a standardized approach to concussion identification in all age groups but especially the geriatric population due to time of onset and presentation hindering accurate recognition. While the premorbid mental status of the geriatric adult may be reduced at baseline, initial screening of orientation, attention, recall, and work-ing memory throughout the examination can provide baseline information to identify change throughout the length of stay. Literature suggests including a cognitive screening tool; cognition is often impaired following a concussion. Neurocognitive testing can yield predictability of those that return to the ED within 72 hours or develop post-concussive syndrome.[12]

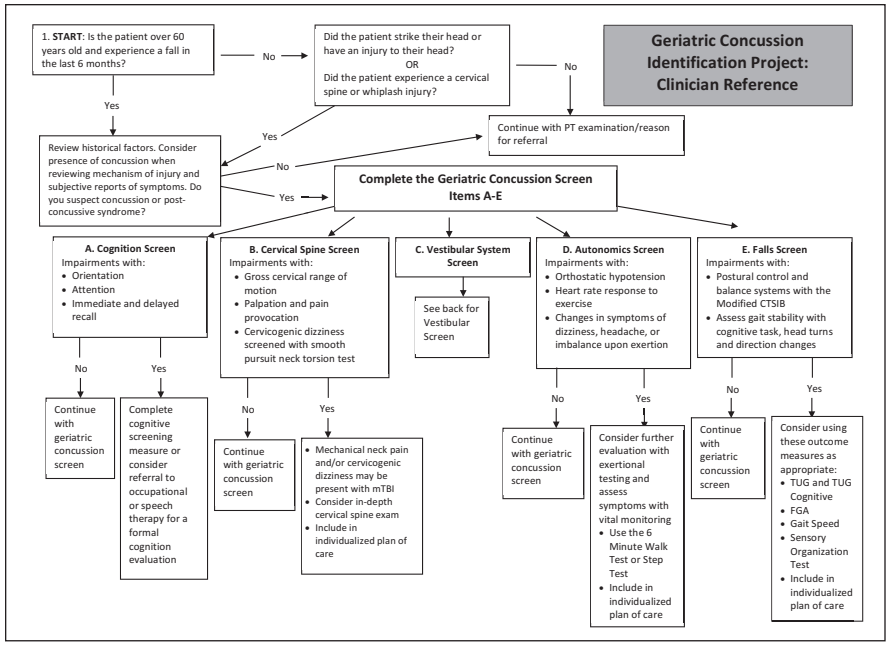

Figure 1. Algorithm to screen for and identify geriatric concussion.

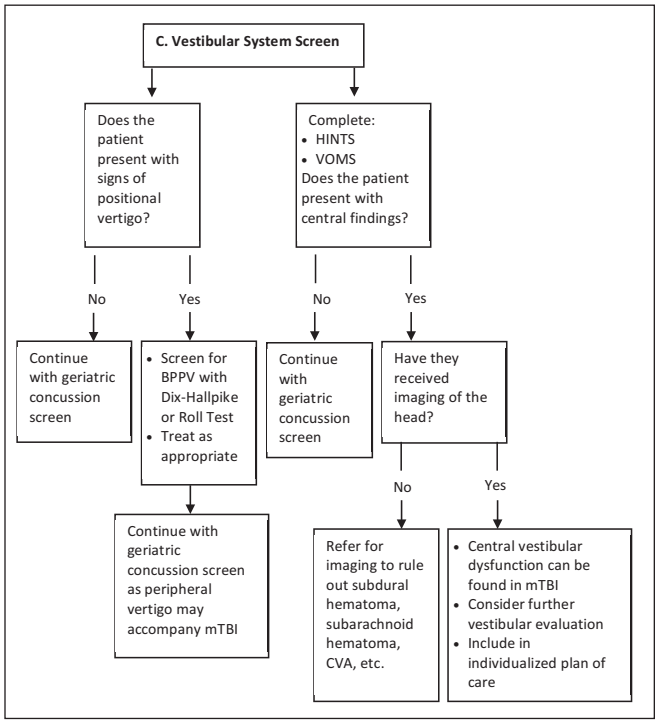

Figure 2. Algorithm to screen for concussion with suspected vestibular system involvement.

Screening of the cervical spine includes ruling out a fracture or ligamentous instability, gross range of motion, palpation and pain provocation patterns, and screening for cervicogenic dizziness. Adequate screening of cervical spine range of motion and strength can aid in deciphering confounding factors including headaches and dizziness that can further contribute to visual disturbance and poor postural control.[3] Cervicogenic dizziness may result from a head injury or whiplash injury leading to a feeling of imbalance, dizziness, and pain in the cervical spine.[13] Clinicians can screen for cervicogenic dizziness using the smooth pursuit neck torsion test.[13]

Within a normal physical therapy exam, vitals should be monitored closely due to the autonomic dysregulation that may manifest as exercise intolerance, heart rate variability, dizziness, or orthostatic hypotension following a mild TBI.[3,14,15]

When a concussion is suspected, the addition of a Vestibular/Ocular Motor Screening (VOMS) is beneficial in increasing the probability of presence of a concussion. A VOMS exam includes evaluation of smooth pursuits, horizontal and vertical saccades, near point convergence distance, horizontal visual-ocular reflex, and visual motion sensitivity.[4] It is reported that up to 40% of patients with concussion have visual dysfunction including reduced point of convergence, poor accommodation, and oculomotor tracking abnormalities.[3,4]

The use of the HINTS (Head Impulse Test, Nystagmus and Test of Skew) can be used to aid in triaging patient's presenting with an acute vestibular disorder to rule out central disorders that require urgent intervention including an acute stroke, subarachnoid hemorrhage, or brainstem encephalitis.[16] Indications of a central lesion with a negative head impulse test, direction-changing nystagmus, or vertical misalignment in the test of skew would require immediate referral for additional testing to rule out a central disorder.

Following a concussion, one would expect to find impairments of central nervous system origin, though peripheral nervous system impairment may also be present. Screening for benign paroxysmal positional vertigo (BPPV) with the Dix-Hallpike test for posterior canal BPPV or roll test for horizontal canal BPPV is warranted based on nature of symptoms, mechanism of injury, and patient presentation.[3]

To fully appreciate physical functional decline, a similar multimodal approach to functional testing is recommended to capture activity and participation limitations. As those with concussion are more likely to have balance and gait deficits leading to future falls, a similar approach to evaluation of fall risk in the geriatric population is suggested to aid in recognition of concussion and quantification of functional deficits in the older adult. Recommended screening measures include the Modified Clinical Test of Sensory Interaction in Balance (Modified CTSIB) and screening of dynamic gait with dual task challenges to capture multi-sensory fall risk.[17-19] Further evaluative outcome measures validated in older adults to assess fall risk and impairment recognition of those with mild TBI include the Timed Up and Go (TUG) and TUG Cognitive, gait speed, Functional Gait Assessment (FGA), and Five Times Sit to Stand.[17-19] Literature suggests dual cognitive task testing with performance of gait speed or TUG to assess for cognitive motor interference.[19] Given the multifactorial nature of falls in the geriatric population, multiple means of quantifying fall risk are required to appreciate impairment and future fall risk.

RED FLAG RECOGNITION

Due to potential progression of mild TBI, clinicians should recognize patient presentation that warrants referral to the ED. This includes worsening headache without relief, weakness, numbness, decreased coordination, repeated vomiting or nausea, slurred speech, changes in behavior, increased confusion, restless or agitated state, loss of consciousness, or experience convulsions or seizures.[4] Clinician awareness of red flag conditions following a fall is necessary for appropriate patient education due to potential delayed onset of symptoms. Ongoing assessment of related symptoms is required for accurate recognition of mild TBI among the geriatric population due to potential delayed onset of symptoms following injury.

SUMMARY

As physical therapists evaluate and provide treatment across the continuum of health care, there is an increasing need for knowledge of recognition of mild TBI in the geriatric population to best preserve the functional independence of this population. Physical therapists can assist in the evaluation and treatment of symptoms experienced after sustaining a concussion including vestibular and balance rehabilitation, manual therapy, fall prevention, and graded exertional training in order to maximize functional independence and return to prior level of function.

Augmenting a physical therapy evaluation with an evidence-based, multimodal approach can aid in recognition of deficits even in the high-functioning older adult to best allow the physical therapist to make appropriate intervention and discharge recommendations. Older adults who suffer a concussion are at a greater risk of suffering subsequent falls, and require a thorough evaluation to best determine the safety of a community discharge and recommend follow-up care. Clinician awareness of red flag conditions following a fall is necessary for appropriate patient education due to potential delayed onset of symptoms.

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(Continued from page 16)

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Fear of Falling

Jill Heitzman, PT, DPT, PhD; Tamara Gravano, PT, DPT, EdD

As one ages, the risk of being affected by more than one medical condition increases. The Center for Disease Control (CDC)[1] reports 65% of people over age 65 had 4 or more chronic health conditions. Having more than one health condition may lead to an individual requiring assistance with activities of daily living (ADLs) and an increased fall risk.[1,2] Medical costs for Americans with multiple conditions account for 75% of United States health care spending and more than 90% of Medicare spending.[3,4] Due to the effects of multiple medical conditions on overall physical function, falling is a major concern for this population.

DEFINITION OF FALL

There is no single definition of a "fall." Many older people describe a fall as a loss of balance, whereas health care professionals often refer to falls as events leading to injuries and ill health.[5] Zecevic and colleagues[6] surveyed 477 community-dwelling seniors and 31 health care providers, reviewed relevant literature, and consulted with the authors of several studies on falls. The results showed that older adults and health care providers both focused on events that happened prior to the fall and the consequences of falling, whereas published research and researchers emphasized the overall fall risk factors and descriptions of fall events.[6] Focusing on the consequences of the fall increases the potential for individuals to omit reporting falls that are non-injurious, near falls, mishaps, and missteps, all of which may identify the need for early intervention and participation in fall prevention programs.[6] In addition, falls can be described using frequency. Peeters et al[7] identified the occasional faller as a person that interacts with extrinsic factors and the recurrent fallers as those who are affected by intrinsic factors accompanied by an extrinsic factor 2 or more times within a 6-month period. An extrinsic factor is one that is outside of the person, such as poorly fitting shoes, uneven walkways, or poor lighting. Intrinsic factors are related to the individual, such as visual acuity, proprioception, or vestibular function. Noohu and colleagues[8] stated that recent agreement among the research community asserts that "[t]he event of a fall is when the person comes to a lower level or on the ground unintentionally." The World Health Organization (WHO) recommended using the definition of "inadvertently coming to rest on the ground, floor or other lower level, excluding intentional change in position to rest in furniture, wall or other objects.[5]" Noohu et al[8] further identified a fall as one of external causes with unintentional injury.

Falling has been identified as an increasing issue and a major health risk in the aging population,[9] not only the United States, but worldwide.[10] A health risk is defined by WHO as the probability that a future unwanted health event will occur; for older adults, one particularly dangerous health risk is falling.[10-12] The WHO[5] also reported that there is variability in incidence of falls among countries with 28% to 35% of people over age 65 worldwide falling each year, and this rate increases to 42% for those over the age of 75. More recently, WHO[12] found that those over age 80 are particularly prone to falls and are the fastest growing population expected to represent 20% of the overall worldwide aging population by 2050.

In the United States, the CDC reports that 1 of 4 older adults fall each year and that only half report the fall to their primary care provider.[13,14] One in 5 falls result in serious injury, resulting in over 2.8 million older adults treated in the emergency room at a cost of over $28 billion.[15]

Self-efficacy refers to the perception of one's ability to do tasks, in this case perform activities without loss of balance or falling.[16] Balance confidence is related to fear of falling and has been seen as a barrier to function, increasing the risk of falling.[16] Once a person has sustained a fall, even if not injured, there is an increased fear of falling.[14] Mehdizadeh et al[17] studied 139 participants with an average of 60.2 years (SD 12.27) and found that all dimensions of quality of life were significantly affected by the intensity of the fear of falling. Actual falling and fear of falling have been shown to contribute to decreased mobility resulting in increased sedentary lifestyle. This reduced physical activity level increases functional dependence among aging adults.[18] Fear of falling can lead to a reduction in everyday activities and a downward spiral of decreased physical activity. Fear of falling often predisposes individuals to self-induced activity restriction and social isolation, which has the potential to markedly diminish a person's quality of life.[19] As shown in Figure 1, fear of falling can progress to reduced activity.[20] Decreased physical activity can proceed to muscle weakness, which may negatively influence walking and balance function, further reducing the physical activity. The reduced muscle activity affects one's ability to walk and maintain balance/postural control that results in a fall. Once a person as fallen,

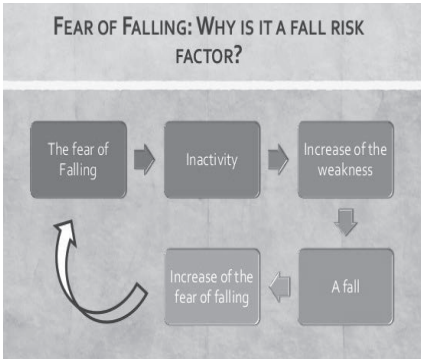

Figure 1. Fear of falling cycle.[20]

the fear of future falls increases and the cycle repeats.[21] Thus, the patient's *perceived* functional ability and fear of falls can lead to further falls.[11,22]

The Activities Based Confidence (ABC) Scale is a self-reported questionnaire used to measure an individual's confidence in performing 16 various activities[23] and assess the participant's fear of falling or experiencing unsteadiness with daily activities.[19] Powell and Myers[23] examined the psychometrics of the ABC and determined that the ABC scale is suitable to detect loss of balance confidence in highly functioning seniors, was an efficient discriminator between fallers and non-fallers, and demonstrated good test-retest reliability, convergent and criterion validity. A higher score indicated greater confidence to perform activities without falling with scores below 67% indicate a risk for falling and can accurately classify people who fall 84% of the time with an 89% sensitivity and 96% specificity.[9]

Landers et al[24] studied the psychological factors that may predict future falls. Their prospective cohort study included 64 older adult participants (mean age 72) with a variety of medical conditions including Parkinson's disease, stroke, and cardiovascular disease.[24] The participants were measured at baseline and then contacted 1 year later to record the falls that occurred during the subsequent year. Baseline measures included participants' fall history, self-reported measures of Falls Efficacy Scale (FES), Activities-specific Balance Confidence Scale (ABC), the physical performance measures of the Berg Balance Scale (BBS), Dynamic Gait Index (DGI), self-selected gait speed (GS), Timed Up and Go test (TUG), and the Sensory Organization Test (SOT). After 1 year, a multiple regression was done with all the baseline measures as potential predictors. Landers et al[24] used a multiple regression and determined balance confidence and fear of falling were most predictive of actual falling, 38% and 5.6%, respectively with TUG being the next variance of significance across all the populations. These results suggest people have a better sense of their overall fall risk than a measurement of balance performance at one specific moment in time.[24] The only limitation was the ability to remember all falls after 1 year. Having a daily diary may have improved the recall, but then may have also made the participants more aware of fall risks, thereby increasing their fear of falling.

Delbaere et al[25] found that those with balance limitations, gait deficits, and decreased muscle strength have an increased risk for falls. Those with concerns about falling and previous history of falls increased that risk. However, individuals with high levels of fear of falling, independent of their physical limitations, were related to prediction of future falls.

The fear of falling can lead to agonist-antagonist muscular co-contraction resulting in increased muscle stiffness leading to a fall.[6] This highly-guarded state can decrease one's ability to react to perturbations and lead to a loss of balance and/or inability to recover from an unintentional shift in the center of gravity. Frequent falls lead to increased fear of falling, which in return amplifies the risk of fall.[8,15,24,26-28] This cycle of falls and fear can continue to worsen if left unaddressed by health care practitioners.

Reduced physical activity is a component of the cycle that results in falls; loss of muscle strength leads to falls and a subsequent fear of falling, so the individual recognizes a heightened risk, and further reduces his or her physical activity and the cycle continues. The Physical Activity Cycle from the CDC (Figure 2) shows that fear of falling leads to a reduction in physical activity. This results in further loss of muscle mass, strength, and more falls.[21]

Physical inactivity results in decreased overall standing time per day, with older adults spending less than two hours in an upright posture.[29] Yen and colleagues[30] studied the relationships between fall risk and sedentary time in 86 participants age 65 and older. They found that the self-reported sitting time increased as muscle strength and mobility decreased. This inverse relationship demonstrates that as individuals spend more time sitting the risk factors for falls increase. The increased sitting time has been shown to be related to decreased mobility, increased falls and fall risk, and all-cause mortality.[29]

There are a number of tools available to assess falls and fear of falling. Hassenkhani et al[31] performed a literature review to identify and describe fall identification tools. They found 32 self-reporting tools on fear of falling. Self-report of balance limitations appears to be an important component of fall risk assessment in identifying future falls.[32] Lusardi et al[11] discussed the contribution that fear of falling has on the perceived risk for falling and, as a result, individuals reducing their physical activity based on this perceived risk may have clinical utility for screening by health care professionals.

Self-reported questionnaires, on the other hand, are frequently administered and focus on behaviors that are clinically relevant to the need for assistance and caregiving. Landers et al[24] concluded balance confidence and fear of falling were most predictive of falls in older adults. However, there has been concern that these self-reported physical function assessments provide insufficient information regarding the type of deficit and lack sensitivity to changes in severity, are biased by environment, culture, and attitudes, and are unlikely to identify early impairments.[33] Goldman et al[33] performed a longitudinal study of 3409 older adults across two countries, aged 53 and older to compare multiple performance-based measures (gait speed, grip strength, pulmonary function, and sit to stand) with self-reported measures of ADL function. Using a Receiver Operator Characteristic (ROC) curve the authors found that over a 5-year period, though performance-based measures identified subtle variations of physical capability, the predictability of functional decline was not significantly different between performance based and self-reported tools. The results suggested that adding self-reported measures to at least 2 performance-based measures appear to be better predictors of functional decline than a single measure.[33]

This multifactorial approach appears to work. Using tools that assess risk factors, physical performance, and

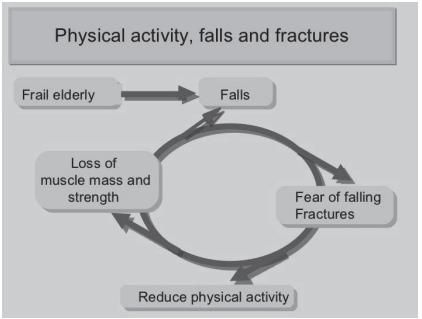

Figure 2. Physical activity cycle.[21]

fear of falling were found most successful in identifying fall risk in older adults.[31] Lajoie and Gallagher[9] supported this statement by comparing postural sway and reaction time between fallers and non-fallers. The results showed that both BBS and ABC total scores contributed to fall prediction, supporting a multifaceted approach to fall risk assessment.[9]

Grimbergen et al[34] examined the effect of falls, fall history, consequences of falls, balance confidence, and fear of falling in relation to the objective measure of balance using POMA (Tinetti Performance Oriented Mobility Assessment) for 74 individuals with Parkinson's disease. The authors assessed the Parkinson Disease Quality of Life and examined patients using the United Parkinson Disease Rating Scale (UPDRS) and POMA along with the falls questionnaire, fall history, balance confidence, and fear of falling self-reported measure. They found disease severity accounted for 43% of the differences in the quality of life. Grimbergen and colleagues[34] performed a standardized regression to determine how fear of falling, balance confidence, and fall frequency were reflected in quality of life. Standard regression coefficients were calculated: 0.34 for fear of falling, 0.28 balance confidence, and 0.13 fall frequency. The authors concluded that fear of falling negatively affects quality of life and needs to be included in all balance screens.[34]

Norris and Medley[28] compared those with high balance confidence to those with low balance confidence. They used 4 reaching situations including (1) traditional functional reach (TFR), (2) functional reach while standing on foam (FRF), (3) object present functional reach (OPFR), and (4) object present functional reach on foam (OPFRF). For conditions 3 and 4, the object was moved further and further away until maximum reach was obtained. Their results showed that those with high balance confidence performed better than those with low balance confidence in all activities and contexts indicating that self-assessment of balance correlates to function.[28]

Kafri et al[16] studied 45 residents of a geriatric center with a mean age of 90 yrs. (± 3.7 years) and discovered those who had reported at least one fall had a significant lower self-confidence as indicated by the ABC than those who did not fall in the previous year. The ABCs was also found to be a significant predictor of falls (p=0.0009).[16]

Using a cutoff of 67% on the ABC in fallers, Reelick et al[35] found that gait speed decreased and variability of stride length and cadence increased with those who had a fear of falling.[35] They concluded that various adaptations for gait occurred because of fear of falling that could lead to increased fall risk.[35] There is also excellent correlation documented between ABC score and the TUG test.[22,35-37]

In addition to physical and mobility factors, perceived functional ability and fear of falling are considered personal factors that must be screened by the physical therapist when performing a multifactorial fall risk assessment. A clinical guidance statement from the Academy of Geriatric Physical Therapy of the American Physical Therapy Association provided recommendations for physical therapists to perform a comprehensive and systematic screen of fall risk where one's perceived abilities influenced fall risk.[38]

Based on this literature review, a person's perception of his or her balance has been shown to be indicative of gait changes and reduction of physical activity that impacts overall functional decline. After an individual has sustained a fall, besides the injury that may or may not have occurred, the therapist should assess and address the confidence factor in perception of balance and fear of falling. This confidence factor may be the key connection to subsequent falls if not adequately addressed.

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Home Modifications—After the Fall

Meri Goehring, PT, PhD

HOME SAFETY CHECKLIST: INTRODUCTION

Although the title of this article indicates home modifications occur after a fall, first, let's try to PREVENT the fall. Realistically, that's probably not always going to happen. However, in order to encourage readers to consider prevention, here is a simple, safety checklist that you can use and/or share.[1] Some ideas for home modifications that may be useful after a fall will then presented.

Each year, many older adults suffer accidental injuries in and around the home or are victims of crime in their home. Falls, fires, or burglaries can result in substantial injury or even death. In 2004, accidents or unintentional injuries were the 5th leading cause of death in the United States after heart attack, cancer, stroke, and lower respiratory diseases. As the population ages, problems with walking, balance, vision, and thinking increase the risk of falls and other accidents in the home. A home safety assessment is an intervention targeted at maximizing a person's function and their ability to live safely and independently in the community.

This checklist has been developed by the geriatrics faculty at the University of Miami Miller School of Medicine to be completed during a home safety assessment. The questions on this checklist evaluate various aspects of safety in and around the home. For each potential safety hazard identified, one or more recommendations are provided, many of which can be accomplished with little or no cost.

Entrance

- **Q. Are the walkways and other pathways around the house even?** Repair the uneven surface
- **Q. Are the walkways and other pathways free of clutter?** Remove the clutter
- **Q. Is there adequate lighting near home entrances?** Consider having a handyman or electrician install a light fixture near home entrances

Stairs and Steps

- **Q. Are there objects such as papers, shoes, books, or other clutter on the steps?** Always keep the stairs clear by removing and storing items elsewhere
- **Q. Are some steps broken, uneven, or slippery?** Fix loose or uneven steps Attach non-slip rubber treads to the steps
- **Q. Has the carpet on the steps become loose or torn?** Fix any areas of carpet that are worn or not firmly attached to the steps
- **Q. Are the edges of the steps clearly visible?** Install bright-colored adhesive strips on the front edges of each step
- **Q. Is there a sturdy and well attached handrail on both sides of the stairs?** Repair any loose handrails or install new ones. Make sure all handrails are as long as the stairs. Consider installing a second handrail on the other side of the stairs
- **Q. Does the stairway have adequate lighting with light fixtures and light switches at the top and bottom?** Replace burned out light bulbs. Consider having a handyman or electrician install light fixtures and/or light switches at both the top and bottom of the stairs

All Living Areas

- **Q. Do tables or other furniture have sharp edges?** Arrange furniture so sharp edges do not protrude into the walkway. Consider replacing rectangular shaped tables with round tables
- **Q. Do you have to walk around furniture within rooms or when you walk from room to room?** Rearrange the furniture so the walkways are open Consider removing, replacing, or donating furniture that is bulky or used infrequently
- **Q. Do you have to avoid electrical wires or telephone cords when you walk around your home?** Attach cords and wires to a nearby wall. Use a mat especially designed to cover or secure electric wires or telephone cords (do not cover wires or cords with rugs or carpets). Consider having an electrician install extra outlets so electric wires do not cross the walking path
- **Q. Do you have more than 2 electric wires plugged into any outlets?** Always use a safety-rated power strip to plug in more than 2 cords. Consider having an electrician install extra outlets where needed
- **Q. Are the flooring and floor coverings safe (no uneven or slippery surfaces, no deep pile carpets)** Avoid highly waxed floors Secure all carpeting. Consider buying new carpets with short, dense pile. Wear low-heeled shoes with soles that have good traction
- **Q. Do you use throw rugs in your home?** A. Where possible, remove the rugs; where a rug is needed, secure it using double-sided tape or use a rug with a non-slip backing
- **Q. Are there objects such as papers, magazines, shoes, books, or other clutter on the floor?** Always keep the floor clear by removing and storing items elsewhere; store frequently used items at an easy to reach level
- **Q. Do chairs have armrests, good back support, and comfortable height for sitting?** Consider replacing chairs that are too low, that do not have armrests and are not supportive
- **Q. Is there ample lighting in all areas, are light bulbs working, and are light switches readily accessible?** Replace burned out light bulbs. Consider having an electrician install additional light fixtures and light switches where needed

Kitchen

- **Q. Are dishes you use often stored on high shelves?** Rearrange your dishes so that items you use often are within easy reach
- **Q. Do you use a steady and sturdy stool to reach upper shelves?** Get a steady and sturdy step stool with a bar to hold on to. Never stand on a chair to reach upper shelves
- **Q. Are the control knobs for the stove clearly marked and legible, and in front of the stove?** Replace knobs if the writing has worn off. If you are considering a new stove, buy one with the knobs that are not directly behind the burners and/or one with knobs that can be disabled to prevent use by a child or unqualified adult
- **Q. Is there adequate ventilation?** Use a ventilation fan or open windows while cooking

Fire and Burn Prevention

- **Q. Do you have a fire extinguisher near the kitchen exit?** Install a fire extinguisher near the kitchen exit
- **Q. Do you have a smoke alarm close to the kitchen?** Have a smoke alarm installed outside but near the kitchen
- **Q. Do you check your smoke alarm regularly to see if it works?** Test it at least twice a year and check the batteries monthly
- **Q. Do you have a carbon monoxide detector?** Consider installing a carbon monoxide detector near each of the bedrooms
- **Q. Has your family discussed and agreed upon a fire escape plan?** Develop and practice a fire escape plan with your family
- **Q. Is your water temperature at or below 120º?** Lower the setting on your hot water heater to "Low" or 120 degrees

Sleeping Areas

- **Q. Is there an easy to reach light or light switch near the bed?** Keep a lamp close to the bed within easy reach. Consider installing a light switch close to the bed
- **Q. Do you have a telephone near the bed?** Place a pushbutton telephone with large, easy-to-dial numbers near the bed (be careful with the telephone cords)
- **Q. At night, is there enough light to go from your bed to the bathroom?** Install a nightlight along the path to your bathroom
- **Q. Is your bed very high or very low?** Adjust the height of your bed so that when you are sitting on the edge with your feet on the floor your knees are at a 90° angle

Bathrooms

- **Q. Does the tub or shower floor have a non-slip surface?** Install a rubber mat or self-stick strips on the floor to prevent slips
- **Q. Do you have grab bars by the toilet, tub, and shower?** Consider installing grab-bars in all bathrooms, by the toilet and in the bathtub or shower (It is a good idea to have two bars in the tub: one on the sidewall and one on the back wall)
- **Q. Do you have difficulty getting on or off the toilet?** Consider installing an elevated toilet seat (in addition to grab bars)
- **Q. Do you have a fixed showerhead?** Consider installing a hand held adjustable showerhead

Preventing Medication Mishaps & Poisonings

- **Q. Are your medications clearly labeled and safely stored?** Store medicines in containers with their original labels Keep your medications stored separately from those of other family members. Discard outdated medications. Store medications away from direct sunlight in a place with minimal humidity
- **Q. Are cleaners, household chemicals, and other poisons clearly marked and stored away from food?** Store cleaners, chemicals and poisons in their original clearly marked containers in a secure area away from edibles
- **Q. Do you routinely check if any food items are expired?** Check the expiration date on all food items regularly and discard expired items**.** Date leftovers so they can be used within a safe time period
- **Q. Do you have a first aid kit?** Get a first aid kit approved by your doctor or the American Red Cross
- **Q. Do you have emergency numbers posted near the phone?** Keep emergency numbers by the phone: poison control center, hospital emergency room, doctor, neighbors, relatives, and friends

Crime Prevention

- **Q. Do all windows and doors lock properly?** Check all windows and doors regularly to make sure they lock properly
- **Q. Do you have a deadbolt on exterior doors and can you see who is at the door?** Secure all exterior doors with a deadbolt. If you cannot see through a window, install a door viewer (peep hole) in all external doors
- **Q. Do you have a home security system?** Considering installing a home security system
- **Q. Is the property well lit?** Consider installing lighting to illuminate the edges of your property
- **Q. If you have a firearm in your home, is it stored safely?** Store the firearm unloaded in a locked box, out of reach of children; store it loaded only if you want ready-access for defensive use
- **Q. If you have a firearm in your home, do you know how to use it?** Obtain firearm training or consider turning it over to the local police department

So, you have gone through the safety list and you have decided to make some home modifications. Let's see recent literature tell us about home modifications.

HOME MODIFICATIONS: PARTNER WITH OCCUPATIONAL THERAPY

In a study published in 2018 in the *American Journal of Occupational Therapy*, researchers performed a randomized, controlled trial where community dwelling older adults age 65 or older who had sustained a fall in within 6 months were recruited.[2] There were 42 individuals in the treatment group that completed the study and 42 in the sham control group. All received six, 90-minute sessions of Occupational Therapy (OT) treatment over an 8-week period with final follow-up at 12 weeks. The treatment group received an assessment of their abilities and home environment, identification of activities of daily living (ADL) problems, shared decision making regarding interventions and home modifications and participant training and active practice. The sham group received a standardized kit of adaptive equipment for fine motor tasks.

Researchers found that effective home modifications include changes to the

environment as well as self-management strategies to safely perform daily activities, motivational enhancement strategies to promote client-centeredness, and shared decision making.[2] Additionally, occupational therapy practitioners can effectively deliver home modifications with high fidelity with modest training for relatively low cost. Interestingly, this study found that the effects of the home modifications and safety training strategies were maintained for at least 12 months.[2]

The take home message? Let consider partnering with OT when making decisions regarding how to best recommend home modifications and training to individuals after a fall.

HOME MODIFICATIONS: CONSIDER SOME POTENTIAL SAFETY ISSUES

In another 2018 article published in the journal, *Safety*, home modifications were provided to individuals in an attempt to prevent falls.[3] Participants in the study were provided with builders and/or individuals who provided the home modifications. Although in general, participants were satisfied with the modifications, there were clear safety issues with some of the modifications. The results indicate that there is a need for monitoring and remediation work to follow-up with interventions and a need for some regulation of the quality of some of the safety products.[3]

It may be helpful to review some the problems encountered with home modifications in this study.

1. **Slippery steps and/or poor visibility of steps.**
   The modification was often edgings for outside steps. The advantages are that they are relatively easy to retrofit having aluminum channels with a luminous, slip-resistant insert. An issue was that there were some exposed aluminum edges that were sharp and presented a cutting hazard. The solution proposed are strips span the full width of the step and that any sharp edges be blunted.

2. **Lack of handrails in the bath or shower.**
   Grab rails with suction cups were provided. The advantages are that these can be installed without interfering with existing tiles or wall surfaces. The issue is that there is often failure of the suction after a few months. The solution proposed is to install grab rails with permanent fixing to walls.

3. **Poor outside lighting.**
   Solar powered outside lighting was provided. The advantages are that it does not require connection to wiring of the house, so installation is relatively inexpensive. The issue is that there is a high failure rate of this type of lighting, potentially from poor weather proofing. The solution proposed is to install a better product that is more fit for the lighting purpose.

4. **Fire/smoke hazard.**
   Smoke detectors were installed. The advantage is that these are inexpensive and quick to install. The issue is that the batter life is expected to be around one year and that occupants often fail to replace the batteries. The solution proposed was that a longer life battery (such as 10 years) be installed.[3]

Take home message? Be sure to have the correct modifications performed and have the ability to contact anyone who performed the modifications if changes are needed.

So, what should you as a physical therapist do to encourage the appropriate kind of home modifications that may be needed after a patient falls? As mentioned before, consider partnering with an occupational therapist when considering home modification options. Make sure that the patient clearly understands why the home modifications are necessary. Then, check to make sure the home modifications are correctly performed and/or installed and are safe and effective. Finally, make a follow-up call in a few months and see if the patient has adjusted appropriately to the modifications and see if there are any new problems reported by your patient.

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