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Healthy Aging: Seniors' Mobility Toolkit for Physiotherapists





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Introduction



Physiotherapy Alberta's Healthy Aging: Seniors' Mobility Toolkit (Toolkit) was developed to help promote healthy aging in community-dwelling older adults. Mobility is vital to healthy aging; its loss can affect the physical, psychological and social aspects of an older adult's life.²

Just as management of health conditions such as high blood pressure includes addressing any modifiable factors, it is essential to identify and treat any modifiable factors that can limit mobility.³ Mobility limitations are common and assessment can be incorporated within routine primary care for older adults.⁴

The Toolkit offers a physiotherapy-specific framework for the assessment of community dwelling older adults (65+) at risk of mobility loss and the modifiable factors agreeable to physiotherapy interventions that will support healthy aging.

The Toolkit is designed to be used within a health promotion initiative in the community or integrated within a physiotherapy treatment program to help maintain or improve physical function in older Canadians.

In a health promotion initiative in community or private practice settings, the physiotherapist uses the Toolkit to develop an individualized mobility risk profile for seniors. The mobility risk profile would identify factors that may contribute to future loss of functional mobility and that are agreeable to selected interventions. Following administration of the five tools, and the subsequent development of the risk profile, the physiotherapist discusses the appropriate next steps with the senior. These may include:

- Further assessment by either the physiotherapist or another appropriate health professional if there are areas of concern
- A physiotherapy specific intervention program to address the identified risks
- Referral in to a community program (e.g., seniors' fitness program, Tai Chi)

Healthy aging "maximizes function and minimizes decline."¹

In an active treatment setting, a physiotherapist treating a senior for an acute or chronic condition may see indications of risk for loss of functional mobility. They would select the most appropriate tool(s) from the Toolkit to screen those risk factors. For example, for a senior referred for treatment following a Colles' fracture, the mechanism of injury may suggest that balance was a contributing factor and may be a risk for future mobility loss. The Single Leg Balance Test is a quick screening tool that will help determine if a more comprehensive evaluation of his/her balance is required. Based on the results, the physiotherapist may add in components of balance training to the rehabilitation program. Similarly, following rehabilitation for a fractured ankle, the physiotherapist may choose tools from the Toolkit to assess balance or functional mobility concerns resulting from any residual loss of range of motion or strength, and determine any additional components for rehabilitation.

Scores from the tools may also identify individuals who would benefit from referral to other health-care professionals or a specialized geriatric service for more in-depth assessment and management.

The Toolkit is not intended to be an exhaustive review of risk factors or to substitute for a more comprehensive assessment of mobility loss. Rather, it is intended to provide tools that can easily be used to screen components of function and identify risk factors for mobility loss that may lead to overall functional decline. It provides guidance specifically on modifiable motor components affecting mobility limitation and should be used within the context of a broader assessment.

The Toolkit is organized into three sections: Mobility in Healthy Aging, Age Related Modifiable Factors, and Assessment Tools, including a Test Score Summary Table and a Decision Tree which provides guidance on decisions for further management.

Mobility in Healthy Aging



Canadians are living longer and are healthier than ever before.⁵ Seniors over 65 represent a large and growing proportion of the population: the majority live in the community and are active participants in both family and community life.⁶ In 2015, over three quarters of seniors over 65 engaged in or participated in exercise, walking, social activities, volunteering, and the regular use of technology.⁷ 91% of women over 65 years of age regularly did housework in their homes, as did 83% of senior men.⁸

Mobility is the ability to move within one's home as well as in the neighborhood or beyond. For older adults, a decline in, or loss of, mobility can affect all aspects of their life and may restrict their ability to obtain groceries, participate in social activities or have timely access to a needed service or appointment.⁹

Mobility is essential to healthy aging. Older adults think mobility is "integral to (their) sense of self and feeling whole."¹⁰ It signifies "independence, well-being and freedom,"¹¹ and its loss is a key disadvantage of aging.¹²

Mobility loss is complex and may be due to a number of factors that are physical, cognitive, and/or environmental.¹³ It can be the result of acute or chronic musculoskeletal injuries or conditions, obesity, pain, chronic disease (e.g., COPD, Parkinson's disease, cardiovascular disease), cancer, or medication. It may also be due to new or challenging environmental barriers, such as a move to a new location. Depression or cognitive difficulties¹⁴ as well as age-related conditions such as sarcopenia¹⁵ or loss of vision may also be factors that contribute to mobility limitation.¹⁶

Limitation in mobility may be the first observable sign of functional decline.¹⁷ However, this may not be irreversible. There is evidence that mobility is a dynamic process, with frequent transitions between independence and mobility loss; individuals may, therefore, respond to appropriate interventions or programs.¹⁸

Healthy aging includes early recognition and management of modifiable factors, such as diet, lifestyle, or physical activity.¹⁹ For example, sustained physical activity in older age is associated with improved overall health and even health benefits for those who become physically active relatively late in life.^{20,21}

Physiotherapy, exercise and/or rehabilitation interventions, as part of multidimensional programs, can increase strength, function, gait speed and energy in community dwelling seniors.^{22,23}

Age-Related Modifiable Factors in Mobility Loss



Each of the tools in the Toolkit assess musculoskeletal components that contribute to the individual's performance. Aging is a heterogenous process, and any functional decline individuals experience will be influenced by general physical activity level and the effects of any existing chronic condition(s) or co-morbidities on their overall health and abilities.²⁴

Musculoskeletal conditions are the most common factors in developing functional impairment.²⁵ Interventions that address these factors may play an important role for older adults by promoting and maintaining their physical independence.

The following section provides an overview of the neuro-musculoskeletal factors that contribute to poorer scores and that may be agreeable to physiotherapy interventions in support of healthy aging.

Range of Motion (ROM)

Loss of range or flexibility in the joints of the lower extremity can affect the individual's ability to perform daily activities such as walking, rising from sitting, or bending and reaching. While age may be associated with a decline in flexibility, older adults are able to improve flexibility with targeted programs.²⁶ Early interventions to correct trunk posture and decreased ROM in the hip, knees or ankles may improve general strength and balance, restore gait speed, and delay onset of functional decline in the older adult.²⁷

For example:

- Trunk mobility maintains functional independence in daily activities, such as dressing and bathing.²⁸
- Trunk (spinal) range of motion is associated with dynamic balance and is a factor in the risk for falls.²⁹
- Decreased hip extension can reduce walking speed, shorten stride length and, if unilateral, alter gait symmetry.^{30,31,32}
- Limitation end hip or knee range extension becomes a factor in gait stride and speed.³³
- Range of motion in the ankles is critical for balance while walking and the ability to reach forward while standing.³⁴ Limited dorsiflexion in one or both ankles is associated with an increase risk of falls.³⁵

Strength

The aging process includes loss of muscle mass (sarcopenia) and loss of strength (dynapenia).³⁶ However, strength decreases two to three times faster than muscle mass, and is a stronger factor for risk of disability than mass.³⁷ It can compromise an individual's ability to live independently and carry out daily activities. It can also be a factor in disproportionate fatigue.³⁸ For older adults, the loss of strength can limit their ability to manage stairs, to get up from a chair, to go shopping, and to enjoy leisure activities.

Prescription of a tailored strengthening exercise program is effective in the management of both sarcopenia and dynapenia and the subsequent maintenance of mobility and independence.³⁹ As an example, trunk muscle strength is a modifiable factor for maintaining balance and functional performance and is a factor in falls risk.⁴⁰ Strengthening exercises will increase extensor endurance and improve balance and mobility in older adults.⁴¹

Balance

Postural stability is maintained by the integration of inputs to the somatosensory, vestibular and visual systems and the responses of the musculoskeletal system.⁴² Each of these deteriorates with age and are contributing factors in age related dizziness and balance disorders.

The following section provides an overview of factors affecting balance that may contribute to mobility impairment.

Cervical Spine

Cervical spine injury/dysfunction may cause dizziness, headache, or difficulty with balance and unsteadiness with walking and turning. Postural disorders such as forward head posture and kyphosis can increase strain on skeletal muscles and spinal mechanics and may be factors in postural control and balance. Older adults with neck pain may have reduced postural stability compared to those without neck pain.⁴³

Somatosensory system/Proprioception

There is evidence that all age groups are more dependent on proprioception than on vision to maintain balance,⁴⁴ which indicates that proprioception may also be a factor in falls risk. One study suggests that older adults rely more on proprioception than on visual or vestibular cues for postural control.⁴⁵

Vestibular System

Vestibular dysfunction is one of the most common reasons for dizziness in older adults. Benign paroxysmal positional vertigo (BPPV) is the most frequent vestibular disorder⁴⁶ but often may not be recognized. In one study, 80% of individuals who had fallen had unidentified vestibular dysfunction.⁴⁷

Vestibular vertigo presents as:

- Rotational, the illusion of self-motion or object motion
- Positional, precipitated by change in position
- Recurrent dizziness with nausea or a visual disturbance, and imbalance

If an individual experiences any one of these,⁴⁸ they may be experiencing a vestibular disorder.

The Modified Romberg Test,⁴⁹ conducted with an individual standing first on a firm and then a compliant surface (e.g., foam balance pad), may be used as a screening test for vestibular dysfunction. For older adults, the inability to maintain this position with their eyes closed for more than 20 seconds may be indicative of vestibular dysfunction.⁵⁰

Additional testing includes the Dix-Hallpike manoeuvre⁵¹ which may be also carried out in side lying if the individual has limited range of motion or other MSK conditions. Testing should only be conducted by clinicians with training and experience in the assessment and management of vestibular disorders. In all other cases, if history and preliminary screening indicate a possible vestibular dysfunction, referral to a vestibular physiotherapist or physician is indicated.

Assessment Tools



Objective physical capability measures are effective tools in the health assessment of older adults and are indicators of health status and the risk for mobility loss and functional decline.⁵²

Selection of Tools

The Toolkit contains the physical capability measures used in the Healthy Aging Across the Life Course (HALCYon) project, a research collaboration on three aspects of healthy aging: physical and cognitive capability, social and psychological well-being, and the underlying biology of aging.⁵³ In addition, there is evidence linking each tool to an individual's functional status and/or specific functional activities.

The tools are familiar to physiotherapists, inexpensive and easy to use in all clinical situations, as well as relevant to daily activity requirements. The tools have also been used in a number of populations and cultures, confirming their validity for use broadly. Finally, the tools may be used both as assessment and as outcome measures for individual treatment programs.

Each tool is described, with relevant norms and cut point scores indicating risk of mobility limitation. Scores indicating risk of mobility loss are used with permission of Roberta E. Rikli, PhD (Department of Kinesiology, College of Health and Human Development, California State University, Fullerton) and C. Jessie Jones, PhD (Department of Health Science, California State University, Fullerton).

1. Normal walking speed

Walking speed has been described as “the sixth vital sign.”⁵⁴ It is considered an inexpensive and reliable indication of functional status.⁵⁵ A recent systematic review confirmed that normal walking speed in autonomous community dwelling seniors is a predictor for such adverse outcomes as “disability, cognitive decline, hospitalization, falls and/or mortality.”⁵⁶ One study found that improvement in gait speed over one year resulted in a significant reduction in mortality.⁵⁷

The “10 metre walk test”⁵⁸ measures self-selected gait speed over six metres, allowing two metres at each end that allow for acceleration and deceleration. The physiotherapist begins timing once the individual's foot crosses the first two metre mark and ends when his/her foot crosses the second marker. Assistive devices may be used, but they must be present for any repeated tests. Conduct three repetitions and average the three times. To determine actual walking speed, divide the average by six.

NB. If an individual requires assistance in walking the test is invalid.

- Usual gait speed for adults has been determined as 1.2 to 1.3 m/sec.⁵⁹
- Crossing a street safely can require gait speeds ranging from 0.74 to 1.2m/sec.⁶⁰



The table below presents cut points for gait speed in community dwelling older adults that incorporate the effects of subclinical or undiagnosed conditions on gait speeds.⁶¹

Superior	Normal	Mildly Abnormal	Seriously Abnormal
≥ 1.4m/s	1.0-1.4m/s	0.6-1.0 m/sec	<0.6m/sec

For the purposes of the Toolkit:

- Gait speed < .80 m/sec indicates mobility impairment⁶²
- Gait speed <.60 m/sec may be indicative of poor health or limited function⁶³

In addition, an individual whose gait slows to talk may be indicative of a balance disorder, early cognitive decline or the effects of polypharmacy (over five medications).^{64,65}

Click here for detailed instructions and recording form for the 10 metre walk test from Geriatric ToolKit.

2. Standing Balance

The Single Leg Stance Test (SLS) is used for a range of conditions with individuals from ages 18-99. Performance scores are associated with gait speed, the risk for falls and level of functional independence.^{66,67} For example, the ability to stand on one leg is essential for a normal gait pattern and is essential for activities of daily living such as turning, bathing, stair climbing, and dressing.⁶⁸ Individuals unable to perform the SLS for more than five seconds are at significant risk for falls.⁶⁹ A recent study found that for otherwise healthy older adults, the inability to stand on one leg with eyes open for 20 seconds may be associated with cognitive decline, cerebral small vessel disease, and stroke.⁷⁰

For the SLS, the individual places his/her hands on his/her hips (alternatively: arms across chest, hands on shoulders) and is then asked to stand on one leg, unassisted. The physiotherapist uses a stopwatch to time three trials of standing on one leg, eyes open. The test ends when the individual puts his/her foot down, puts the raised leg against the stance leg, or uses his/her arms for balance.

Normative values for Single Leg Stance Test⁷¹

Age	Gender	Eyes Open - Best of three trials (sec)	Eyes Open - Mean of three trials (sec)
60-69	Male	33.8 (16.2)	28.7 (16.7)
	Female	30.4 (16.4)	25.1 (16.5)
70-79	Male	25.9 (18.1)	18.3 (15.3)
	Female	16.7 (15.0)	11.3 (11.2)
80-99	Male	8.7 (12.6)	5.6 (8.4)
	Female	10.6 (13.2)	7.4 (10.7)

Individuals unable to perform SLS longer than 10 seconds are at risk for balance impairment,⁷² while a score of less than five seconds is significant risk for a fall.⁷³

3. Grip Strength Test

Grip strength is recognized as a predictor for mobility limitation,⁷⁴ general body strength⁷⁵ and for physical performance.⁷⁶

It is tested using a hand-held dynamometer, and the individual chooses which hand will be tested first. The individual is seated comfortably with both feet on the ground. His/her arm is at his/her side, with elbow flexed to 90 degrees, holding the dynamometer in one hand with wrist in the neutral position. The physiotherapist asks the individual to squeeze the dynamometer to his/her maximum ability for six seconds. They are allowed a sub-maximal trial with each hand before the measurement is recorded.

Click here to watch a NIH Toolbox video demonstration of Grip Strength Test

A recent analysis of pooled data from multiple studies identified clinically relevant cut points for grip strength associated with mobility impairment in individuals over 65 years of age.⁷⁷ Mobility impairment was identified as a gait speed of < .8 m/sec. Three categories were identified - normal, intermediate and weak, with normal strength used as the comparator. Cut points for both the intermediate and weak categories indicate weakness associated with risk of mobility impairment, although the weakness in the “intermediate” category was considered less severe.

In both “intermediate” and “weak” levels, cut points are associated with functional limitations, and individuals scoring in either category may benefit from a general strength training program.⁷⁸

Strength categories for grip strength associated with mobility limitations⁷⁹

Strength Category	Men	Women
Normal	>32 (greater than or equal to)	>20 (greater than or equal to)
Intermediate	26-32 kg	16-20 kg
Weak	<26 kg	<16 kg

4. Timed Up and Go Test

The Timed Up and Go (TUG) is used widely as a measure for lower extremity function, mobility and fall risk in a range of populations and ages. It tests multiple components of balance and mobility and is valid for healthy older adults.^{80,81} For the purpose of this Toolkit, the TUG is a useful tool to assess functional mobility in community dwelling adults as it does not have a floor or ceiling effect, and has been found to be associated with executive function.⁸²

Higher scores for the TUG and a slower usual gait speed have been shown to be predictors for disability in basic Activities of Daily Living (ADL) and instrumental Activities of Daily Living (iADL) and increased dependence.⁸³ TUG score may be used as an outcome measure for improved function through exercise programs.

The TUG measures the time, in seconds, it takes an individual to stand from a standard chair (seat height 46 cm, chair arm height 65 cm) and walk at his/her usual speed for three meters, turn, and walk back to the chair and sit down. The individual begins sitting well back in chair, resting arms on chair arms, feet flat on floor and wearing comfortable shoes. They may use any walking aid they use regularly. Following one trial to ensure the individual understands the instructions, the physiotherapist uses a stopwatch to time the TUG from the point the patient is instructed to “go” until they sit down.

If the individual does not complete the test correctly the first time, they may repeat it.

Higher scores on the TUG may indicate mild cognitive impairment.⁸⁴

Variations on the original TUG include a cognitive TUG and/or a manual TUG, which test dual function.⁸⁵

- For the TUG Cognitive, the individual is asked to complete the task counting backwards from a randomly selected number between 20 and 100 (chosen by physiotherapist).
- For the TUG Manual, the individual is asked to complete the task while carrying a full glass of water.

Older ambulatory adults are able to complete the TUG in ≤ 10 seconds.

Cut scores for risk of falls are:

- TUG ≥ 13.5 seconds
- TUG cognitive ≥ 15 seconds
- TUG manual ≥ 14.5 seconds

NB Loss of ROM and/or weakness in L/E may contribute to performance score in TUG.⁸⁶

[Click here to watch Centre for Disease Control Video of the TUG.](#)

5. 30 Second Chair Stand

The 30 Second Chair Stand Test (Chair Stand) is essential in mobility assessment as it evaluates lower body strength in relation to high-level functional activities such as climbing stairs or getting up from a chair. It is also used to assess any fatigue caused by the number of repetitions, which may be an early predictor of functional decline in active older adults.⁸⁷ The Chair Stand is recommended as a predictor for risk of future mobility loss in community-dwelling older adults.⁸⁸

For the Chair Stand, the individual is seated on a chair with the standard height of 43 cm that is stabilized against a wall, with feet flat on the floor and arms crossed over chest. The physiotherapist goes over test instructions and the individual carries out one or two trials to ensure his/her form is correct and that his/her balance is adequate.

At the signal “go” from the physiotherapist, the individual will stand up fully and sit back down as many times as they can in 30 seconds. The physiotherapist uses a stopwatch to time the test.

Normal ranges for Chair Stand test in the table below are

Age	60-64	65-69	70-74	75-79	80-84	85-89	90-94
Men	14-49	12-18	12-17	11-17	10-15	8-14	7-12
Women	12-17	11-16	10-15	10-15	9-14	8-13	4-11

excerpted from Rikli and Jones.⁸⁹

Less than eight repetitions indicates the individual (both men and women) is at risk for mobility loss.⁹⁰

Chair Stand should not be conducted in the presence of these exclusion criteria:

- Patient has been advised not to exercise by physician
- Patient has history of CHF, chest pain, dizziness, or angina during exercise
- BP > 160/100⁹¹

[Click here to watch a Centre for Disease Control video for the 30-Second Chair Stand Test.](#)



Using the Toolkit



Physiotherapy Alberta’s Healthy Aging: Seniors’ Mobility Toolkit was developed for use within a health promotion program or for integration within an existing physiotherapy program when the physiotherapist is concerned his/her patient may be at risk for mobility loss or limitation.

The Toolkit may be used as a package to develop a risk profile, or selectively, to assess potential risk for mobility loss. A summary of the tools and their relevant cut points, along with a Decision Tree, are provided to demonstrate clinical decisions physiotherapists may make following administration of the Tools.

If the individual’s score is positive for one or more of the Tools, review the scoring in the context of the patient’s overall status and determine if further assessment is warranted. For example:

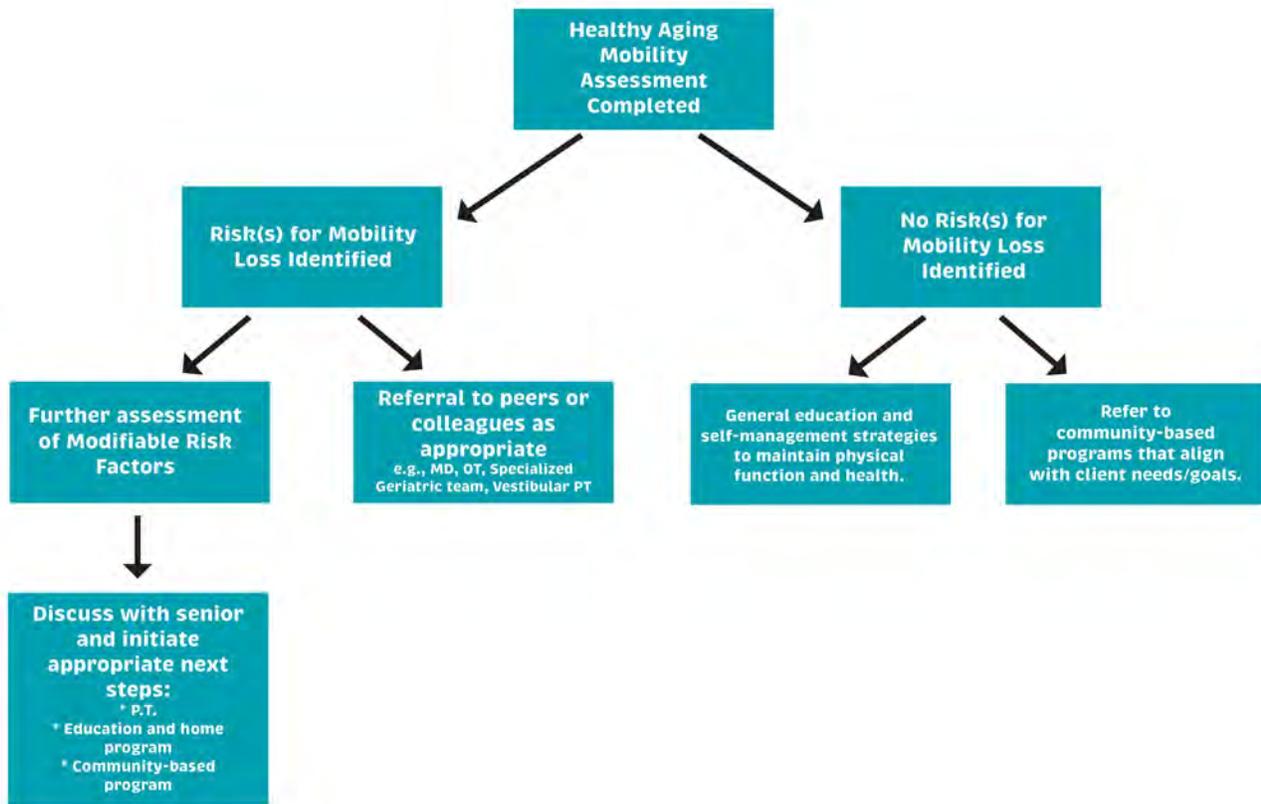
- A sedentary 70-year-old man has “intermediate” Grip Strength and the Single Leg Stance Test is positive. Is a referral for a comprehensive falls assessment appropriate? Is there a question of polypharmacy that indicates consultation with a physician or a pharmacist? Or is this an indication that this individual is at risk for loss of functional mobility and further assessment of the modifiable factors is appropriate?
- A healthy-appearing 68-year-old woman has a “weak” Grip Strength. Is this finding indicative of early functional decline? Should the physiotherapist provide the patient with education and a home program and discuss self-management strategies? Or should the woman be referred to a community program, such as a senior’s strength training program? Should the woman’s family physician be notified?

In all situations, the decision for ongoing management is based on the individual’s history and the physiotherapist’s overall assessment and his/her clinical judgment.

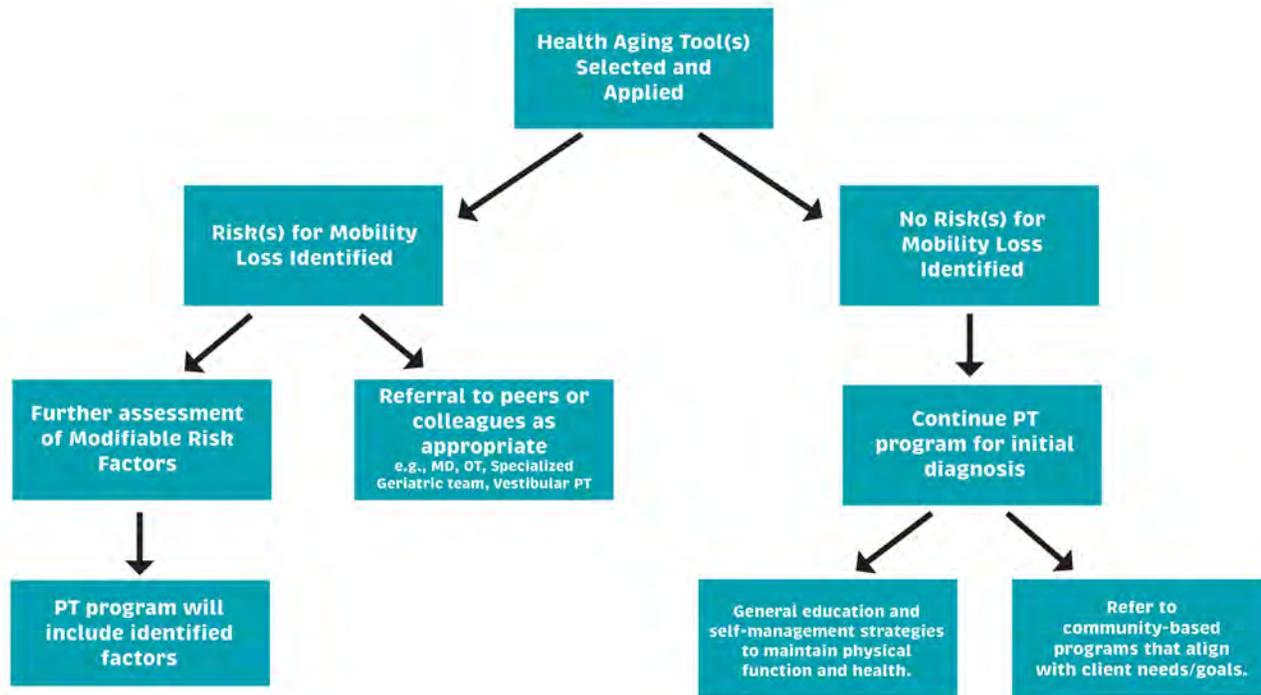
Scores for Risk of Mobility Loss

Tool	Cut Scores		Risk for	Modifiable Factors			
				ROM	Strength	Balance	
10 MWT	< 0.8 m/s		Mobility impairment	X	X	X	
	< 0.6 m/s		Poor health, limited function	X	X	X	
Single Leg Stance	< 10 sec		Balance impairment		X	X	
	< 5 sec		Significant risk: fall		X	X	
Grip Strength	Men	Women	Decreased general body strength and physical performance, mobility limitation		X		
	Int	26-32 kg		16-20 kg			
	Weak	< 26 kg		< 16 kg			
TUG	Both Men & Women N ≤ 10 sec ≥ 13.5 sec Fall Risk ≥ 15 sec - cog ≥ 14.5 sec - mental		Decreased functional mobility, executive function	X	X	X	
30 sec Chair Stand	< 8 reps		Mobility loss, endurance	X	X		

Scenario A: Health Promotion Initiative Decision Tree



Scenario B: Active Treatment Setting Decision Tree



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Acknowledgments

Advisory Committee

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A panel of physiotherapy educators, managers and clinicians reviewed an early draft of the Healthy Aging - Seniors Mobility Toolkit. Physiotherapy Alberta wishes to thank them for their contribution to the development of the document. Their comments and recommendations were essential to the project outcome.

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