ASSESSMENT FOR GAIT AID USE IN PEOPLE WITH DEMENTIA

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People with dementia fall twice as often as their cognitively healthy peers at 60-80% each year.[1] Balance and gait problems are common and progressive in people with dementia, and are prominent risk factors for falls.[2] In general, the prescription of a gait aid, such as a 4-wheeled walker, is a common treatment given to people with balance and walking problems as it provides physical support and confidence to allow greater participation in society.[3] Yet a completely opposite effect to these intended benefits occurs in people with dementia: the use of a gait aid triples the risk of falling.[2] Falls can have a dramatic negative effect on the independence, function, mobility, confidence and quality of life of people with dementia.[4] Falls are also associated with increased caregiver burden and long-term care admissions.[5]

Dementia not only causes memory problems but also problems with balance and walking, so the use of gait aids is common. Additionally, most people do not see a healthcare professional when they start using a gait aid and they do not receive any education to size the aid or training on how to use the gait aid correctly.[6,7] If the gait aid is provided through a healthcare professional, the practitioner should consider the severity of physical impairments (i.e., balance, gait, strength) and if the need for a gait aid is indicated then further decision making on the level of support required for stability. The aim is to provide a gait aid that delivers the appropriate level of support required for the individual. Once a decision about the type of gait aid has been determined, the gait aid needs to be sized for the person[8] (e.g., adjusted to the person's height) and then education along with practice with the gait aid can facilitate motor learning enabling the safe performance of the skilled use of the aid[9].

Factors that could link gait aid use to an elevated fall risk in people with dementia include the underlying neurodegenerative processes, incomplete motor learning, limited insight into safe gait aid use and increased cognitive demands related to attentional processing and neuromotor control.[10,11] Lack of knowledge for how to use an aid safely can also increase the risk for falling, which can result from a lack of training and limited insight into one's physical abilities in a given situation. The effects of dementia on physical function (balance, gait, strength), problems with doing multiple tasks at the same time and distractions in the

environment increase demands on the brain which increase instability. Additionally, safety issues with using a gait aid are not addressed in current falls prevention strategies.[12]

The following guide provides a framework for healthcare professionals who are:

1) referred people with dementia for assessment for the provision of a 4-wheeled walker
2) the evaluation of people who are already using a gait aid.

ASSESSMENT FOR THE USE OF GAIT AIDS

The information presented in this document on the assessment of gait aids for people with dementia uses best available evidence to inform clinical practice. The assessment outlined below should be done on initial evaluation for the prescription of a gait aid and strongly suggest that it is done yearly or in response to a change in function. As balance, gait and strength are expected to progressively deteriorate over the course of the disease, it is important that a regular evaluation ensures that the gait aid continues to meet the needs for the individual over time.

Walking aid provision is a common strategy that allows for independence in mobility as it provides physical support and haptic sensory feedback.[3] An estimated 24% of community-dwelling and 70% of institution-dwelling older adults use mobility aids,[13] yet most obtain their device without consulting a healthcare professional, which can result in improper sizing and unsafe technique.[6,7] Walking aids require coordinated movements, can come in contact with obstacles or a person's own body, can obstruct visual space, and can be difficult to maneuver under certain situations (e.g., opening a door).[3] The most common aids used by older adults are single-point canes and 4-wheeled walkers.

Assessment for Mobility Aids

1. Meet the person with dementia and have a carer present if they are available.

2. In the subjective history, review medical information to assist planning of walking/mobility abilities and information related to mobility aid use.

3. Clinical assessment:
   a. Assess, examine and evaluate the person to determine limitations
      i. Subjective interview
         1. Home environment
         2. Pain
         3. Use of mobility aids before and what type
         4. Usual activity level
      ii. Range of motion – upper extremity and lower extremity
      iii. Strength
         1. Upper extremity – shoulder depressors, should extensors and flexors, elbow extensors, finger flexors, scapular stabilizers
         2. Lower extremity – hip abductors, hip extensors, knee flexors, knee extensors, ankle dorsiflexors, ankle plantarflexors
      iv. Cognition
         1. Alert and oriented
         2. Able to follow commands
         3. Not impulsive
         4. Anxiety and fear of falling
      v. Endurance
      vi. Comorbidities
         1. Vision, neurological disease or impairment, hearing, BMI
      vii. Balance
   b. Determine appropriate equipment – essentially how much stability is required
      i. Weight-bearing status
      ii. Limitations from above evaluation in "a"
      iii. Real world needs for the person
      iv. Environmental inventory for home setting - stairs, one or two storey home or apartment, railings, steps into home, washroom

SECTION ONE – THE SUBJECTIVE HISTORY

It will be important to have a carer present during the assessment to assist/corroborate the history and provide their observations regarding any concerns related to mobility. Research supports that people with dementia are able to appreciate the need for and positive effect of a mobility aid to provide support and stability that ultimately leads to an acceptance of the gait aid.[14] It is important to appreciate that carers are at times instrumental in ensuring the people with dementia use their gait aid and use it appropriately. [14] Lastly, use of gait aids by the person with dementia has been associated with a reduction in anxiety and relief of burden in carers that is related to the person with dementia's improved safety. [14] Research supports that the increased risk of falls among people with dementia using a mobility aid is also not well known among carers. [14] The questions in this section explore areas that have been recognized as important to explore.

1.1 Gait Aid Use:

1.1.1 Not currently using a cane or walker:

Include questions that probe the person with dementia's understanding for the prescription and use of a 4-wheeled walker. Explain why you are there to see them about the gait aid and what will be involved – asking questions and then doing an assessment.:

- Ask the person with dementia, and/or their carer, what they understand is the reason for them being asked to use a gait aid, such as a cane or walker?
- Do they feel they need to use a gait aid, such as a cane or walker? (Yes/No)
    - o Do they feel unsteady when standing or walking?
        - ▪ If yes
            - • When do they feel unsteady or what activities makes them feel unsteady?

- Ask if the person with dementia has used any kind of gait aid in the past? (Yes/No)

    - o If yes
        - ▪ When and what did they use?

1.1.2 Currently using a gait aid (cane or walker):

It is important to be aware that more than 50% of people do not see a healthcare professional to get a gait aid. Therefore, the evaluation will need to address the following points:

1) Appropriateness of the aid they are currently using
2) Sizing of the aid
3) Mechanical review of the aid

It is common for people to use more than one kind of aid depending on the setting of use (i.e., indoors versus outdoors). If more than one type of aid is used, it is important to explore what aids are used and when or where they are used.

- Ask what type of aids they use?

If using a cane:

- Determine how long they have used the cane?
- Establish if the cane was prescribed by a healthcare professional? (Yes/No)
    - o If yes:
        - Who prescribed the cane (e.g., professional designation)?
- Was the cane sized/fitted/adjusted for them? (Yes/No)
- Did someone teach them how to use the cane? (Yes/No)
    - o If yes:
        - What was included in the training?
        - How often were they seen? (Number of sessions over what time frame?)
- Determine if the cane is used at all times for walking? (Yes/No)
    - o If no:
        - When do they use the cane?
- Does the person feel steadier when they use the cane? (Yes/No)
- Did someone teach them how to maintain and check for mechanical problems with the cane? (Yes/No)
    - o If yes:
        - How often do they check for mechanical problems?
- Do they have any problems using the cane?
    - o What are the problems?

If using a walker:

- What type of walker are they currently using? (e.g., standard, 2-wheeled, 3-wheeled, 4-wheeled)
- How long have they used the walker?
- Was the walker prescribe to them by a healthcare professional? (Yes/No)
    - o If yes:
        - ▪ Who prescribed the walker (e.g., professional designation)?
- Did someone size/fit/adjust the walker for them? (Yes/No)
- Did someone teach them how to use the walker? (Yes/No)
    - o If yes:
        - ▪ What was included in the training session?
        - ▪ How often were they seen? (Number of sessions over what time frame?)
- Do you use the walker at all times for walking? (Yes/No)
    - o If no:
        - ▪ When do they use the walker?
    - o If the walker is not used indoors:
        - ▪ Ask if there is enough space indoors to use the walker if they wanted to use it?
- Do they feel steadier when they walk using the walker? (Yes/No)
- Ask if someone taught them how to maintain and check for mechanical problems with the walker? (Yes/No)
    - o If yes
        - ▪ How often do they check for mechanical problems?
- Do they have any problems using the walker?
    - o What are the problems?
- Do they have any problems lifting the walker in/out of a vehicle?

Questions specifically for the carer:

- Do you need to remind your family member to use their gait aid? (Yes/No)
    - o If yes, in what situations do you need to remind them?
- Do you have any problems lifting the walker in/out of a vehicle? (Yes/No)
    - o If yes, what are the specific problems with this activity (e.g., weight and/or shape of the aid; your vehicle)?

1.2 History of falls in the past 12 months?

It is important to provide a standardized definition for a fall for people. A fall should be defined as "an unexpected event in which the participant comes to rest on the ground, floor, or lower level".[15] The self-reporting of fall events is significantly influenced by the dementia severity, but clinicians are encouraged to directly ask the person with dementia about falls.[16] Recall periods for falls should be as short as one week for people with dementia and additional information by carers increases accuracy of reports. The retrospective recall of falling with long recall periods is not recommended.[16] Specifically, a 12-months recall as recommended in clinical practice guidelines for falls prevention for cognitively-healthy community-dwelling older adults[12] is considered an inaccurate time frame for fall recording in people with dementia.[16]

- Ask if they have had a fall in the last 1 week. (Yes/No)
- Ask the caregiver for falls over a longer period of time, such as 6-months.
- If yes – How many falls?
    - What as the person doing at the time of the fall(s)?
    - If currently using a gait aid:
        - Were they using the gait aid when they fell? (Yes/No)
            - If yes
                - Do they think the gait aid made them fall? (Yes/No)
            - If no
                - Were they doing an activity they would have normally done while using their gait aid? (Yes/No)
    - Did they hurt themselves during the fall(s)? (Yes/No)
        - If yes
            - What was the injury? Did they have to see a doctor?

1.3 Past Medical History:

- As per usual practice
- List of prescription medications
- **Vision** – Aging is associated with changes in vision and an increasing prevalence of eye pathology (e.g., cataracts, glaucoma, macular degeneration). The underlying disease process of dementia also results in changes in vision, in particular loss of depth perception and contrast sensitivity leading to difficulty in perceiving distances and visualization in 3-dimension. Vision is the most prominent sensory system used in balance and gait control,

alterations can have a significant impact on stability and ability to manoeuvre through a person's environment.

- Specifically ask about eye pathology (e.g., glaucoma, macular degeneration, cataracts, cataract surgery)

- Glasses

  - Ask if the person wear glasses. (Yes/No)
  - Do they wear the glasses all the time or sometimes?
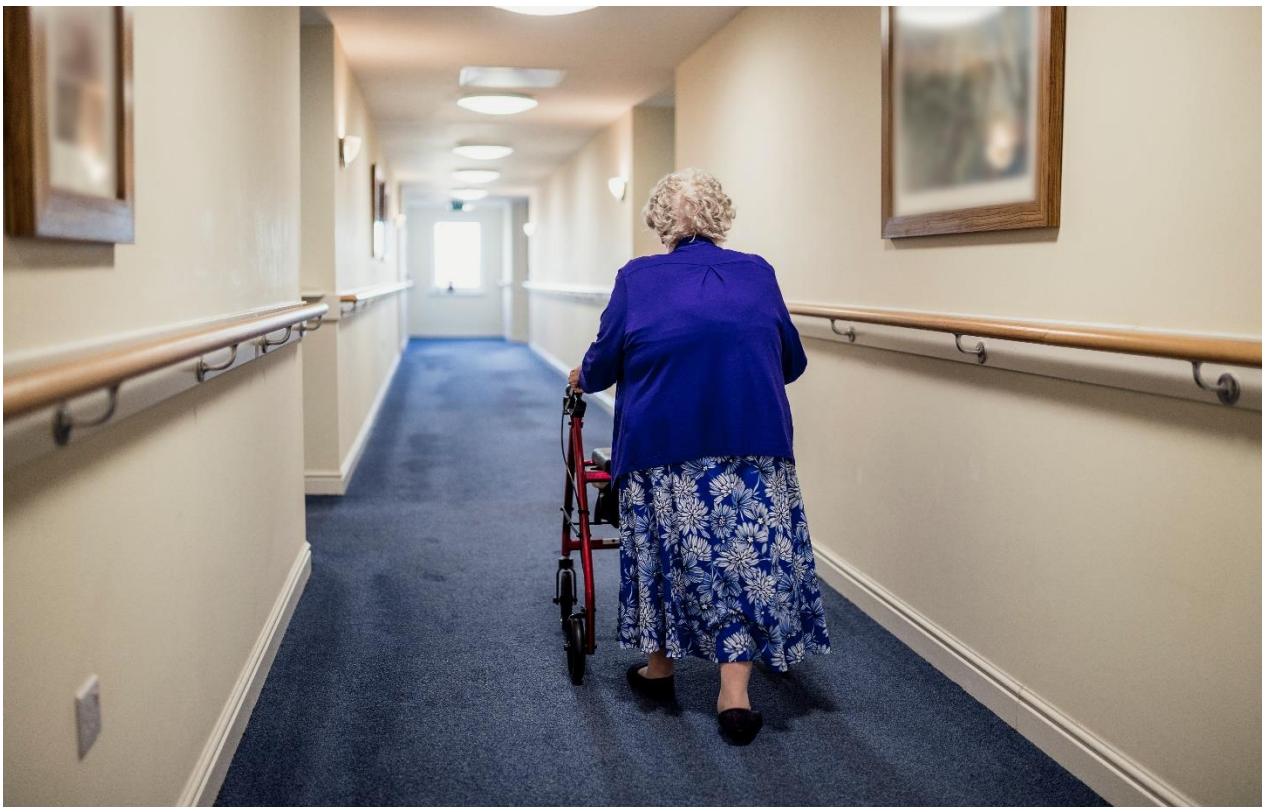   - If sometimes:
      - When do they wear the glasses?
  - When did you last have your vision checked?
    - Did your glasses prescription change?
    - Did you get new glasses because of the prescription change?

- **Hearing** – Aging is also associated with changes in hearing and therefore it is important to ask about use of aids for hearing.

SECTION TWO – THE PHYSICAL ASSESSMENT

While dementia is considered a cognitive disorder, it also results in changes and loss in functional abilities. Specific changes in functional ability include gait changes, postural instability, apraxia, bradykinesia and paratonia.[17]

Cognitive and gait function are intricately related, including the control of routine walking. Gait changes are common and occur early in the dementia disease process, in fact research has found that they may actually precede the development of cognitive symptoms in people who later present with symptoms of dementia.[18] There is some evidence that the type of dementia has a relationship to the severity of gait and balance disorders, specifically that gait disorders may be more pronounced in dementia of Lewy bodies and frontotemporal dementia than Alzheimer's dementia.[19] Common changes in gait among people with dementia include decreased gait speed, decreased step and stride length, increased single limb stance time, double limb support time and increased gait variability.[17]

Mobility requires significant cognitive resources for balance and adapting walking to negotiate obstacles and planning a path.[20] Executive function is essential for mobility[21]; deficits in executive function happen early in AD and increase fall risk.[22] Observing people during a gait or balance task while they simultaneously perform another task, the dual-task paradigm, is an accepted way to assess the interaction between cognition and mobility and reflects activities that lead to falls in real-life.[23,24] If the demands of doing multiple tasks simultaneously exceed the cognitive capacity of an individual, then the performance on one or all tasks will deteriorate.[23,25] The cognitive load, or difference between the single and combined tasks, quantifies the demands on executive function resources and an increased cognitive load increases falls risk[25]. Research supports that walking with a gait aid (e.g., cane or 4-wheeled walker) in novice[10,11] and experience users of 4-wheeled walkers[26] results in increased cognitive load and gait instability.

The clinical assessment of the client will include evaluation of gait, balance and lower extremity function using observational assessment and quantitative tests. There are no thresholds for these clinical tests that are predictive of the need to start the use of a gait aid or indicate that greater support than the current aid is needed.[27]

It is recommended that assessments be performed in a well-lit setting and the area should be quiet with no auditory of visual interference.[28] People should wear comfortable clothes and their own footwear, preferably closed toe walking shoes with a heel height not exceeding 3cm. [28]

2.1 Observational Gait Assessment

An observational gait assessment is a qualitative visual description of an individual's upper and lower extremities, pelvis and trunk motion during ambulation. The assessment is performed in two stages: 1) gross overview to sense flow of action and 2) detailed view of events at each joint. The goals of the observational gait assessment is to provide an accurate description of gait pattern and gait variables; an identification and description of all gait deviations; an analysis of the deviations and identification of the mechanisms responsible for producing abnormalities in gait; assessment of balance, endurance, energy expenditure and safety; and determination of the person's functional walking capabilities in relation to demands of the person's home and community.

For people who are not currently using a gait aid, the assessment will be done without use of an aid with the person walking at their usual comfortable walking speed. If an individual is already using a gait aid, the observational gait assessment should be done with and without the use of the aid. It is important to determine and understand the baseline function without use of the aid. When the test is repeated with use of the aid, you will be able to determine if use of the aid changes the gait performance and if those changes are for the better or improve function.

2.2 Physical Performance Measures (Quantitative Evaluation)

Numerous clinical tests of balance and function exist, but most were developed in cognitively healthy older adults. However, these tests may not be appropriate for use in people with dementia due to disease-specific cognitive deficits. Specifically, an ability to understand complex instructions and memory to execute multi-step commands are common requirements for clinical tests. For example, the Timed Up & Go Test is a six-step command. Therefore, these tests may be more of a test of a person's understanding of instructions and not a true reflection of physical ability.

As a consequence of neurodegenerative changes with the disease process of dementia, people with dementia often demonstrate reduced balance and gait performance that puts into question how reliable and valid these clinical tests are. It is important to have confidence that the test is evaluating the underlying physical function and not the ability of a person to follow commands. More importantly, relying on clinical tests with no known or poor psychometric properties in use among people with dementia affects healthcare professionals' ability to accurately quantify ability, track progress and initiate intervention. Therefore, balance and mobility tests that have been developed and evaluated for reliability and validity in cognitively healthy older adults need to be evaluated in people with dementia.

Below we have provided a listing of balance and mobility tests with demonstrated reliability in people with dementia. (See Appendix 1 for copies of the scales and testing instructions) The absence of a recommendation can reflect that a particular test has not met acceptable levels of reliability or is a result of a lack of evaluation of the tool within this population. (Please see Appendix 2 for the listing of all physical performance measures that were reviewed and evaluated in the systematic review by Baker et al.[29])

2.2.1 Balance and Mobility

i) Community-Dwelling Older Adults with Dementia (mild to moderate disease)

Clinical tests that have demonstrated the most suitability with good relative and absolute reliability. All these tests were evaluated among people with Alzheimer's dementia.

- Step Test[30]

- Modified Clinical Test for Sensory Interaction in Balance[30]

ii) Institutional-dwelling Older Adults with Dementia (mild to moderate disease)

The following test has demonstrated excellent absolute and relative reliability and was evaluated in a sample of people with different types of dementia.

- Berg Balance Scale (BBS) [31]

iii) Older Adults with Dementia (across continuum including severe disease)

The following test has demonstrated excellent absolute and relative reliability and was evaluated in a sample of people with different types of dementia.

- Physical Mobility Scale[32]

2.2.2. Gait

The following tests provide a quantitative evaluation of gait, unlike the observational gait assessment they do not provide an assessment of the quality of the activity. Therefore, a comprehensive assessment of gait should include both an observational gait assessment and a quantitative test. All the tests with established reliability can be performed with and without use of a gait aid.

For people who are not currently using a gait aid, the assessment will be done without use of an aid with the person walking at their usual comfortable walking speed. If an individual is already using a gait aid, the tests should be done with and without the use of the aid. It is important to determine and understand the baseline function without use of the aid. When the test is repeated with use of the aid, you will be able to determine if use of the aid changes the gait performance.

i) Community-Dwelling Older Adults with Dementia (mild to moderate severity of disease)

Clinical tests that have demonstrated the most suitability with good relative and absolute reliability. All these tests were evaluated among people with Alzheimer's dementia.

- 6-Meter Walk Test[33]

- Dual-task testing (walking and talking) [30]

- Timed Up & Go Test (TUG) [30,33,34]

ii) Institutional-dwelling Older Adults with Dementia (mild to moderate severity of disease)

The following tests have demonstrated excellent absolute and relative reliability and were evaluated in samples of people with different types of dementia.

- Groningen Meander Walk Test (GMWT)[35]

- 6-Meter Walk Test[31]

- Dual-task testing (walking and talking over a fixed distance usually 6-meter walk) [36]

iii) Older Adults with Dementia (across continuum including severe disease)

The following test has demonstrated excellent absolute and relative reliability and was evaluated in a sample of people with different types of dementia.

- Rating Scale for Gait Evaluation in Cognitive Deterioration[32]

2.2.3.1 Dual-Task Gait Testing

Gait is a very complex process that requires higher order cognitive processing, in particular executive function, even for the regulation of routine walking.[24] Mobility requires significant cognitive resources for adapting walking to negotiate obstacles, and planning a path to move through a person's environment.[20] Executive function is essential for mobility [21]; deficits in executive function happen early in dementia and lead to an increased fall risk [22].

Observing people during a gait task while they simultaneously perform another task - the dual-task paradigm - is an accepted way to assess the relationship between cognition and mobility. The test isolates the cognitive component of gait and provides insights into the mechanisms of motor control for an individual.[37] Importantly, daily activities require the simultaneous performance of multiple tasks[23], such as walking and talking at the same time, and reflects circumstances that lead to falls in real-life.[23,24] If the demands of doing multiple tasks simultaneously exceed the cognitive capacity of an individual, then the performance on one or both tasks will deteriorate.[23] The cognitive load, or difference between the single and combined tasks, quantifies the demands on executive function resources.

Cognitive load is increased in healthy young and older adults when first learning to use a walker.[3,38,39] Among people with dementia, cognitive load is increased in people newly learning to use a single-point cane compared to walking with an aid.[10,11] The addition of a cognitive task to walking with a walker leads to a deterioration in the quality of gait for people with dementia learning to use a cane and 4-wheeled walker and those experienced in using a 4-wheeled walker.[10,11,40] The deterioration seen with an increased cognitive load includes a decrease in gait velocity and increased instability.

For people who are not currently using a gait aid, the dual-task assessment will be done without use of an aid with the person walking at their usual comfortable walking pace under two task conditions – only walking and then walking while talking. If an individual is already using a gait aid, the tests should be done with and without the use of the aid. There will be three test conditions for current gait aid users – walking without the aid, walking with the aid,

and walking with aid and talking. You will be able to determine the effect of progressively increasing cognitive demands on gait performance.

The choice of the talking task is important. There is currently no consensus about which cognitive challenge task should be used with walking or the predictive ability of one task over another.[37] In the clinical setting to determine effect and the individual's prioritization of tasks, there should be no instructions to prioritize the gait or cognitive task in the dual-task gait testing. Commonly used and validated cognitive tasks to pair with the walking task are counting backwards by 1s from 100 out loud, counting backwards by 7s from 100 out loud, and a verbal fluency task, such as listing as many animal names as possible.[28] Prior to performing the combined gait and cognitive task, ensure that the person with dementia is able to complete the cognitive task as a single task while they are sitting in a chair. The tasks are not interchangeable as the difficulty level of each is not the same.[41]

Set up the 6-meter distance with clear markers of the start and finish points. The instructions for dual-task gait testing are[28]:

Usual gait – "When I say GO, please walk at your usual pace in a comfortable and safe way until you cross the line [Indicated the end line]".

Counting backwards – "When I say GO, please walk at your usual pace and at the same time count backwards from 100 by 1s out loud until you cross the line [Indicate the end line]. Remember it is important that you do not stop your walking or counting"

- If participants have difficulty understanding, the assessors are allowed to clarify the instructions by providing a verbal example, "For example, 100,99,98… and so on". Assessors are also allowed to provide prompts during the task if the person tends to stop walking.

Naming animals – "When I say GO, please walk at your usual pace and at the same time try to name as many different animals as you can think of out loud until you cross the line [Indicate the end line]. Remember it is important that you do not stop walking or talking."

You will record the time, using a stop watch, for the single task of walking, the dual-task of walking with and without the gait aid, as appropriate. Gait speed is distance/time for a value in meters per second. The cognitive load is calculated using the gait speed as ((single task – dual task)/single task) x100%. If the dual-task gait speed is slower than the single task, the

cognitive load calculation will be a positive value – this should be interpreted as motor-cognitive interference. Values less than 20% are considered within a normal range.[42]

2.2.3 Lower Extremity Strength

i) Community-Dwelling Older Adults with Dementia (mild to moderate severity of disease)

Clinical test that has demonstrated the most suitability with good relative and absolute reliability. All these tests were evaluated among people with Alzheimer's dementia.

- Timed Chair Stand Test[30]

2.2.4 Safe Use of Gait Aid

The Safe Use of Mobility Aids Checklist (SUMAC) evaluates physical function with the gait aid, specifically the 4-wheeled walker which is the most prevalent gait aid among older adults, along with safe use of a gait aid.[43] The tool has nine tasks that mimic real-life activities that a person would do with their gait aid to allow healthcare professionals to identify and implement specialty rehabilitation to reduce falls risk.

The SUMAC tool is in the public domain and the scale is available in three languages (English, French, Spanish), user's guide (English, French) and an online training module. These can be accessed at http://mobility-in-aging-lab.ca/ .

2.2.5 Concern of Falling:

A concern for falling is an umbrella term for several fall-related psychological concepts.[44] One important concept is fear of falling, a lasting concern about falling that leads a person to avoiding activities that the person is physically capable of performing.[44] Two related concepts are falls efficacy, confidence in one's ability to perform activities of daily living without falling[45], and balance confidence, which is a person's confidence to maintain balance and remain steady while performing daily activities[46]. While these three concepts are related and are sometimes used interchangeably in the falls literature, they represent distinct domains that need to be clearly defined and assessed from each other.

The research has some contradictory findings as relates to a concern for falling among people with dementia. There is some support that older adults with cognitive impairment report high levels of a concern for falling which is related to physical impairments.[47] Yet in contrast, it has been suggested that people with Alzheimer's dementia report lower levels of concern for falling and that the level of concern is unrelated to the frequency of falls.[47,48]

People with cognitive impairment potentially have limitations that can influence the responses obtained from self-report questionnaires, specifically concerns related to lack of insight of individual risk or performance ability, memory impairment, attention deficits and deficits in orientation.[47] Two scales to measure falls efficacy have been specifically developed for people with dementia. Both scales have demonstrated validity and reliability for use in people with dementia.

The first scale is called the Falls Efficacy Scale International (FES-I).[47] The FES-I has 16 items which are rated on confidence the person will not fall while performing each task. Each task has 4 categories (not at all, somewhat, fairly, very concerned) with scores ranging from 16 (high falls efficacy) to 56 (low falls efficacy and more concern for falling). The FES-I can be self completed or interview administered. (See Appendix 3 for the Falls Efficacy Scale International tool)

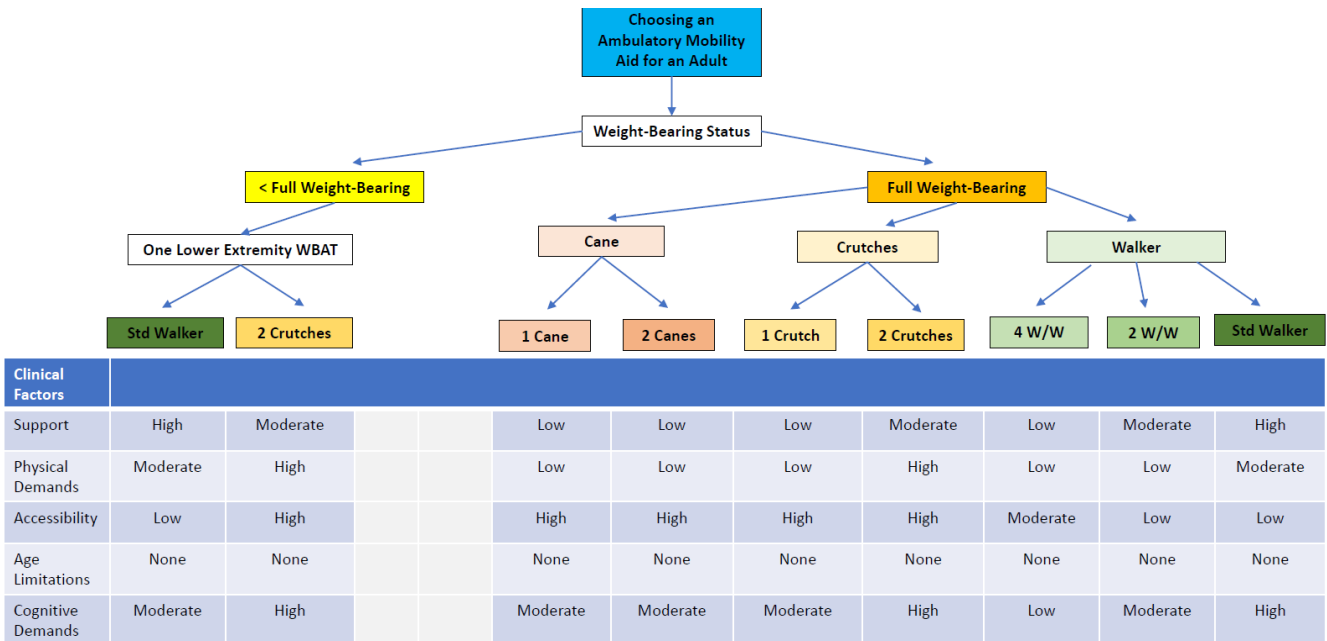The second scale is called the Iconographical Falls Efficacy Scale (Icon-FES).[49] The compensates for reduced abstract thinking abilities by using pictures to match the verbal descriptions of tasks to be evaluated. The Icon-FES is an interview-based questionnaire and contains 10 items scored on a 4-point scale (1=not at all concerned to 4= very concerned). A higher score represents lower falls efficacy.

SECTION 3 – CONSIDERATION FOR USE OF A GAIT AID

The need consideration for use of a gait aid can be for temporary or long-term use. It is also important to consider that likely factors for need to use a gait aid, such as balance, gait and strength deficits, are potentially modifiable with exercise. The evidence supports that people with dementia are able to make gains in balance, strength and gait with participation in a rehabilitation program.[50] Even after successful participation in rehabilitation there may still be ongoing deficits that require use of a mobility aid.

Once use of a gait aid is indicated then it is important to determine the level of support required for stability. The aim is to provide a gait aid that delivers the level of support required by the individual.

Figure. Algorithm for determining type of gait aid

Clinical Factors											
Support	High	Moderate			Low	Low	Low	Moderate	Low	Moderate	High
Physical Demands	Moderate	High			Low	Low	Low	High	Low	Low	Moderate
Accessibility	Low	High			High	High	High	High	Moderate	Low	Low
Age Limitations	None	None			None	None	None	None	None	None	None
Cognitive Demands	Moderate	High			Moderate	Moderate	Moderate	High	Low	Moderate	High

Now consider the following factors: short-term versus long-term needs, co-morbidities, cognition, lifestyle, environment, physical ability – strength (upper & lower), balance, gait, sensory (vision, proprioception, vestibular), pain, client's perceived need & acceptability

Once the decision about type of gait aid has been determined, there is a need to adjust the gait aid to an appropriate height.

Canes:

Single-point cane provides the least weight-bearing offset and quad canes the most.

Indication: Enhance stability through weight redistribution

Considerations for prescription: Appropriate for individuals who need balance and stability assistance with minimal weight-bearing offset.

Measuring the height: The person should wear the shoes they would normally use to go walking. The cane is placed about 6 inches from the lateral border of the foot. With the person's arm hanging comfortably at their side while in standing, the top of the cane handle should be at the level of the wrist crease. This will provide slight elbow flexion of approximately 20°. Some also recommend using the level of the greater trochanter instead of the wrist crease.

Use of cane: Principles of which hand to use for a unilateral gait aid (e.g. a stick) and sequencing of stick and leg movement are important to maximise stability, spread weight/load and optimise gait function. Similarly, principles of sequencing gait aid and leg, and use of the aid when turning and ascending/descending a curb or step, or negotiating obstacles are critical for optimal and safe use.

Walkers:

Indication: Offers greater stability and significant weight-bearing shift from legs to arms than cane.

Considerations for prescription: Permits more weight-bearing shift than cane – up to non-weight-bearing – and with more stability than crutches. Most stable is a standard walker as this can be use from full weight-bearing up to non-weight-bearing on one lower extremity. A standard walker is more challenging to use than a wheeled walker. A rolling walker is less stable than a standard walker but is easier to propel and manoeuvre. A problem with all walkers is difficulty with use on stairs.

Measuring the height: The person should wear the shoes they would normally use to go walking.

APPENDIX 1

Assessment Scales with Established Reliability for Use in People with Dementia

- all the scales listed below are within the public domain and free of charge to use

1. Berg Balance Scale
2. Groningen Meander Walking Test
3. Modified Test for Sensory Interaction in Balance
4. Physical Mobility Scale
5. Rating Scale for Gait Evaluation in Cognitive Deterioration
6. Step Test
7. Timed Up & Go Test

Berg Balance Scale

1. SITTING TO STANDING
INSTRUCTIONS: Please stand up. Try not to use your hands for support.
(4) able to stand without using hands and stabilize independently
(3) able to stand independently using hands
(2) able to stand using hands after several tries
(1) needs minimal aid to stand or to stabilize
(0) needs moderate or maximal assist to stand

2. STANDING UNSUPPORTED
INSTRUCTIONS: Please stand for two minutes without holding.
(4) able to stand safely 2 minutes
(3) able to stand 2 minutes with supervision
(2) able to stand 30 seconds unsupported
(1) needs several tries to stand 30 seconds unsupported
(0) unable to stand 30 seconds unassisted If a subject is able to stand 2 minutes unsupported, score full points for sitting unsupported. Proceed to item #4.

3. SITTING WITH BACK UNSUPPORTED BUT FEET SUPPORTED ON FLOOR OR ON A STOOL
INSTRUCTIONS: Please sit with arms folded for 2 minutes.
(4) able to sit safely and securely 2 minutes
(3) able to sit 2 minutes under supervision
(2) able to sit 30 seconds
(1) able to sit 10 seconds
(0) unable to sit without support 10 seconds

4. STANDING TO SITTING
INSTRUCTIONS: Please sit down.
(4) sits safely with minimal use of hands
(3) controls descent by using hands
(2) uses back of legs against chair to control descent
(1) sits independently but has uncontrolled descent
(0) needs assistance to sit

5. TRANSFERS
INSTRUCTIONS: Arrange chairs(s) for a pivot transfer. Ask subject to transfer one way toward a seat with armrests and one way toward a seat without armrests. You may use two chairs (one with and one without armrests) or a bed and a chair.
(4) able to transfer safely with minor use of hands
(3) able to transfer safely definite need of hands
(2) able to transfer with verbal cueing and/or supervision
(1) needs one person to assist
(0) needs two people to assist or supervise to be safe

6. STANDING UNSUPPORTED WITH EYES CLOSED
INSTRUCTIONS: Please close your eyes and stand still for 10 seconds.
(4) able to stand 10 seconds safely
(3) able to stand 10 seconds with supervision
(2) able to stand 3 seconds
(1) unable to keep eyes closed 3 seconds but stays steady
(0) needs help to keep from falling

7. STANDING UNSUPPORTED WITH FEET TOGETHER
INSTRUCTIONS: Place your feet together and stand without holding.
(4) able to place feet together independently and stand 1 minute safely
(3) able to place feet together independently and stand for 1 minute with supervision
(2) able to place feet together independently but unable to hold for 30 seconds
(1) needs help to attain position but able to stand 15 seconds feet together
(0) needs help to attain position and unable to hold for 15 seconds

( ) TOTAL SCORE (Maximum = 56)

8. REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING
INSTRUCTIONS: Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. (Examiner places a ruler at end of fingertips when arm is at 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that the finger reaches while the subject is in the most forward lean position. When possible, ask subject to use both arms when reaching to avoid rotation of the trunk.).
(4) can reach forward confidently >25 cm (10 inches)
(3) can reach forward >12 cm safely (5 inches)
(2) can reach forward >5 cm safely (2 inches)
(1) reaches forward but needs supervision
(0) loses balance while trying/requires external support

9. PICK UP OBJECT FROM FLOOR FROM A STANDING POSITION
INSTRUCTIONS: Pick up shoe/slipper which is placed in front of your feet.
(4) able to pick up slipper safely and easily
(3) able to pick up slipper but needs supervision
(2) unable to pick up but reaches 2-5cm (1-2 inches) from slipper and keeps balance independently
(1) unable to pick up and needs supervision while trying
(0) unable to try/needs assist to keep from losing balance or falling

10. TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING
INSTRUCTIONS: Turn to look directly behind you over toward left shoulder. Repeat to the right. Examiner may pick an object to look at directly behind the subject to encourage a better twist turn.
(4) looks behind from both sides and weight shifts well
(3) looks behind one side only other side shows less weight shift
(2) turns sideways only but maintains balance
(1) needs supervision when turning
(0) needs assist to keep from losing balance or falling

11. TURN 360 DEGREES
INSTRUCTIONS: Turn completely around in a full circle. Pause. Then turn a full circle in the other direction.
(4) able to turn 360 degrees safely in 4 seconds or less
(3) able to turn 360 degrees safely one side only in 4 seconds or less
(2) able to turn 360 degrees safely but slowly
(1) needs close supervision or verbal cueing
(0) needs assistance while turning

12. PLACING ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING UNSUPPORTED
INSTRUCTIONS: Place each foot alternately on the step/stool. Continue until each foot has touched the step/stool four times.
(4) able to stand independently and safely and complete 8 steps in 20 seconds
(3) able to stand independently and complete 8 steps >20 seconds
(2) able to complete 4 steps without aid with supervision
(1) able to complete >2 steps needs minimal assist
(0) needs assistance to keep from falling/unable to try

13. STANDING UNSUPPORTED ONE FOOT IN FRONT
INSTRUCTIONS: (DEMONSTRATE TO SUBJECT) Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot. (To score 3 points, the length of the step should exceed the length of the other foot and the width of the stance should approximate the subject's normal stride width).
(4) able to place foot tandem independently and hold 30 seconds
(3) able to place foot ahead of other independently and hold 30 seconds
(2) able to take small step independently and hold 30 seconds
(1) needs help to step but can hold 15 seconds
(0) loses balance while stepping or standing

14. STANDING ON ONE LEG
INSTRUCTIONS: Stand on one leg as long as you can without holding.
(4) able to lift leg independently and hold >10 seconds
(3) able to lift leg independently and hold 5-10 seconds
(2) able to lift leg independently and hold = or >3 seconds
(1) tries to lift leg unable to hold 3 seconds but remains standing independently
(0) unable to try or needs assist to prevent fall

Groningen Meander Walking Test

The dimensions of the GMWT are shown in Figure 1.
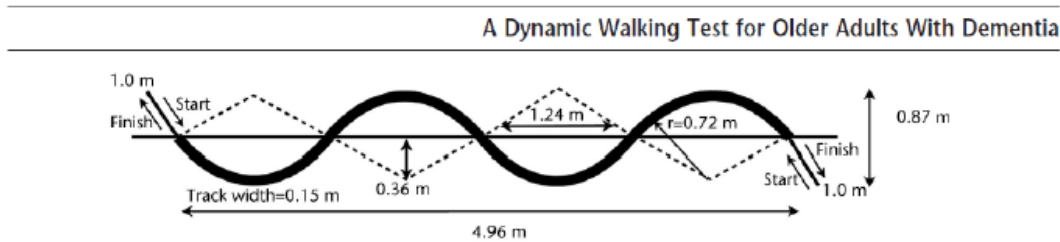
Figure 1.
Dimensions of the Groningen Meander Walking Test (GMWT). r=radius to draw the curved GMWT path.

The path is 6.00-m, the meandering track is marked out for people to follow. The width of the meandering track is 0.15 m from the straight line path. To exclude the effects of start-up speed and slowdown speed, participants start the test 1 m before the start of the track and stopped 1 m after the end of the track. The total test is performed in 2 parts: first forth and then back (therefore two repetitions in total)

Participants are instructed to walk as fast and accurately as possible. The instructions are: "Please walk over the path as fast and accurately as possible. Try not to step outside the white lines. We will measure the time and count the number of times you step outside the lines." A mobility aid is allowed.

The first outcome measure recorded is the time to perform the test. The forth and back walks are timed separately. The final score is the mean time (in seconds) of the forth and back walks. A faster time score indicates better performance.
The second outcome measure, simultaneously measured with the time score, is the number of oversteps outside the track. If the participant steps completely outside the indicated track, this is noted as an overstep. The oversteps of the forth and back walks are counted separately. The final score is the mean number of oversteps of the forth and back walks. A fewer number of oversteps indicates a better performance.

Modified Clinical Test for Sensory Interaction in Balance

*<u>Administer only one trial per condition if participant able to complete first trial without loss of balance.</u>

Condition One:	*Eyes Open, Firm Surface*			
	Trial One	Total Time:	_____ /	30 sec
	Trial Two	Total Time:	_____ /	30 sec
	Trial Three	Total Time:	_____ /	30 sec
Condition Two:	*Eyes Closed, Firm Surface*			
	Trial One	Total Time:	_____ /	30 sec
	Trial Two	Total Time:	_____ /	30 sec
	Trial Three	Total Time:	_____ /	30 sec
Condition Three:	*Eyes Open, Foam Surface*			
	Trial One	Total Time:	_____ /	30 sec
	Trial Two	Total Time:	_____ /	30 sec
	Trial Three	Total Time:	_____ /	30 sec
Condition Four:	*Eyes Closed, Foam Surface*			
	Trial One	Total Time:	_____ /	30 sec
	Trial Two	Total Time:	_____ /	30 sec
	Trial Three	Total Time:	_____ /	30 sec
		TOTAL:	_____ /	**120**

sec

<u>Purpose of Test:</u>

This test is designed to assess how well an older adult is using sensory inputs when one or more sensory systems are compromised. In condition one, all sensory systems (i.e., vision, somatosensory, and vestibular) are available for maintaining balance. In condition two, vision has been removed and the older adult must rely on the somatosensory and vestibular systems to balance. In condition three, the somatosensory system has been compromised and the older adults must use vision and the vestibular system to balance. In condition four, vision has been removed and the somatosensory system has been compromised. The older adults must not rely primarily on the vestibular inputs to balance.

Begin timing each trial using a stopwatch. The trial is over when (a) the participant opens his/her eyes in an eyes closed condition, (b) raises arms from sides, (c) loses balance and requires manual assistance to prevent a fall.

Physical Mobility Scale

	Physical Mobility Scale	Date

Supine to side-lying
Note: Indicate R and L directions separately
    Patient in supine.
Instructions: Please roll onto your left/right
    side.
	(0) No active participation in rolling
	(1) Requires facilitation at shoulder and lower limb but actively turns head to roll
	(2) Requires facilitation at shoulder or at lower limb to roll
	(3) Requires equipment (eg, bedrail) to pull into side-lying. Specify:
	(4) Requires verbal prompting to roll—does not pull to roll
	(5) Independent—no assistance or prompting
		R
		
		L

Supine to sit Patient in supine. *Instructions:* Please sit up at the edge of the bed.	(0) Maximally assisted, no head control (1) Fully assisted but controls head position (2) Requires assistance with trunk and lower limbs or upper limbs (3) Requires assistance with lower limbs or upper limbs only (4) Supervision required only (5) Independent and safe	

Sitting balance
Patient sitting at the edge of the bed, feet on
    the floor.
Instructions:
(If able to maintain balance without support)
    Please turn and look over your shoulder/
    reach forward and touch the floor.
	(0) Sits with total assistance, requires head support
	(1) Sits with assistance, controls head position
	(2) Sits using upper limbs for support
	(3) Sits unsupported for at least 10 seconds
	(4) Sits unsupported, turns head and trunk to look behind, to (L) and (R)
	(5) Sits unsupported, reaches forward to touch floor and returns to sitting position
	    independently	

Sitting to Standing
Patient sitting at the edge of the bed.
Instructions:
Please stand up. Try not to use your hands for
    support.
	(0) Unable to weight bear
	(1) Gets to standing with full assistance from therapist, describe:
	(2) Requires equipment (eg, handrails) to pull to stand. Specify equipment/method used:
	(3) Pushes to stand, weight unevenly distributed, stand-by assistance required
	(4) Pushes to stand, weight evenly distributed, may require frame or bar to hold onto once
	    standing
	(5) Independent, even weight bearing, hips and knees extended, does not use upper
	    limbs	

Standing to sitting
Patient starts standing near the edge of the
    bed.
Instructions:
Please sit down. Try not to use your hands for
    support.
	(0) Unable to weight bear
	(1) Gets to sitting with full assistance from therapist, describe:
	(2) Can initiate flexion, requires help to complete descent, holds arms of chair, weight
	    evenly/unevenly distributed
	(3) Poorly controls descent, stand-by assistance required, holds arms of chair, weight
	    evenly/unevenly distributed
	(4) Controls descent, holds arms of chair, weight evenly distributed
	(5) Independent and does not use upper limbs, weight evenly distributed	

Standing balance
Patient starts standing supported/unsupported
Instructions:
Please turn and look over your shoulder/pick
    (the object) up from the floor/stand on your
    left/right leg for as long as you can.
	(0) Unable to stand without hands-on assistance
	(1) Able to safely stand using an assistive device
	(2) Able to stand independently for 10 seconds without an assistive device
	(3) Stands and turns head and trunk to look behind (L) and (R)
	(4) Able to bend forward to pick up object from floor safely
	(5) Single limb stand *for > 10 seconds.* (L)_____seconds; (R)_____seconds	

Transfers Patient starts sitting at the edge of the bed. *Instructions:* Please stand up and sit in your wheelchair/ chair.	(0) Non—weight-bearing hoist (full hoist) (1) Weight bearing hoist (standing hoist) (2) Assistance required by 2 persons, describe: (3) Assistance required by 1 person, describe: (4) Stand-by assistance(prompting required only (5) Independent	
Ambulation/mobility Patient starts standing with or without assistive device or sitting in wheelchair. *Instructions:* Please walk/push your wheelchair.	(0) Bed/chair bound (1) Wheelchair mobile (*50 feet without assistance*) (2) Ambulant with assistance of two (3) Ambulant with assistance of one (4) Stand-by assistant/prompting required only (5) Ambulates independently, aid required: Aids/assistance. Specify equipment used:	
	Total (Out of 45 points)	

Rating Scale for Gait Evaluation in Cognitive Deterioration

Task	Rating Scale	Score
A. Functional Ability (Historical; in the past week)		
1. Arising from chair/getting out of bed	0. Normal 1. Mild slowing and /or difficulty but completely independent 2. Moderate slowing and /or difficulty, can need support or some assistance to get up 3. Unable to arise without help	
2. Climbing stairs	0. Normal 1. Mild impairment but could be normal for an older person 2. Moderately impaired (slowing, difficulty, fatiguing); occasionally may need assistance 3. Needs significant assistance or cannot climb stairs at all	
3. Walking	0. Normal 1. Mild slowing and/or difficulty 2. Moderate slowing and/or difficulty, but requires little or no assistance 3. Severe slowing and/or difficulty, requiring significant assistance or cannot walk even assisted	
4. Falling	0. None 1. Rare falling 2. Occasionally falls, but less than once per day 3. Falls once per day or more	
B. Examination		
5. Rigidity in lower limbs (patient seated, with feet side by side and with hip and knees flexed around 90°; resistance to passive abduction/adduction)	0. Absent 1. Slight or barely detectable 2. Moderate, but full range of motion is easily achieved 3. Severe; the range of motion is achieved with difficulty	
6. Arising from chair (patient attempts to arise from straight-backed with arm rests, 45cm chair with wrist resting on proximal thighs)	0. Normal 1. Mild slowing but sits upright at first attempt 2. Needs more than one attempt and/or support (e.g., from arms of chair) but needs no assistance 3. Unable to arise without help	
7. Gait initiation (patient is instructed to initiate gait from standing immediately after the command)	0. Normal 1. Mild slowing 2. Moderate slowing; may have start hesitation 3. Unable or severely impaired in initiating gait	
8. Freezing of gait	0. None 1. Occasional freezing 2. Frequent freezing; occasional falls from freezing 3. Unable to walk or frequent falls from freezing	
9. Step length	0. Normal 1. Mild shortening of step length 2. Moderate shortening of step length 3. Severe shortening of step length	

10. Arm swinging	0. Normal 1. Decreased arm swing (uni- or bilateral) 2. Absence of arm swing (uni- or bilateral), but the upper extremities keep a normal posture 3. Absence of arm swing with flexion of upper extremities	
11. Turns (180°)	0. Normal 1. Mild slowing or cautiousness; performed in one or two phases 2. Moderate slowing or difficulty; performed in three or more phases 3. Turns are very slowed and difficult or assistance is required.	
12. Dynamic balance while walking	0. Normal 1. Occasional impairment with self-adjustment or minimal support 2. Moderately impaired; requires support (e.g., gait aid) or mild assistance to walk; occasional falls due to imbalance 3. Severely impaired or unable to walk even when assisted; frequent falls due to imbalance	
13. Posture	0. Normal 1. Not quite erect, slightly stooped; it could be normal for an older person 2. Moderately stooped posture, definitely abnormal; can be slightly leaning to one side 3. Severely stooped posture; can be moderately leaning to one side	
14. Postural stability (response to sudden posterior displacement produced by pull on shoulders from behind while the patient is erect with eyes open and feet slightly apart (~30cm); patient is prepared)	0. Normal 1. Retropulsion, but recovers unaided 2. Retropulsion without recovery; wold fall if not caught by examiner 3. Very unstable, tends to fall spontaneously or unable to stand without assistance	

The Step Test

The Step Test assesses dynamic single leg standing balance. The participant stands with feet parallel and 10 cm apart, with a 7.5 cm height block placed 5 cm directly in front. The participant is instructed to place the whole foot onto the block, then return it fully back down to the floor repeatedly as fast as possible for 15 seconds. Each leg is tested separately and performance on the left or right side with the least number of steps is used.

The Timed Up & Go Test

Time to Complete: ▪ 1-2 minutes

Equipment Required: ▪ Armchair – approximate seat height = 43-46 cm and approximate arm height = 65 cm
          ▪ Measuring tape to measure 3 meter distance referred to below
          ▪ Line on the floor 3 meters away from chair
          ▪ Walking aid, if required
          ▪ Stopwatch

Client Start Position: ▪ Wears regular footwear
          ▪ Seated in arm chair
          ▪ Back against the chair, arms resting on chair arms
          ▪ Uses customary walking aid

Test: ▪ Client: From start position, client stands, walks a distance of 3 meters (there must
              not be any obstructions), turns, walks back to the chair, and sits down
          ▪ Assessor: Start timer on the word "go"; Stop timer when the client sits down
              i.e. client's buttocks contact the chair

Practice: ▪ One practice walk is allowed - Record test result on 2nd trial

Instructions: ▪ 'On the word "go", get up, walk at a comfortable, safe pace to the line on the
          floor, turn, return to the chair and sit down'

Record: ▪ Note difficulties in getting out of the chair, walking, turning and/or sitting down

Date	Time in Seconds to Complete (TUG) Test	Gait Aid Used	Difficulties Identified
		❏ Cane ❏ Two canes ❏ 4-Wheeled walker ❏ 2-Wheeled walker ❏ Solid walker ❏ No mobility aid	

A. Listing of clinical tests of physical performance reviewed in the systematic review by Baker et al.[29]

The systematic review included research papers that evaluated the following tests for reliability and/or validity in community-dwelling populations of people with dementia.

- Berg Balance Scale[34]
- Functional Reach Test[34]
- Limits of Stability[30]
- Modified Clinical Test for Sensory Interaction in Balance[30]
- Physiological Profile Assessment[51]
- Quick Turn Test[30]
- Spatial temporal gait parameters[52,53]
- Step Test [30]
- Timed Up & Go Test[30,33,34]
- Timed Up & Go Test (Cognitive task)[30]
- Timed Up & Go Test (Motor task) [30]
- 6-Meter Walk Test[33]

The systematic review included research papers that evaluated the following tests for reliability and/or validity in institution-dwelling populations of people with dementia.

- Berg Balance Scale[31]
- BOOMER[54]
- Groningen Meander Walk Test[35]
- Short Physical Performance Battery[54]
- Spatial temporal gait parameters[36]
- Timed Up & Go Test (Cued)[55]
- Tinetti Performance Oriented Mobility Assessment[56]
- 2-Minute Walk Test (Cued)[55]
- 4-Meter Walk Test (Cued) [55]
- 6-Meter Walk Test[31]
- 6-Minute Walk Test[57]
- 25-Foot Walk Test[57]

The systematic review included research papers that evaluated the following tests for reliability and/or validity in samples of people from different living settings.

- Berg Balance Scale (Korean version)[58]
- Dual-task Gait Test (cognitive secondary task)[59]
- Figure of 8 Walk Test[60]
- FICSIT-4 Test of Balance[60]
- Groningen Meander Walk Test (Korean version) [58]
- Short Physical Performance Battery (Norwegian version)[61]

- Spatial temporal gait parameters[62]
- Timed Up & Go Test[60,62]
- Timed Up & Go Test (Korean version)[58]
- 4-Meter Walk Test (Korean version)[58]
- 6-Meter Walk Test[60]
- 6-Minute Walk Test[62]
- 6-Minute Walk Test (Cued)[63]
- 10-Meter Walk Test (Cued) [63]

Assessment scales with established reliability and validity for the evaluation of falls efficacy in people with cognitive impairment.

- the scales listed below are within the public domain and are free of charge to use

1. Falls Efficacy Scale International
2. Iconographical Falls Efficacy Scale - This scale is available for download as a pdf at https://www.neura.edu.au/wp-content/uploads/2016/05/Icon-FES_10item-house.pdf

Falls Efficacy Scale – International

Instructions to Participants: I would like to ask some questions about how concerned you are about the possibility of falling. For each of the following activities, please circle the opinion closest to your own to show how concerned you are that you might fall if you did this activity. Please reply thinking about how you usually do the activity. If you currently don't do the activity (example: if someone does your shopping for you), please answer to show whether you think you would be concerned about falling IF you did the activity.

	Not at all concerned	Somewhat concerned	Fairly concerned	Very concerned
Cleaning the house (e.g. sweep, vacuum, dust).	1	2	3	4
Getting dressed of undressed.	1	2	3	4
Preparing simple meals.	1	2	3	4
Taking a bath or shower.	1	2	3	4
Going to the shop.	1	2	3	4
Getting in or out of a chair.	1	2	3	4
Going up or down stairs.	1	2	3	4
Walking around in the neighborhood.	1	2	3	4
Reaching for something above your head or on the ground.	1	2	3	4
Going to answer the telephone before it stops ringing.	1	2	3	4
Walking on a slippery surface (e.g. wet or icy).	1	2	3	4
Visiting a friend or relative	1	2	3	4
Walking in a place with crowds	1	2	3	4
Walking on an uneven surface (e.g. rocky ground, poorly maintained pavement).	1	2	3	4
Walking up or down a slope	1	2	3	4
Going out to a social event (e.g. religious service, family gathering, or club meeting).	1	2	3	4

Please check you have answered all the questions

* Yardley L, Beyer N, Hauer K, Kempen G, Piot-Ziegler C, Todd C. Development and initial validation of the Falls Efficacy Scale-International (FES-I). *Age Ageing*. 2005;34(6):614-619. doi:10.1093/ageing/afi196.

Total Score: _____

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