

A COMPARITIVE STUDY BETWEEN STEP SQUARE AND Wii BOARD EXERCISES TO PREVENT FALL IN PATIENTS WITH MULTIPLE SCLEROSIS

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INTRODUCTION:

Due to the demyelination of different distributions throughout the central nervous system (CNS), multiple sclerosis (MS) patients frequently present with disorders of balance, sensation coordination, and strength¹. As a result of the imbalance and frequent falls, these patients may experience fear of falling, which may have an adverse effect on their quality of life². Sufficient balance depends on appropriate motor reactions and the integration. Even in individuals with limited clinical evaluation issues, patients with multiple sclerosis frequently experience poor balance control, which is one of the major risk factors for developing the disease^{3,4}.

200 new cases of multiple sclerosis are reported each week⁵. In the United States, where an estimated 2.5 million people have the disease [1.33/100000 persons in India were diagnosed with multiple sclerosis Females are impacted more frequently than males by MS, which primarily affects young adults between the ages of 20 and 40⁶. Although people as young as 20 and as elderly as 75 have developed it, most cases are identified between the ages of 20 and 50²⁰.

Multiple sclerosis patients are at an increased risk of falling, especially when walking, due to their slower proactive equilibrium reactions, decreased ability to maintain balance when reaching, central integration impairment, slow somatosensory conduction, fatigue, delayed reaction, attention deficit, difficulty maintaining stability in the presence of external disturbances, and overload fatigue of the motor cortex. Individuals with MS experienced a decrease in trunk stability when standing, an increase in trunk sway, and an increase in postural sway when performing two tasks at once^{7,9}.

The risk of falling increases in MS because people with the disease frequently exhibit decreased capacity to move approach the limits of stability, swaying while standing, slowness in both gait and reactions to postural sway⁸.

Physical treatment for MS patients focuses mostly on improving balance¹⁰. The Square Stepping Exercise (SSE) is therefore considered a form of deeply explicit equilibrium training to prevent falls that primarily depends on the protective execution strategy to maintain balance in various activities and situations and also increases intellectual fall risk factors^{11,12}. The SSE contains a number of directional advance step pattern examples that are applied to a thin mat that is divided into squares and incorporate a progression of various modified and complex step patterns. As a result, the SSE can speed up reaction times by using restorative stepping patterns, which is in line with its goal of raising the bar for proactive and reactive reactions^{13,14}.

Active gaming, sometimes known as "exergaming," such as the Wii Fit, is becoming increasingly well-liked among people of all ages, even the elderly. Yoga, strength training, aerobics, and balance games are all available on the Wii Fit¹⁵. For the video monitor to give the participant information about their alignment and balance control during the activities, the player stands on the Wii Balance Board, which tracks and monitors the position of the player's centre of pressure on the board¹⁶. There is minimal literature available currently to say whether Wii Fit exercise helps elderly people with their balance¹⁷.

NEED OF THE STUDY

The primary focus of the current investigation is to ascertain the effect of Wii exercise training and SSE on the risk of fall in multiple sclerosis. This is because the primary goal of the rehabilitation programme in multiple sclerosis with the risk of fall is to improve the interactions between sensory-motor integration and proactive equilibrium reactions to regain the ability to perform a complex step pattern with an adequate reaction. There is a wealth of material on balance and coordination in MS, and it will be useful in MS rehabilitation procedures¹. Numerous studies have been done on multiple sclerosis to prevent falls but limited studies on the step square and Wii board exercises. Therefore, I

sought to be comparative study of step square and Wii board exercises to prevent falls in patients with multiple sclerosis.

REVIEW OF LITERATURE:

Lama Saad EI-Din mohamoid et.al (2022) studied a randomised control trail on effectiveness of cudoose and step square exercises on risk off fall in multiple sclerosis total number of subjects and equal to 52 and it is divided 26 each group balance training 26 and step square exercises 26 the duration of the study was 4 weeks the data was collected by using biodex balance system, fall index test, short physical performance battery and mores false scale before and after the technique. There is significant reduction in mores fall scale and risk of fall scores($p<0.05$) and increase in balance Gate the author concluded that the combination of both hard a significant effect in reducing the risk of improving balance in patients with multiple sclerosis¹⁸.

Asuncion Mayoral-Moreno et.al (2021) studied on a fall's prevention and quality of life improvement by square stepping exercises in people with multiple sclerosis total number of subjects $N=69$ (SSE=30 and Care=30). The study duration was 8 weeks with 24 sittings alternatively. The data was collected by using symbol digit modalities Test, California learning verbal, brief visual special memory test before and after application of technique. The author concluded that the study would contribute to promoting the economy of people with multiple sclerosis and could reduce health causes by reducing the number of falls¹⁹.

Clare Walton et.al (2020) studied on Raising prevalence of multiple sclerosis worldwide it is from September 2019 to March 2020 and analysis with 2013 data where conducted the database collected by compendium of epidemiology of multiples sclerosis and the availability of resources people with multiple sclerosis reported at country regional and global levels. Total number of 2.8 million people are estimated to line with multiple sclerosis worldwide and the incidence rate across 75 countries is 2.1 for 10000 persons by year the main age is 32 years female or highly affected with multiple sclerosis the author concluded that the Global prevalence of multiple sclerosis as raisin since 2013²⁰.

Edward Mc Auley et.al (2018) studied on the study design and methods for a home based square stepping exercises program among older adults with multiple sclerosis total number of subjects 40 the study duration was 12 week period which was divided into 24 sittings alternatively the data was collected by using timer up and go test and 6 minute walk test before and after the application of technique the support the feasibility, acceptability and possible efficacy on home based step square excessive intervention for adults with multiple sclerosis author concluded that this study as potential to help older adults with multiple sclerosis patients²¹.

Ereson Sebastia et.al (2016) studied on validity of the timed up and go test (TUG) as a measure of functional mobility in persons with multiple sclerosis. The total number of subjects $N= 47$. The duration of the study was 7 days the data was collected by using TUG test, timed 25- foot walk test, 6-minute walk test, multiple sclerosis walking scale, disability status scale and Number of steps per day, The TUG test was strongly associated with other valid outcome measures of ambulatory mobility and disability status. Moderately to strongly associated with balance confidence and weekly associated with balance control. The author concluded that TUG test is a valid measurer of functional mobility in both clinical and research practiced in persons with multiple sclerosis³¹.

Massimiliano Pav et.al (2015) studied on effectiveness of limitations of unsupervised home-based balance rehabilitation with Wii in people with multiple sclerosis. Total number of subjects $N=27$ the duration of the study was 5 weeks. The data was collected by using centre of pressure time series were recorded by pressure platform and proceed to calculate square area displacement the results shown significant reduction spray area and velocity the author concluded that that Wii games not fully suitable for rehabilitation in multiple sclerosis on into square flexibility and adaptability to multiple sclerosis needs and does specific software should be developed²².

Akkradale siriphorn et.al (2015) studied on Wii board exercise to improve balance and lower limb muscle strength of overweight found adults total number of subjects N=16 the duration of the study was 8 weeks alternatively twice a week for 30 minutes the data was collected by using a neuro come balance master and a hand held dynamometer where used to measure balance performance according to this comparison of pre and post intervention measurements the Wii balance board exercise program significantly improve the limit of stability parameters the author concluded that Wii balance board exercise program can be used to improve the balance and lower Limb muscle strength of overweight young adults²³.

Jacob J sosnoff et.al (2013) studied on the home-based exercise program and fall risk reduction in older adults with multiple sclerosis. Total number subjects N=13. The study duration was 3 times a week for 12 weeks alternatively 36 sittings. The data was collected by using berg balance scale, fall risk pre and post of Intervention. Fall risk was found to decrease in the exercise group while there was an increase in fall risk in the control group. The author concluded that home-based exercises was found to be feasible safe and effective for reducing phycological fall risk in older adults with multiple sclerosis²⁴.

Yiva Elisabet Nilsagard et.al (2014) studied a single group pre-test and post-test trial on balance exercise program reduced values in people with multiple sclerosis total number of subjects N=32 the data was collected by using berg balance scale and 4 square test timed up and go test before and after the technique no differentials were detected for perceived limitations in walking balance confidence the time up and go test the author was concluded that using this program reduces falls and improves balance performance in patients with multiple sclerosis²⁵.

Giampaola Brichetto et.al (2013) studied on the effect of Wii board balance in people with multiple sclerosis the total number of subject N= 36 the duration of the study was 2 weeks the data was collected using burg balance scale and modified fatigue impact scale under the condition of opened and closed Eyes. Balance scale showed a statistically significant improvement in the Wii group. The Other calculated that Wii would be more effective than the current standard protocol in improving balance disorder in multiple sclerosis²⁶.

Jessica Rodriguez Pereira et.al (2014) studied on effectiveness of square stepping exercises in balance and depressive symptoms in order adults. The total number of subjects N=32. Which is divided into two groups steps for excise group and control group. The study duration was 16 weeks. The data was collected by using berg balance scale and time up and go test before and after the treatment significant improvement were observed in training group on the time of perform get up and go test which reflects better functional mobility than control group. The other concluded that step square exercise improve balance and prevent falls²⁷.

Ereson Sebastia et.al (2015) studied on validity of the timed up and go test (TUG) as a measure of functional mobility in persons with multiple sclerosis. The total number of subjects N= 47. The duration of the study was 7 days the data was collected by using TUG test, timed 25- foot walk test, 6-minute walk test, multiple sclerosis walking scale, disability status scale and Number of steps per day, The TUG test was strongly associated with other valid outcome measures of ambulatory mobility and disability status. Moderately to strongly associated with balance confidence and weekly associated with balance control. The author concluded that TUG test is a valid measurer of functional mobility in both clinical and research practiced in persons with multiple sclerosis³¹.

Yiva E Nilsagard et.al (2012) studied on balance exercise for persons with multiple sclerosis using Wii games. The total number of subjects N=84 among 4 were lost to follow up. The duration of study was 6-7 weeks alternatively twice a week that 30 minutes your session. The database collected using time up and go test and dynamic Gate index. Statistically significant improvements within the excise group present for all measures except in walking speed and balance confidence the non-excise group showed statistically significant improvements for the step square test under

dynamic gait index. The author concluded that exercise using Wii feat did not tender statistically differences but presented moderate exercises for several measures of balance performance²⁸.

Ryosuke shigemastu et.al (2008) studied on square stepping exercises and fall risk factors in older adults the total number of subjects N=68. The duration of study was 12 weeks which is divided into trice a week alternatively. The database collected by using chase stand functional reach standard up from lying down positions before and after the technique. During follow up period the fall rates per year in the steps square exercise and walking sessions group where 23.4% and 33.3% respectively. The author was concluded that square stepping exercise is more effective than walking in reducing factors and that is recommended as a Health Promotion access in older adults with multiple resources²⁹

Sebastian emerson et.al (2008) studied on home based square stepping exercise program among older adults with multiple sclerosis. Total number of subjects N=26. The duration of the study is 12 weeks. The data was collected by using feasibility matrix test, 25 feet walking get up and go test, symbol digit modalities test before and after application of technique. In step square exercise program may improve cognition and mobility function. The author concluded that this square stepping exercises program for adult with multiple sclerosis was safe and feasible³⁰.

Fusun sachin MD et.al (2008) studied on reliability and validity of the Turkish version of Berg balance scale. The total no. of subjects N=60 older than 65 years. The duration of the study is 2 weeks alternatively 4 sittings. The data was collected by using modified Barthel index (MBI) and timed up and go test (TUG). The BBS showed good result than TUG and MBI. The author concluded that the Turkish version of BBS is a reliable and valid scale to be used in patients with multiple sclerosis³².

OBJECTIVE OF THE STUDY:

To assess the effectiveness of step square exercises to prevent falls in older adults with multiple sclerosis.

To assess the effectiveness of Wii board exercises to improve balance and reduce falls in patients with multiple sclerosis.

To compare immediate effectiveness of step square technique and Wii board exercises to prevent falls in multiple sclerosis patients.

HYPOTHESIS

Null Hypothesis:

There is no significant difference between step square exercises and Wii board exercises to reduce fall in patients with multiple sclerosis.

Alternate Hypothesis:

There is significant difference between step square exercises and Wii board exercises to reduce falls in patients with multiple sclerosis.

MATERIALS AND METHODS

OUTCOME MEASURES: Four square step test and Berg balance scale

TOOLS:

Stopwatch, 2 standard chairs, 4 feet walkway

A ruler, a foot stool or step

SOURCE OF DATA

Garden city university Physio Care, East Point hospital, Multiple sclerosis Society of India at Bengaluru.

METHOD OF COLLECTION OF DATA:

Department approval and IEC approval



Population with multiple sclerosis



Selecting sample based on inclusion and exclusion criteria



Instructions to the sampling population and taking consent



Patients will be assessed using the timed up and go test and berg balance scale for their postural control and balance. Group A will be given step by step square exercises and group B will be given by Wii board exercises.



Data analysis pre-test and post test

STUDY DESIGN: Experimental design

SAMPLE SIZE: Not yet decided

SAMPLING TECHNIQUE: Convenience sampling

INCLUSION CRITERIA

- Multiple sclerosis diagnosed according to the Mc Donald criteria
- Walking ability not exceeding 200 m
- Definite relapsing - remitting Multiple sclerosis diagnosed by Neurologist
- No evident signs of an exacerbation, or corticosteroid treatment in the past 3 months
- No current infections and Anaemia
- Subjects aged 18 years and above
- Subjects who can follow the instructions during this study.

EXCLUSION CRITERIA

- Severe cognitive impairment
- Bilateral visual impairment
- Severe upper limb function impairment
- Primary sleep disorders
- Impaired walking in the last 3 months
- Administration of 4-aminopyridine durithe in the last 30 days
- History of trauma or fractures
- Osteoporosis
- Participating in balance exercises

METHODOLOGY:

- Participants with multiple sclerosis population will be selected based on the inclusion and exclusion criteria.
- Instructions and consent form will be given to the participants and consent will be taken.
- patients will be assessed for the fall's frequency using four timed up and go test test and berg balance scale.
- Data will be obtained after the assessment and analysis will be done for the same.

The Square-Stepping Exercise (SSE)

The SSE is a simple foot placement pattern that comprised of forward, backward, lateral, and Diagonal steps using gridded floor squares [21], their size were (90 × 90 cm) which partitioned into (30 × 30 cm) nine equal squares, that were made from the extra non-slip mat. Before starting, the Therapist performed the pattern in front of the patient to describe it in detail, then the patient Performed the same step pattern on the floor squares. Pattern recognition and memorization could Usually be accomplished after 4-5 repetitions, as when the patient effectively completed the pattern, a

Different pattern was described by the therapist, as the session consisted of three to five different Progressive more complicated step patterns. The difficulty level increased gradually session by session

Upon four standards: the complexity of the pattern, length, execution in dual multi-tasking conditions and execution speed. Also, there was 1-minute rest after each pattern.

DURATION: 6 months

STATISTICAL TOOL

Both paired and unpaired T tests were used for each parameter in an intra group analysis for the pre and post-test experimental investigation to determine the significance of improvement attained through intervention. The significance of the differences between the two groups was then determined using an unpaired T test (intergroup analysis).

Paired t test used to compare the effect within the same groups T test for period values

Unpaired t test was used to compare the effects between two groups T test for unpaired values

RESEARCH TOOLS

1. Stopwatch
2. Ruler
3. 2 Standard chairs
4. A Foot stool or Step
5. 4 feet walkway

ETHICAL CLEARENCE

LIST OF REFERENCES:

- 1.Lassmann H. The Pathology of Multiple Sclerosis and Its Evolution. *Philosophical Transactions: Biological Sciences*. 1999 Oct 29;1635-40.
- 2.Kalron A Achiron A. Postural control, falls and fear of falling in people with multiple sclerosis without mobility aids. *Journal of the neurological sciences*. 2013;335(1-2):186-90.
- 3.Cattaneo D, Jonsdottir J, Coote S. Targeting Dynamic Balance in Falls-Prevention Interventions in Multiple Sclerosis: Recommendations from the International MS Falls Prevention Research Network. *International journal of MS care*. 2014;16(4):198-202.
- 4.Mazumder R, Murchison C, Bourdette DN, Cameron M. Falls in people with multiple sclerosis compared with falls in healthy controls. *PLoS one*. 2014;9(9): e107620-.
- 5.Gunn H, Creanor S, Haas B, Marsden J, Freeman J. Frequency, characteristics, and consequences of falls in multiple sclerosis: findings from a cohort study. *Archives of Physical Medicine and Rehabilitation*. 2013 Sep 18;95(3):538-45.
- 6.Bhatia R, Bali P, Chowdhary R. Epidemiology, and genetic aspects of multiple sclerosis in India. *Annals of Indian Academy of Neurology*. 2015 Sep 1;18(5):6-.
- 7.Corporal SH, Gensicke H, Kuhle J, Kappos L, Allum JH, Yaldizli Ö. Balance control in multiple sclerosis: correlations of trunk sway during stance and gait tests with disease severity. *Gait & posture*. 2013 Jan;37(1):55-60.
- 8.Abelkader NA, Mahmoud AY, Fayaz NA, Mahmoud LS. Decreased neck proprioception and postural stability after induced cervical flexor muscles fatigue. *J Musculoskeletal Neuronal Interact*. 2020;20(3):421-
- 9.Corporaal SH, Gensicke H, Kuhle J, Kappos L, Allum JH, Yaldizli O. Balance control in multiple sclerosis: Correlations of trunk sway during stance and gait tests with disease severity. *Gait & Posture*. 2013;37(1):55-60.
- 10.Martínez-Amat A, Hita-Contreras F, Lomas-Vega R, Caballero-Martínez I, Alvarez PJ, Martínez-López E. Effects of 12-week proprioception training program on postural stability, gait, and balance in older adults: a controlled clinical trial. *Journal of Strength and Conditioning Research*. 2013 Aug 1;27(8):2180-8.
- 11.Shigematsu R, Okura T, Nakagaichi M, Tanaka K, Sakai T, Kitazumi S, Rantanen T. Square-stepping exercise and fall risk factors in older adults: a single-blind, randomized controlled trial. *Journals of gerontology. Series A: Biological sciences and medical sciences*. 2008;63(1):76-82.
- 12.Gunn H, Markevics S, Haas B, Marsden J, Freeman J. Systematic Review: The Effectiveness of Interventions to Reduce Falls and Improve Balance in Adults with Multiple Sclerosis. *Archives of Physical Medicine and Rehabilitation*. 2015 Jun 10;96(10):1898-912.
- 13.Freeman JA, Gear M, Pauli A, Cowan P, Finnigan C, Hunter H, Mobberley C, Nock A, Sims10 R, Thain11 J. The effect of core stability training on balance and mobility in ambulant individuals with multiple sclerosis: A multi-centre series of case studies. *Multiple Sclerosis*.;16(11):1377-84.
- 14.Fisseha B, Janakiraman B, Yitayeh A, Ravichandran H. Effect of square stepping exercise for older adults to prevent fall and injury related to fall: systematic review and meta-analysis of current evidence. *Journal of exercise rehabilitation*. 2017 Feb 28;13(1):23-9.
15. Francoa JR, Jacobsb K, Inzerillo C, Kluzikb J. The effect of the Nintendo Wii Fit and exercise in improving balance and quality of life in community dwelling elders. *Technology and Health Care*. 2012; 20:95-115.
16. Guidi I, Giovannelli T, Paci M. Effects of Wii exercises on balance in people with multiple sclerosis. *Multiple sclerosis (Houndmills, Basingstoke, England)*. 2013 Jun;19(7):965.
17. BRICHETTO G, SPALLAROSSA P, LOPES DE CARVALHO ML, BATTAGLIA MA. The effect of Nintendo® Wii® on balance in people with multiple sclerosis: a pilot randomized control study. *Multiple sclerosis*. 2013;19(9):1219-21.
- 18.Lama Saad El-Din Mahmoud, Sobhy M. Aly, Marian M. Shafeek, Hanan Hosny M. Battasha
Effect of CoDuSe and step square exercises on risk of fall in multiple sclerosis: a randomized controlled trial. *Phys Act Rev* 2022; 10(2): 12-22. doi: 10.16926/par.2022.10.17.
19. Mayoral-Moreno A, Chimpén-López CA, Rodríguez-Santos L, Ramos-Fuentes MI, Vaz-Leal FJ, Moral MA, Pérez-Gómez J, Adsuar JC. Falls Prevention and Quality of Life Improvement by Square Stepping Exercise in People with Parkinson's Disease: Project Report. *Journal of Personalized Medicine*. 2021 Apr 30;11(5):361-.

20. Walton C, King R, Rechtman L, Kaye W, Leray E, Marrie RA, Robertson N, La Rocca N, Uitdehaag B, van der Mei I, Wallin M. Rising prevalence of multiple sclerosis worldwide: Insights from the Atlas of MS. *Multiple Sclerosis Journal*. 2020 Nov 11;26(14):1816-21.
21. Sebastião E, McAuley E, Shigematsu R, Motl RW. Feasibility study design and methods for a home-based, square-stepping exercise program among older adults with multiple sclerosis: The SSE-MS project. *Contemporary Clinical Trials*. 2017; 7:200-7.
22. Pau M, Coghe G, Corona F, Leban B, Marrosu MG, Cocco E. Effectiveness and Limitations of Unsupervised Home-Based Balance Rehabilitation with Nintendo Wii in People with Multiple Sclerosis. *BioMed Research International*. 2015;2015.
23. Siriphorn A, Chamonchant D. Wii balance board exercise improves balance and lower limb muscle strength of overweight young adults. *Journal of physical therapy science*. 2015 Jan;27(1):41-6.
24. Sosnoff JJ, Finlayson M, McAuley E, Morrison S, Motl RW. Home-based exercise program and fall-risk reduction in older adults with multiple sclerosis: phase 1 randomized controlled trial. *Clinical Rehabilitation*. 2013 Aug 27;28(3):254-63.
25. Nilsagård YE, von Koch LK, Nilsson M, Forsberg AS. Balance exercise program reduced falls in people with multiple sclerosis: a single-group, pretest-posttest trial. *Archives of Physical Medicine and Rehabilitation*. 2014 Jul 6;95(12):2428-34.
26. BRICHETTO G, SPALLAROSSA P, LOPES DE CARVALHO ML, BATTAGLIA MA. The effect of Nintendo® Wii® on balance in people with multiple sclerosis: a pilot randomized control study. *Multiple sclerosis*. 2013;19(9):1219-21.
27. Pereira JR, Gobbi S, Teixeira CV, Nascimento CM, Corazza DI, Vital TM, Hernandez SS, Stella F, Shigematsu R. Effects of Square-Stepping Exercise on balance and depressive symptoms in older adults. *Motriz rev. educ. fís.(Impr.)*. 2014;454-60.
28. Nilsagård YE, Forsberg AS, von Koch L. Balance exercise for persons with multiple sclerosis using Wii games: a randomised, controlled multi-centre study. *Multiple Sclerosis (Houndmills, Basingstoke, England)*. 2012 Jun 6;19(2):209-16.
29. Shigematsu R, Okura T, Nakagaichi M, Tanaka K, Sakai T, Kitazumi S, Rantanen T. Square-stepping exercise and fall risk factors in older adults: a single-blind, randomized controlled trial. *The Journals of gerontology. Series A, Biological Sciences and Medical Sciences*. 2008 Jan 1;63(1):76-82.
30. Sebastião E, McAuley E, Shigematsu R, Adamson BC, Bollaert RE, Motl RW. Home-based, square-stepping exercise program among older adults with multiple sclerosis: results of a feasibility randomized controlled study. *Contemporary Clinical Trials*. 2018 Sep 19; 73:136-44.
31. Sebastião E, Sandroff BM, Learmonth YC, Motl RW. Validity of the Timed Up and Go Test as a Measure of Functional Mobility in Persons with Multiple Sclerosis. *Archives of Physical Medicine and Rehabilitation*. 2016;97(7):1072-7.
32. Sahin F, Yilmaz F, Ozmaden A, Kotevoglou N, Sahin T, Kuran B. Reliability and Validity of the Turkish Version of the Berg Balance Scale. *Journal of Geriatric Physical Therapy*.;31(1):08.

APPENDIX:**TIMED UP AND GO TEST (TUG)**

Description: Measure of function with correlation to balance and fall risk.

Equipment: Stopwatch, Standard chair, Measured distance of 3 meters (10 feet).

Patient instructions: My commands for this test are going to be ready, set, go, I want you to stand up from the Chair. You may use the arms of the chair to stand up or sit down. Once you are up, you may take my path you like, but I want you to move quickly as you feel safe and comfortable until you pass this piece of tape with both feet. Turn around and walk back to the Chair. I will stop the clock when your back touches the back of the chair. You will complete one practice run and two that are counted

Therapist instructions: Start timing on the word go and stop timing when the subject is seated again correctly in the chair with their back resting on the back of the chair. The subject is seated again correctly in the chair with their back resting on the back of the chair. The subject wears their regular footwear may use any gait aid that they normally use during ambulation but may not be assisted by another person. There is no time limit. They may stop and rest (but not sit down) if they need to.

Interpretation:

<10 seconds = Normal.

< 20 seconds = Good mobility, can go out alone, mobile without gait aids.

<30 seconds = Problems, cannot go outside alone, requires gait.

A score of >14 seconds has been shown to indicate considerable risk of falls.

BERG BALANCE SCALE

Equipment:

1. Yardstick
2. One standard chair with arm rests
3. One standard chair without arm rests
4. Footstool/step
5. Stopwatch or wristwatch
6. 15-foot walkway

Reliability: Cronbach's alphas were greater than 0.83 for stroke patients and 0.97 for elderly residents.

Scoring:

A five-point scale, a range of 0-4.

0 = lowest level of function

4 = highest level of function.

Highest score = 56

Score of < 45 indicates a greater risk of falling

41-56 = low fall risk

21-40 = medium fall risk

0 –20 = high fall risk

1. SITTING TO STANDING

INSTRUCTIONS: Please stand up. Try not to use your hand 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 stabilize
- 0 needs moderate or maximal assist to stand

2. STANDING UNSUPPORTED

INSTRUCTIONS: Please stand for two minutes without holding on.

- 4 able to stand safely for 2 minutes
- 3 able to stand 2 minutes with supervision
- 2 able to stand 30 seconds unsupported
- 1 need several tries to stand 30 seconds unsupported
- 0 unable to stand 30 seconds unsupported

If a subject can stand 2 minutes unsupported, score full points for sitting unsupported. Proceed to item.

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 for 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 assist to sit

5. TRANSFERS

INSTRUCTIONS: Arrange chair(s) for 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 cuing and/or supervision
- 1 need 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 safely
- 0 needs help to keep from falling

7. STANDING UNSUPPORTED WITH FEET TOGETHER

INSTRUCTIONS: Place your feet together and stand without holding on.

- 4 able to place feet together independently and stand 1 minute safely
- 3 able to place feet together independently and stand 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

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 the 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 fingers reach 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 (5 inches)
- 2 can reach forward 5 cm (2 inches)
- 1 reaches forward but needs supervision
- 0 loses balance while trying/requires external support

9. PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION

INSTRUCTIONS: Pick up the 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 2-5 cm (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 the 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 4 seconds or less

2 able to turn 360 degrees safely but slowly

1 needs close supervision or verbal cuing

0 needs assistance while turning

12. PLACE ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING UNSUPPORTED

INSTRUCTIONS: Place each foot alternately on the step/stool. Continue until each foot has touch 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 in > 20 seconds

2 able to complete 4 steps without aid with supervision

1 able to complete > 2 steps need 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 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 if you can without holding on.

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 \geq 3 seconds

1 tries to lift leg unable to hold 3 seconds but remains standing independently.

0 unable to try of needs assist to prevent fall

TOTAL SCORE WILL BE MAXIMUM 56