**Learning Objectives:**

After reading this literature review, the PT student/clinician will be able to correctly:

1. Describe the effectiveness of the original Otago Exercise Program.
2. Explain the need for alternative implementation strategies of the Otago Exercise Program.
3. Describe variable group formats in which Otago Exercise Program can be effectively implemented.
4. Describe the relative effectiveness of the Otago Exercise Program implemented in variable group formats.

**Introduction**

Fall risk is an issue which physical therapists should take into consideration when evaluating any patient who is 65 years of age or older, particularly as over a quarter of older adults residing in the United States (US) reported one or more falls over the course of 2014.1 Falls have significant implications for older adults’ health as over one third of the individuals reporting a fall in the year of 2014 sustained one or more injuries.1 Injurious falls may increase older adults’ likelihood of mortality as it has been found that fifty percent of individuals who require hospitalization as a result of injuries sustained from a fall will die within one year’s time.2 In addition to the aforementioned detrimental impacts of falls occurring amongst older adults, falls have also been associated with significant costs to the US healthcare system.3 In 2015, it was estimated that falls which did not result in mortality cost Medicare approximately 31.3 billion dollars, and this number is anticipated to continue rising with the expected 55% growth in older adults residing in the US over the next 10 years.1,3

Some of the risk factors for falls occurring amongst older adults have been established and include the occurrence of prior falls, the utilization of numerous medications, environmental obstacles, being female, increased age, and the presence of deficits in balance, gait, vison, and cognition.4 Additional risk factors for falls, which have been identified amongst older adults, include augmented postural sway, reduced activity levels, and the presence of strength deficits.5 Many of these risk factors are considered to be modifiable and therefore, have been targeted to varying degrees by a number of falls prevention programs.4,5

The Otago Exercise Program, which is a program with a main objective of minimizing falls amongst older adults, was originally developed to be a home-based program in which strengthening, flexibility, and balance exercises, in combination with a walking program, are assigned and progressed over one year by a trained physical therapist or nurse.6–10Execution of this program in its original format requires only six home visits in addition to periodic check-in phone calls.7 Participants in this program are instructed to perform strengthening and balance exercises in addition to a five-minute warm up comprised of flexibility exercises for a duration of 30 minutes at a frequency of three times a week.7 Additionally, a walking program is implemented as part of the Otago Exercise Program with durations prescribed on an individualized basis to be completed two times a week.7

This review will first consider the effectiveness of the Otago Exercise Program implemented in its original individualized format and then summarize challenges to implementation of this program encountered within the US.11,12 These challenges have led to the need for physical therapists within the US, particularly those treating older adults, to have increased awareness of alternative strategies to implement this evidence-based program, therefore, a number of these variable implementation formats will be briefly summarized.13 One alternative implementation format of the Otago Exercise Program is group implementation, and this format has been associated with a number of benefits which will also be summarized in this review.13–15 As there are many benefits exclusive to this implementation strategy, the remainder of this review will consider updated information regarding variable group implementation formats of the Otago Exercise Program.13–18

**Evidence Supporting the Original Otago Exercise Program**

A systematic review and meta-analysis was published by Thomas et al. in 2010 considering the effectiveness of the Otago Exercise Program*.*11Seven controlled trials, with and without randomization, were considered in this review and all of these studies included individuals who were ages 65 and up, living within the community, and ambulatory.11 Additionally, men and women were included in all but two of the studies examined, and those two studies were comprised of exclusively women.11 The Otago Exercise Program was employed as the experimental intervention in all studies and the control intervention was comprised of either socialization or typical medical care.11 Results of this meta-analysis demonstrated that engagement in the Otago Exercise Program for one year results in a mortality risk that is 0.45 (95% CI: 0.25 to 0.80; P= 0.007) times that of individuals who did not participate in this exercise program.11 In addition to supporting the efficacy of the Otago Exercise Program, this outcome may serve as additional evidence to support the relationship identified between increased fall rates and an augmented mortality risk observed amongst the older adults*.*11,19Additionally, this meta-analysis concluded that participation in the Otago Exercise Program for one year resulted in a fall rate 0.68 (95% CI: 0.56-0.79; P<0.00001) times that of individuals in the control group*.*11Lastly, twelve months following the initiation of the Otago Exercise Program, 36.7% of the individuals, remaining in their studies, maintained strict adherence to the recommendations for exercise suggested by the Otago Exercise Program*.*11Although this adherence rate appears relatively low, it is important to note that over half of these individuals were exercising at least twice a week.11Additionally, of the seven studies included in this review, four reported adverse events occurring as a result of participation in the Otago Exercise Program with one report of new unspecified pain, three reports of falls, two reports of new episodes of low back pain, and one report of an injury which was classified as moderate*.*11

**Challenges to Implementation in the US**

The Otago Exercise Program originated within a universal healthcare system, therefore its execution in the US has been accompanied by some significant challenges*.*12In an effort to adapt this program for use in the US, the original Otago Exercise Program manual was adjusted, and then reviewed in an online training provided to a number of physical therapists residing in the US*.*12Some of the main difficulties surrounding adoption of the Otago Exercise Program in the US were brought to light during this training*.*12One challenge identified was a lack of understanding amongst clinicians on how to translate an evidence-based program into clinical practice.12This is certainly a significant barrier to utilization of the Otago Exercise Program in the US, as the efficacy of an evidence-based program may be jeopardized with improper translation of the program*.*12

Another challenge identified was the discrepancy which exists between individuals included in the original research on the Otago Exercise Program and patients commonly encountered in the US*.*12It was noted that participants in the initial Otago Exercise Program studies did not have deficits aside from being at an increased risk for falls; however, patients commonly encountered in the US must have deficits beyond being at risk for falls in order to receive insurance coverage*.*12Additionally, physical therapists were worried about the prolonged duration and low frequency inherent to the Otago Exercise Program as physical therapists feared this type of treatment plan would be somewhat unusual and might lead to an investigation by Medicare.12Apprehension was also expressed regarding the lack of freedom with regards to physical therapists’ ability to make clinical decisions resulting from the relatively rigid nature of the Otago Exercise Program.12

Additionally, both “reimbursement issues”, and “current policies regarding frequency and duration of physical therapy treatment” became barriers to implementation of the Otago Exercise Program in the US following the establishment of the “The Final Rule”, which was enacted by Centers for Medicare and Medicaid Services in 2011*.*12 This rule restricted physical therapy home health plans of care to 60 days, at which point significant paperwork would need to be completed in order to lengthen the plan of care duration*.*12 Additionally, the “Final Rule” established poorer reimbursement rates for patients who were less acutely ill*.*12 As the original Otago Exercise Program was designed to be executed over the course of one year and was not designed for implementation amongst an acutely ill population, this rule made it significantly more difficult for physical therapists working in the home health setting to incorporate the Otago Exercise Program into their usual practice*.*12 Although the provision of physical therapy treatment provided within a patient’s home under Medicare Part B is a feasible solution, there is still a considerable amount of administrative work for the physical therapist associated with implementation of this program.12 Clearly there are significant barriers to implementing the Otago Exercise Program within the US.12 However, researchers have undertaken efforts to establish the efficacy of this home-based exercise program in alternative formats.12

**Variable Strategies for Implementation**

Researchers have strived to establish that the effectiveness of the Otago Exercise Program is preserved within the context of a variety of alterations to the original program.13 One such alteration includes the utilization of technology to assist with implementation.20–22 Technology-assisted implementation strategies include provision of the Otago Exercise Program by means of in-person and DVD instruction or implementation with the addition of augmented reality.20–22 The provision of the Otago Exercise Program supplemented by augmented reality resulted in within-group improvements on measures of postural stability, fear of falling, and ambulation.20 Additionally, as compared to the provision of no intervention, the provision of a video-assisted Otago Exercise Program resulted in significantly greater improvements in measures of fall risk.21 These results were supported by another study which found significantly greater improvements in measures of fall risk, lower extremity strength, and postural stability amongst a group of individuals who participated in a video-assisted Otago Exercise Program as compared to individuals who did not receive any intervention.22 Although a qualitative study revealed that the delivery of a video-assisted Otago Exercise Program was viewed by older adults as a largely beneficial and flexible means by which to improve their health, particularly with respect to mental and physical aspects, the absence of social interaction was cited as a potential downfall of this intervention style.23 Therefore, the provision of the Otago Exercise Program to a group of individuals in a community setting may serve as a superior intervention for those individuals who desire more social interaction.23 The effectiveness of this implementation strategy has been considered by a number of researchers, and encouraging results have been found supporting preserved efficacy, and in some cases additional benefits, resulting from Otago Exercise Program implementation in a group format.14–18 Therefore, this form of implementation will be explored in greater detail throughout the remainder of this review.

**Benefits of Group Implementation of the Otago Exercise Program**

Performance of the Otago Exercise Program in a group has been associated with a number of benefits which may increase its appropriateness for select individuals.13–15 One benefit associated with the performance of the Otago Exercise Program in a group is the facilitation of increased social interaction*.*13This increase in social interaction may result in mental health benefits.14 In one study, group implementation of the Otago Exercise Program resulted in maintained scores on the mental health component of the Short Form-12, whereas individuals receiving usual care demonstrated a significant decrease on this instrument following a 9-month intervention period*.*14Additionally, decreased costs compared to typical care and individualized implementation of the Otago Exercise Program is another benefit which has been found as a result of implementation of the Otago Exercise Program in a group format*.*14,15Lastly, implementation in a group format may be associated with increased adherence rates when comparing the Otago Exercise Program to an alternative group exercise program*.*15

**Group Implementation of the Otago Exercise Program**

The effectiveness of Otago exercises, performed and progressed in a group format, has been examined in two studies.15,16 One of these studies, completed by Kydalen et al., considered the effect of group performance of the Otago Exercise Program in addition to a walking program on balance, lower extremity strength, fall risk, fear of falling, and quality of life as compared to participation in the original Otago Exercise Program.16 Assessments were completed following three months of participation in these interventions, as well as twelve weeks following the conclusion of the intervention period.16 The study population was comprised of community-residing older adults who were able to walk without assistance, had an elevated risk for falls, and did not have significant cognitive deficits.16 The intervention group participated in a group Otago Exercise Program for a duration of 45 minutes, bi-weekly, in addition to a walking program which was prescribed for a minimum duration of 30 minutes, three times per week.16 Groups were relatively small, ranging from four to eight individuals.16 The control group received the original Otago Exercise Program, which included home-based strengthening, balance, and flexibility exercises for 30 minutes, three times per week, as well as participation in a walking program which also was performed for a minimum duration of 30 minutes, three times per week.16 It should be noted that this study used a higher frequency for the walking program, for both the intervention and control group, than was prescribed in the original Otago Exercise Program.7,16 No significant between-group differences were identified on the Berg Balance Scale, the Short-Form-36-Physical Health Index, and the 30 Second Sit to Stand assessments at baseline.16 The researchers found that participation in the group Otago Exercise Program resulted in significantly better performance on the Berg Balance Scale, the Short Form-36-Physical Health Index, and the 30-Second Sit to Stand assessment as compared to participation in the original Otago Exercise Program.16 Three months after the end of the intervention period, individuals who participated in the group Otago Exercise Program performed significantly better on the TUG and the 30-Second Sit to Stand assessments as compared to individuals who participated in the original Otago Exercise Program.16 Individuals participating in the original Otago Exercise Program did not demonstrate improvements beyond improvements observed amongst individuals participating in the group Otago Exercise class on any outcome measure.16 Additionally, significant within-group improvements were observed after three months of participation in the original Otago Exercise Program on the Berg Balance Scale, the Timed Up and Go test, the 7-Item Falls Efficacy Scale International, and the Short Form-36-Mental Health Index.16 These improvements were maintained three months following the conclusion of this intervention.16 Significant within-group improvements were also observed amongst individuals participating in the group Otago Exercise intervention on the Berg Balance Scale, the Timed Up and Go test, the 30-Second Sit to Stand test, the 7-Item Falls Efficacy Scale International, and the Short Form-36.16 For all measures except for the Short Form-36 Mental Health domain, these improvements were maintained three months following the conclusion of the intervention period.16 These results imply that the Otago Exercise Program adapted for group implementation may be superior to the original Otago Exercise Program in terms of some the outcomes considered in this study; however, the original Otago Exercise Program was still an effective intervention with regards to many of the outcomes measured.16 While the benefits to implementation of the Otago Exercise Program in a group format appear rather impressive, it is important to keep in mind that transportation was offered to the group exercise classes to any study participant who reported transportation difficulties.16 Unfortunately, this is not always a service which is feasible for physical therapists to offer.

Another study, by Waters et al., considered the effects of group performance of exercises included within the Otago Exercise Program on outcomes assessing fall risk, balance, functional mobility, and lower extremity strength after a 10 week and one-year intervention period.15,24–28 Three intervention groups were included in this study, two of which participated in group performance of the exercises included in the Otago Exercise Program, with one being led by a trained peer and the other led by a trained healthcare professional.15 The control group performed an alternate exercise routine consisting of cardio and mobility exercises performed in a seated position.15 Individuals included in this study were older adults who had the ability to walk without assistance, had intact cognition, and were at an elevated risk for falling.15 Individuals within all intervention groups participated in a group exercise class which was one hour in duration at a frequency of once per week.15 Performance on the Time Up and Go assessment, Functional Reach Test, One-leg Stance Test, 30-Second Sit to Stand assessment, and the Step Test amongst participants in the two experimental groups were drastically improved as compared to individuals participating in the control intervention, at the 10 week and 12-month outcome assessment points.15 However, a significant reduction in falls was not observed when comparing individuals participating in either of the experimental interventions to individuals participating in the control intervention at the 12-month outcome assessment point.15 The lack of a reduction in falls may be attributed to the decreased duration and/or frequency of exercise performance in this program compared to the frequency and duration of exercise utilized in the Original Otago Exercise Program.7,15

**Group Otago and Supplemental Exercises**

Although group performance of Otago exercises appears to be an effective variation of the original program, a number of other studies have been completed demonstrating the effectiveness of group performance of Otago exercises supplemented by additional exercises.14,17,18 One study explored the impact of group performance of the Otago exercises in combination with more advanced balance challenges, a motor learning technique, and a home exercise program consisting of Otago strengthening exercises on fall rate and the combined rate of hospitalizations, nursing home placements, and deaths observed amongst participants.17 The advanced balance challenges were eclectic and included the performance of functional activities and activities which elicited a righting response, and the motor learning technique included the performance of backwards chaining.17 The group class lasted for a total of one hour and was held weekly and the home exercise program was prescribed at a bi-weekly frequency for a total of 20 to 40 minutes.17 This experimental intervention was compared to bi-weekly independent performance of flexibility exercises and both interventions were implemented for a total of 36 weeks.17 Only older females, residing in the community, with 12-month history of multiple falls were included in this study.17 Significant results, observed an average of 49.7 weeks after the end of the intervention period, included that individuals participating in the experimental intervention were found to have experienced 0.69 times the number of falls as compared to the control group and a reduction in the combined rate of hospitalizations, nursing home placements, and deaths as compared to the control group.17 Therefore, this study provides evidence supporting the effectiveness of an intervention which may be appropriate for individuals who are insufficiently challenged by the Otago exercises, but are at an increased risk for falls.17 Additionally, this intervention is less standardized than the original Otago Exercise Program, which may make it more appealing to some clinicians.17

A similar study was conducted considering the impact of the Otago exercises in combination with “dynamic self-resistance exercises” as compared to usual care on outcomes assessing fall risk, frailty, activities of daily living restrictions, fear of falling, lower extremity performance, and quality of life over nine months.14,29,30 There were a total of 26 “dynamic self-resistance exercises” and 34 Otago exercises utilized throughout this program and these exercises were combined in groups of 6 to create 10 exercise routines.14 The exercise class was held for a duration of 45 minutes and took place two times a week.14 Individuals included in this study were older adults, living within the community, with intact cognition, and no significant physical impairments.14 Following 9 months of participation in the experimental and control interventions, outcomes were reassessed.14 Within the experimental group, a 45.5% decrease in participants’ risk for falling was found.14 Additionally, statistically significant improvements including a 31% decrease in frailty, a 6% decrease in ADL restriction, a 33% decrease in doctors’ visits, and an overall increase in lower extremity performance, were observed within the experimental group.14 Conversely, the control group experienced statistically significant declines, including a 9% reduction in participants’ physical health-related quality of life, as well as a 7% reduction in the participants’ mental health-related quality of life.14As such, this intervention provides yet another way to combine more advanced exercises with Otago exercises, resulting in an intervention which may be more appropriate for some patients who are insufficiently challenged by the Otago exercises alone.14

Lastly, a study was completed comparing the impact of eight weeks of home training on “multisensory balance exercises” as compared to home training on “active range of motion stretching” as indicated on dynamic balance and falls risk, with each intervention provided in combination with an accompanying home exercise program and group performance of Otago exercises.18 The home training was provided for a duration of 45 minutes two times a week, and the accompanying home exercise program was prescribed two times per day, on days when individuals were not provided with home training.18 Group performance of Otago exercises was completed for a duration of one hour, two times per week.18 Participants in this study were older adults without vestibular dysfunction and a one-year history of frequent falls.18 Following four weeks of intervention, participants’ receiving the “multisensory balance exercises” demonstrated a significantly larger improvement on the Functional Gait Assessment compared to those receiving the flexibility home training.18 Additionally, following eight weeks of intervention, individuals receiving the “multisensory balance exercises” demonstrated a significantly larger improvement on the Functional Gait Assessment and the Physiological Profile Assessment, as compared to those receiving mobility training.18 Therefore, this study provides support for a potential intervention for individuals who are at risk for falls which incorporates Otago exercises in combination with exercises aimed at improving sensory integration.18

**Conclusion**

The aforementioned research provides evidence that the Otago Exercise Program may be successfully implemented in a variety of alternative formats.14–18,31 The studies completed by Kyrdalen et al. and Waters et al. suggest that the Otago exercises may be effectively performed in a group format and therefore may be a more appropriate intervention for older adults seeking more social interaction.15,16 However, an increased duration and frequency than that utilized in the study by Waters et al. may be required in order to achieve a reduction in falls.15 Additionally, group performance of Otago exercises combined with alternative exercises may be an effective intervention for older adults at an increased risk for falls, providing participants with increased challenge and increasing the freedom of clinical decision-making by physical therapists.14,17,18

 Bibliography

1. Bergen G, Stevens MR, Burns ER. Falls and Fall Injuries Among Adults Aged ≥65 Years - United States, 2014. *MMWR Morb. Mortal. Wkly. Rep.* 2016;65(37):993-998. doi:10.15585/mmwr.mm6537a2.

2. Rubenstein LZ. Falls in older people: epidemiology, risk factors and strategies for prevention. *Age Ageing* 2006;35 Suppl 2:ii37-ii41. doi:10.1093/ageing/afl084.

3. Burns ER, Stevens JA, Lee R. The direct costs of fatal and non-fatal falls among older adults - United States. *J. Safety Res.* 2016;58:99-103. doi:10.1016/j.jsr.2016.05.001.

4. Ambrose AF, Paul G, Hausdorff JM. Risk factors for falls among older adults: a review of the literature. *Maturitas* 2013;75(1):51-61. doi:10.1016/j.maturitas.2013.02.009.

5. Campbell AJ, Borrie MJ, Spears GF. Risk factors for falls in a community-based prospective study of people 70 years and older. *J Gerontol* 1989;44(4):M112-7. doi:10.1093/geronj/44.4.m112.

6. https://www.ncoa.org/wp-content/uploads/2017-OEP-Guidance-Statement.pdf. Available at: https://www.ncoa.org/wp-content/uploads/2017-OEP-Guidance-Statement.pdf. Accessed January 27, 2020.

7. Accident Compensation Corporation (ACC). OTAGO Exercise Programme To prevent falls in older adults .

8. Campbell AJ, Robertson MC, Gardner MM, Norton RN, Tilyard MW, Buchner DM. Randomised controlled trial of a general practice programme of home based exercise to prevent falls in elderly women. *BMJ* 1997;315(7115):1065-1069. doi:10.1136/bmj.315.7115.1065.

9. Robertson MC, Devlin N, Gardner MM, Campbell AJ. Effectiveness and economic evaluation of a nurse delivered home exercise programme to prevent falls. 1: Randomised controlled trial. *BMJ* 2001;322(7288):697-701. doi:10.1136/bmj.322.7288.697.

10. Robertson MC, Gardner MM, Devlin N, McGee R, Campbell AJ. Effectiveness and economic evaluation of a nurse delivered home exercise programme to prevent falls. 2: Controlled trial in multiple centres. *BMJ* 2001;322(7288):701-704. doi:10.1136/bmj.322.7288.701.

11. Thomas S, Mackintosh S, Halbert J. Does the “Otago exercise programme” reduce mortality and falls in older adults?: a systematic review and meta-analysis. *Age Ageing* 2010;39(6):681-687. doi:10.1093/ageing/afq102.

12. Shubert TE, Smith ML, Ory MG, et al. Translation of the otago exercise program for adoption and implementation in the United States. *Front Public Health* 2014;2:152. doi:10.3389/fpubh.2014.00152.

13. Martins AC, Santos C, Silva C, Baltazar D, Moreira J, Tavares N. Does modified Otago Exercise Program improves balance in older people? A systematic review. *Prev. Med. Rep.* 2018;11:231-239. doi:10.1016/j.pmedr.2018.06.015.

14. Alhambra-Borrás T, Durá-Ferrandis E, Ferrando-García M. Effectiveness and Estimation of Cost-Effectiveness of a Group-Based Multicomponent Physical Exercise Programme on Risk of Falling and Frailty in Community-Dwelling Older Adults. *Int. J. Environ. Res. Public Health* 2019;16(12). doi:10.3390/ijerph16122086.

15. Waters DL, Hale LA, Robertson L, Hale BA, Herbison P. Evaluation of a peer-led falls prevention program for older adults. *Arch. Phys. Med. Rehabil.* 2011;92(10):1581-1586. doi:10.1016/j.apmr.2011.05.014.

16. Kyrdalen IL, Moen K, Røysland AS, Helbostad JL. The Otago Exercise Program performed as group training versus home training in fall-prone older people: a randomized controlled Trial. *Physiother Res Int* 2014;19(2):108-116. doi:10.1002/pri.1571.

17. Skelton D, Dinan S, Campbell M, Rutherford O. Tailored group exercise (Falls Management Exercise -- FaME) reduces falls in community-dwelling older frequent fallers (an RCT). *Age Ageing* 2005;34(6):636-639. doi:10.1093/ageing/afi174.

18. Liston MB, Alushi L, Bamiou D-E, Martin FC, Hopper A, Pavlou M. Feasibility and effect of supplementing a modified OTAGO intervention with multisensory balance exercises in older people who fall: a pilot randomized controlled trial. *Clin. Rehabil.* 2014;28(8):784-793. doi:10.1177/0269215514521042.

19. Sylliaas H, Idland G, Sandvik L, Forsen L, Bergland A. Does mortality of the aged increase with the number of falls? Results from a nine-year follow-up study. *Eur J Epidemiol* 2009;24(7):351-355. doi:10.1007/s10654-009-9348-5.

20. Yoo H-N, Chung E, Lee B-H. The Effects of Augmented Reality-based Otago Exercise on Balance, Gait, and Falls Efficacy of Elderly Women. *J Phys Ther Sci* 2013;25(7):797-801. doi:10.1589/jpts.25.797.

21. Davis JC, Hsu CL, Cheung W, et al. Can the Otago falls prevention program be delivered by video? A feasibility study. *BMJ Open Sport Exerc. Med.* 2016;2(1):e000059. doi:10.1136/bmjsem-2015-000059.

22. Benavent-Caballer V, Rosado-Calatayud P, Segura-Ortí E, Amer-Cuenca JJ, Lisón JF. The effectiveness of a video-supported group-based Otago exercise programme on physical performance in community-dwelling older adults: a preliminary study. *Physiotherapy* 2016;102(3):280-286. doi:10.1016/j.physio.2015.08.002.

23. Agha A, Liu-Ambrose TYL, Backman CL, Leese J, Li LC. Understanding the Experiences of Rural Community-Dwelling Older Adults in Using a New DVD-Delivered Otago Exercise Program: A Qualitative Study. *Interact J Med Res* 2015;4(3):e17. doi:10.2196/ijmr.4257.

24. Timed Up and Go | RehabMeasures Database. Available at: https://www.sralab.org/rehabilitation-measures/timed-and-go. Accessed September 2, 2019.

25. 30 Second Sit to Stand Test | RehabMeasures Database. Available at: https://www.sralab.org/rehabilitation-measures/30-second-sit-stand-test. Accessed September 18, 2019.

26. Single leg stance or “One-legged stance test” | RehabMeasures Database. Available at: https://www.sralab.org/rehabilitation-measures/single-leg-stance-or-one-legged-stance-test. Accessed February 24, 2020.

27. Functional Reach Test / Modified Functional Reach Test | RehabMeasures Database. Available at: https://www.sralab.org/rehabilitation-measures/functional-reach-test-modified-functional-reach-test. Accessed February 24, 2020.

28. Step Test | RehabMeasures Database. Available at: https://www.sralab.org/rehabilitation-measures/step-test. Accessed February 24, 2020.

29. Falls Efficacy Scale – International | RehabMeasures Database. Available at: https://www.sralab.org/rehabilitation-measures/falls-efficacy-scale-international. Accessed February 27, 2020.

30. Short Physical Performance Battery | RehabMeasures Database. Available at: https://www.sralab.org/rehabilitation-measures/short-physical-perfromance-battery. Accessed February 27, 2020.

31. Mat S, Ng CT, Tan PJ, et al. Effect of modified otago exercises on postural balance, fear of falling, and fall risk in older fallers with knee osteoarthritis and impaired gait and balance: A secondary analysis. *PM R* 2018;10(3):254-262. doi:10.1016/j.pmrj.2017.08.405.