An Examination of the Predictive Properties of the Fullerton Advanced Balance (FAB) Scale

Danielle Hernandez, M.S. and Debra J. Rose, PhD.
Fall Prevention Center of Excellence • California State University Fullerton

Introduction

Falls are a major concern for the aging population. One in three older adults aged sixty-five years or older, who are living in the community, fall at least once per year.[1] The propensity for fall-related injury in older adults is influenced by a high occurrence of co-morbid diseases. Conducting focused fall risk screenings and assessments constitute an important method for identifying subtle changes in balance and mobility abilities. Performance-based assessments that are sensitive to the subtle changes in balance abilities and capable of identifying older adults at different levels of fall risk are needed for effective intervention. In an effort to address the need to identify more subtle changes in the multiple dimensions of balance (e.g., motor, sensory, musculoskeletal) among independently functioning older adults, the Fullerton Advanced Balance (FAB) scale was developed.[2-3] In addition to evaluating the multiple dimensions of balance in both static and dynamic environments, the FAB scale includes test items that are specifically designed to challenge the balance abilities of independently functioning older adults.

Purpose

To investigate the predictive validity of the Fullerton Advanced Balance (FAB) scale relative to faller status.

Participants

A data set comprised of 200 participants was used to examine the predictive psychometrics of the FAB scale relative to faller status. The data set included 139 non-fallers and 61 recurrent fallers.

Methods

This study was a sub-study of a larger research project conducted by the Fall Prevention Center of Excellence (FPCE) at California State University, Fullerton. Secondary data from the CSA Fall Prevention Dataset was utilized for the purposes of this study.

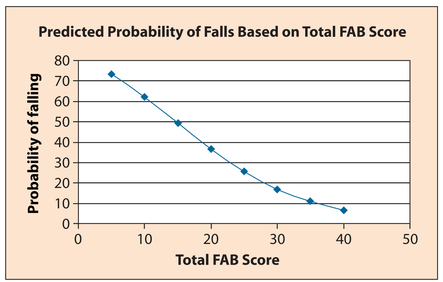
Participants attended a single, 90-minute fall-risk screening session conducted at a community-based facility. During registration, a self-reported retrospective history of falls was obtained. Participants were then randomly assigned to one of four testing stations. Trained personnel from the FPCE administered seven physical performance tests (i.e., FAB scale, 30-foot walk at preferred and maximum speed[4], 8 Foot Up and Go, 30-second arm curl and chair-stand tests[5], Limits of Stability® and the Modified Clinical Sensory Integration Test®.[6]

Fullerton Advanced Balance Scale

Item	Description
1	Standing with feet together and eyes closed
2	Reaching forward to retrieve an object (pencil)
3	Turning 360 degrees in the right and left direction
4	Stepping up and over a 6" bench
5	Tandem walking
6	Standing on one leg
7	Standing on foam with eyes closed
8	Two-footed jump for distance
9	Walking with head turns
10	Reactive postural control

Statistical Analyses And Results

Procedure 1: Binary logistic regression, conducted to investigate a predictive model [y = a + b (total FAB scale score)] and produce an odds ratio of being a faller, indicated that the test of the full model was significantly reliable, χ^2 (1, N = 200) = 23.167, p < 0.001, with the total FAB score being predictive of faller status. The overall prediction success rate was 71.5% with 90.61% (N = 126/139) of non-fallers and 27.9% (N = 17/61) of recurrent fallers being correctly classified. Based on the coefficients derived from the regression analysis, the probability of being a faller was then calculated for every 5-point increment on the FAB scale score (i.e., 5, 10, 15, 20, 25, 30, 35 and 40). An inverse linear relationship between the total FAB scale score and the probability of falling was evident. As the total score on the FAB scale increased, the probability of sustaining a fall decreased.



Procedure 2: Receiver Operating Curve (ROC) analysis was performed to determine which total FAB scale cut-off score produced the optimal level of sensitivity and specificity. The results of the ROC analysis indicated that a cut-off score of 25 on the FAB scale produced the highest sensitivity (73.8%) and specificity (54.7%) in predicting faller status.

Possible Cut-off Score	Specificity	Sensitivity
5	100%	3.2%
10	97.1%	11.5%
15	89.2%	29.5%
20	76.3%	50.8%
25	**54.7%**	**73.8%**
30	22.3%	95.1%
35	5.0%	100%

Procedure 3: The 10 individual FAB scale test items were analyzed using DFA to evaluate which individual test items or groups of test items (functions) were most discerning of faller status. One significant discriminant function was obtained (Wilks' Lambda (0.859) χ^2 = 29.155, p < 0.001) which accounted for 100% of the between-group variability. The discriminant function correctly classified 89% (N = 124/139) of the non-fallers and 30% (N = 18/61) of the recurrent fallers. The strongest predictor variables in discerning faller status using the more stringent cut-off value of 0.5 were item 4 (Up and Over the Bench; 0.865), item 7 (Standing on Foam with Eyes Closed; 0.595), item 8 (Two-footed Jump; 0.582), item 5 (Tandem Walk; 0.569) and item 6 (Single Leg Stance; 0.524).

Discussion

The FAB scale is a predictive measure of faller status when used with independently functioning older adults. A practitioner can be confident in more than 7 out of 10 cases that an older adult who scores 25 or lower on the FAB scale is at high risk for falls and in need of immediate intervention. Moreover, an inverse relationship was evident between the total FAB score and the probability of falling with every one-point decrease being associated with an 8% increase in the probability of sustaining a fall. Although the BLR and DFA analyses yielded lower sensitivity values than desired, this is likely due to the fact that the results were based on expected versus actual observed frequencies and that the FAB scale is comprised of test items that are indicative of subtle changes in balance but necessarily heightened fall risk. This is supported by the fact that only five of the 10 individual test items were predictive of faller status. Finally, unlike other tests of balance, the FAB scale appears less prone to ceiling effects when used with independently functioning older adults. Of the 200 participants tested in the current sample, only one achieved the maximum score of 40/40 and only three participants achieved the next highest score of 38/40. As such, this tool is likely to be a more sensitive indicator of changes in balance over the course of an intervention.

References

1. American Geriatrics Society, British Geriatrics Society, and American Academy of Orthopaedic Surgeons Panel on Falls Prevention. (2001). Guideline for the prevention of falls in older persons. *Journal of the American Geriatrics Society, 49*, 664-672.
2. Rose, D.J. (2003). Fallproof. A comprehensive balance and mobility program. Champaign, IL: Human Kinetics.
3. Rose, D.J., Lucchese, M., & Wiersma, L. (2006). Development of a multidimensional balance scale for use with functionally independent older adults. *Archives of Physical Medicine and Rehabilitation, 87*(11):1478-85.
4. Theou, O., French, J., Hernandez, D. & Rose, D. (2006). Measuring older adult gait speed in community settings using the 30 foot-walk at preferred and maximum speed. *Medicine & Science in Sports and Exercise, 38*(5), S330.
5. Rikli, R., & Jones, J. (1999). Development and validation of a functional fitness test for community-residing older adults. *Journal of Aging and Physical Activity, 7*, 162-181.
6. Neurocom International, Inc. Balance Master Manual.

This study was partially funded by Archstone Grant # 05-01-11 awarded to Debra J. Rose, PhD.