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Interpretability of Change Scores in Measures of Balance in People With COPD

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BACKGROUND: Balance deficits and an increased fall risk are well documented in individuals with COPD. Despite evidence that balance training programs can improve performance on clinical balance tests, their minimal clinically important difference (MCID) is unknown. The aim of this study was to determine the MCID of the Berg Balance Scale (BBS), Balance Evaluation Systems Test (BESTest), and Activities-Specific Balance Confidence (ABC) scale in patients with COPD undergoing pulmonary rehabilitation.

METHODS: We performed a secondary analysis of data from two studies of balance training in COPD (n = 55). The MCID for each balance measure was estimated using the following anchor and distribution-based approaches: (1) mean change scores on a patient-reported global change in balance scale, (2) optimal cut-point from receiver operating characteristic curves (ROCs), and (3) the minimal detectable change with 95% confidence (MDC_{95}).

RESULTS: Data from 55 patients with COPD (mean age, 71.2 ± 7.1 y; mean FEV_1, 39.2 ± 15.8% predicted) were used in the analysis. The smallest estimate of MCID was from the ROC method. Anchor-based estimates of the MCID ranged from 3.5 to 7.1 for the BBS, 10.2 to 17.4 for the BESTest, and 14.2 to 18.5 for the ABC scale; their MDC_{95} values were 5.0, 13.1, and 18.9, respectively.

CONCLUSIONS: Among patients with COPD undergoing pulmonary rehabilitation, a change of 5 to 7 points for the BBS, 13 to 17 points for the BESTest, and 19 points for the ABC scale is required to be both perceptible to patients and beyond measurement error.

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Poor balance is a key modifiable risk factor for falls in older adults.[1] Given the negative health sequelae and high economic burden of falls,[2] fall prevention is a major health-care priority. Exercise with balance-specific training has been shown to be the only effective intervention for successfully reducing both the rate and risk of falling.[3] Accordingly, there is a large body of evidence devoted to examining exercise interventions for improving balance in older adults and in clinical populations with established balance impairment.

People with COPD have well-documented deficits in balance,[4-12] and several studies have noted a high risk of falls in this population.[13-15] In a study of > 16,000 older adults, the presence of COPD was the only chronic condition, out of the 13 examined, that predicted falls.[15] Individuals with COPD have an estimated annual fall rate of 1.2 per person, a fivefold higher rate than that reported for older adults.[14] We have previously shown that balance training incorporated into pulmonary rehabilitation (PR) can improve performance on measures of balance that are associated with fall risk.[16]

Therefore, it is important to establish the amount of improvement that can be considered important to patients and beyond measurement error. This information is critical for informing clinical practice and development of fall prevention strategies in this population.

A systematic review identified the Balance Evaluation Systems Test (BESTest), the Berg Balance Scale (BBS), and the Activities-Specific Balance Confidence (ABC) scale as recommended tools for assessing balance in patients with COPD, based on their breadth of content and validity.[17] However, this review highlighted that there was insufficient research examining their responsiveness in COPD. The aim of this study was to determine the minimal clinically important difference (MCID) of the BBS, BESTest, and ABC scale in patients with COPD enrolled in PR. Given the inherent strengths and weaknesses of distribution and anchor-based methods for determining responsiveness,[18] we used a combination of techniques to determine a range of MCID values that can be applied in specific clinical contexts.

Materials and Methods

We performed a secondary analysis of data from 55 subjects who participated in either a randomized controlled trial (RCT) of balance training (n = 36) (NCT01424098)[16] or a study of knowledge translation of balance training into PR (n = 19) (NCT02080442).[19] Both studies were conducted at the same center and used identical procedures for screening and assessing patients. Details of the balance training, study methods, and outcomes used have been previously published.[16] Briefly, the studies both involved individuals with COPD, enrolled in PR, who met one or more of three criteria: (1) a self-reported problem with their balance, (2) a history of one or more falls in the last 5 years, or (3) a report of a recent trip or loss of balance that resulted in a near fall. Those with comorbid conditions that might affect communication, balance, or safety were excluded. Patients assigned to the intervention group in the RCT and those in the knowledge translation study underwent 30 min of balance training three times a week for 6 weeks in conjunction with PR. Individuals assigned to the control arm of the RCT received only PR. All the outcome measures were collected prior to and on completing rehabilitation by the same rater, and all assessments were conducted by physiotherapists experienced in administering the balance tests. All subjects gave written informed consent, and the studies were approved by the West Park Healthcare Centre and Bridgepoint Health joint research ethics board (13-011-WP).

Balance Measures

Berg Balance Scale: The 14-item BBS[20] is a commonly used measure of balance in older adults. Discrete physical tasks, such as changes in body position, reaching, stair tapping, and standing on one leg, are evaluated on a scale from 0 (unable/unsafe) to 4 (independent/safe). Total scores on the BBS range from 0 to 56, with higher scores for better balance control. Evidence supports the BBS's construct validity[17] and sensitivity to change[21] following PR in individuals with COPD. Test-retest reliability and predictive validity for fall risk has been demonstrated in community-dwelling older adults.[22]

Balance Evaluation Systems Test: The BESTest is a 36-item comprehensive balance measure that evaluates six underlying postural control systems: biomechanics, stability limits/verticality, anticipatory control during postural transitions, reactive control strategies, weighting of sensory information, and stability during gait.[23] Total scores range from 0% to 100%, with higher scores indicating greater balance ability. Evidence supports the BESTest's construct validity in COPD[5,17] and sensitivity to change, test-retest reliability, and concurrent validity in adults with and without balance disorders.[23,24]

ABC Scale: Patients are asked to rate their confidence in maintaining their balance during 16 specific activities requiring progressively increased balance control on an 11-point scale.[25] Examples of tasks include standing on a chair and walking on an icy sidewalk. Overall scores range from 0% to 100%, with higher scores indicating greater balance confidence. The ABC scale has good test-retest reliability and predicts falls in older adults residing in the community.[22,25] In patients with COPD, the ABC scale has demonstrated construct validity as well as criterion validity for falls.[4,17]

Global Rating of Change Scale: The global rating of change scale (GRC) was administered only at 6 weeks; participants were asked to rate the amount of change they experienced in their balance over the 6-week period on a 5-point Likert scale with the following options: much better, a little better, no change, a little worse, or much worse. We selected a 5-point GRC to facilitate discrimination between categories of change and to be consistent with the number of categories (five to seven) previously recommended for such scales.[26]

Analysis

To optimally determine increments of meaningful change, a combination of distribution (ie, statistical distributions of change and reliability) and anchor-based approaches (ie, external criterion that reflects a patient's perspective) are recommended.[18,27] The following methods were used to calculate meaningful change estimates for each balance measure: