

## **Item Reduction and Factor Distribution of the Functional Arm Scale for Throwers© (FAST©)**

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**Background:** Upper extremity injuries in throwers may result in diminished health-related quality of life. The Functional Arm Scale for Throwers (FAST) is a region-specific patient self-report scale currently under development using a three-stage scale development process. During stage I, a 54-item scale was developed that reflects aspects of the disablement model (pain, impairment, functional limitations, disability and societal limitations).

**Purpose:** To complete stage II of the scale development process, including item reduction, factor distribution and discriminability assessment, thereby reducing the scale to less than 25 items, while preserving the variance characteristics and factor structure of the 54-item scale.

**Design and Setting:** Cross-sectional field study.

**Patients or Other Participants:** Convenience sample of 267 injured (122) and non-injured (145), male (192) and female (75) baseball and softball players (age=19.5±1.1 years, 11.9±4.8 years of experience) from multiple levels of competition (high school, college, professional).

**Methods:** Participants completed a demographic questionnaire and the original 54-item FAST. Pitchers (117) also completed a 9-item pitching module. FAST item response distributions, along with subscale and total scale Cronbach's alpha, inter-item correlations, factor structure, correspondence with 54-item version and association with known groups (injured vs non-injured). Items were selected from each subscale based on distributional characteristics (mean, variance, non-missing). Remaining items were examined with respect to inter-item correlation and item-to-scale correlations. Cronbach's  $\alpha$  was calculated for each subscale and items that lowered alpha were considered for exclusion. Discrimination of injured vs non-injured athletes was also tested.

**Results:** Exploratory factor analysis (maximum likelihood, varimax rotation) of the original 54-item scale yielded 4 factors. Factors reflected: Throwing (21 items), Activities of Daily Living (10 items), Psychological Effects (7 items) and Advancement (9 items). Following item reduction, 22 items were retained. The number of items retained and Cronbach's  $\alpha$  were: Throwing (10,  $\alpha=.95$ ), Activities of Daily Living (5,  $\alpha=.84$ ), Psychological Effects (4,  $\alpha=.85$ ) and Advancement (3,  $\alpha=.94$ ). A Pain subscale, crossing factor dimensions, was also tested (6 items,  $\alpha=.85$ ). Receiver operating characteristic curves were calculated, using known group (injured vs non-injured) as the state variable. Areas under the curve (AUC) were: Throwing (.92), Activities of Daily Living (.85), Psychological Effects (.79) Advancement (.93) and Pain (.91). For the full 22-item scale, AUC=.93. The factor structure was preserved and the 22-item scale accounts for 98% of the variance in the original scale. The 9-item pitching module was retained ( $\alpha=.98$ , AUC=.89).

**Conclusions:** The FAST was reduced from 54 to 22 items using an empirical item-reduction process.

**Clinical Relevance:** The reduced scale is more efficient to administer and score, has preserved the factor structure of the original scale and shows excellent discriminability for upper extremity injury in throwing athletes. Stage III of the scale development process will evaluate the measurement properties of the FAST.