



## INTRODUCTION

Patient reported outcomes are important for healthcare Unidimensionality: providers, and measuring latent variables can be challenging. Are we measuring one factor? The Foot and Ankle Activity Level Scale (FAALS) is a survey instrument for orthopaedic practitioners to collect information First factor should explain > 50% of variance. from patients. I used Item Response Theory, specifically the Rasch Measurement Model, to check the reliability and validity of the FAALS instrument based on a sample of 800 responses collected via webased survey platforms. Objectives

- 1. Test for Unidimensionality (One Factor = Ankle Activity)
- 2. Test for Reliability of the instrument scores (Repeatability)
- 3. Test for Validity of the instrument scores (Accuracy)
- 4. Examine various outputs of the instrument

## METHODS

- ‡ Collected data from webased survey platforms.
- ‡ Exactly 800 good quality, usable responses:
- **‡** 406 from SurveyMonkey and
- **±** 394 from Qualtrics
- *‡* Imported data into SAS for cleaning and sorting. <sup>‡</sup> Data cleaning described in another poster.
- **‡** Used WinSteps software for Rasch Analysis.
- **‡** Rasch Measurement Model for polytomous data:  $P_{nik}$  ( $X_{ni} = k | B_n, D_i, F_k$ ) =  $e^{(Bn-[Di+Fk])} / 1 + e^{(Bn-[Di+Fk])}$
- ‡ Answers were on-**p**oint Likert Scale.
- **‡** Used Principal Components Analysis of raw data to check for Unidimensionality.
- **‡** Rasch Measurement Model estimates Person and Item Reliability scores.
- **‡** Rasch Measurement Model estimates Infit and Outfit scores for validity using chiquare test.
- ‡ Rasch Measurement Model estimates Person Ability and Item Difficulty.

### SAS CODE SAMPLES

Used SAS for Data Clean Up, Organization, and Principal Components Analysis

Used WinSteps software for Rasch Analysis

Principal Components Analysis:

```
factor data = PCA method = prin plots = all ;
var FAALS_1 through F AALS_22;
where REJECT=0;
run;
     princomp data =PCA;
proc
    FAALS_1 through FAALS_22;
where REJECT=0;
run;
```

# Analysis of the Foot and Ankle Activity Level Scale (FAALS) Instrument Using the Rasch Measurement Model Greg Balkcom (2<sup>nd</sup> Year MSAS Student)

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### Reliability:

Value should be near 1.0

Validity:

InFit and OutFit between 0.4 and 1.4

Item Characteristic Curve

## Rasch Model Outcomes for Measuring Ankle Activity:

Wright Person-Item Map

Probability Category Curve

Reliability: Person Reliability = 0.9 and Item Reliability = 1.0Both well within accepted values.

Validity : Person InFit = 0.99, Person OutFit = 1.00, Item InFit = 1.00 ar Item OutFit = 1.01. All values near target of 1.0

Invariance (Differential Item Functioning): Measured by testing for Differential Item Functioning. Items 16, 19, and 21 suspect in SurveyMonkey (t > 1.96)

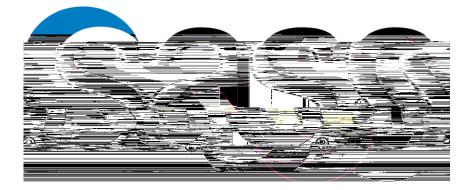
Measuring Ankle Activity and Item Difficulty:

Wright PersonItem Map Shows person ability and item difficulty on the same scale (log scale, or logodds). Shows number of people at each ability level, and item difficulty for each question.

Item Characteristic Curve This curve ties together Person Ability and Item Score on eac item. X-axis is difference between Person Ability and Item Difficulty. Higher ability = Higher score.

Probability Category Curve Curve that indicates the probability of selection for each of the answer categories (Unable to Do, Extreme Difficulty, Moderate Difficulty, Slight Difficulty, and No Difficulty). Higher ability = Higher score.

<sup>‡</sup> Data were collected through 2 different **fay** data crowdsourcing platforms: Qualtrics and SurveyMonkey **‡** Rasch Measurement Model does not account for : *‡* Item Discrimination or Guessing ‡ Other modeling approaches could be used: ‡ Classical Test Theory (See James Down Poster) ‡ 1-Parameter or-₽arameter Item Response Theory



## RESULTS

### Unidimensionality:

Principal Components Analysis indicates one factor explains 63.28% of variance. To meet assumptions, first facto should explain > 50% of variance.

### **Conditional Probabilities**

Indicates the thresholds between the answer categories.

### **Test Information Curve**

### LIMITATIONS