Repeated Measures in the Rasch Model

Maren Böcker¹, Mike Horton²

1. Institute of Medical Psychology and Medical Sociology, RWTH Aachen University, Germany
2. Psychometric Laboratory for Health Sciences, University of Leeds, UK
Measurement of change in clinical rehabilitation

• Assessment of change with PRO measures = one of the most significant areas of application of assessment instruments

pre-treatment  Treatment  post-treatment
ERTG-meeting 2016
Repeated Measures

Sunday

Friday
Measurement of change in clinical rehabilitation

- Longitudinal data designs play an important role in:
  - tracking therapy progression & outcome of single patients
  - evaluating therapy outcome of whole clinics (quality management)
  - judging treatment effects of psycho-therapeutic or medical treatments in effectiveness or efficacy studies

**Importance of:**
- statistically sound assessment instruments
- appropriate methods for analyzing multiple assessment points
Some problems of traditional approach of measurement of change

- Use of sum score of a PRO (ordinal scale!)
- Assumption of measurement invariance over time
- Assumption that measurement error is constant across the construct being measured
Some problems of traditional approach of measurement of change

- Use of sum score of a PRO (ordinal scale!)
- Assumption of measurement invariance over time
- Assumption that measurement error is constant across the construct being measured
Use of sum score of a PRO

**Implications**

Not meaningful to calculate:
- means & sd
- t-tests & ANOVAs, …
- change measures

**Ordinal scale**

**Interval scale**
Some problems of traditional approach of measurement of change

- Use of sum score of a PRO (ordinal scale!)
- Assumption of measurement invariance over time
- Assumption that measurement error is constant across the construct being measured
Measurement invariance over time???

? =

______

______
Some problems of traditional approach of measurement of change

- Use of sum score of a PRO (ordinal scale!)
- Assumption of measurement invariance over time
- Assumption that measurement error is constant across the construct being measured
Assumption that measurement error is constant across the construct being measured
Possible solution: Family of Rasch models

\[ P(x_{vi}=1) = \frac{\exp(\xi_v - \sigma_i)}{1 + \exp(\xi_v - \sigma_i)} \]
The Problems & the Rasch model

• use of sum score of a PRO (ordinal scale!) ✓
  sum score → interval scaled person estimate

• assumption of measurement invariance over time ✓
  can be tested and accounted for (e.g. DIF)

• assumption that measurement error is constant across the
  construct being measured ✓
  variable measurement precision (TIF)
Rasch model = THE SOLUTION!
Traditional Rasch approach of measurement of change

- Use of ordinal Rasch model ⇒ originally developed for data analysis of one assessment point

BUT, in a longitudinal data design we have to account for

- Item parameter drift
- Trait dependence over time
- Local dependence of items across time

⇒ Even most of the longitudinal Rasch models don‘t address all of these issues. 😞
Measurement of Change: Approaches

I. separate analysis (without anchor)
   (Or, in CTT, just compare raw scores)

II. separate analysis (with anchor)
   or

III. Stacking

IV. Mallinson-Approach
Mallinson-Approach

Time 1 & 2, each person once (randomly)

apply anchor files to ...

or