

Adaptive Assessment of Stroke Impact

Part of the STIRCAT Project
(Stroke, Item Response Theory and
Computerized Adaptive Testing)



Thomas E. Love, Ph. D.

Case Western Reserve University

thomaslove@cwru.edu

August 2003 – JSM San Francisco

Stroke: #1 Cause of Adult Disability in the U.S.

- Each year, about 750,000 Americans will suffer a new or recurrent stroke.
- Stroke kills 160,000 Americans each year
- Annual US stroke care cost: ~ \$30 Billion
- Stroke affects multiple dimensions of health
- Tremendous variation in presentation, severity of stroke, and outcomes

No Single Measure Covers the Range of Stroke's Impact

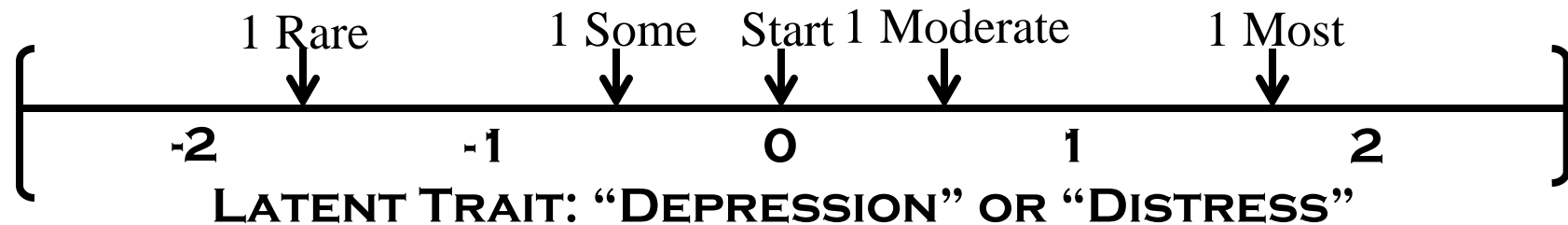
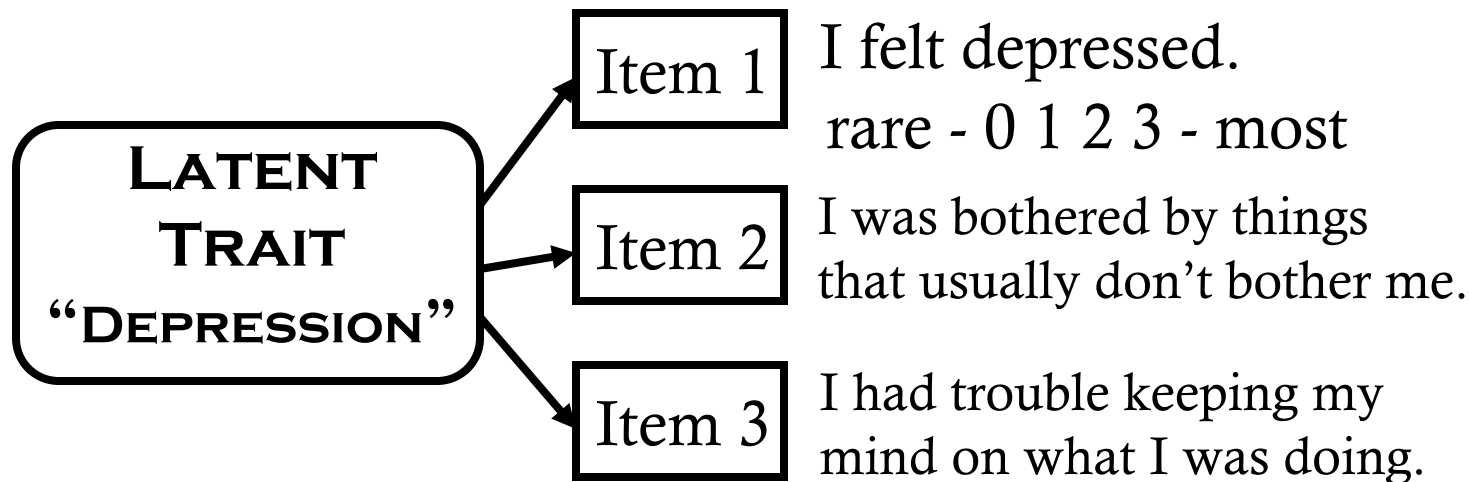
- No gold standard – no consistency across trials or even in timing of assessments
- Need for multi-dimensional outcomes
 - What to focus on? Neurological impairment, Functional disability, Daily tasks, Behavior?
 - Physical, Emotional, Social domains of QoL
- Existing measurement tools (i.e. SF-36) show pronounced floor and ceiling effects, and poor sensitivity to change

Measuring Stroke's Impact in Acute Stroke Trials

- Barthel ADL Index, NIH Stroke Scale
- Modified Rankin Scale
 - 0 = No symptoms
 - 1 = No significant disability
 - 2 = Slight disability
 - 3 = Moderate disability
 - 4 = Moderately severe disability
 - 5 = Severe disability
 - Often dichotomized (i.e. Rankin ≤ 2 or not)

See Parmigiani et al. in the June 2003 *JASA*


Item Response Theory [IRT]




- IRT is a family of mathematical descriptions of what happens when a subject meets an item.
- IRT explicitly postulates a single dimension of an underlying (latent) trait that explains item responses.

Computerized Adaptive Testing [CAT]


ITEM POOL	ADL	○○○○○○○○
□□□□□□□□	△△△△△△△	Impairment
Depression	△△△△△△△	○○○○○



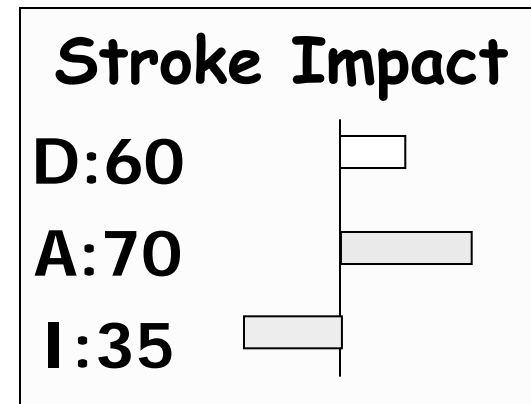
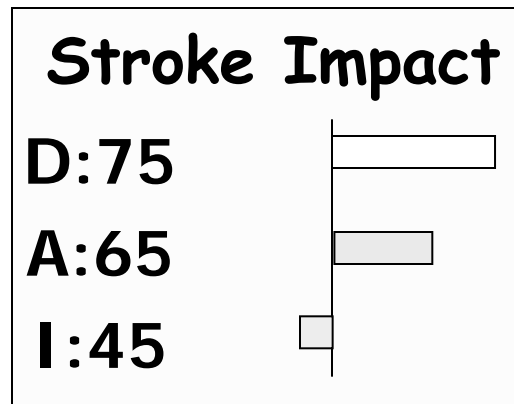
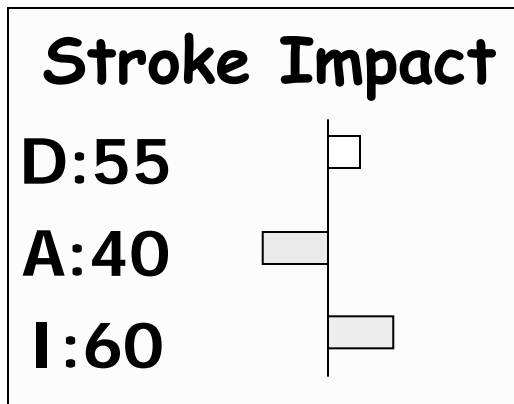
□□
△△
○○○○○○



□□□□□
△△△
○○



□□□
△△△△
○○○



Tailored assessment for each patient/study.

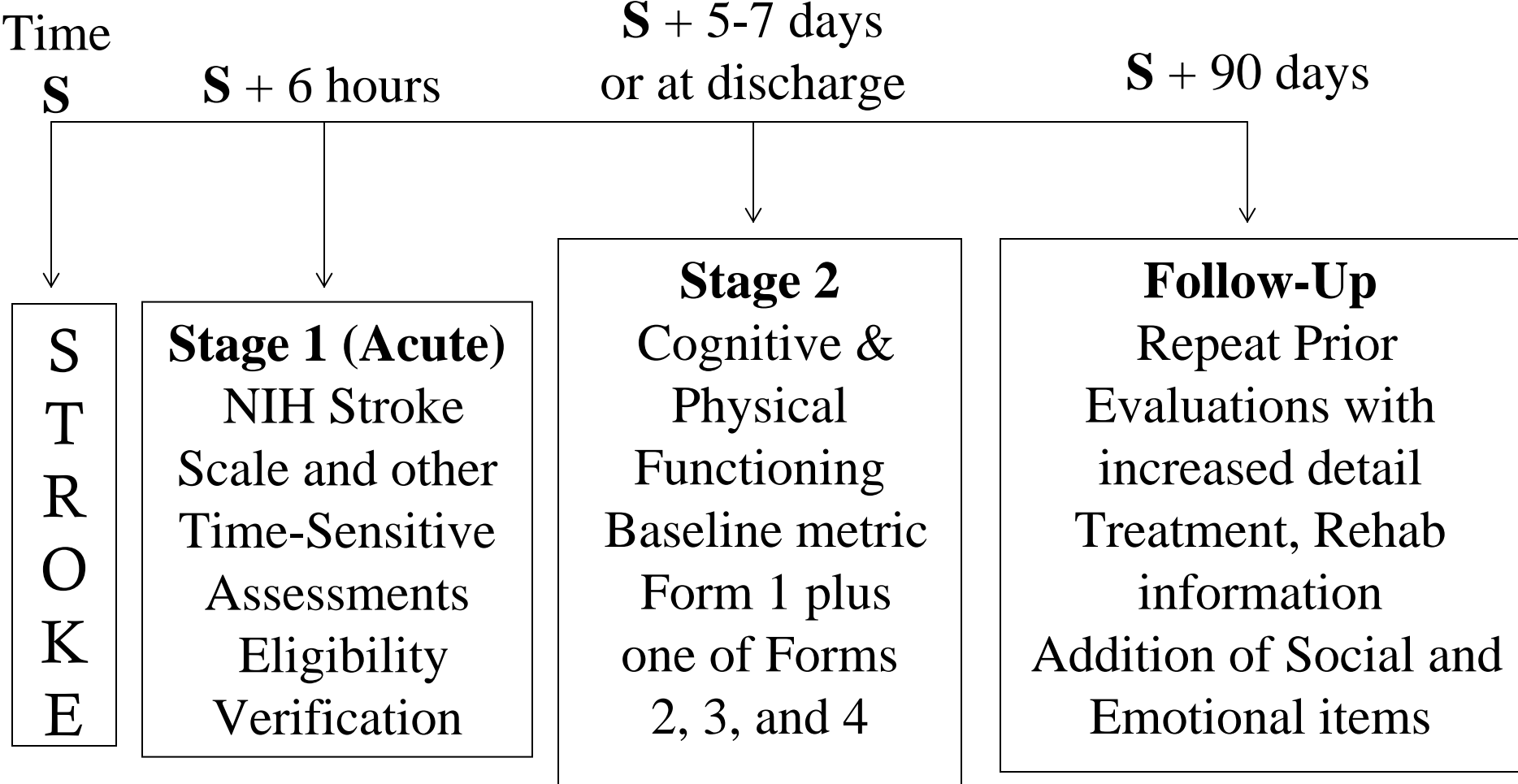
Pilot: Foundations for Adaptive Stroke Impact Assessment

Goal: Multi-dimensional metric to assess impact of post-stroke interventions.

1. Develop an **item bank** to cover the range of outcomes in domains of interest.
2. Perform **item calibration** study.
3. Fit polytomous IRT models to data (partial credit and graded response approaches)
4. Assess **value** of IRT/CAT for Stroke.

Pilot Support from MetroHealth: NIH grant #GCRC M01 RR00080

STIRCAT Assessment Timeline



Impact of STIRCAT Project

- Large **database** of items and responses available for development of new tools
- Flexible **CAT procedures** available for pilot use, complete with adaptive scoring algorithms and summary reports.
- Brief **tailored scales** available for individual dimensions with well-described psychometric properties.