Hearing Aid Outcome Measures in Older Adults:
What to Measure and *When*

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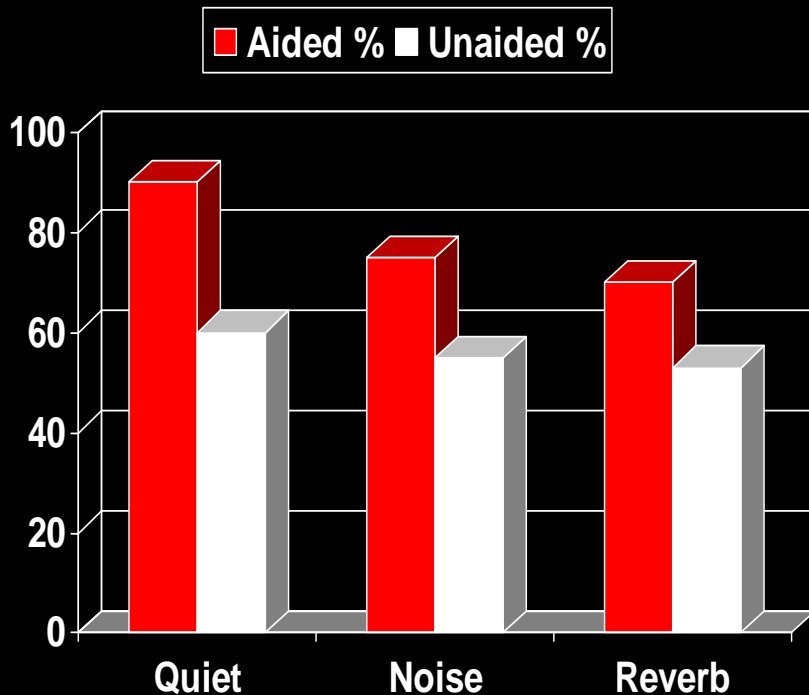# Hearing-Aid Outcome Measures

Objective Performance and Benefit

Subjective Benefit

Satisfaction

Usage

Objective Performance and Benefit
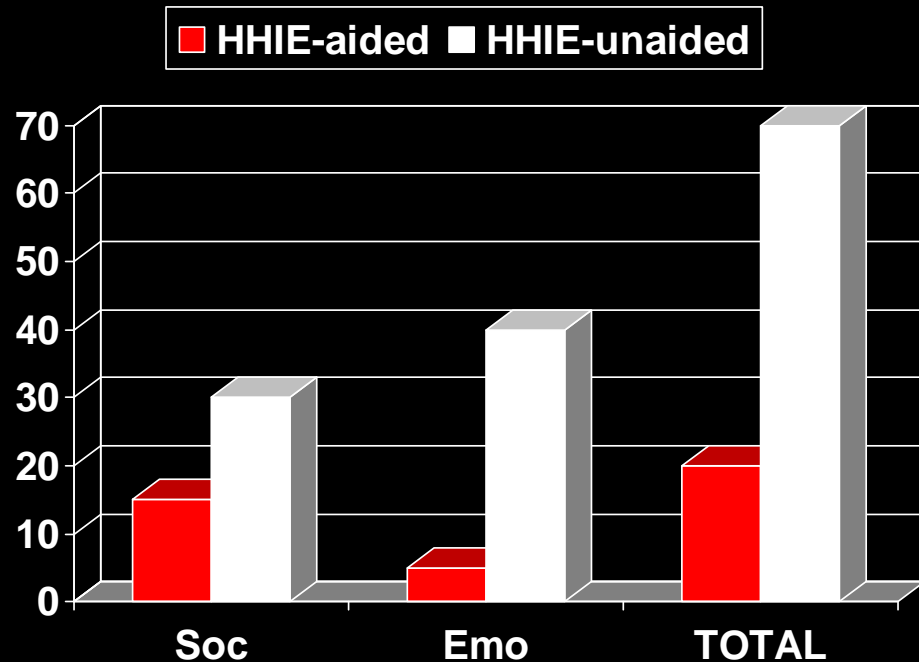

Aided and Unaided
Speech Recognition

- Materials
  - Syllables, words, sentences
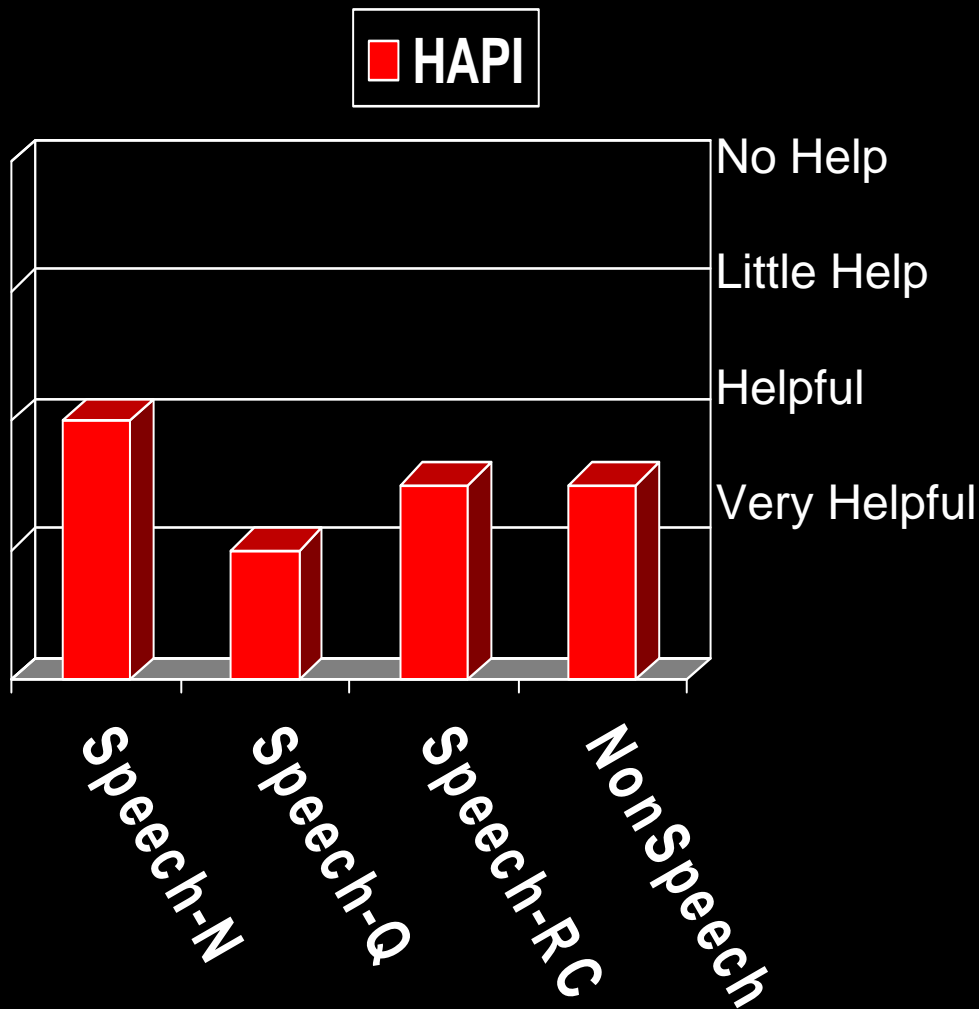
- Listening Conditions
  - Speech Level
  - Background
  - Azimuth

Subjective Benefit

- Subjective Scales
- Assessment of *CHANGE* from Unaided to Aided
- Examples
  - HAPI or SHAPIE
  - Benefit Profiles
    - PHAB, APHAB, COSI
  - Hearing Handicap
    - HHIE

Subjective Benefit

HAPI

Chart with categories Speech-N, Speech-Q, Speech-RC, NonSpeech and y-axis labels (top to bottom): No Help, Little Help, Helpful, Very Helpful

- Self-Report Scales

- Assessment of *CHANGE* from Unaided to Aided via "helpfulness" of HA

- Example
  - HAPI, Hearing Aid Performance Inventory

Hearing Aid Satisfaction

Rate your satisfaction with the following *HA features* (VS,S,N,D,VD)

- Overall fit/comfort
- Hearing aid size
- Visibility to others
- Ease of adjusting volume
- Whistling/feedback
- Clearness of sound

Rate your satisfaction with the HA in the following *listening situations*

- Conversation with 1 person
- In small groups
- Outdoors
- In large groups
- Watching TV
- On the telephone

MarkeTrak series, S. Kochkin

Hearing Aid Usage

- Objective Measures
  - "Datalogger"
  - Battery weight
- Subjective Measures
  - single reports of "typical usage"
  - diaries or use "logs"
  - average hours used per day vs. recommended hours

Many Outcome Measures

Performance

Benefit

Satisfaction

Usage

- How are they related?
- Do they all measure the same thing?
- Do they interact in a simple or complex manner?
- Are some more important than others?
- ????

Our Approach to Sorting this Out

- Obtain multiple measures of hearing-aid outcome from large numbers of hearing aid wearers at the same time (4-6 wks post-fit)

- Examine associations (correlations) among measures

- Determine if the large set of outcome measures can be reduced to a smaller set (factor analysis)

The IU Studies
(IU-1 to IU-4)

KEY COLLABORATORS:
Nathan Amos
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Gretchen Burk
Carolyn Garner
Lisa Goerner
Dana (Wilson) Kinney
Elizabeth Thompson
+ many students!

IU-1 (Humes et al., 2001, 2002)

- Study with 173 HA wearers
  - Binaural full-concha **ITE** hearing aids
  - *single-channel LINEAR Class D w/ OLC* (NAL-R)

IU-2 (Humes et al., 2004)

- Study with 53 HA wearers
  - Binaural *ITC* hearing aids
  - *2-channel WDRC* (FIG 6 Rx)

IU-3
(Humes, 2007; Humes et al., 2009)

- Study with 109 HA wearers
  - Binaural digital 4-channel WDRC ITE hearing aids
  - With directional mics (in ½ of wearers)
  - NAL-NL1

IU-4 (Humes et al., 2009)

- Follow-up IU study with 35 HA wearers
  - Binaural digital 6-channel WDRC BTE open-fit hearing aids
 - With directional mics
  - NAL-NL1

Common Features across IU Studies

- Shared set of 12 outcome measures
- Outcome measures completed at 4-6 weeks post-fit
- Strict protocol followed in each study, with many common features across studies
  - Older adults with typical bilateral sloping hearing loss as participants
  - Similar gain targets and real-ear verification
  - Same core team of clinicians in same clinic

Summary of Outcome Measures

- 12 outcome measures common to all four studies of hearing-aid outcome
  - 3 measures of speech recognition--aided & unaided (2x ea), plus difference between them
    - CST, 65 dB SPL, +8 dB SNR (babble), 0/180
  - 4 HAPI subscales
  - 1 HA Satisfaction (from MarkeTrak), HASS
  - 3 GHABP (use, benefit, satisfaction)
  - 1 HA Use (avg hours/day), from daily diaries

Results (N=368)
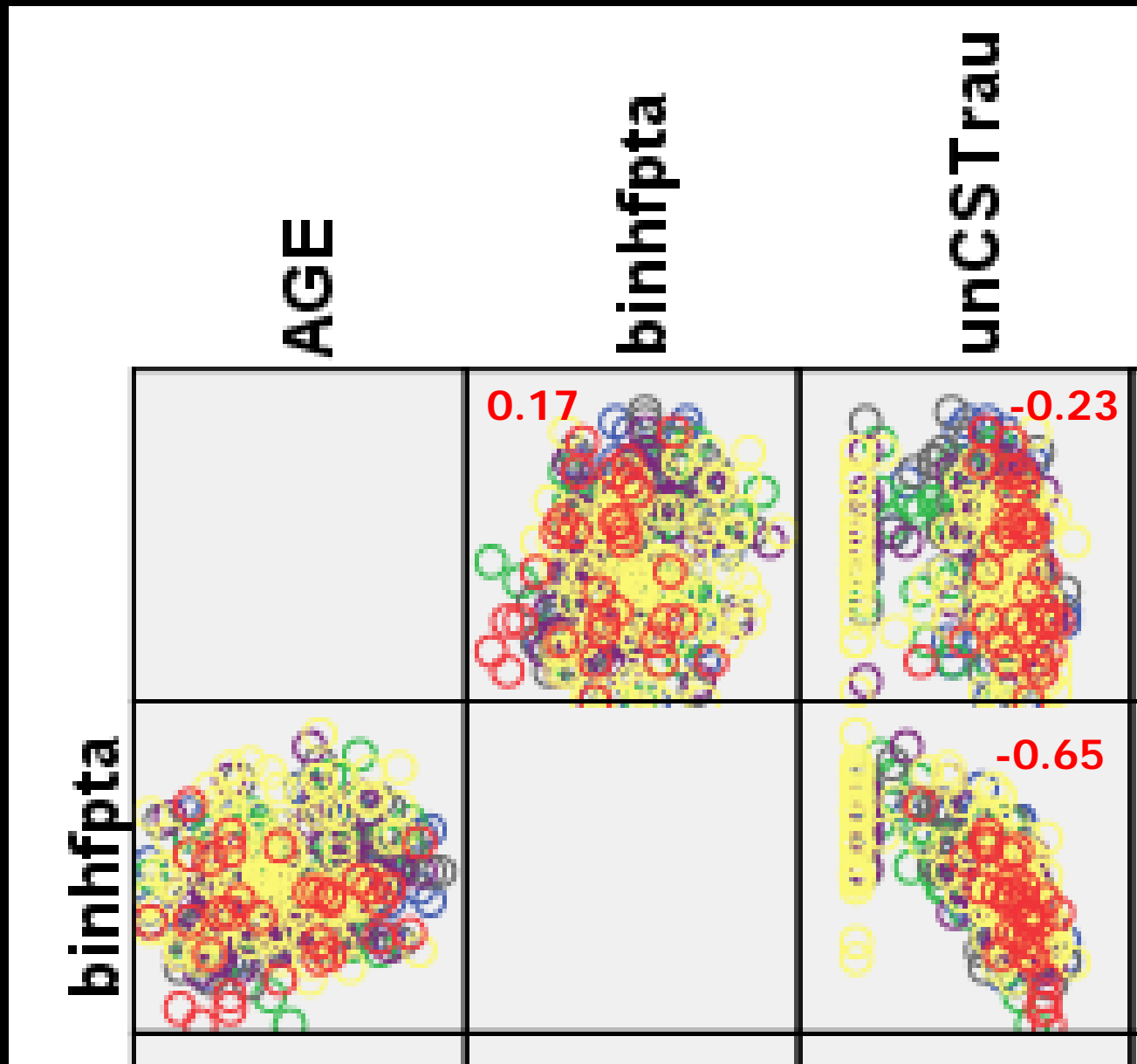
Results (N=368)

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Factor Analysis Overview

- **Attempts to reduce redundancy among measures or variables by examining the way in which the measures co-vary (*correlations*)**

- **# of factors can range from 1 to *n*, where *n* is the number of measures**

- **"Goodness of fit" for the factor structure that emerges is indicated by % of variance accounted for by all factors, which also reflects the importance of each factor**
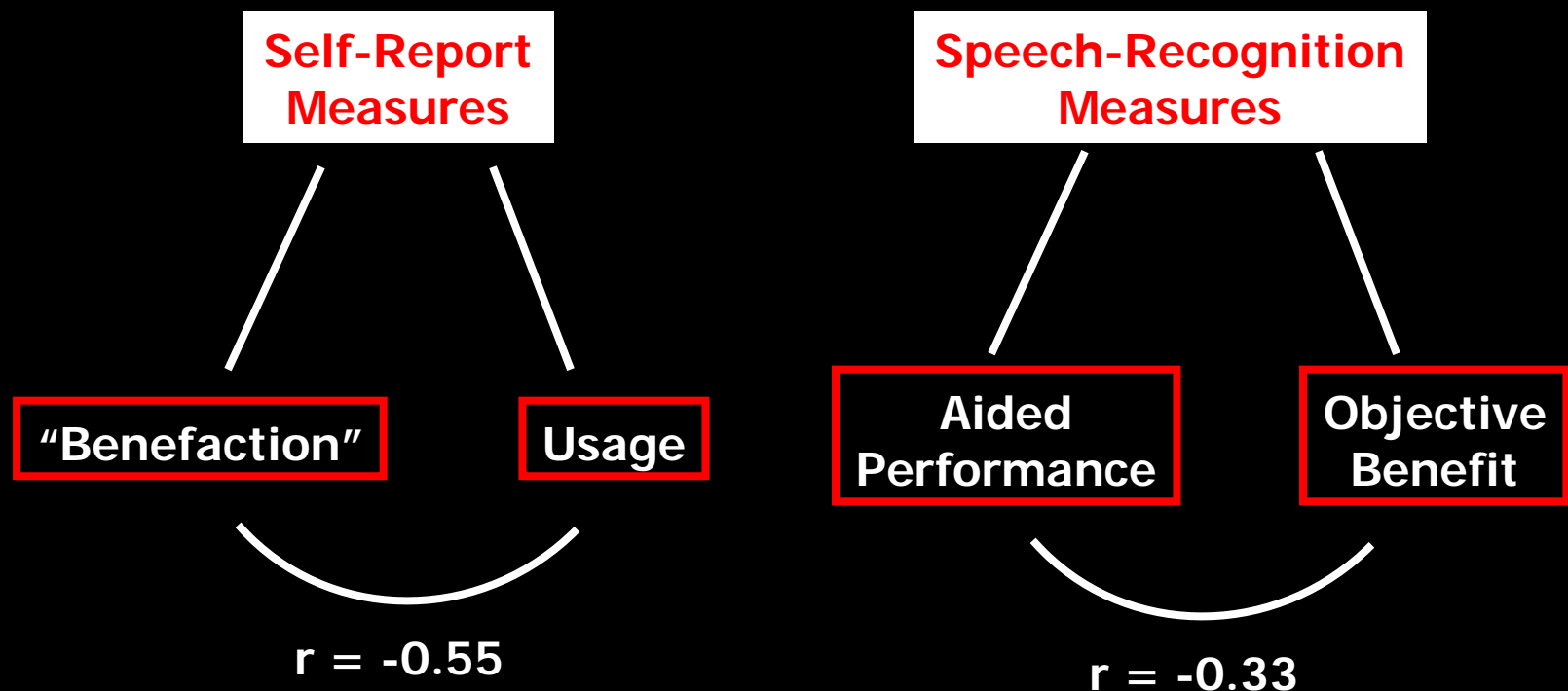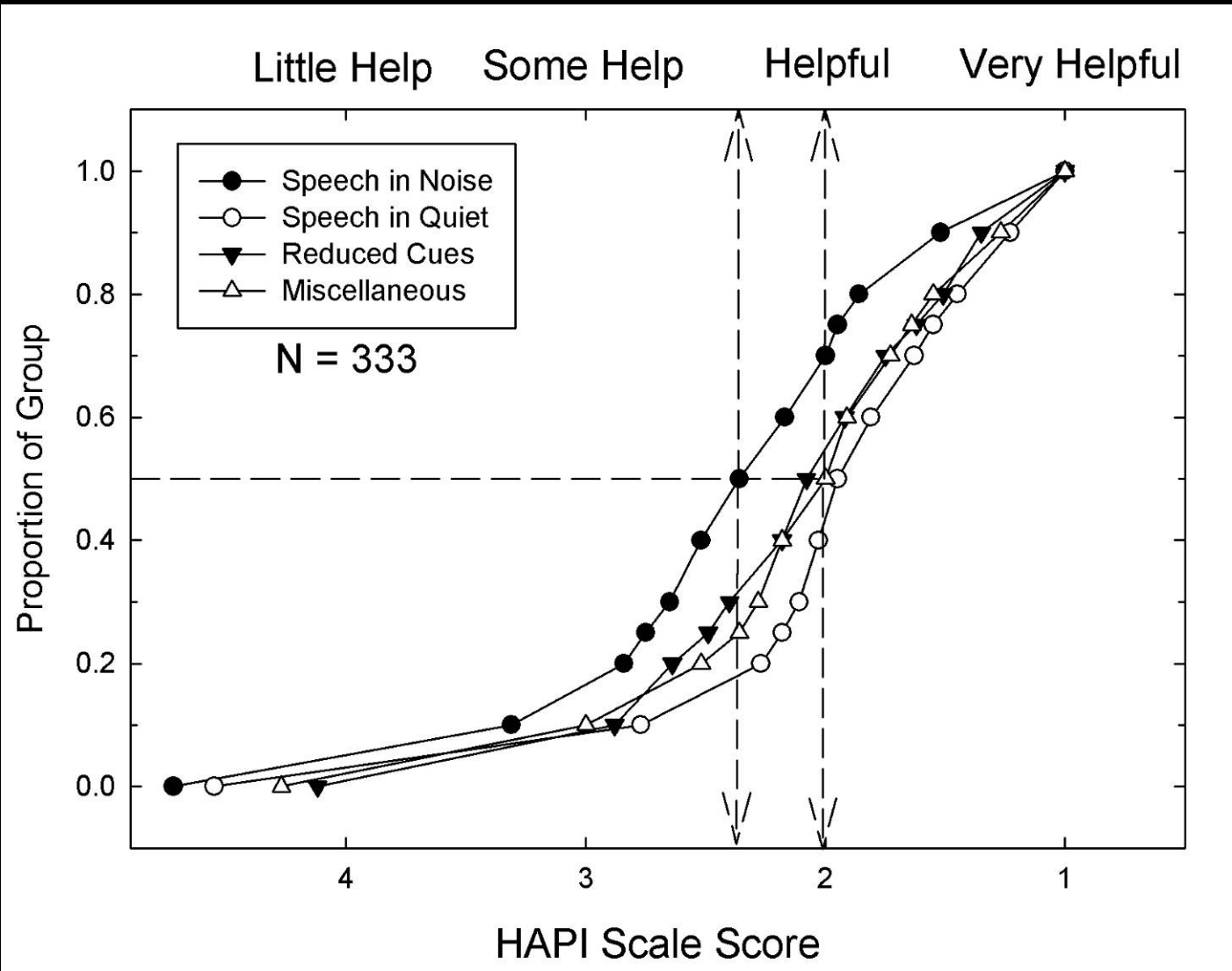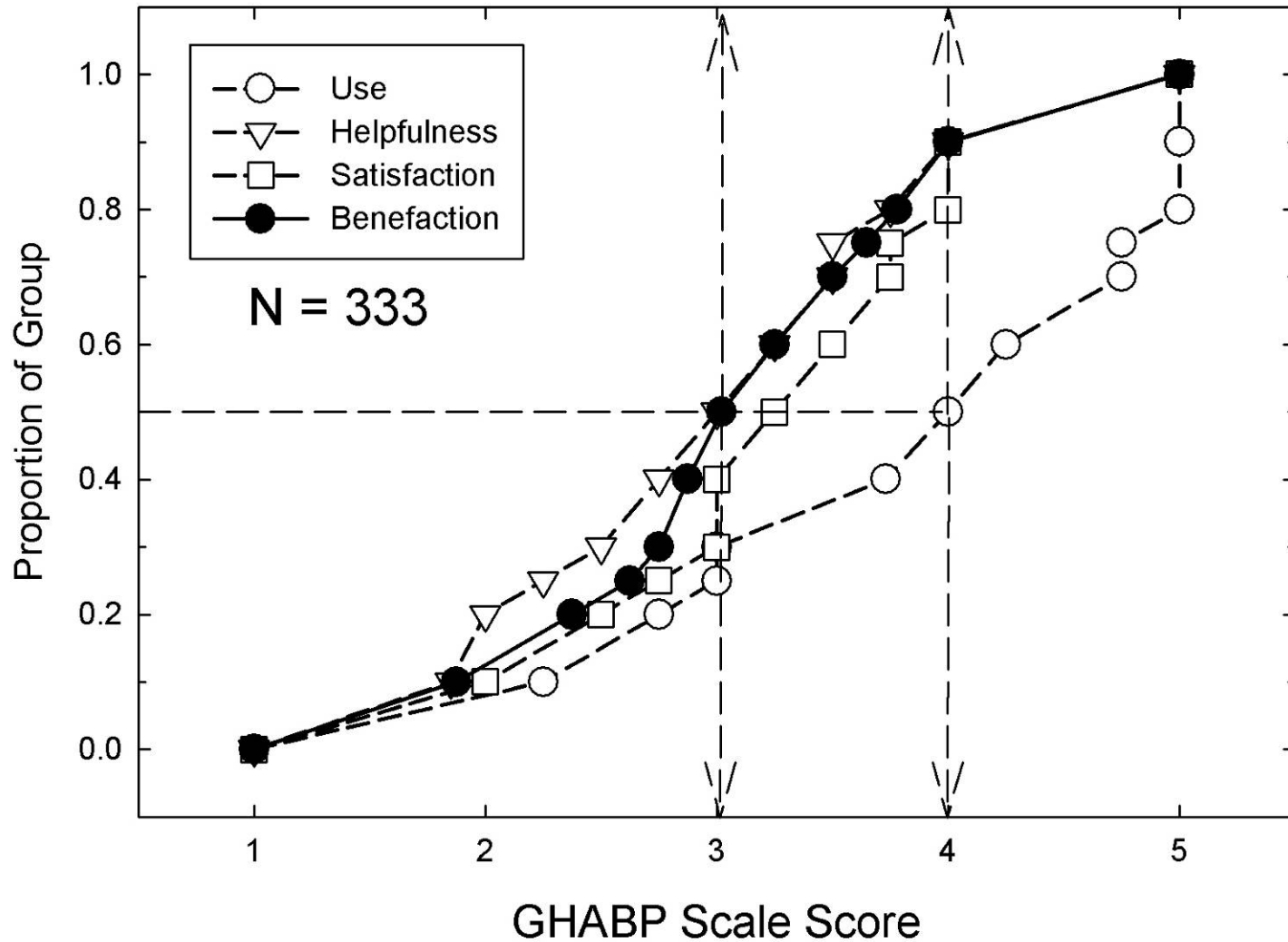
Conclusions re: *What* to Measure

- There are four dimensions of hearing-aid outcome
  - Subjective Benefit and Satisfaction ("benefaction")

  - Hearing Aid Usage

  - Aided Speech-Recognition Performance

  - Objective Benefit (Aided vs. Unaided Speech-Recognition Performance)
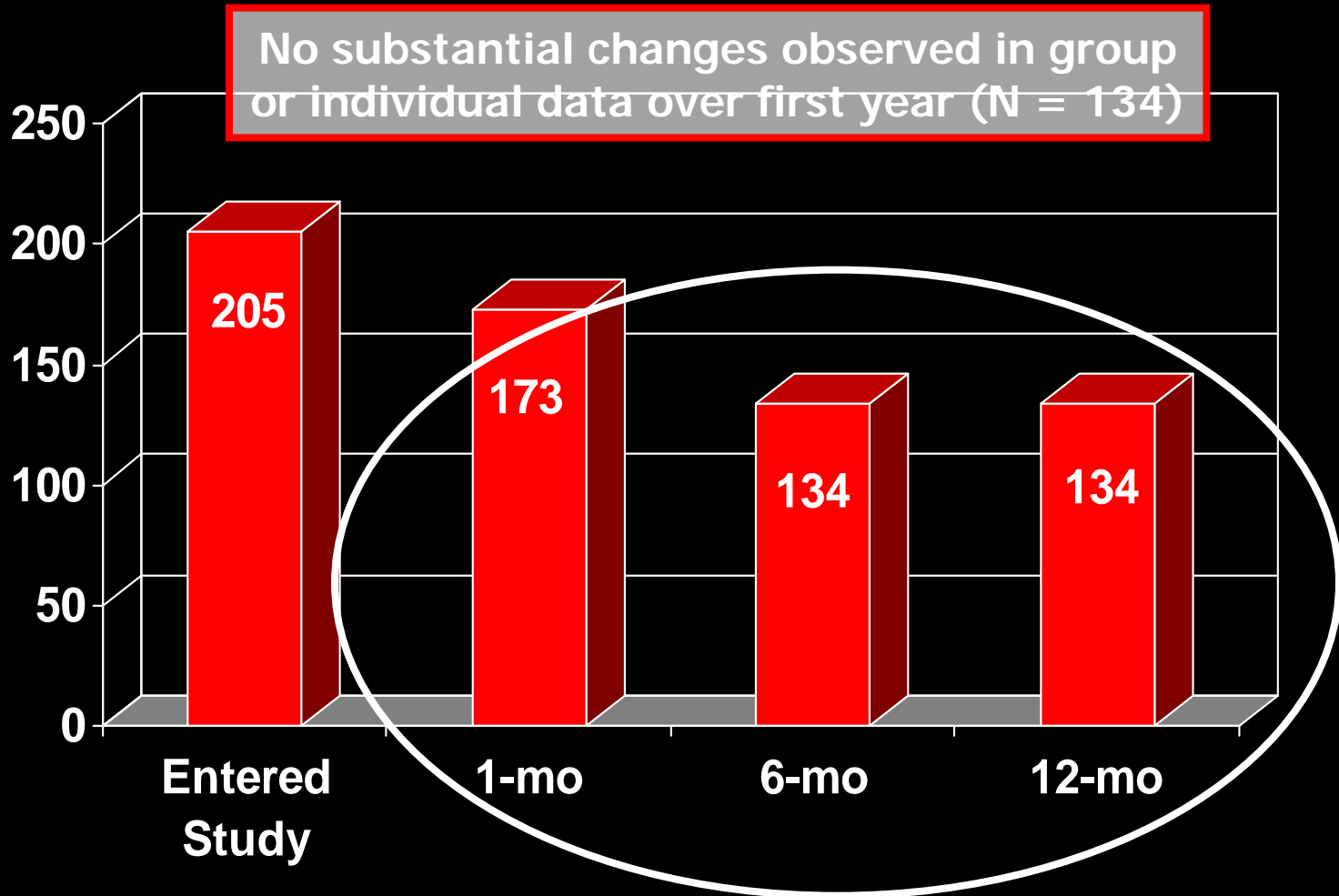
Norms (Humes et al., 2009)

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When to Obtain Measures?

- Do the outcome measures change over time and, if so, in a similar manner for most people?

Summary of Longitudinal Data

No substantial changes observed in group or individual data over first year (N = 134)

Smaller groups followed for 2 years (N = 43) and 3 years (N =9) with the same results

CONCLUSIONS re: *When* to Measure

- Few changes in "objective" performance or benefit were observed over time

- Some changes in "subjective" measures (benefit, satisfaction, use) occurred over time

  – Measures got WORSE after 1 month of use

Valid Outcome Measures Can Be Obtained at 4-6 Weeks Post-fit