

Relationship between Acceptable Noise Levels and Hearing Aid Success

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INTRODUCTION

Rationale

Audiologists and consumers both desire the ability to predict hearing aid success prior to purchase. Poor success with hearing aids can occur for several reasons, but the primary reason is difficulty understanding speech in the presence of background noise. In 1991, Nabelek et al. hypothesized that a person who accepts more background noise will be more successful with hearing aids. The researchers developed the Acceptable Noise Level (ANL) test, to test their theory on speech in noise tolerance. The ANL test measures a person's acceptance of background noise.

The ANL test is proposed to predict hearing aid success. Developers of the ANL test have used a single question about HA use as the measure for hearing aid success. One limitation of this application is that HA use encompasses only one aspect of HA success. Many researchers have conducted studies on the components of HA success and found that hearing aid success is multi-dimensional. Based on a review of the literature, a working definition of HA success was created for this study using seven different outcome domains.

The purpose of this study was to investigate the association between ANL scores and hearing aid success, when hearing aid success is defined using a multi-dimensional format.

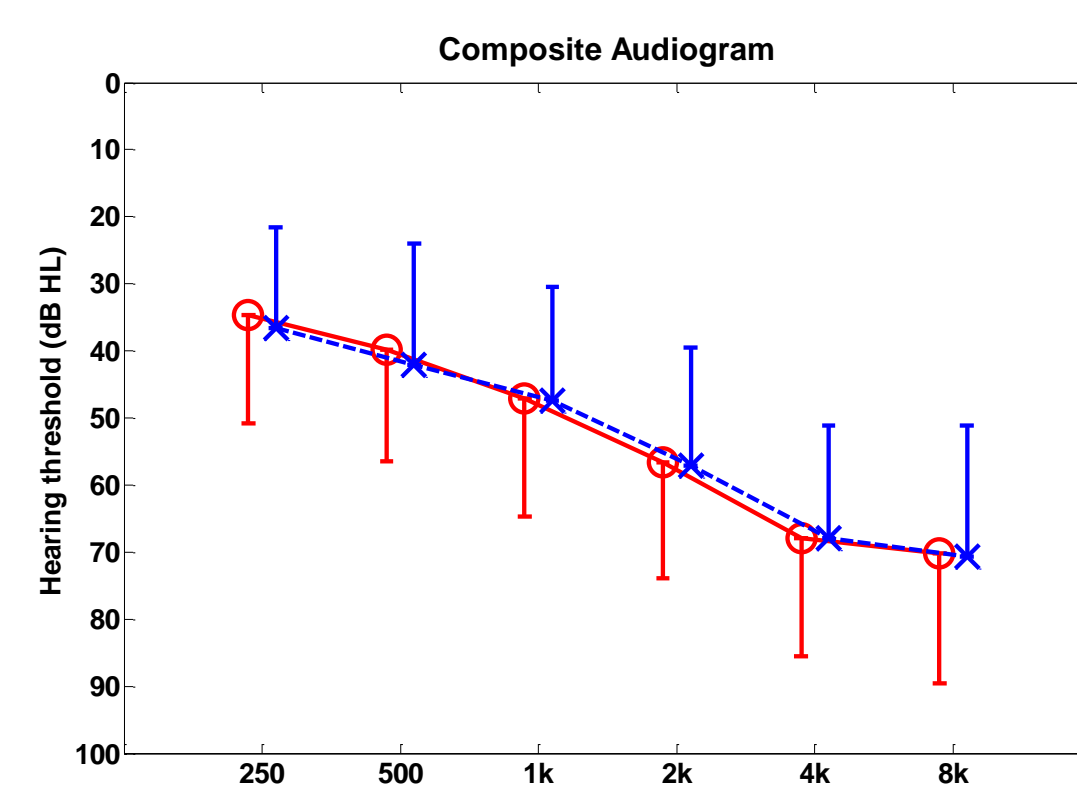
Research Questions

1. To what extent are the seven outcome domains of hearing aid success associated with ANL scores?
2. Can clinically obtained ANL scores allow audiologists to predict whether a patient will be successful with hearing aids?

METHODS

Subjects

- 42 subjects with sensorineural hearing loss
- Mean age: 66 yrs
- Range: 40 – 82 yrs
- At least 6 months of bilateral hearing aid experience



Predictor Variable

Acceptable Noise Level Test

Stimuli: ANL Test CD

Condition: Unaided

ANL Administration

- Subjects controlled sound with a hand-held response box
- Most Comfortable Level (MCL) established
- Background Noise Level (BNL) established
- ANL calculated by MCL - BNL
- Scoring was computed by averaging 2 ANL scores

METHODS

Measuring Hearing Aid Success

Although no universal description of hearing aid success has been published, extensive literature review revealed seven hearing aid outcome domains that contribute to hearing aid success. One test was chosen to measure each domain.

Outcome Domain	Abbreviation	Test
Subjective Speech Benefit	APHAB	Abbreviated Profile of Hearing Aid Benefit (Global Score)
Objective Speech Benefit	QSIN	Quick Speech In Noise Test
Change in Quality of Life	PIADS	Psychosocial Impact of Assistive Devices Scale
Satisfaction	SADL	Satisfaction with Amplification in Daily Life
Residual Problems	HHIE	Hearing Handicap Inventory for the Elderly
Hearing Aid Use	USE	Device Oriented Subjective Outcome (Use Subscale)
Change in Negative Reactions to Loud Sounds	AV	Abbreviated Profile of Hearing Aid Benefit (AV Subscale)

PROCEDURE

Outcome Variables

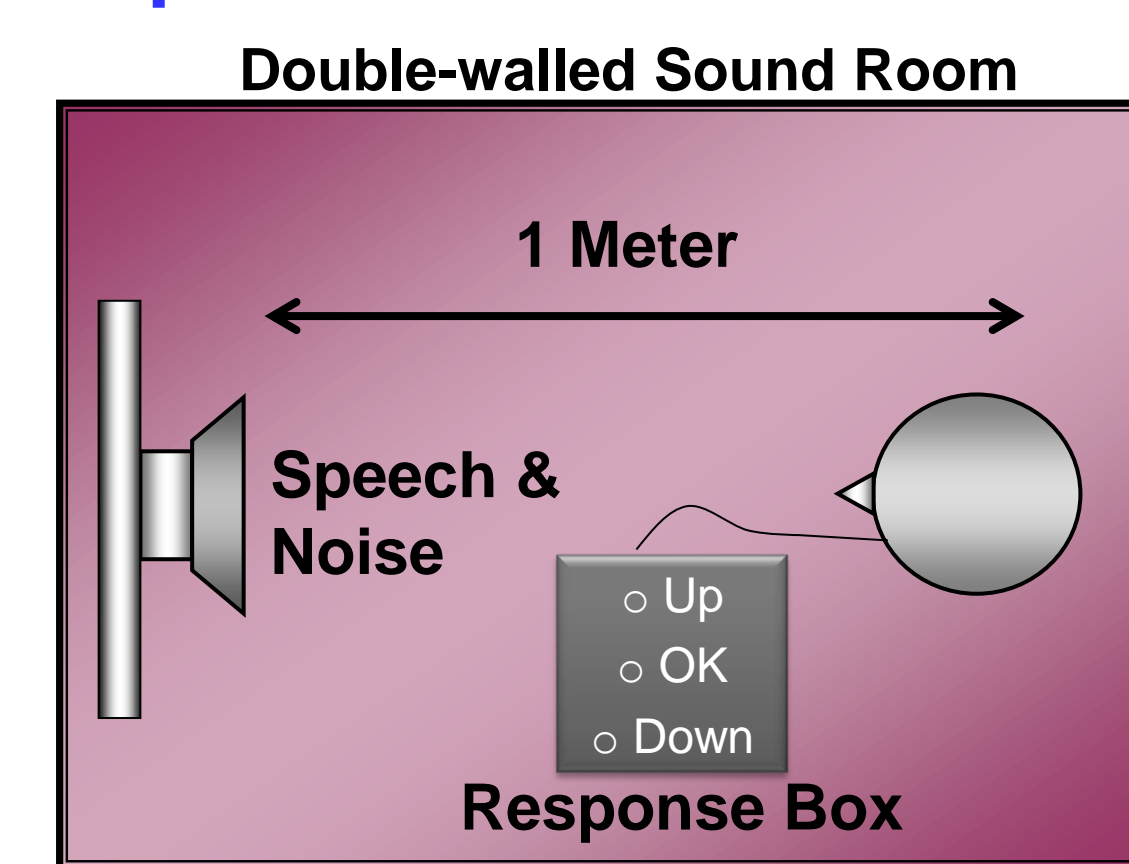
Questionnaire Administration

- All questionnaires were administered prior to speech testing
- Questionnaire order was randomized to minimize bias

QSIN Administration

- Conditions: Unaided and Aided (Bilateral)
- Stimulus level: 50 dBHL
- Listening conditions and lists were controlled to minimize learning and fatigue effects
- 6 QSIN lists per condition (aided and unaided)
- Scoring calculated by total words correct (each condition)
- Benefit score was computed by Aided score – Unaided score

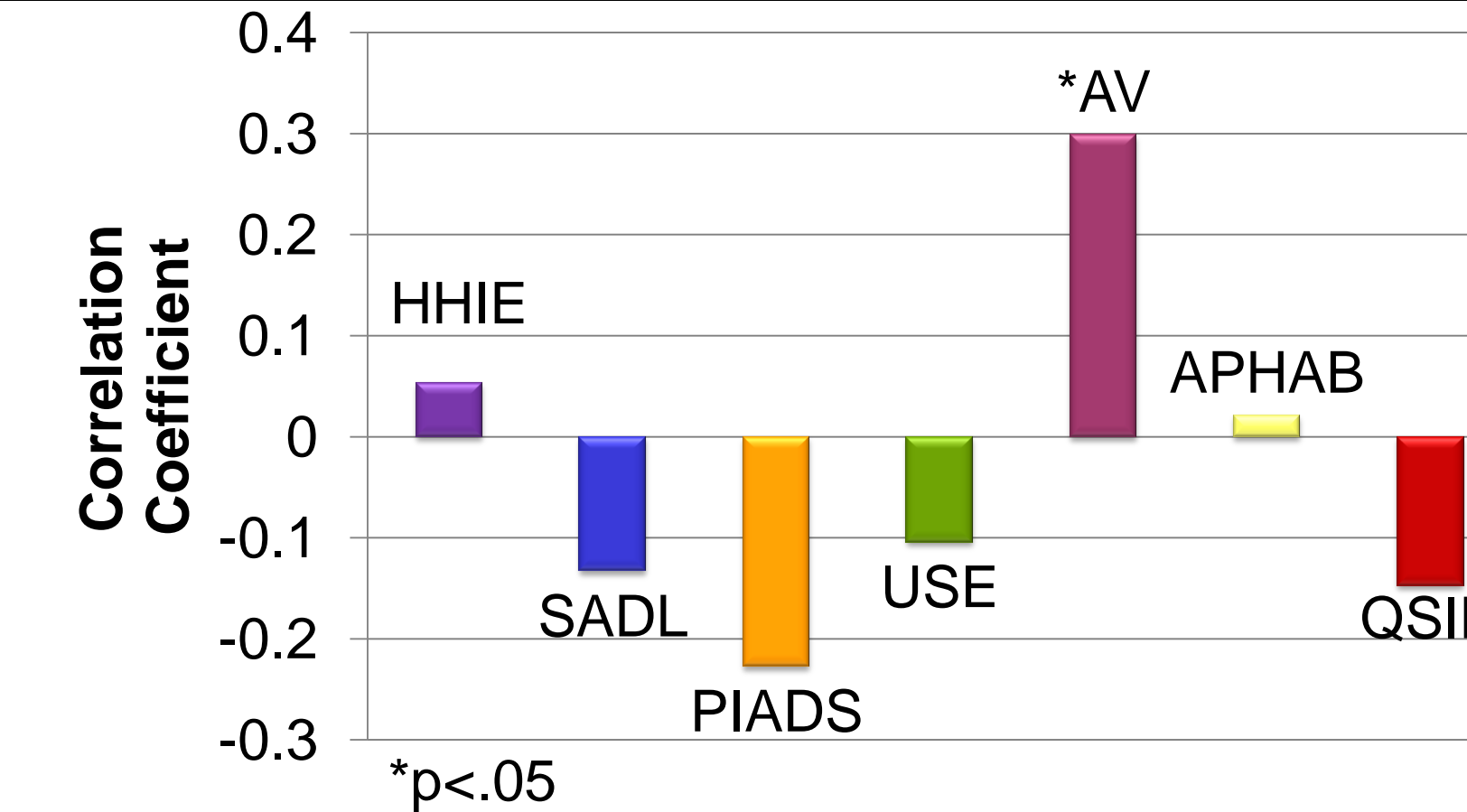
Speech Test Set-Up for ANL and QSIN



RESULTS

1. To what extent are the seven outcome dimensions of hearing aid success associated with ANL scores?

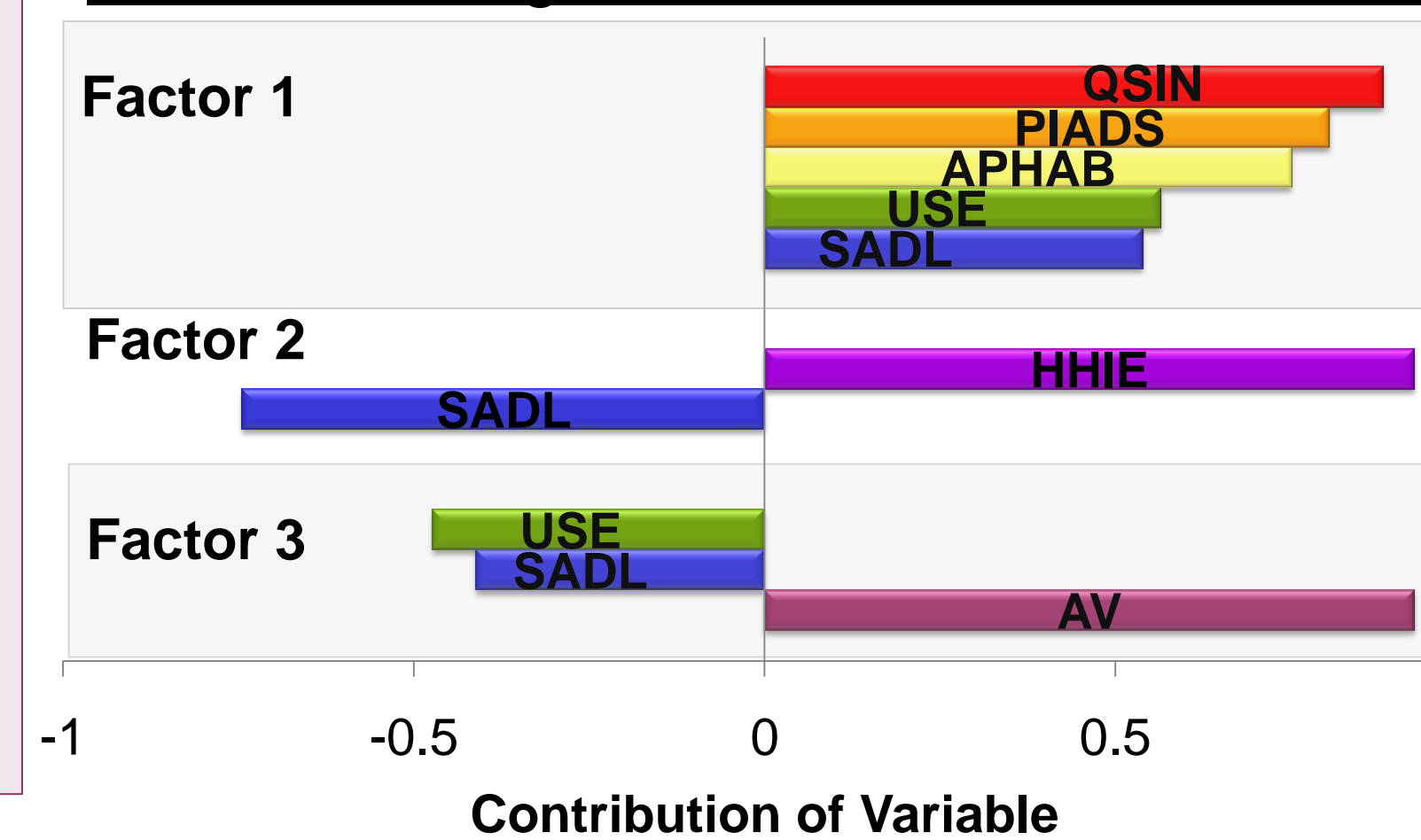
Correlation Between Each Outcome Domain and ANL Score



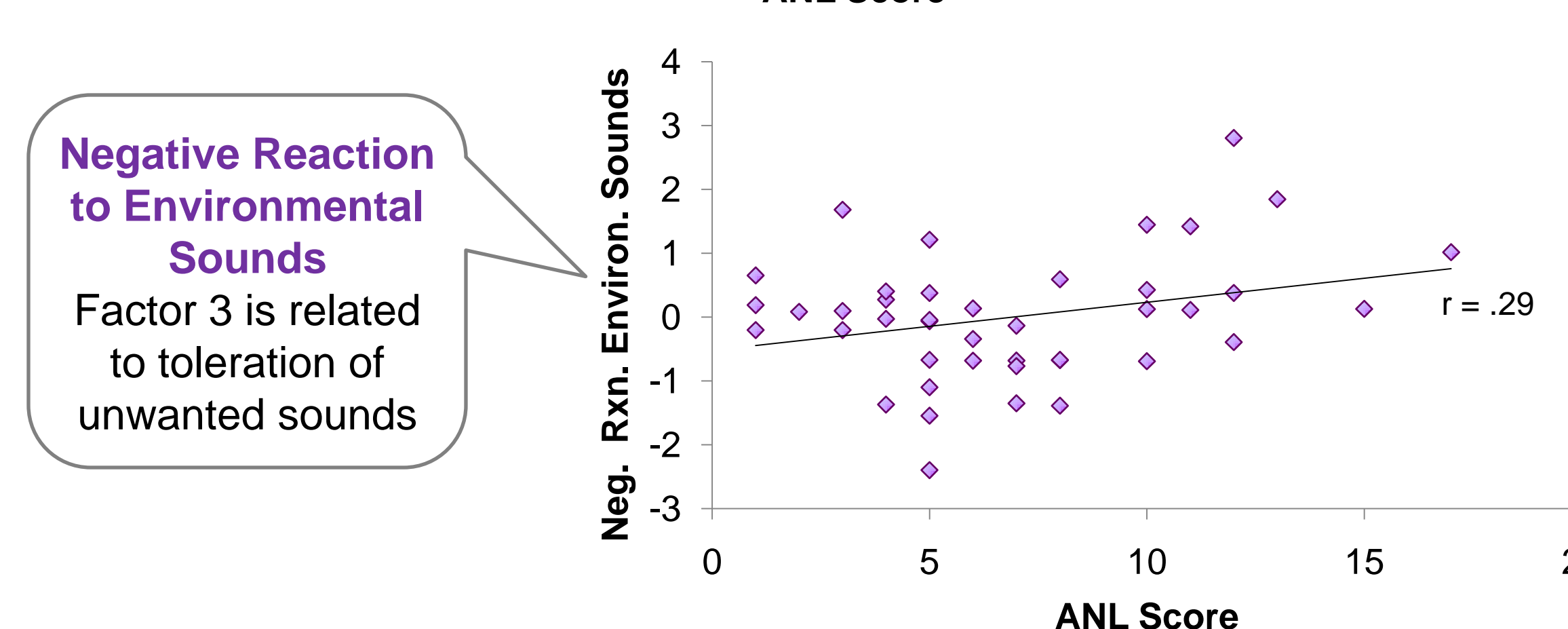
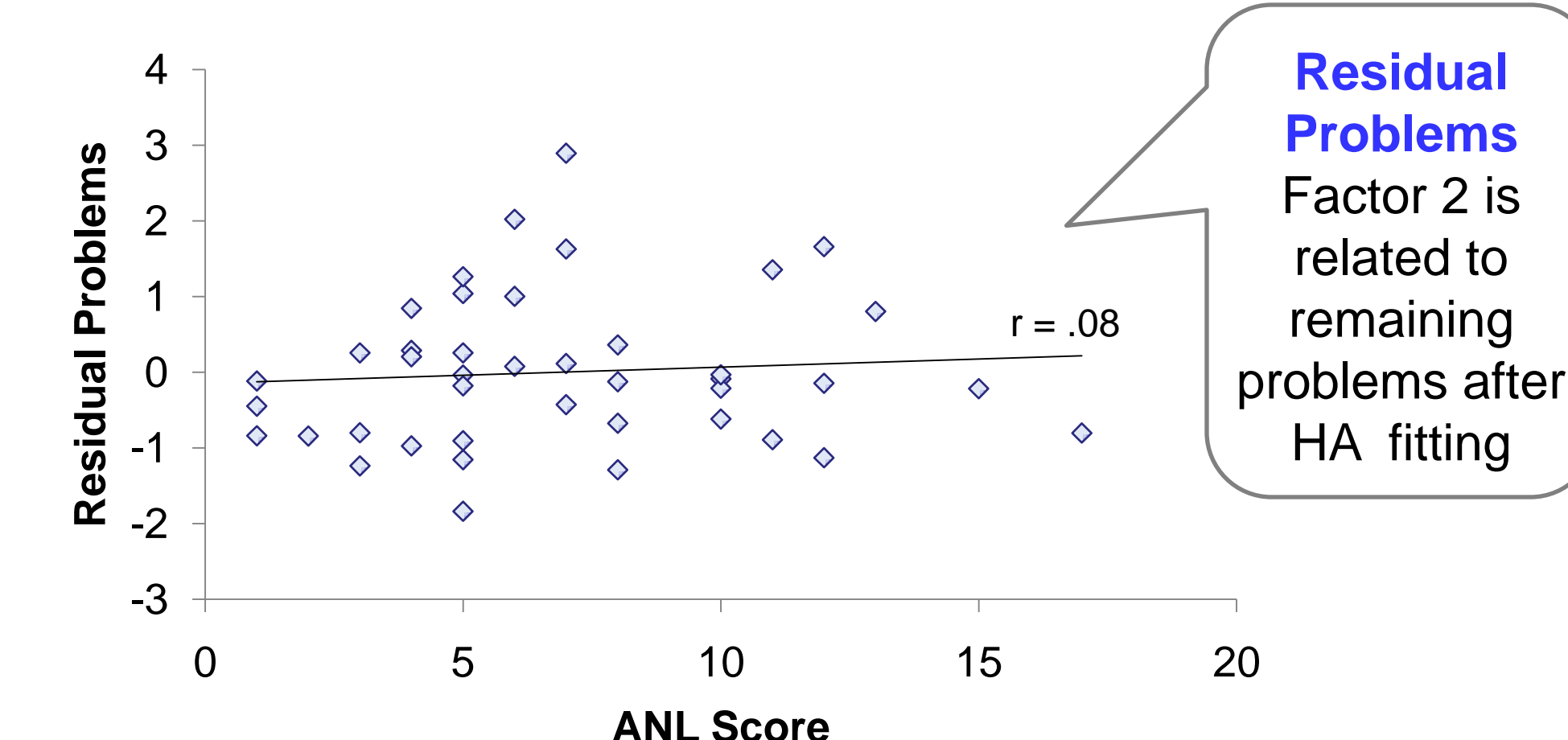
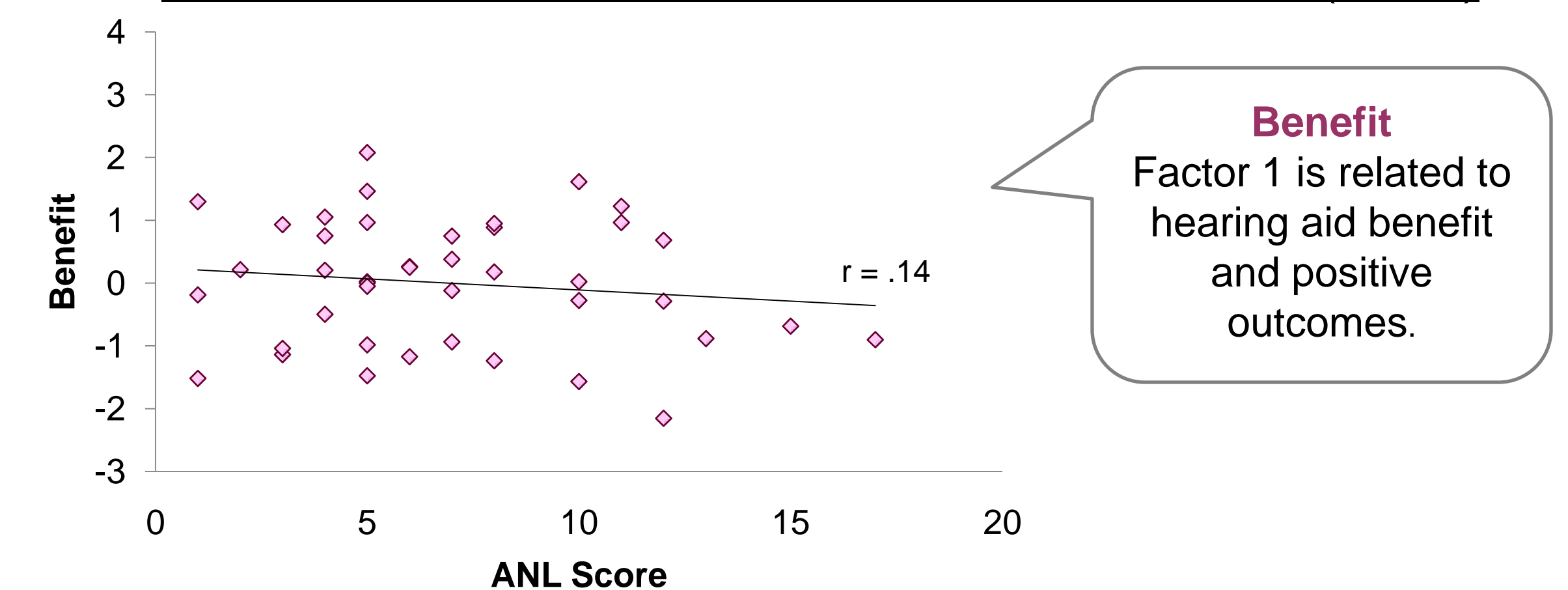
2. Can clinically obtained ANL scores allow audiologists to predict whether a patient will be successful with hearing aids?

- A factor analysis was conducted to explore different dimensions of HA outcomes.
- Factor Analysis revealed three factors in which the seven domains loaded in an expected, logical way.

Factor Loading of the 7 Outcome Domains



Correlation of the 3 Factor Scores and ANL Score (N=42)



DISCUSSION

Correlation results indicate that:

- (1) The ANL score is significantly associated with aversiveness to loud sound.
 - Specifically, the higher (poorer) the ANL score, the less acceptance a person will have for loud amplified sounds.
- (2) The ANL score is not significantly related to any of the other six outcome domains.
 - Our study measured the domain of Use using three different approaches of quantifying hearing aid use. This way of measuring Use is different from Nabelek et. al. (2001).

Factor Analysis results indicate that:

- (1) Factor 1: There was a slight non-significant trend towards an increase in HA benefit as the ANL score became smaller (better).
- (2) Factor 2: There was no observable trend between residual problems and ANL scores.
- (3) Factor 3: A lower (better) ANL score was associated with less negative reactions to environmental sounds.

CONCLUSIONS

Based on the methods used in this study, there is evidence to suggest that ANL scores are associated with aversiveness to environmental sounds, but not to other domains of hearing aid success.

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