# Examining Relationships between AABR and Frequency-Specific TEOAE Screening Outcomes within a Two-Tier Newborn Hearing Screening Protocol

Yana Estes, B.S., Hammam AlMakadma, Au.D. Ph.D

*Department of Otolaryngology & Communication Disorders, Program in Audiology, University of Louisville School of Medicine, Louisville, KY USA*

## ♦ Objectives

Two-tier newborn hearing screening (NHS) protocols utilize a combination of transient-evoked otoacoustic emission (TEOAE) and Automated-Auditory Brainstem Response (AABR) test technologies. Each test assesses different aspects of the auditory function and, when used in combination, can inform improved referral paradigms. Varying screening outcomes between the two tests is also related differences in sensitivity to subject or environmental noise and/or to the presence of temporary sound conduction dysfunction, e.g., ear canal vernix. Pass/fail outcomes for TEOAE vs. AABR have been compared previously, but not by TEOAE frequency band.

Frequency-dependent changes in TEOAE pass/fail outcomes are expected in day-2 (D2) screening due to resolution of slightly different types of conductive dysfunction from day-1 (D1). As well, TEOAE tests that fail D2 re-screening may exhibit frequency-dependent patterns that vary between ears that fail or pass the AABR screening in the same session.

The overall goal of this work is to examine patterns of TEOAE and AABR outcomes while controlling for TEOAE noise levels. Specifically, to:

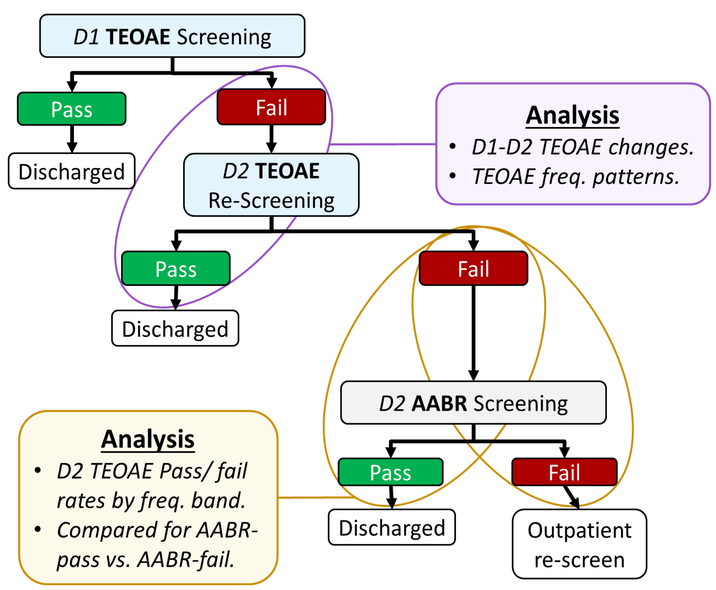
1) Describe differences between same-day frequency-specific TEOAE and AABR screening outcomes.
2) To evaluate frequency-specific change in TEOAE measures from day-1 compared to day-2.

## ♦ Methods

- **Participants:** Well-infant nursery babies who:
  (a) 200 who failed D1 TEOAEs screening and received D2 screening.
  (b) 136 who failed D2 TEOAE and receive a same-session AABR test.
  **Instruments:** MACIO EasyScreen .
- **Screening Protocols**: University of Louisville Hospital employs a two-tier, two-technology AABR and TEOAE screening protocol.



- **Data Collected:** Retrospectively retrieved screening outcomes since August 2023; data collected includes AABR pass/fail outcomes, test quality measures (electrode impedances, noise, etc.), TEOAE pass/fail outcomes, TE response, noise, and SNR levels at center-frequencies 1.4, 2.0, 2.8, and 4.0 kHz.

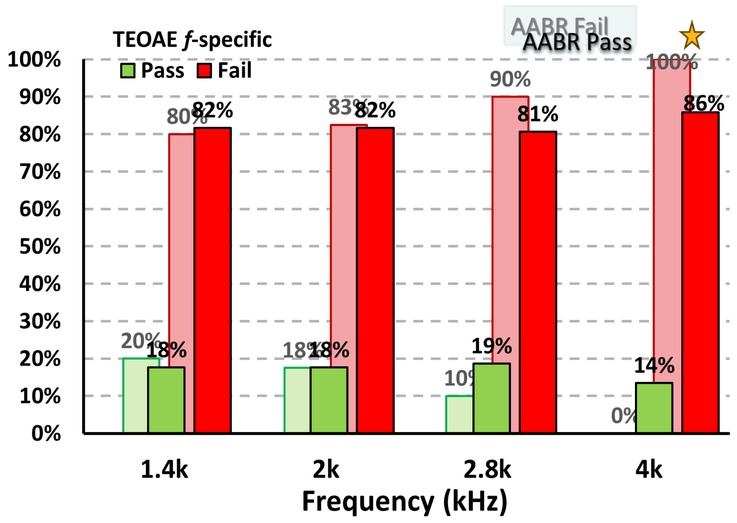



- **Statistics:** ΔTE (TEOAE difference) were compared using repeated one-sample t-test, One-way ANOVA. Chai-square test compared TEOAE Pass/fail rates for different conditions & TE frequency.

## ♦ Results

### Analysis 1
***Freq-Specific TEOAE Outcomes For Ears That Pass or Fail AABR***

#### 1.a) Overall comparison between AABR groups

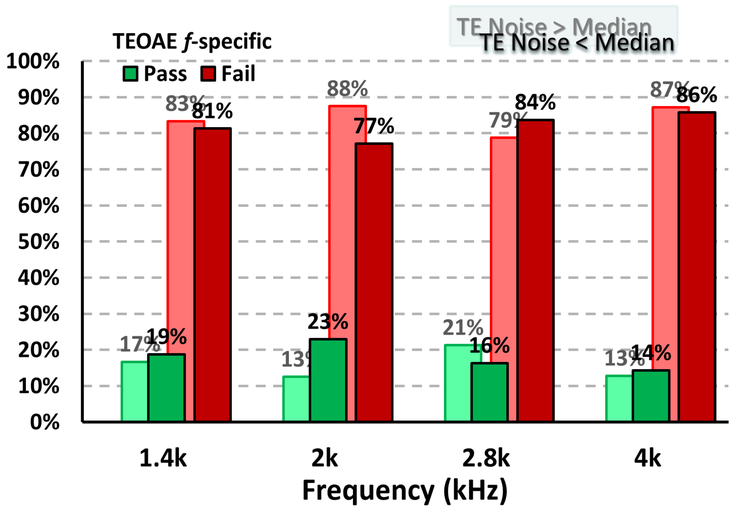



AABR Pass (*N= 96*), Fail (*N = 40*).

Proportion of TEOAE pass/fail were significantly different between AABR pass vs. AABR fail groups only at 4 kHz:

- $X^2(1, N= 136) = 5.99, p=014$

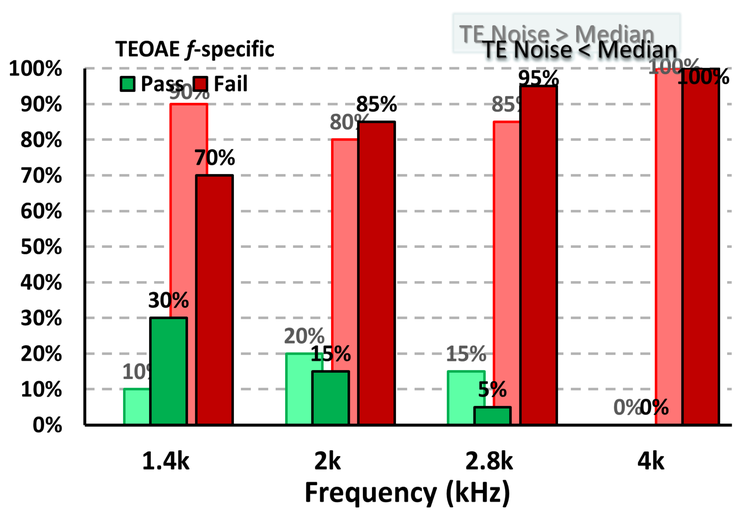
#### 1.b) Effect of TEOAE band noise for the *AABR pass* group




TE Noise < Median (*N= 48*), > Median (*N = 48*)

Chi-square analysis showed no significant differences for low-noise vs. high-noise groups at any TEOAE frequency.

#### 1.c) Effect of TEOAE band noise for the *AABR fail* group



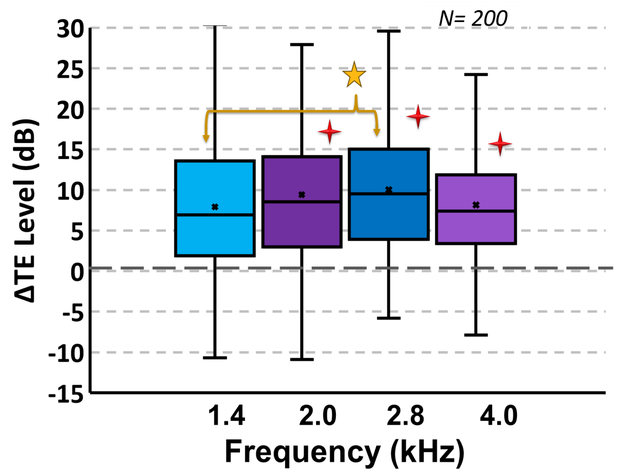

TE Noise < Median (*N= 20*), > Median (*N = 20*)

Chi-square analysis showed no significant differences for low-noise vs. high-noise groups at any TEOAE frequency.

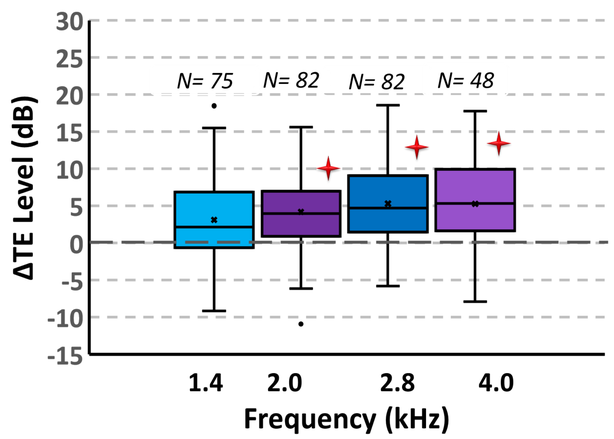
At 1.4 kHz, high noise increased fail rate by 20% compared to low TEOAE noise.

### Analysis 2
***D1-D2 Freq-Specific Changes in TEOAE***

#### 2.a) ΔTE Level from all ears.




#### 2.b) ΔTE Level from ears with >1dB SNR




- One-Sample t-tests showed ΔTE Level at all frequencies were significantly different from 0.
- One-way ANOVA teats showed a significant effect of frequency for analysis (2.a) (2.8 kHz > 1.4 kHz), that disappeared after controlling for noise (2.b).
- Comparison of means between analyses (2.a) & (2.b) showed that controlling for noise significantly reduced ΔTE Level at frequencies 2.0, 2.8. & 4.0 kHz, but not at 1.4 kHz.

## ♦ Discussion & Conclusions

1. AABR screening passed in 66% of ears that received and failed TEOAE screening in the same session. In ears that passed AABR, there were no frequency-dependent patterns in TEOAE pass/fail outcomes. However, when AABR failed, there was a significant change in TEOAE pass/fail outcomes at 4.0 kHz. Controlling for TEOAE noise did not impact these findings.

2. TEOAE levels improved from D1 to D2 at all frequencies. However, the magnitude of improvement was smaller when controlling for TEOAE noise at frequencies 2.0, 2.8, & 4.0 kHz. Overall, improvements in TEOAE level were observed as a function of frequency, although these patterns were not statistically significant.

## ♦ Acknowledgment

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