Evaluating The Effect of Test Environment Using The Digits-In-Noise Test

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Objectives: Our goal was to use a speech-in-noise test to answer the following questions:
1) Can speech-in-noise be measured accurately outside a controlled soundbooth?
2) Do children with hearing loss have more difficulty detecting speech-in-noise than peers with normal hearing?

Background: Growing evidence suggests that audiometric evaluations should include measures of hearing in the presence of noise. Current testing focuses on establishing hearing thresholds in quiet, but these may not accurately reflect challenges children encounter in noisy listening environments. A potentially useful measure, Digits-in-Noise Test (Smits et al.,2004), involves presentation of three monosyllabic digits in speech-weighted noise. The minimum signal-to-noise ratio (dB SNR) for triple digit identification has shown to predict hearing loss in adults (Koole et al.,2016). This is a good alternative for testing children as digits are part of early language learning (Knudsen et al.,2015). Moreover, testing might not rely on a quiet environment (i.e.,soundbooth) which would increase feasibility for use in multiple settings.

Methods: We evaluated 33 children, ages 6-15 years old (11-hearing loss and 22-normal hearing). All children had age-appropriate vocabulary and cognitive abilities. Digits and noise stimuli were presented using an app on an Android tablet through ER-3A insert earphones. Testing was conducted in a busy waiting room and sound-treated booth. A sound-level meter was used to measure background noise levels in each environment.

Results: Logistic regression analyses revealed:
1) Children performed nearly the same in the soundbooth and waiting room, suggesting that sound level in the test environment does not interfere with the child's test performance.
2) 66.7% is a suitable threshold derived from the proportion of presentations detected.
3) Children performed better when listening bilaterally and children with unilateral hearing loss present with a disadvantage in their poorer ear.

Conclusions: The Digits-in-Noise test adds to our understanding of how children hear in everyday listening environments and offers a major improvement in test accessibility.