

## Research

### Hearing Loss: An Analyzation of Various Audiogram Tests

#### Purpose/Need For Study

An estimated 1.57 billion people globally had hearing loss in 2019, accounting for one in five people. (Haile et al. 2021). Although automated pure-tone testing methods have existed for many years, they have not been used extensively for diagnostic audiometry (Margolis, Morgan 2008). With audiometry being the test of hearing mechanism function this points to a lack of information on the instruments used for pure-tone testing. The purpose of this exploratory study is to compare the effectiveness and efficiency of different audiogram hearing tests in diagnosing hearing loss. The hypothesis of this study is that “There is no difference between the AMTAS™ audiogram and the Mimi Hearing Test and the Hearing Test & Ear Age Test mobile applications”.

#### Objectives:

1. Assess the sensitivity and specificity of each hearing test in detecting various levels of hearing impairment.
2. Describe the time required to test a patient’s hearing by instrument.
3. Determine the difference between each hearing instrument.
4. Describe the frequency recorded by each hearing instrument.

#### Theoretical Framework

Psychometrics theory was the framework that was used to guide this study. This framework was used due to its focus on validity and reliability of instruments used to assess cognitive abilities. Peripheral hearing loss has been associated with poorer cognitive performance and accelerated cognitive decline. (Fulton et al., 2015). Employing a psychometric framework in this study enhanced the rigor, reliability, and validity of the research findings. This framework also allows researchers to evaluate the practicality of each audiogram test and make the most informed decision when deciding which test to use in which setting.

#### Methods

To conduct this study the researcher utilized three different audiogram tests. Each used an audiogram tone threshold test. Test one was the AMTAS™ audiogram that was downloaded onto a tablet that uses its own set of headphones, and was the most expensive. The other two tests were free mobile applications. There are multiple tone threshold tests available to download onto smartphones, the top two rated free tests were selected for this study. The top two rated free tests were the Mimi Hearing Test and the Hearing Test & Ear Age Test. There were a total of 12 participants who completed all three audiograms. Participants used each test with a relaxation gap in between use. All tests were administered in a quiet environment to ensure the accuracy of

the test. Researchers used measures of central tendencies as well as a univariate ANOVA to derive results. To determine significance, an a-priori of .05 was set.

## Results

Preliminary results reveal evidence for significant differences at 1,000 Hz  $p \leq .0001$  and 4,000 Hz  $p \leq 0.007$ . Preliminary findings suggest no difference between the different audiogram tests at the frequency levels of 250 Hz, 500 Hz, 2000 Hz, and 8000 Hz.

## inconvenience

Researching NIHL, and tools needed to diagnose it, is crucial because NIHL is one of the most common, yet preventable, causes of hearing impairment worldwide

## Analyzation

## Implications

Results of this study were found to be in rejection of the null hypothesis due to finding inconsistencies at different frequencies. Diagnostic accuracy is crucial for clinicians, comparing these audiogram tests and looking at inconsistencies allows for a more accurate diagnosis for patients. Using a more accurate audiogram test could lead to earlier detection and intervention for patients who are suffering from hearing impairment. Identifying inconsistencies in audiogram tests can improve clinical practice by ensuring accurate and consistent diagnosis of hearing loss and damage. Many career fields expose workers to noisy environments which can lead to hearing damage. Hearing loss and impairment can lead to atrophy of the brain which may result in development of dementia.

## Moving Forward

The inspiration for this test began when looking at early dementia indicators. There are numerous factors in play as to why someone might develop dementia. Surface level knowledge of dementia development is that it can be genetic and therefore inherited from family members. Research has shown that there are numerous indicators that we can look at in determining risk for developing dementia. There are specific indicators that can help determine if a patient will develop dementia overtime. Some indicators present a larger risk factor than others, hearing loss is considered to be one of the largest risk factors in developing cognitive decline leading to dementia. (Ray et al., 2019). With hearing loss being one of the largest indicators besides genetics it is important to identify the most efficient way to test the hearing of our target audience. Farmers have frequent exposures to loud noises from machinery and animals, which can lead to hearing loss. (Depczynski et al., 2005).

## References

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