Bedside Evaluation of Conductive Hearing Loss with the Hum Test
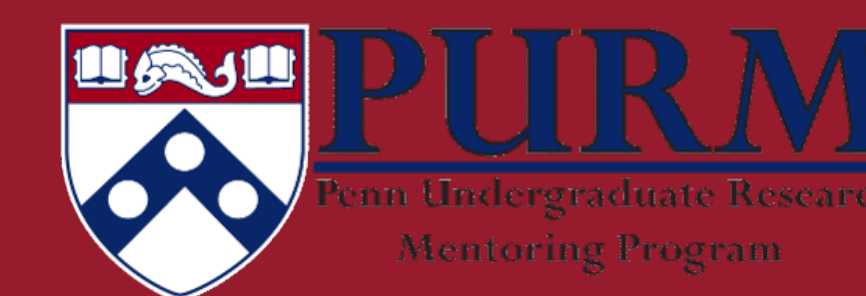
Yoojin Jo (COL 2027); Garv Mehdiratta (COL 2027); Kevin Wong, MD (Department of Otolaryngology-Head and Neck Surgery); Tiffany Hwa, MD (Department of Otolaryngology-Head and Neck Surgery)

INTRODUCTION

- In clinical settings, tuning fork tests — namely, the Weber and Rinne tests — are used to determine whether patients exhibit normal hearing or conductive hearing loss (CHL).
- However, in many clinical settings, tuning forks are not readily available or accessible, limiting successful evaluation of CHL in patients.
- This project aims to formally study whether humming can be used as a reliable alternative to tuning fork tests to assess for CHL in low-resource settings.

METHODS

- The Weber test was performed by striking the tuning fork and placing it on the patient's forehead or front teeth.
- The Rinne test was performed by placing the vibrating tuning fork on the patient's mastoid bone.
- During these tests, patients were asked to report lateralization of tuning fork vibrations (Weber) and signs of an air-bone gap (Rinne).
- Then, the hum test was performed, during which patients were asked to hum at normal, high, and low pitches and report lateralization of hum sounds.

RESULTS

- 46 adult patients with CHL participated in this study. 28.26% were diagnosed with cholesteatoma, 17.39% with otosclerosis, 26.09% with tympanic membrane perforation, 6.52% with ossicular causes, and 26.09% with other causes. Some received more than one diagnosis.

- There was no significant difference in percent accuracy for the normal-pitched, high-pitched, and low-pitched hums for the hum test, the values for which were 58.70%, 54.35%, and 58.70%, respectively.
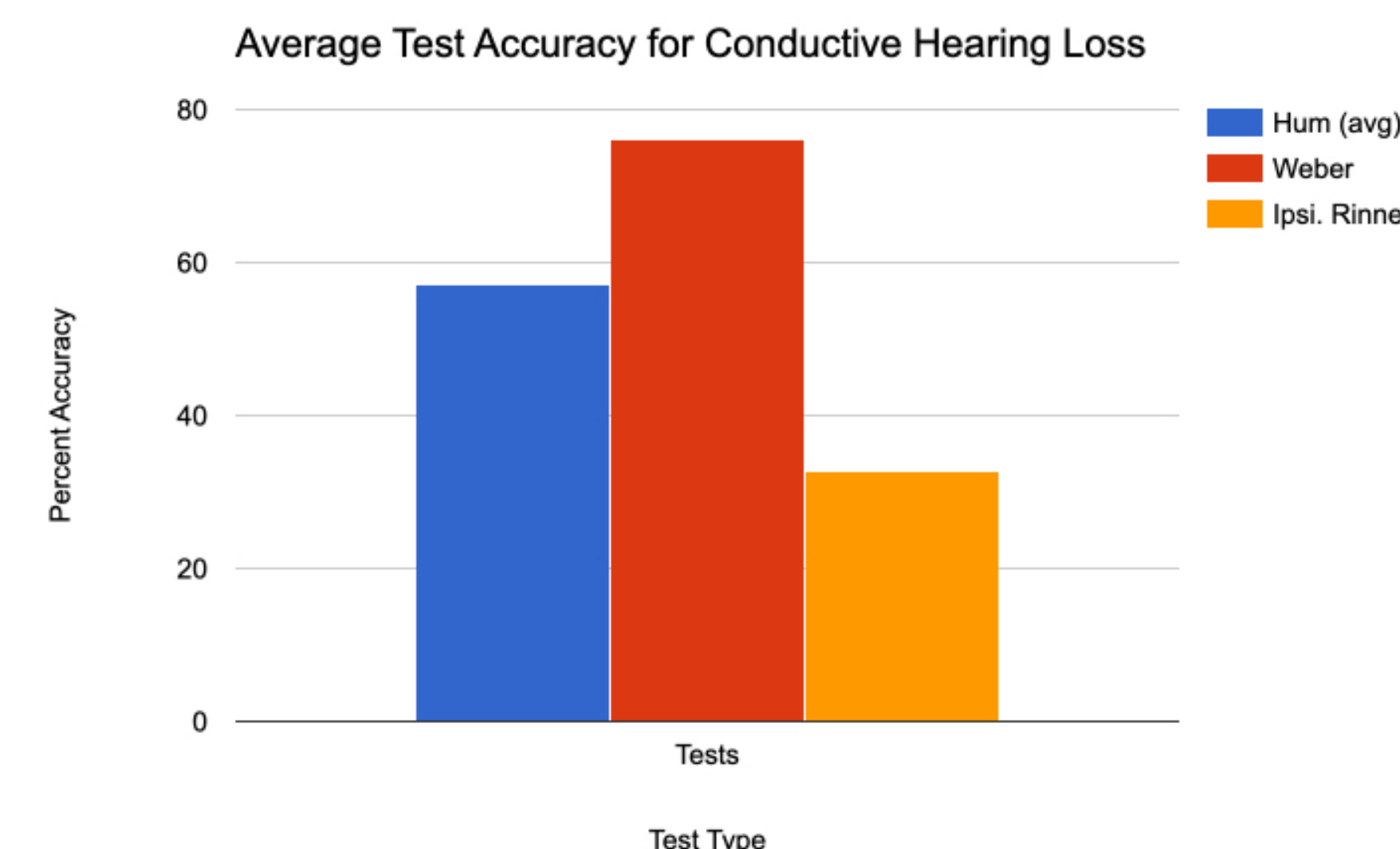

Figure 1. Based on the 46 tests performed, on average, the hum test's accuracy was 24.59% higher than that of the ipsilateral Rinne test. The Weber test was 18.89% more accurate than the hum test.

Mean Age, Range	46.91, 19-81
Female (n, %)	63.04%
Male (n, %)	36.96%
Average Hum Intensity	57.82 dB
Average Hum Frequency	223.49 Hz

Figure 2. Demographic data for the 46 patients tested as part of this study.

- Across the 46 data points, the Weber test had a 76.09% accuracy in identifying CHL. This was followed by the hum test, which, on average, was 57.20% accurate. The ipsilateral Rinne test had the lowest accuracy, at 32.61%.

CONCLUSION

Using the Weber test as a baseline since it is the clinical standard for CHL testing, the hum test was not as accurate as the Weber test but was more accurate than the Rinne test. These results demonstrate that in low-resource settings without reliable access to tuning forks, the hum test can be used as a viable alternative to tuning fork-based tests to predict the presence of CHL in patients.

ACKNOWLEDGEMENTS