The Effect Of Subway Station Noise Exposure On Commuter Hearing

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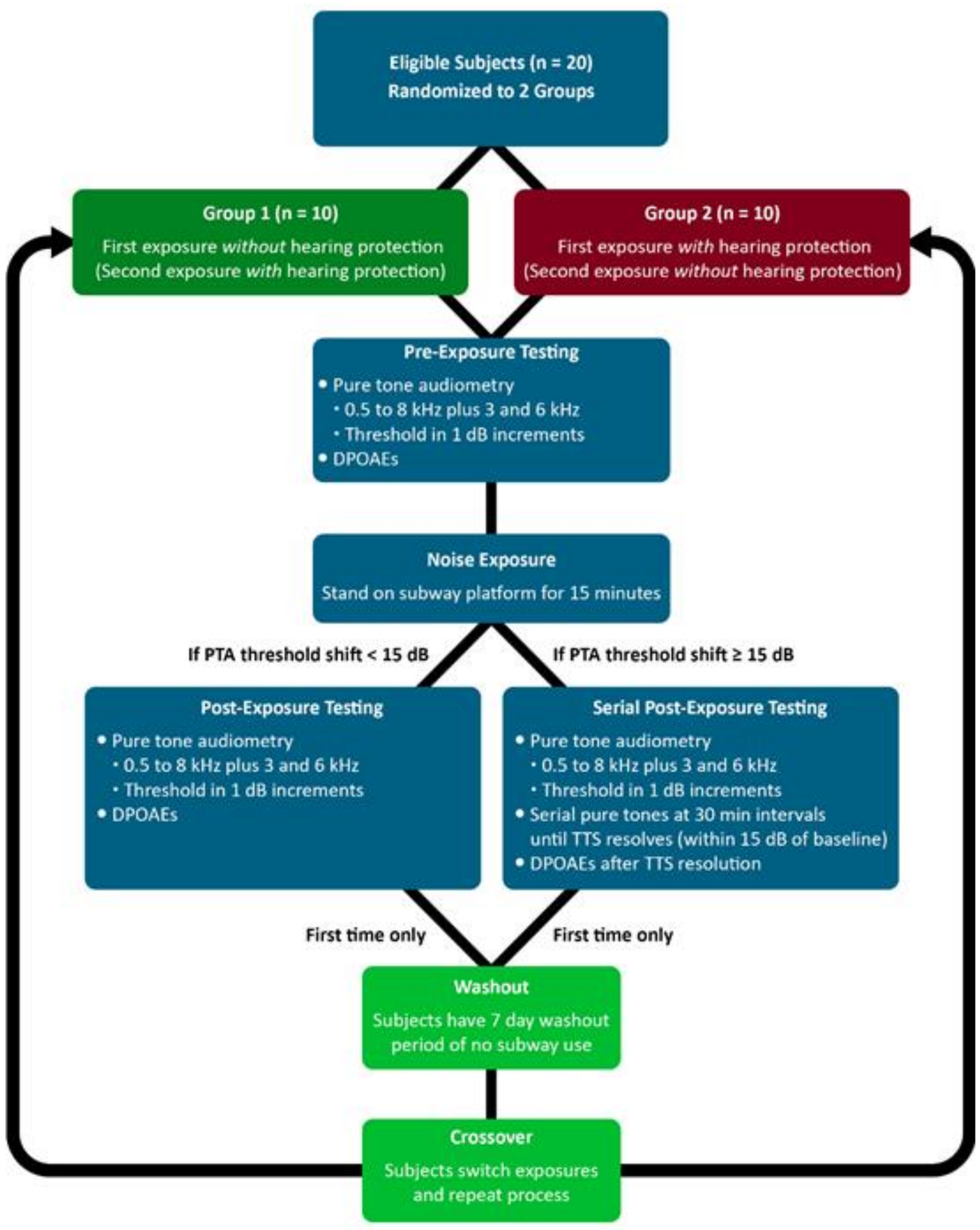
Introduction

The New York City (NYC) subway is the 7th busiest worldwide and carries 5.7 million riders on an average weekday.[1] Unfortunately, for all their utility, subways are notoriously noisy. In NYC, subway noise averages 80-90 A-weighted decibels (dBA) and reaches peaks of 104-121 dBA.[2-4] These peak subway noise levels raise concern for noise-induced hearing loss (NIHL). Above 105 dBA, recommended noise exposure limits are on the order of minutes.[5,6] Excessive noise exposure risks NIHL as well as other adverse medical and quality of life issues.[3,7,8]

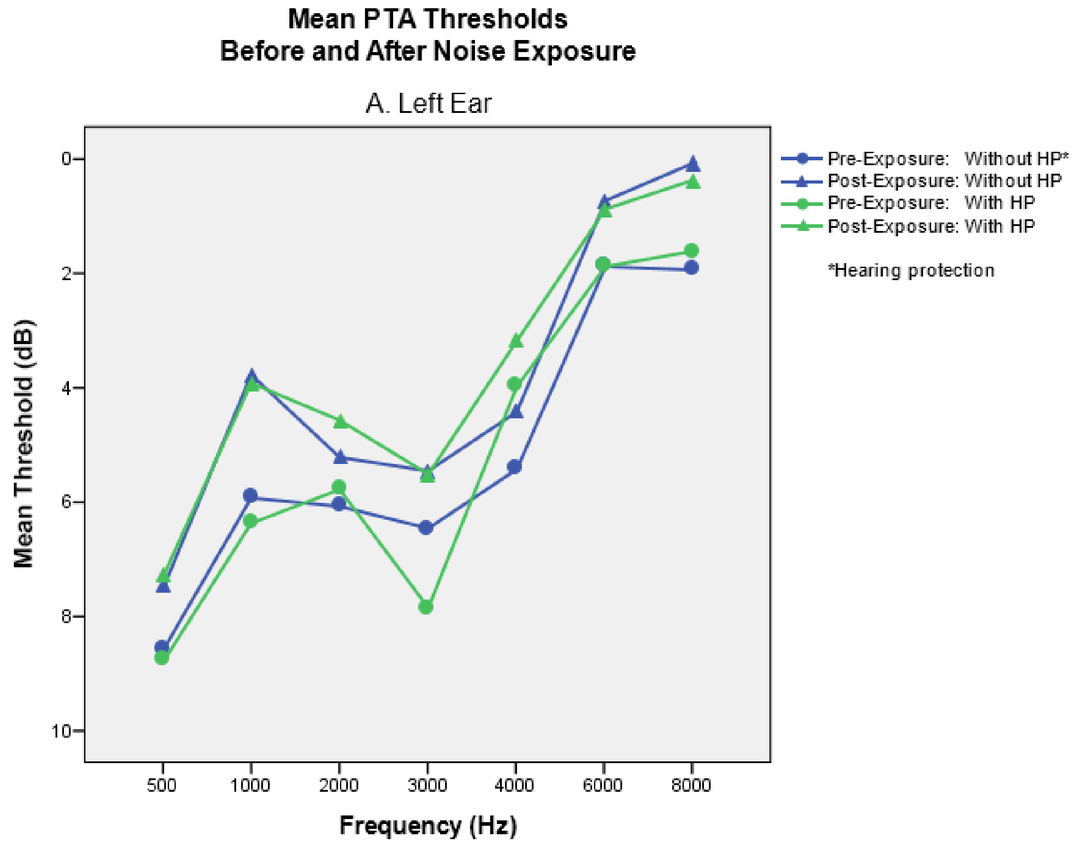
Although these data have clear implications for employees, who are required to wear hearing protection by occupational safety regulation, the impact of subway noise on the hearing of daily commuters has yet to be studied.[3,9] Screening for temporary threshold shift (TTS) is a promising way to potentially identify those at risk for developing NIHL.[12] In addition, although the typical subway commute does fall within federal standards of allowable daily noise exposure (Table 1),[2,5,6] Kujawa and Liberman's work demonstrating the progressive consequences of noise exposure on hearing alerts us to the hidden risks of a seemingly temporary threshold shift (TTS) in hearing.[13,14]

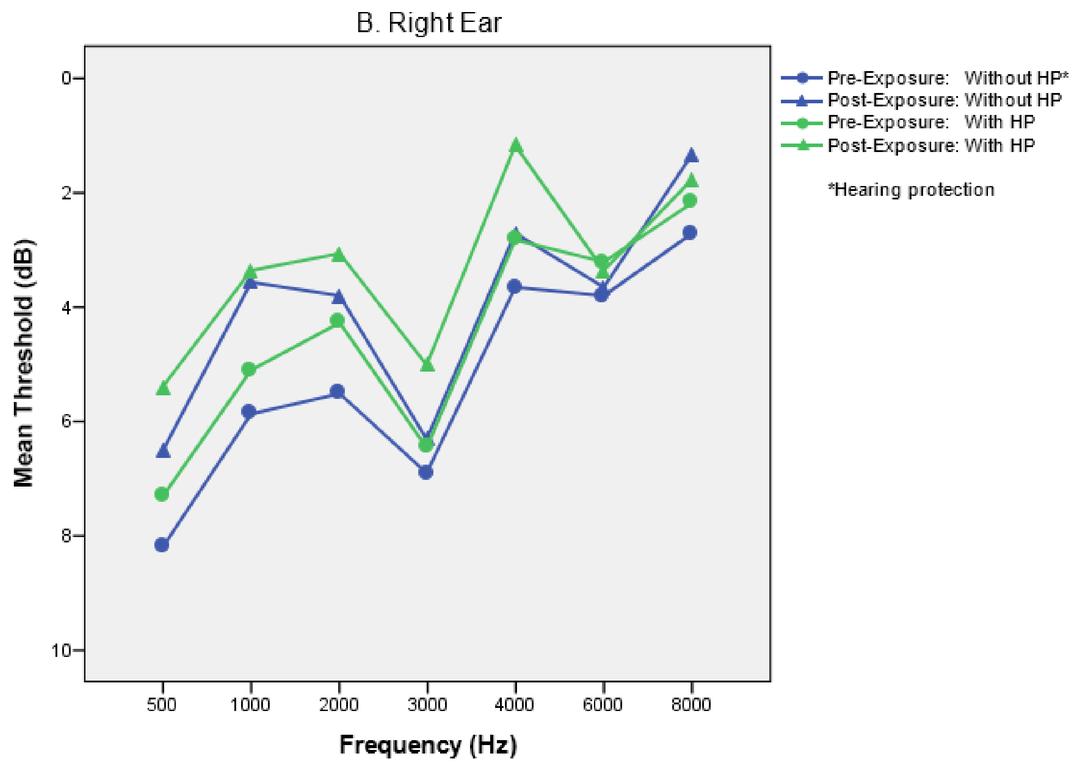
In this study, we evaluate subjects for TTS after subway noise exposure with and without hearing protection, using both pure tone audiometry (PTA) and distortion product otoacoustic emissions (DPOAEs). We aim to better understand the chronic effects of repeated short-term noise exposure, beginning with whether single short term exposures lead to appreciable TTS.

Methods



Results





- A statistically significant improvement in PTA thresholds after subway noise exposure was identified, for subjects with and without hearing protection ($p<0.001$).
- For exposure without hearing protection, the mean threshold was 5.19 dB pre-exposure and 3.91 dB post-exposure (decrease of 1.28 dB; 95% CI, 0.82 – 1.74).
- For exposure with hearing protection, the mean threshold was 4.81 dB pre-exposure and 3.47 dB post-exposure (decrease of 1.34 dB; 95% CI, 0.89 – 1.79). Thresholds returned to baseline during the washout period.

Conclusions

- Subjects exposed to subway noise did not experience detrimental temporary threshold shift during the assessment time period.
- Rather, subjects demonstrated a small but statistically significant sensitization in hearing on pure tone audiometry and distortion product otoacoustic emissions after subway noise exposure.
- Larger studies assessing subway commuter hearing over time would provide a more thorough understanding of the long-term auditory consequences of daily subway noise exposure.
- Still, due to the potential for hidden hearing loss and other adverse effects associated with excessive noise, designing future stations to mitigate commuter noise exposure remains an important public health goal.

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