RELATING USE OF PORTABLE AUDIO DEVICES TO AUDIOMETRIC THRESHOLDS IN UNIVERSITY STUDENTS

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1. INTRODUCTION

Hearing loss in adults has been largely associated with the process of aging, whereas noise and noise-induced trauma were believed to be primarily an industrial health problem. Accordingly, most people have not considered recreational and leisure activities to pose a threat to hearing (but see Health & Welfare Canada, 1988).

Researchers, however, have known for quite some time that noisy leisure activities may pose a real danger to people's hearing if the ears are not adequately protected. In fact, many common household items have been a source of concern because of the high level of noise they produce. For example, in the past, noise associated with the ring of the cordless telephone was the subject of a great deal of concern. Similarly, the vacuum cleaner, the hair dryer and even the household electric knife have been thought to pose a risk to hearing (Health & Welfare Canada, 1988). Despite efforts to educate the public about these effects, it seems that most people are resistant to the idea, and that young adults are the most difficult people to convince about the dangers of excessive exposure to non-industrial noise.

The hearing health of young adults is a concern now more than ever because of the introduction of portable audio devices with mass storage that enables a listener to hear a larger selection of music. The enhanced selection options are presumed to entice listeners to wear the devices for much longer durations compared to earlier technologies. The increasing popularity of these devices has prompted the media to draw attention to the question of whether the extended use of these devices is creating hearing problems, particularly in youth (e.g., Hawaleshka, 2005). Although much research has been done (Fearn & Hanson, 1989), more data are needed to establish a definitive connection between the use of current portable audio devices and hearing loss.

The present experiment is part of a larger study attempting to determine whether or not there is a connection between the use of portable audio devices and early warning signs of hearing loss. We focus on comparing the hearing health of individuals and relating it to the frequency and manner of their use of portable audio devices. The participants' experience with portable audio devices was determined by questionnaire in the first part of the study and a subset of the participants who completed the questionnaire returned to have their hearing thresholds measured.

2. METHOD

Participants

The participants were primarily individuals from the first year Psychology class at the University of Toronto who received course credit for their participation. However, a few other students volunteered to participate in this study without compensation because of their interest in the topic. Participants were those who had completed a questionnaire for a larger study on the use of portable audio devices and had agreed to continue participation in the broader study. In total, the subject pool consisted of 45 university students.

Procedure

Each individual completed a hearing test lasting less than 30 minutes. Thresholds were tested for pure-tones of .25, .5, 1, 1.5, 2, 3, 4, 6, 8, 10, and 14 kHz. Participants sat in a sound-attenuating double-walled IAC booth. Standard test frequencies were delivered to Telephonics TDH-50P HB7 headphones from a Grason-Stadler GSI-61 audiometer. High-frequency testing (above 8 kHz) was conducted using a special option on the audiometer and Sennheiser HAD 200 headphones. Using a standard ascending procedure, the test tone was presented starting at a level of 30 dB HL, and decreased by 10 dB until the participant no longer responded and then the level of the tone was increased by 5 dB until a response was made. This bracketing procedure was repeated to determine the level at which the participant correctly detected each frequency 50% of the time. The ear to which the stimulus was presented was that which the participant believed to be of lesser ability or if both ears were believed to be equally good then the left ear was tested

Clinically normal results for hearing thresholds are considered to be between 0-25 dB HL (Mencher, 1997). Following the recommendation of Mencher, if the thresholds of any participant exceeded 20 dB HL at 3 kHz or 30 dB HL at 4 kHz, and if the person wished to have a diagnostic hearing test then a referral to an audiologist

would have been made; however, no participant met the criteria that would have triggered a referral

3. RESULTS

The distribution of hearing thresholds (dB HL) measured at each of the test frequencies presented is shown in Figure 1. All 45 students had thresholds less than 10 dB HL at 1, 1.5, and 4 kHz. For all other frequencies, except 6 kHz, at least ¾ of the students had thresholds of 5 to 10 dB HL, well within the normal range. Outliers with thresholds falling outside of the range considered to be clinically normal were observed at 30 dB HL for .25 kHz, and at 40 dB HL for 14 kHz.

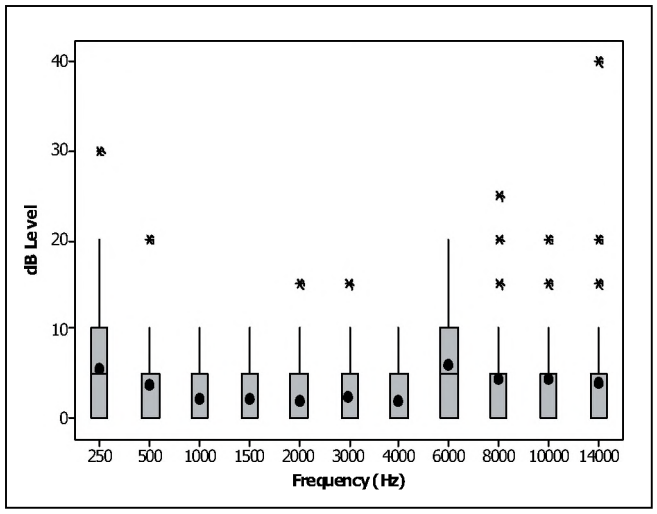

Figure 1. Box and whisker plots showing the mean dB HL threshold (black dots), median (centres of box), inter-quartile ranges(box ends), and minimum and maximum (ends of whisker lines) thresholds of hearing (dB HL) at each pure-tone frequency tested. Outliers are indicated by *.

4. DISCUSSION

The results obtained from the current study indicate that there is no evidence of clinically significant hearing loss in the group of 45 students tested, with the exception of two participants, one of who had a threshold of 30 dB HL at .25 kHz and one who had a threshold of 40 dB HL at 14 kHz. Importantly, all students had thresholds no worse than 10 dB HL at 4 kHz where the first signs of noise-induced hearing loss are expected to be observed. Moreover, the high thresholds of two participants at the extreme frequencies cannot be attributed to noise exposure.

The result of the present study cannot be extended to the general population of young adults for a number of reasons. It is important to consider that the sample was comprised of self-selected university students whose lifestyle may differ from that of the general population of their peers. For example, university students may be more likely to have had little industrial work experience, whereas peers without post-secondary education are more likely to be working, many in jobs with high levels of noise exposure, such as in factory or construction workplaces. It is also possible that the university students, especially those who self-selected for the study, may be more health-conscious than their peers and they may take fewer health risks, including engaging in noisy hobbies. A third likely difference is that because of the financial and time demands on them, university students may have less opportunity than their peers to engage in noisy hobbies.

6. CONCLUSIONS

In light of the present audiometric results, it is not possible to conclude that noise-induced hearing loss is widespread amongst university students, either as a result of the use of portable listening devices or from any other cause. It may simply be too early to discern whether noise-induced damage has begun in young adults who listen to portable audio devices such as today's iPod. This should not, however, discount the fact that sound presented to the auditory system at a level of 85 dB A for 40 hours per week over an extended period of time has been documented to be enough to result in permanent noise-induced hearing loss, and is mandated against by occupational safety regulations (Mencher, 1997). Although young adults may not show signs of such loss yet, this should not suggest that prolonged exposure to portable audio devices at these levels will not result in future hearing loss. Furthermore, even if an effect had been found in our study, it would be difficult to establish that portable audio devices were the primary culprit. Longitudinal studies will be needed to shed more light on this important question. Future research should focus on isolating the direct effect of portable audio devices on hearing from the effects of environmental noise exposure in a larger sample and also to relate audiometric measures to long-term patterns and conditions of usage of these devices.

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