SOUND-LEVEL MONITORING EARPHONES WITH SMARTPHONE FEEDBACK AS AN INTERVENTION TO PROMOTE HEALTHY LISTENING BEHAVIORS IN YOUNG ADULTS

Megan Knoetze1, Faheema Mahomed-Asmail1, Vinaya Manchaiah2,3 and De Wet Swanepoel1,4,5

1Department of Speech-Language Pathology, University of Pretoria, Pretoria, South Africa. 2Department of Speech and Hearing Sciences, Lamar University, Beaumont, Texas, United States of America. 3Department of Speech and Hearing, School of Allied Health Sciences, Manipal University, Karnataka, India. 4Ear Sciences Centre, School of Surgery, University of Western Australia, Nedlands, Australia. 5Ear Sciences Institute Australia, Subiaco, Australia.

Background
• More than a billion adolescents and young adults are at risk of recreational noise-induced hearing loss (RNIHL) due to unsafe use of personal audio systems (PAS) (World Health Organization, 2015).
• Although preventable, once occurred RNIHL is irreversible and can have a severe negative impact on physical and mental health as well as on academic or work performance (Seidman & Standring, 2010).
• New technologies, such as dbTrack, allow users to monitor personal sound exposure by using sound-level monitoring earphones with an accompanying smartphone application (app) (dbTrack, 2018).

Objectives
Phase 1: To determine the effect of sound-level monitoring earphones with smartphone feedback and hearing health information on listening behaviors.
Phase 2: To determine accuracy and reliability of dbTrack (Westone) sound-level monitoring earphones.

Methods
Phase 1: Sound-level monitoring earphone accuracy and reliability
• Accuracy was determined by comparing earphone measurements to sound level meter measurements.
• Intra-device reliability was determined by comparing earphone measurements during test-retest conditions.
• Within-subject reliability was determined by comparing in-ear sound levels of 19 participants measured by the earphones during test-retest conditions.

Phase 2: Effect of sound-level monitoring earphones and app on listening behaviors
• A single-group pretest-posttest design was utilized.
• 40 participants completed an online survey regarding sound exposure through PAS.
• Thereafter, participants utilized the sound-level monitoring earphones with the accompanying dbTrack app for 4 weeks.
• During the first 2 weeks, the app’s smartphone feedback feature was disabled (pretest).
• During the last 2 weeks, participants received a brief guide on hearing health information and the smartphone feedback was automatically enabled on the app (posttest).
• Participants completed a second online survey.
• Average daily intensities, durations and sound dosages measured during pre- and posttest conditions were compared.

Results
Phase 1
• dbTrack earphone measurements were within 1 dB when compared to sound level meter measurements.
• Earphones were also within 1 dB in repeated measures across earphones.

Phase 2
Table 1. Average daily intensity, duration and sound dose measured by the sound-level monitoring earphones during pretest and posttest conditions

<table>
<thead>
<tr>
<th>Intensity</th>
<th>Pretest</th>
<th>Posttest</th>
<th>Difference</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (SD)</td>
<td>59.6 (18.6)</td>
<td>51.2 (21.4)</td>
<td>8.4</td>
<td>0.474a</td>
</tr>
<tr>
<td>Duration</td>
<td>65.6 (52.4)</td>
<td>58 (57.6)</td>
<td>7.6</td>
<td>0.163b</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>5912.7 (24479.9)</td>
<td>1784.3 (6845.9)</td>
<td>4128.4 (24965.5)</td>
<td>-0.373c</td>
</tr>
</tbody>
</table>

Table 2A-C. Examples of dbTrack app’s monitoring screens

Conclusions
• Sound-level monitoring earphones, like dbTrack, with a calibrated in-ear microphone can reliably and accurately measure PAS sound exposure.
• Smartphone feedback on sound exposure measured by sound-level monitoring earphones with hearing health information can:
  ➢ significantly reduce listening intensity and sound dose.
  ➢ potentially promote safe listening behavior in young adults and reduce the risk of acquiring an RNIHL.
• Post-study survey revealed that 95% were motivated by the hearing health information and smartphone feedback to change their listening behavior.
• 90% indicated that the smartphone feedback contributed the most.

References