

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



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## Background

- More than a billion adolescents and young adults are at risk of recreational noise-induced hearing loss (RNHL) due to unsafe use of personal audio systems (PAS) (World Health Organization, 2015)
- Although preventable, once occurred RNHL 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)
- Educational programs alone have not been effective in changing listening behaviors in PAS users (Khan et al., 2018)
- 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

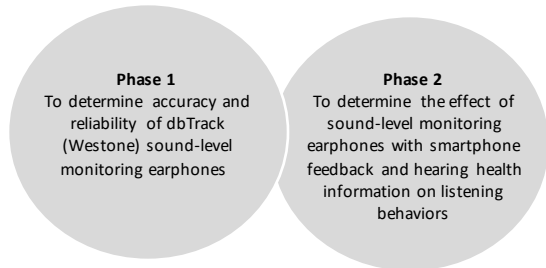


Figure 1. dbTrack (Westone) technology

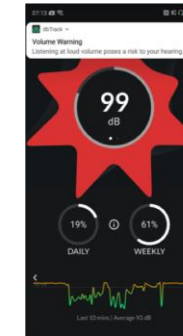
## Methods

### Phase 1: Sound-level monitoring earphone accuracy and reliability

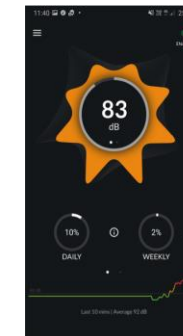
- Accuracy was determined by comparing earphone measurements to sound level meter measurements
- Intra-device reliability was determined by comparing earphone measurements during test-retest conditions
- Within-subject reliability was determined by comparing in-ear sound levels of 19 participants measured 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



A



B



C

Figure 2A-C. Examples of dbTrack app's monitoring screens

## 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 and across participants

### Phase 2

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

	Pretest	Posttest	Difference	Effect size
<b>Intensity Mean (SD)</b>	59.6 (18.6) dBA	51 (21.4) dBA	8.7 (18.3) dBA	0.474 <sup>a</sup>
<b>Duration Mean (SD)</b>	65.6 (52.4) min	58 (57.6) min	7.6 (46.6) min	0.163 <sup>a</sup>
<b>Sound dose Mean (SD)</b>	5912.7 (24479.9)%	1784.3 (6845.9)%	4128.4 (24965.5)% <sup>**</sup>	-0.373 <sup>b</sup>

<sup>a</sup>Significant difference ( $p < 0.05$ ; Paired-samples  $t$  test)

<sup>\*\*</sup>Significant difference ( $p < 0.05$ ; Wilcoxon signed-rank test)

<sup>a</sup>Cohen's  $d$

<sup>b</sup> $r$  value ( $Z/\sqrt{N}$ )

- 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

## 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 RNHL

## References

1. dbTrack. (2018). *dbTrack*. <https://www.dtrack.com/>
2. Khan, K. M., Bielko, S. L., & McCullagh, M. C. (2018). Efficacy of hearing conservation education programs for youth and young adults: A systematic review. *BMC Public Health*, 18(1). <https://doi.org/10.1186/s12889-018-6198-7>
3. Seidman, M. D., & Standring, R. T. (2010). Noise and Quality of Life. *International Journal of Environmental Research and Public Health*, 7(10), 3730–3738. <https://doi.org/10.3390/ijerph7103730>
4. World Health Organization. (2015). *1.1 billion people at risk of hearing loss*. World Health Organization. <http://www.who.int/mediacentre/news/releases/>