NOISE EXPOSURE ESTIMATES OF URBAN MP3 PLAYER USERS

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The “80-90 Rule” for using MP3 players

“Output levels of MP3 players” Portnuff and Fligor, NIHL in Children at Work and Play Conference, October 2006

Estimates 50% noise dose 85 dBA 8-hr LAeq DRC (Roughly 89 dBA for 90 min)
Effect of ambient noise levels

\[ y = 0.3292x + 50.669 \]

\[ R^2 = 0.3659 \]

Fligor & Ives, In review
Participants

- 189 subjects (92 male, 97 female),
  - average 22.2 years of age (range: 18-53)

- Walked onto a college campus in New York City, adjacent to NYC subway station exit, were asked to:
  - Have their earphone levels measured
  - Fill out a questionnaire requesting demographic information

- Ambient sound levels at measurement location average 60.5 dBA (range 56-68)
They were also asked:

- Whether or not they commuted using the subway
  - (Gershon, et al 2006: subway = 83-106 dBA)

- Whether they adjusted the volume of their MP3 after leaving the subway

- The type of MP3 and earphones they used

- The duration and frequency of MP3 use: total hours per day and days per week
Introducing ROXIE:

“The Jolene Cookbook” (OHSU, 2007)
Calibrated using Microphone-in a Real Ear technique (ISO 11904-1, 2002) to determine a coupler to free-field correction factor to report free-field equivalent levels

- TFOE determined using ER-7c probe-mic and 70 dB Pink Noise (digital filter in Audition)
- Mannequin SLM level vs. ER-7c with filter:
  - Earbud difference, avg = 5.0 dB (SD = 0.5)
  - Supra-aural difference, avg = 5.5 dB (SD = 1.1)
- Berger & Stergar (2009): 5-dB correction factor
Results

- Average measured level ($L_R$) from MP3 earphones was 92.6 dBA (SD = 10.7); range of 69-121 dBA

- Reported hours of use per day ($T_R$) and days per week ($\text{Days}_{wk}$) of use = weekly avg 18.4 hours (SD = 17.1); range of 0.5-105 hours per week

- $L_{A8hn} = L_R + 10 \times \log_{10}(T_R/8)$
- $L_{Awkn} = L_R + 10 \times \log_{10}[(T_R \times \text{Days}_{wk})/40]$
Box-and-whisker plot showing listening level median, interquartile range, and maximum and minimum.

No significant difference for gender (p>0.05)

Mean level, female = 92.4 dBA
Mean level, male = 92.7 dBA
Single-session and Weekly estimated sound exposures

Mean LA$_{8\text{hn}}$ = 87.2 dBA
Range = 60 – 115 dBA

Mean LA$_{\text{awkn}}$ = 87.4 dBA
Range = 59 – 116.4 dBA

Box-and-whisker plots showing equivalent continuous 8-hr and 40-hr levels (Leq) for median, interquartile range, and maximum and minimum
Male vs. Female estimated sound exposures

No significant difference for gender (p=0.84)

Box-and-whisker plot showing weekly average exposure median, interquartile range, and maximum and minimum

Mean LAwkn, female = 86.8 dBA  Mean LAwkn, male = 88.0 dBA
A majority (52%) of subjects exceeded a weekly (40-hr) equivalent continuous level of 85 dBA (ie, > half exceeded NIOSH DRC)

No difference in listening levels or duration of use per week between male and female subjects

No difference in listening level or duration of use between subjects who used the subway to commute compared to those who did not
Conclusions

- Estimates of sound exposure suggest that the average MP3 user commuting in NYC is at risk for NIHL, regardless of mode of commute.
- The exposure estimates indicate a similar percent of both sexes are at risk for NIHL.
- “Risk” isn’t small for some:
  - 25% exceeded 95 dBA $L_{Awkn}$
  - 10% exceeded 102 dBA $L_{Awkn}$
  - 5% exceeded 107 dBA $L_{Awkn}$