

## **Hearing Conservation Practices for Workers with Hearing Loss**

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## **Introduction**

Workers with hearing loss (WWHL) pose a unique challenge for hearing conservation professionals who seek to make hearing protection recommendations. The simultaneous need to attenuate hazardous noise and retain the audibility of speech or other important sounds is a “Catch-22” without an easy answer. Although many workers struggle to communicate in background noise while wearing hearing protection, WWHL may experience additional difficulties due to differences in the auditory system. WWHL report many concerns including difficulty understanding speech, failure to detect warning signals, and trouble monitoring equipment (Morata et al., 2005; Leroux et al., 2018). They may also experience decreased productivity, increased risk of injury, impeded career progression, and psychosocial issues including anxiety, depression, and feelings of social isolation (Casali, 2010; Giguère et al., 2010; Hétu et al., 1993; Hétu et al., 2005; Leroux et al., 2018; Morata et al., 2005; Reddy et al., 2012). These issues not only make work challenging, but can reduce overall job satisfaction and quality of life.

To mitigate some of these concerns at work, WWHL may remove hearing protection, even when hazardous noise is present (Morata et al., 2005; Leroux et al., 2018). This of course increases the risk of exacerbating hearing loss and/or tinnitus, and should be avoided. Hearing aid users may feel inclined to wear their hearing aids on the job; however, hearing aid usage in noise is generally contraindicated as it may increase risk of noise-induced hearing loss (OSHA, 2005).

In a guidance document (SHIB 12-27-2005), the Occupational Safety and Health Administration (OSHA) suggests solutions for protecting WWHL, including flat-attenuation hearing protectors, active level-dependent HPDs which amplify low-level sounds and attenuate high-level sounds, and earmuffs worn over the worker’s own hearing aids. These suggestions are meant to be considered on a case-by-case basis by the worker and their hearing conservation professional; however, hearing conservation professionals report lacking sufficient evidence to make informed recommendations for WWHL (Leroux et al., 2018). They are unsure about the safety of hearing aid use in a noisy workplace and want more information about active hearing protection options (Leroux et al., 2018). These concerns deserve our attention. As a reference point for future investigation, we developed a survey to capture the current practices of hearing conservation professionals for protecting the hearing of noise-exposed WWHL.

## **Methods**

A 22-question survey was created in Qualtrics and distributed by email and by link. A total of 283 emails were sent to the National Hearing Conservation Association (NHCA) Professional

Service Provider list and the CAOHC Professional Supervisor list. Links were posted to the NHCA Facebook Page and the American Speech-Language-Hearing Association (ASHA) Special Interest Group 8 (Audiology and Public Health) Message Board for participation and sharing.

Quantitative analysis of closed-set survey responses was performed in MS Excel and SPSS. Qualitative coding of open-ended responses was performed with nVivo software to reveal common themes in the participants' responses. The themes were then quantified for further analysis. For example, the response "*An employee occasionally needs amplification during the work shift (for directions, safety reasons, etc.) and also need protection from noise ... so it's a very challenging situation for many employees*" was coded as "safety", "communication" and "challenging to provide both amplification and protection". These emergent themes were coded by a primary coder (J.D.) and then verified through independent coding by a second coder (T.W.). Any coding discrepancies were addressed through discussion until agreement was reached.

## Results

### Survey Respondents

A total of 92 survey responses were received, including 47 females and 44 males (one individual did not provide their gender). Geographically, 40 U.S. states were represented, with the greatest number of respondents working in Texas (n=10), Ohio (n=8), Washington (n=7) and Oregon (n=6).

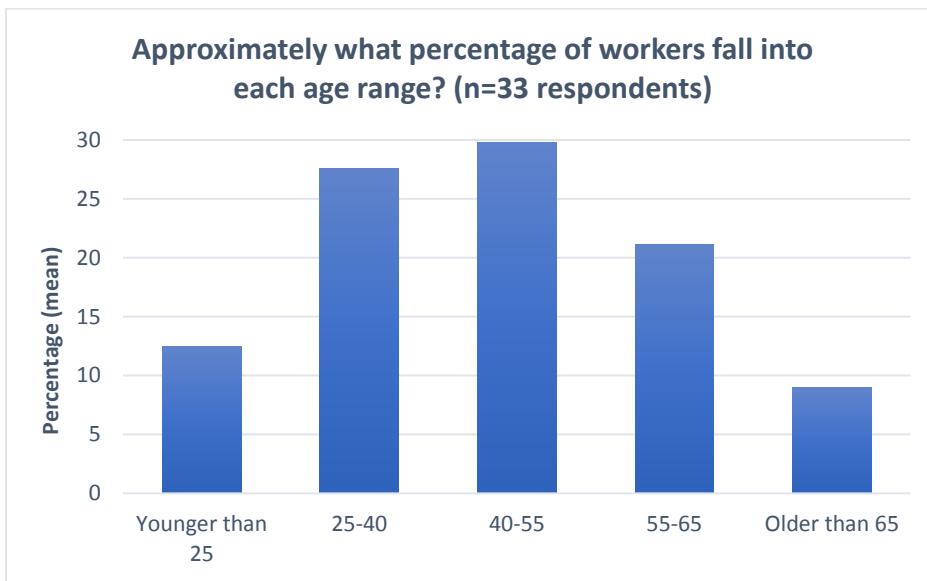
The majority of respondents identified their primary field of work as audiology (66%), followed by occupational medicine (23%) and industrial hygiene (4%). Respondents' involvement with hearing conservation had a mean (sd) tenure of 20.8 (13.0) years. Most respondents (75%) hold one or more CAOHC certifications, including 54 Professional Supervisors, 32 Occupational Hearing Conservationists, and 14 Course Directors. Other than CAOHC certifications, 43 respondents hold an audiology license, 19 have their certificate of clinical competence in audiology (CCC-A) from the American Speech-Language and Hearing Association, 14 hold a medical doctor license, eight have a Master's degree in Public Health, and eight are Medical Review Officers.

Respondents were asked to classify the industries that they work with, which included manufacturing (n=55), construction (n=31), transportation (n=30), mining (n=24), military (n=23), agriculture (n=22) and other (n=21). The 'other' category write-in responses included healthcare, oil and gas production, power generation, food processing, research and education.

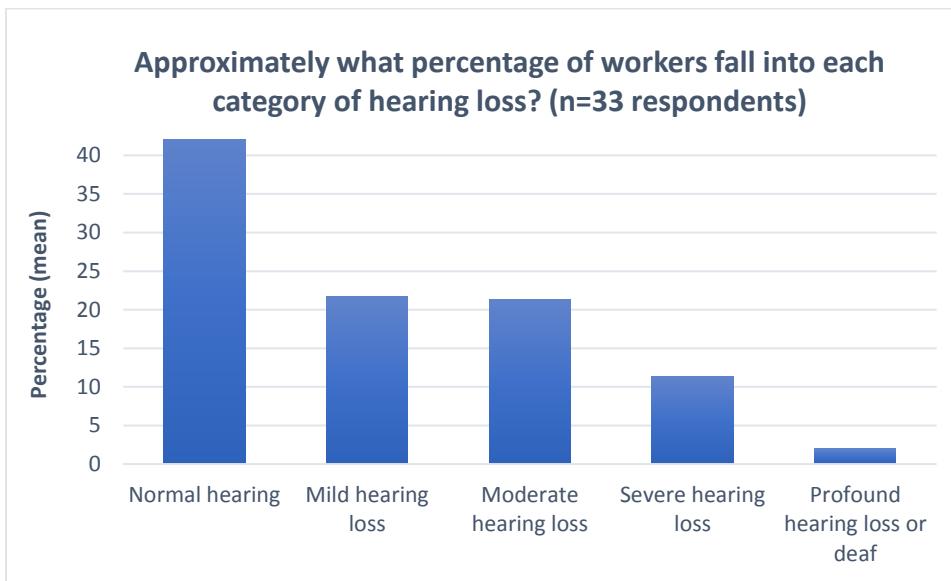
## Worker Population

Respondents were asked to estimate demographic information about the workers that they serve (Figures 1, 2 and 3). They were also asked what types of hearing protection are available to these workers (Figure 4). Most of the 'other' responses to this question referred to custom hearing protection as one of the options available to workers.

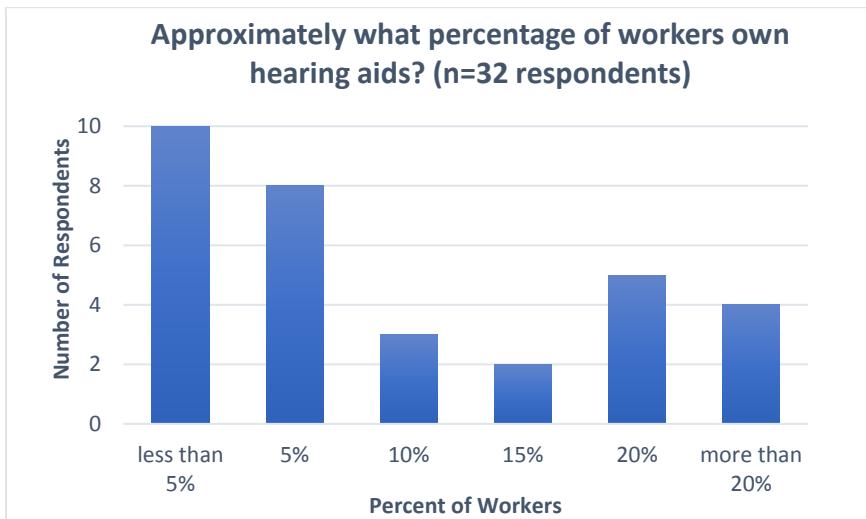
**Figure 1.** Estimated age distribution of worker population expressed as mean percentage.



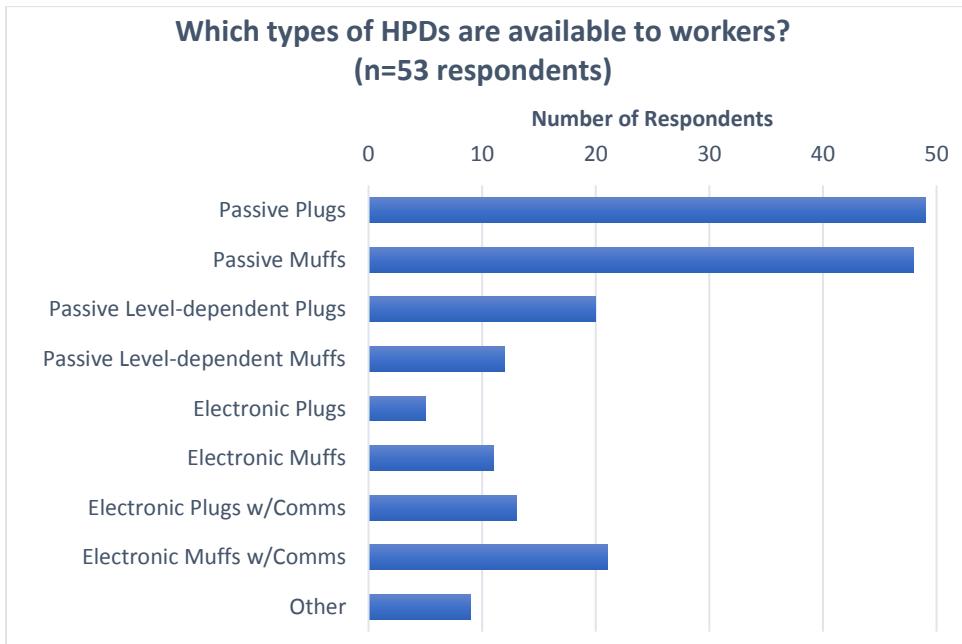
**Figure 2.** Estimated hearing status of worker population expressed as mean percentage.



**Figure 3.** Estimated hearing aid ownership by worker population.



**Figure 4.** Types of hearing protection devices available to workers. Respondents could choose more than one HPD type.



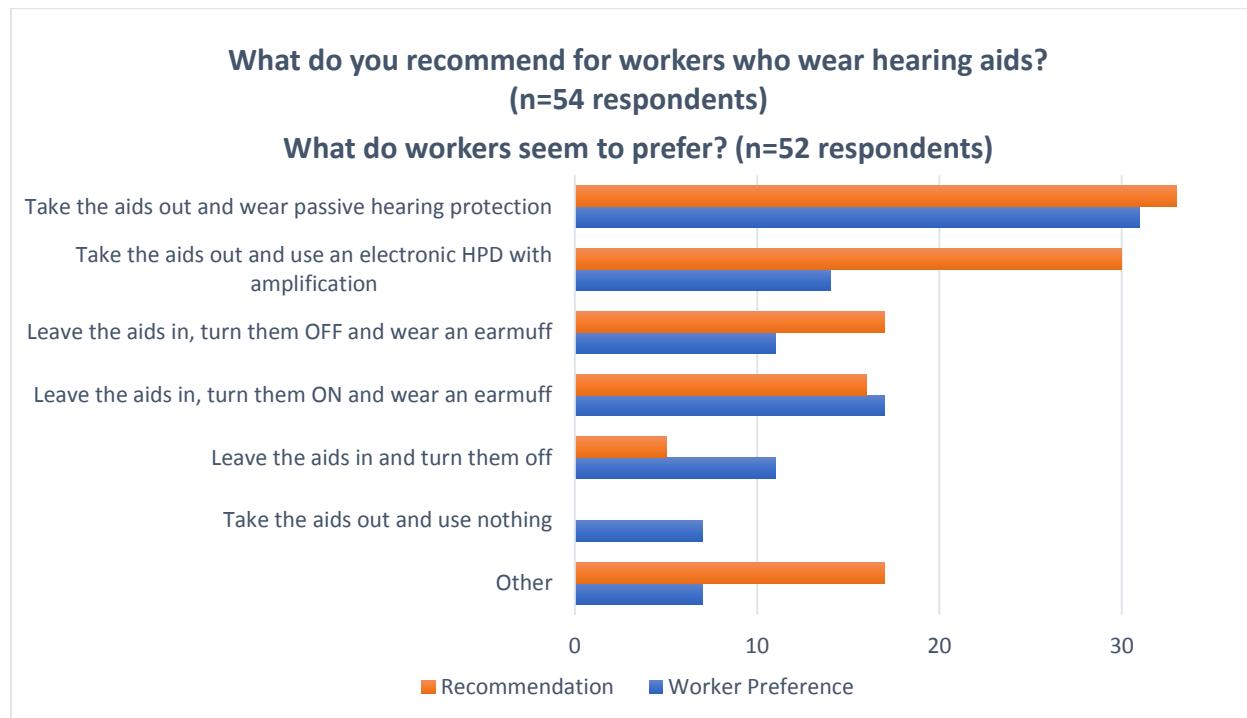
### **Recommendations for Workers with Hearing Loss**

Respondents were asked what recommendations they make for workers who wear hearing aids (Figure 5). Most recommendations involved removing the hearing aids and wearing either passive hearing protection (n=33) or an electronic HPD with amplification (n=30). About half as many recommendations involved leaving the hearing aids in and wearing a passive earmuff over them, with an approximately equal number of respondents recommending turning the aids ‘off’ (n=17) vs. ‘on’ (n=16). The ‘other’ responses (n=17) were varied. Several respondents mentioned that their recommendation depends on other factors, such as the worker’s need for communication or the worker’s personal preferences. On the topic of wearing hearing aids in noisy workplaces, some comments expressed opposition- “Anyone who says to keep the hearing aids in are doing a great disservice” and “never recommend that a worker use aids in noise – serious OSHA violation”. Others specified when and how hearing aids should be used- “Use hearing aid with a LARGE DEEP CUP muff ONLY if the aid has an advanced feedback suppression system. Works in certain instances.”

Respondents were also asked “What do workers seem to prefer?” (Figure 5). Most respondents reported that workers prefer to remove their hearing aids and wear passive protection (n=31). About half as many prefer to “leave the aids in, turn them ON, and wear earmuff” (n=17) or “take the aids out and wear an electronic HPD with amplification” (n=14). However, the survey did not reveal the basis for worker preferences. For example, worker preference for wearing electronic HPDs in lieu of hearing aids appears somewhat low, but whether that is simply due to a lack of experience with electronic HPDs is unknown.

**Figure 5.** Recommendations for workers with hearing aids, and worker preferences.

Respondents could choose more than one option.



Respondents were also asked what they recommend for WWHL who do NOT wear hearing aids. This question was open-ended and received 50 responses. Most responses mentioned passive earplugs or earmuffs (n=21). Another 10 respondents specified some sort of active or electronic hearing protector, four recommended custom plugs, and three recommended flat-attenuation hearing protectors. There were also 25 responses to this question mentioning that the recommendation depends on another factor, such as noise exposure (n=11), communication and/or safety needs (n=5), degree or type of hearing loss (n=4), user preference (n=3), or work environment (n=2).

Respondents were asked “What factors do you consider when making recommendations for workers who wear hearing aids?” The top responses were noise exposure (including level, type and/or duration of noise) (n=20), communication needs (n=20), and degree/type of hearing loss (n=17). Other factors considered included work environment, safety, job duties, compatibility with other protective equipment, comfort, the worker’s level of compliance, type of hearing aids worn, and attenuation characteristics of the hearing protector.

Respondents were asked “Do you have any unique problems/solutions involving your workers with hearing loss?” Of the 25 responses to this question, seven reported problems with counseling and compliance, five reported that it is challenging to provide both audibility and protection at the same time, three had problems specific to military environments (e.g. fitting

hearing protection with flight helmets), and three reported a lack of access to or availability of the hearing protectors they would like to recommend. One respondent also noted that amplification cannot be used in certain environments due to potential fire risk. Another has seen workers using earbuds as an alternative to hearing protection.

The survey concluded with the question “Is there anything else you think it would be helpful for me to know about hearing protection solutions for works with hearing loss?” There were 20 responses to this question, including five referencing problems with access or cost of certain hearing protectors and four referencing the need for fit-testing. Other responses included the need for more education and training for both workers and employers, and a reiteration of the fact that hearing aids and earbuds are not suitable replacements for hearing protection.

### **Discussion**

Protecting the hearing of noise-exposed WWHL remains an ongoing challenge for hearing conservation professionals. The concerns identified by respondents in this survey suggest a continuing need for research, collaboration, and information-sharing in this area.

Although responses varied widely, some trends did emerge in the survey data. The most common recommendation given by hearing conservation professionals to workers with hearing aids was to *remove the hearing aids in noise and wear either passive or level-dependent HPDs instead*. Lack of worker access to electronic level-dependent HPDs was cited as a concern by several respondents. This suggests a need for hearing conservation professionals to advocate for access to suitable accommodations for WWHL.

Less commonly, hearing conservation professionals recommended that workers *leave their hearing aids in and wear earmuffs over them*. An approximately equal number of these respondents recommended turning the hearing aids on vs. off under the earmuffs. However, several respondents expressed concern about the safety of this option. Further research is needed to determine under what circumstances the hearing aid/earmuff combination can be safely worn (Leroux et al., 2018).

Our survey respondents reported that they take a variety of factors into account when making their recommendations, such as communication needs, safety concerns, noise level, or the worker’s hearing loss configuration. Despite having limited guidelines and options available to them, hearing conservation professionals are working creatively with WWHL in an effort to find safe, effective, and acceptable solutions.

Nevertheless, it is apparent that we haven’t come nearly as far as we need to. Electronic hearing protectors may offer improved communication, but access to these devices is still a

barrier. Wearing hearing aids under hearing protection may be an option, but safety is still a concern. Hearing conservation professionals need a stronger evidence base from which to draw their recommendations and more opportunities to share information with other professionals. Through continuous research and collaboration, we can establish best practices that harness both technology and the rich experiences of hearing conservation professionals; contributing to a safe, productive and enjoyable work environment for WWHL.

We would love to hear your thoughts on this topic! Please send them to [Jacqueline.difrancesco@uconn.edu](mailto:Jacqueline.difrancesco@uconn.edu).

Portions of this work were presented at the 2019 National Hearing Conservation Association conference.

## References

- Casali, J. G. (2010). Powered electronic augmentations in hearing protection technology circa 2010 including Active Noise Reduction, electronically-modulated sound transmission, and tactical communications devices: Review of design, testing, and research. *International Journal of Acoustics and Vibration*, 15(4), 168.
- Giguère, C., Laroche, C., Vaillancourt, V., & Soli, S. D. (2010). Modelling speech intelligibility in the noisy workplace for normal-hearing and hearing-impaired listeners using hearing protectors. *International Journal of Acoustics and Vibration*, 15(4), 156.
- Hétu, R., Getty, L., & Quoc, H. T. (1995). Impact of occupational hearing loss on the lives of workers. *Occupational medicine (Philadelphia, Pa.)*, 10(3), 495.
- Hétu, R., Jones, L., & Getty, L. (1993). The impact of acquired hearing impairment on intimate relationships: Implications for rehabilitation. *Audiology*, 32(6), 363-380.
- Leroux, T., Laroche, C., Giguère, C., & Voix, J. (2018). Hearing aid use in noisy workplaces. Institut de recherche Robert-Sauvé en santé et en sécurité du travail, Studies and Research Projects, R-2015.
- Morata, T. C., Themann, C. L., Randolph, R. F., Verbsky, B. L., Byrne, D. C., & Reeves, E. R. (2005). Working in noise with a hearing loss: perceptions from workers, supervisors, and hearing conservation program managers. *Ear and Hearing*, 26(6), 529-545.
- Occupational Safety & Health Administration (2005). Hearing conservation for the hearing-impaired worker. Safety and Health Information Bulletin 12-27-2005.
- Reddy, R. K., Welch, D., Thorne, P., & Ameratunga, S. (2012). Hearing protection use in manufacturing workers: a qualitative study. *Noise and Health*, 14(59), 202.