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HCE-TR-2023-002
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HEARING PROTECTION DEVICE SELECTION TRAINING

Defense Health Agency, Hearing Center of Excellence
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14. ABSTRACT

Sound attenuation through hearing protection devices (HPDs) may raise competing concerns for military personnel in operational settings. The DHA Hearing Center of Excellence (HCE) created tools to aid selection of the most appropriate passive HPDs. Courses available through milUniversity include these tools to support hearing health professionals who recommend HPDs to service members based on their suitability for specific occupational and work environments. Course taker survey responses indicate that these resources improve knowledge of HPDs as well as factors to inform their recommended use.

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Hearing conservation, hearing education, hearing protection, hearing protection device, HPD, passive hearing protection

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TABLE OF CONTENTS

INTRODUCTION

Hearing conservation programs serve multiple objectives including noise surveillance and control, audiometric monitoring, recordkeeping, education and training, and prevention through hearing protection. With effective counseling and committed leadership, hearing conservation programs can substantially improve hearing protection awareness and compliance, and thereby reduce the incidence of occupational hearing loss (Brink et al., 2002; Heyer et al., 2011; Rabinowitz et al., 2018). However, previous reports by the National Academies of Sciences, Engineering, and Medicine (NASEM) and Government Accountability Office (GAO) have concluded that despite various effective local strategies by the U.S. military services to advance hearing conservation objectives, Department of Defense (DOD) hearing conservation programs were, in sum, "inadequate to protect the hearing of service members" (NASEM, 2006, p. 180) and were "not realizing their full potential" (GAO, 2011; p. 30). Findings from recent DOD hearing health surveillance reviews indicate that among DOD service members and civilians enrolled in military hearing conservation programs, hearing loss trends have remained relatively stable for nearly a decade (Barr, 2023; Hearing Center of Excellence, 2021).

Recognizing a need to improve DOD hearing conservation program effectiveness, the DHA Hearing Center of Excellence (HCE) has developed tools and training resources to support hearing conservation personnel in their selection and recommendation of hearing protection devices (HPDs) for service members enrolled in hearing conservation programs.

Hearing Protection Devices (HPDs)

Effective hearing protection is crucial to protect military personnel from potentially hazardous noise in operational and occupational settings. The most widely available and commonly used type of hearing protection is "passive," serving as a physical barrier to reduce hazardous noise entering the inner ear. Examples of passive hearing protection include disposable foam earplugs, custom-molded earplugs, and (non-electronic) earmuffs (Figure 1). Passive sound attenuation may require greater listening effort (Smalt et al., 2020) and distort acoustic cues

that are important to auditory perception (Brown et al., 2015; Gallagher et al., 2014; Ghazaleh et al., 2022; Giguère et al., 2015; Zimpfer & Sarafian, 2014). These effects present competing concerns for military personnel in operational settings where situational awareness, effective communication, and precise detection, identification, and localization of sounds are necessary. Although some advanced passive HPDs are user-adjustable for different sound environments and needs, they are not commonly used in the DOD.

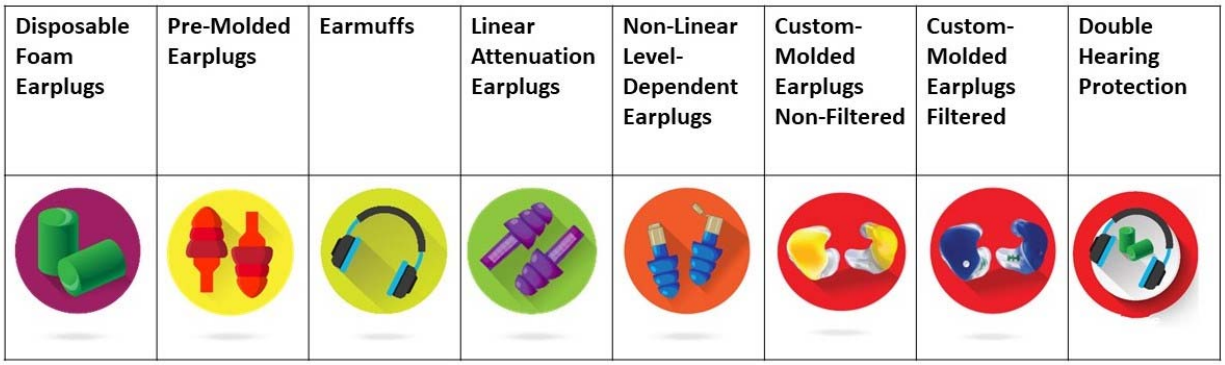

Figure 1. Passive hearing protection devices (HPDs). Disposable foam earplugs, pre-molded earplugs, and earmuffs offer protection from continuous and impulsive noise. Linear attenuation earplugs provide less protection, but with truer experience to sound. Non-linear level-dependent earplugs can be worn open (protects against impulsive noise) or closed (protects against continuous and impulsive noise). Custom-molded earplugs are made from impressions of the user's ear canal; these can be made as a solid earplug, filtered to work like linear attenuation earplugs, or with electronics. Double hearing protection refers to earplugs and earmuff worn in combination, to protect against continuous noise that exceeds attenuation possible with a single passive HPD.

Different passive HPDs may be more or less effective in different environments, for different types of work, and for hearing critical tasks (HCTs). The perceived risks and benefits of hearing protection affect workers' willingness to wear HPDs, as do factors such as comfort, convenience, cost, communication hindrance, and social norms (Abel, 2008; Fauzan et al., 2023; Green et al., 2021; Okpala, 2007; Smith et al., 2014). Ideally, military audiologists and hearing conservation professionals can inform and guide service members to select well-fitting HPDs with the best applicability to user characteristics, specific job requirements, and settings. These information factors have been noted elsewhere as important to guiding the selection of appropriate HPDs (Fink et al., 2019; Kwak & Han, 2021; Nakashima & Farinaccio, 2015).

In the past, noise reduction ratings (NRR) were the only data available for HPDs. These ratings were based on a rescinded assessment standard from the Acoustical Society of America. In 2015, Casali and Lee developed an objective test battery to test the situational awareness effects of HPDs on auditory tasks (Casali & Lee, 2015). They quantified the situational awareness effects of hearing-related devices by looking at performance ratings of subtask elements detection, recognition/identification, localization, and communication. Concurrently, the Air Force Research Lab at Wright-Patterson Air Force Base evaluated the performance of commercially available HPDs looking at continuous noise attenuation, impulsive peak insertion loss, sound localization, auditory detection, and subjective comfort (Gallagher et al., 2014). Based on these two efforts, the HCE developed a poster (Appendix 1; https://hearing.health.mil/-/media/Images/HCE/Materials/Posters/Passive-Device-Poster.ashx) and guidebook designed to help hearing health professionals and service members select the best HPD based on noise reduction, communication, and situation awareness requirements. The HCE titled these resources the "Hearing Protection Device Evaluated Products List" (HPD EPL; Buchanan et al., 2021), designed to aid selection of the most appropriate passive HPDs that can reduce noise exposure while preserving critical hearing for specific environments, missions, and tasks (Barr, 2020; Hearing Center of Excellence, 2018; Hearing Center of Excellence, n.d.). Development of the HPD EPL has provided an important, updated, and relevant new tool to support hearing health professionals who work to identify, select, and recommend specific HPDs to service members based on the suitability of the HPD for specific occupational and work environments.

Hearing Health Education Training

To accompany the HPD EPL poster and guidebook, the HCE also developed an online Hearing Health Education training module, available through milUniversity (Sarantinos-Perrin, 2013), the DOD's secure online learning portal (Figure 2; https://www.milsuite.mil/university/hearing_center_of_excellence/). Instructions to access the training site can be found at: https://hearing.health.mil/Prevention/Evaluated-Hearing-Protection-Devices. The purpose of the training module is to instruct military hearing health

professionals about different types of hearing protection, when they should be used, and how to find and use resources such as the HPD EPL. Content was created by subject matter experts in the military health setting, including military audiologists, industrial hygienists, and bioenvironmental engineers.

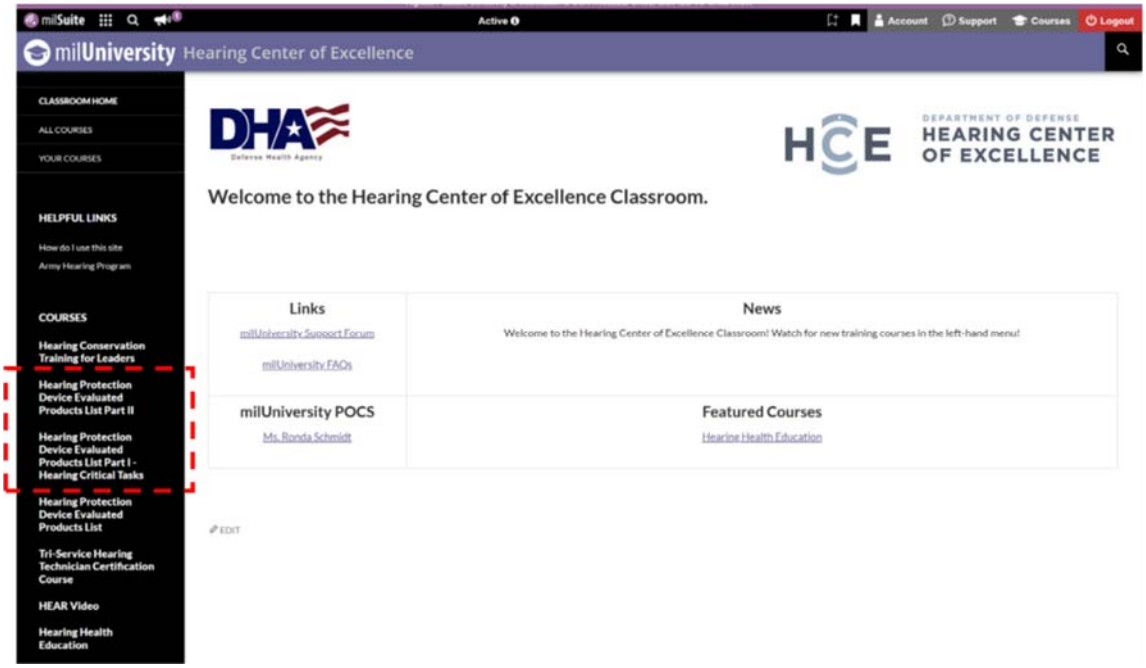

Figure 2. Screenshot of the Hearing Center of Excellence (HCE) classroom on milUniversity with the HPD EPL courses outlined using a red dotted line.

Two courses were designed to improve knowledge and awareness of passive HPDs, and to support better informed HPD recommendations that consider relevant factors such as work process needs, noise levels, noise attenuation, fit, and availability. These courses targeted all active duty and civilian hearing conservation personnel in the Army, Air Force, Navy, and Marine Corps. Hearing conservation personnel represent a variety of different career fields including industrial hygienists, bioenvironmental engineers, and public health, safety, occupational health professionals (e.g., audiologists). The content of the courses was designed to be easily accessible to personnel with different educational levels and training backgrounds, as many hearing conservation personnel have no formal education in audiology or specific training in hearing conservation or protection.

The first (20-30 minutes) course, titled “HPD EPL Part 1: Hearing Critical Tasks,” provides information about how to identify and recognize HCTs such as talking on the phone, localizing important background noise cues, and hearing backup alarms in a vehicle. In military operational settings, HCTs might include identifying different sounds such as gun fire or footsteps, determining where enemy troops may be located, and understanding communications and instructions over a radio. The second (60-90 minutes) course, “HPD EPL Part 2,” explores different types of passive HPDs and provides information for their appropriate selection for different noise environments and priorities including HCTs (Buchanan et al., 2022). Each passive HPD is listed with associated names, accompanied by a list of its key characteristics. Figure 3 shows an example of this using non-linear level-dependent earplugs.

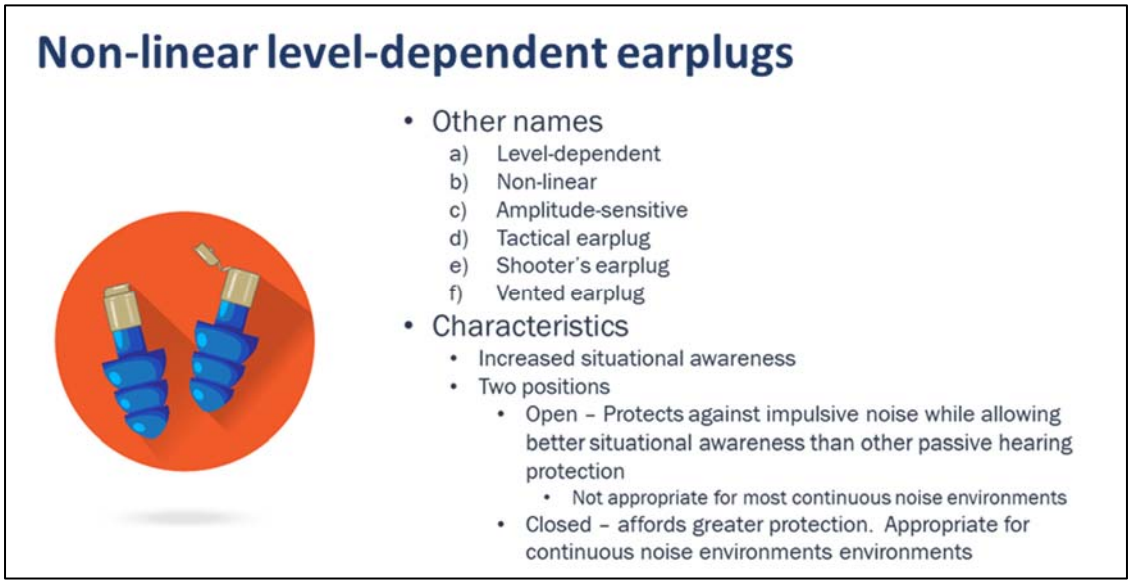

Figure 3. An example of how HPDs are presented in the course and the affiliated information.

Course-takers are then given a choice of how they want the HPD to function (Figure 4). The schema begins with a simple statement, “This hearing protection needs to…”, from which the course-taker considers specific (and perhaps competing) needs to maintain hearing critical functions while protecting against continuous and/or impulse noise hazards.

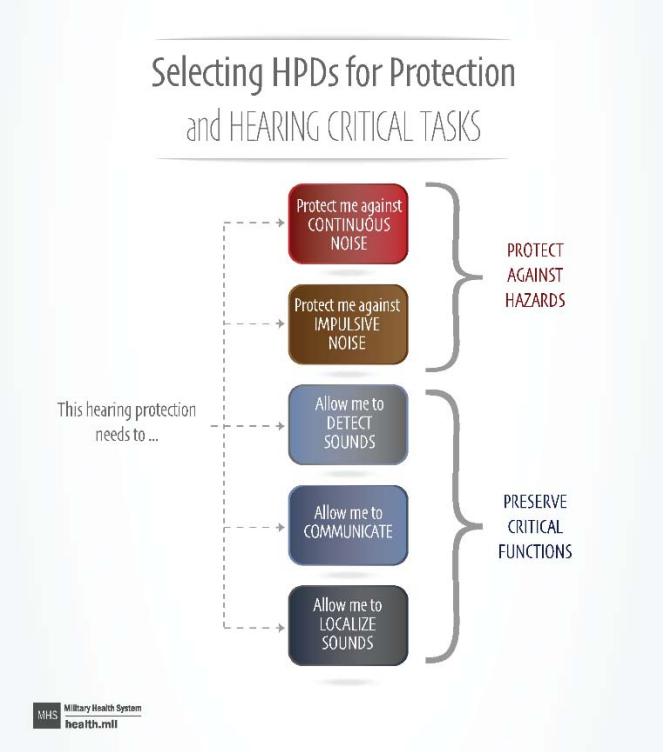

Figure 4. Schema for HPD selection as presented in the HPD EPL Part 2 course. Step one includes choosing the function of the HPD.

Figures 5 and 6 follow on to qualify the loudness of the noise exposure and how critical sound localization is to the task at hand. Based on the answers to these questions, the training recommends the use of either single (earplugs) or double (earplugs and earmuffs) hearing protection. To date, 128 individuals have completed the HPD EPL Part 1 course; 106 individuals have completed the HPD EPL Part 2 course.

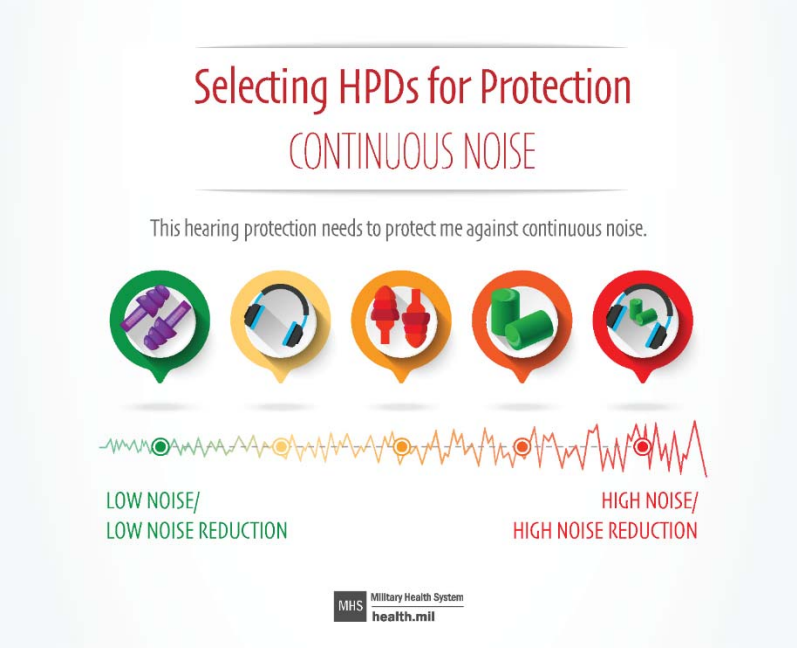

Figure 5. Step two in the schema allows for selection of the loudness of the noise conditions.

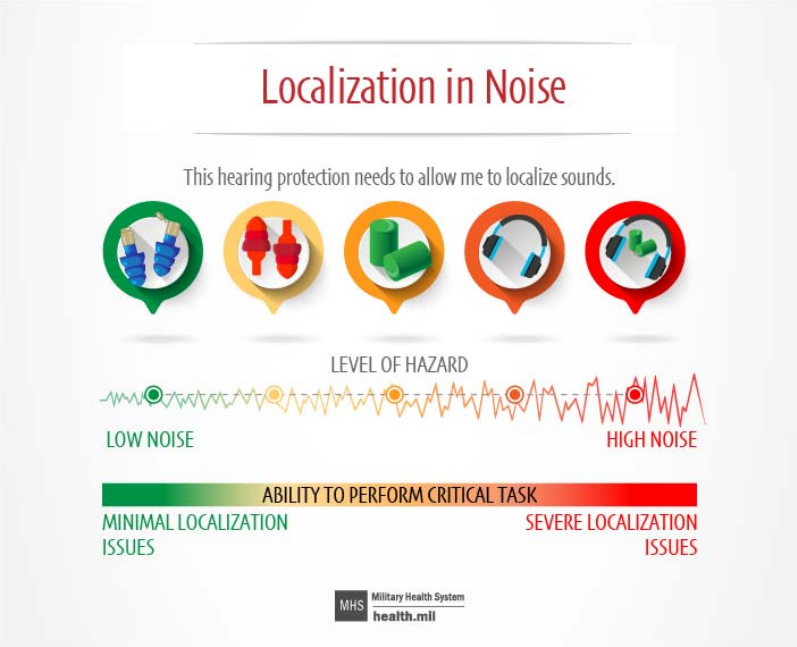

Figure 6. Step three addresses the need for sound localization while wearing the HPDs.

With the creation of the HPD EPL training courses, we wanted to evaluate the program's effectiveness by observing changes, if any, in course takers' self-reported HPD knowledge and

recommendations. We designed a quality improvement (QI) project to explore the utility of the HCE's HPD EPL online training courses for hearing health and hearing conservation professionals. Our target population was professionals who work at the military unit level to make recommendations for hearing protection. As part of this effort, surveyed participants were asked to rate their own knowledge of HPDs and to estimate how often they recommend HPDs based on specific factors (e.g., NRR, availability, best fit, work process needs).

METHODS

This project ("Hearing Protection Device Evaluated Products List Selection Course Effectiveness Evaluation") was submitted to the institutional review board of the U.S. Air Force 59th Medical Wing and received non-research determination (FWH20220010N; 29 October 2021) and approval to use the surveys. Information Management Control review was not required at the time of this review.

Participants

Volunteers were recruited from each of the Services (Army, Air Force, Navy, Marine Corps), with a minimum target of 40 participants. Military service liaisons who support the HCE reached out by email to professional points of contact to distribute the project information and invitation to participate. Fifty-four (54) people initially volunteered to participate. Of the 54 people, thirty (30) people completed both the pre- and post-training survey. Fields of practice represented safety officers (n = 8), industrial hygienists/bioenvironmental engineers (n = 11), public health professionals (n = 6), occupational audiologists (n = 2), and hearing conservation program managers (n = 3). Respondents were aligned as active-duty or National Guard members of the Army (n = 8), Navy (n = 4), Air Force (n = 10), or Marine Corps (n = 8).

Procedures

Participants completed a pre-training survey prior to taking the training course to identify their professional information and experiences, general knowledge of HPDs, and recommendation practices. Directly after completing the training, participants completed a post-training survey to

gather their impressions of the usefulness, format, content, strengths, and weaknesses of the training. Participants were surveyed again at 3-months post-training to assess whether their self-reported HPD knowledge and recommendation considerations had changed. Participants' evaluation of the course content itself falls beyond the scope of this report; responses to the course content survey (immediate post-training) are not reported here. Pre-training and 3-month follow-up surveys are shown in Appendices 2 and 3.

Surveys were sent via SurveyMonkey and took approximately 5-10 minutes to complete. Participants were given up to 45 days to complete the online training courses. Within a few days of completing the training, participants were sent the post-training survey to gather information about their experience with the training module. Finally, a 3-month follow-up survey was sent out to all participants who had completed both surveys and the training within the allowed 45-day period.

Analyses

Individual responses were tracked and observed across the pre-training and 3-month follow-up surveys. Specifically, we were interested in any changes in participants' self-rated knowledge of HPDs and how they estimated their consideration of various factors in making their HPD recommendations.

RESULTS

Some participants did not respond to all questions; therefore, numbers reported in the following graphs do not always reflect all 30 participants.

Knowledge of HPDs

Participants were asked at pre-training and at the 3-month follow-up to rate their knowledge of HPDs. Figure 7 depicts the results and trends of change over time between the pre-training and 3-month follow-up surveys. The left side of the graph indicates self-reported knowledge about

HPDs before training. The right side shows how participants rated their knowledge three months after training.

Overall, participant self-rated knowledge of HPDs improved with the training. Among the 29 participants who answered this question, 20 rated their post-training knowledge as “above average” or “well above average” compared to 13 who rated their pre-training knowledge as “above average” or “well above average.” After training, just 2 of the 29 participants rated their knowledge of HPDs as “below average” or “well below average” compared to 5 participants prior to training. Two participants who rated their pre-training HPD knowledge as “below average” or “well below average” subsequently rated their 3-month post-training knowledge of HPDs as “above average.” Three participants rated their 3-month post-training knowledge as worse than before the training.

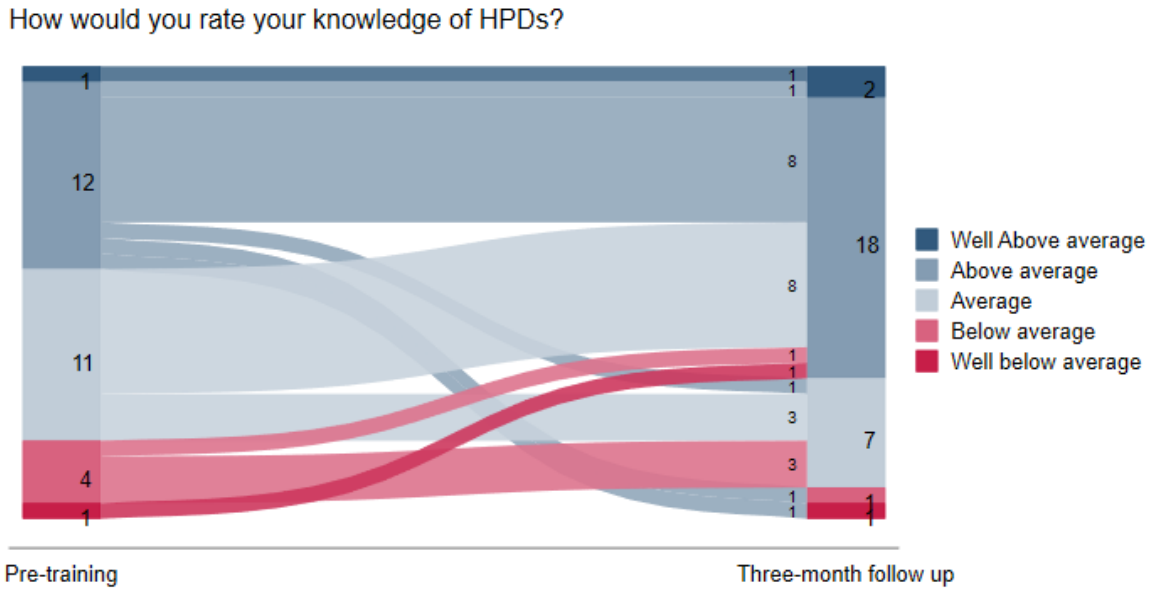

Figure 7. The left column of the graph shows how many people self-reported their knowledge per rating category before taking the training course (pre-training). Knowledge rating categories were “well above average” (dark blue), “above average” (blue), “average” (light blue), “below average” (light red), or “well below average” (dark red). The right column of the graph shows how many people self-reported their knowledge rating at three months after the training (3-month follow up). Each course taker’s response was tracked between their pre-training and 3-month follow up surveys (middle of the graph).

Before training and at 3-month follow-up, participants were asked to estimate how often they recommended specific HPDs. Ten HPDs were listed, with options for participants to answer “Always”, “Often”, “About half of the time”, “Seldom”, “Never”, or “I don’t know what this device is”. With respect to the frequency of recommending different HPDs (data not shown), participants’ answers did not vary much from pre-training to 3-month follow-up. However, there was a noticeable difference in how many participants answered “I don’t know what this device is” before versus after training. Before training, most of the HPDs were unknown to at least two participants, and only three HPDs were known by all who completed the survey. At 3-month follow-up, only two participants responded that they did not know what a device was, and eight HPDs were known by all who completed the survey (Figure 8).

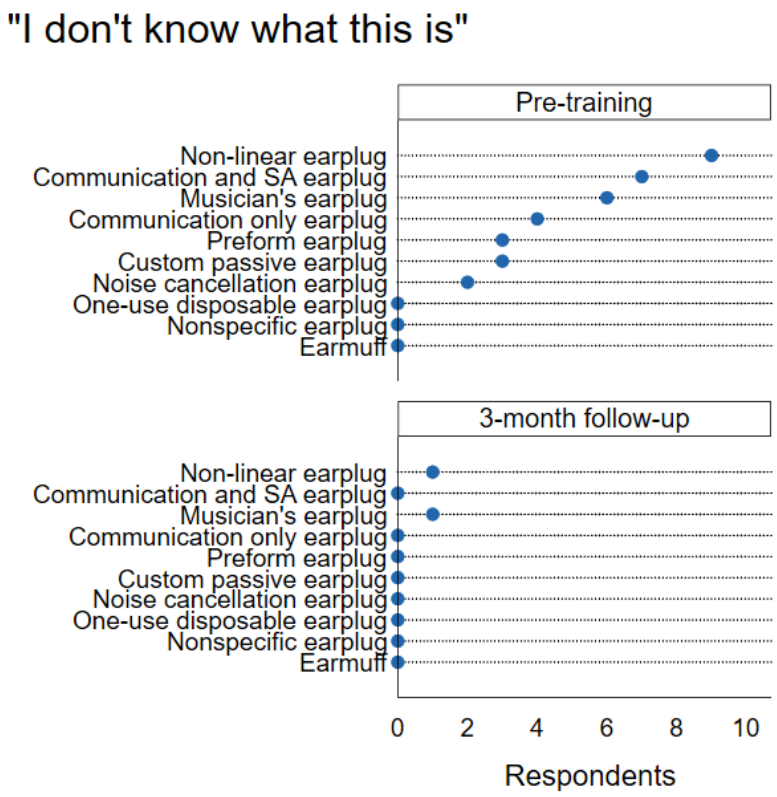

Figure 8. Respondent familiarity with specific HPDs before training and at the 3-month follow-up. The dots represent the number of respondents who did not know what that specific HPD was at the time of the survey.

Recommendation Factors

We also wanted to know what factors were considered by providers when they recommended HPDs. At pre-training and 3-month follow-up, participants were asked to select factors they considered as basis for their HPD recommendations "Always (100% of the time)", "Often (75% of the time)", "About half the time (50% of the time)", "Seldom (25% of the time)", or "Never (0% of the time)". Factors for consideration included availability, work process needs, noise levels, NRR, derated NRR, and best fit. Participants were asked to respond on all factors.

Figure 9 illustrates participants' responses, averaged by profession. Before training, occupational audiologists (red) identified three factors (availability, best fit, and noise levels) as basis for their recommendations 75% of the time or more; after training, they identified those same factors and a fourth (work process needs) that served as basis for their HPD recommendations. Before training, HCP providers (orange) did not identify any of the factors as basis 75% of the time or more when recommending HPDs; after training, they identified two factors (noise levels and work process needs) as basis for their recommendations at least 75% of the time. Before training, industrial hygienists/bio-environmental engineers (green) identified four recommendation basis factors (availability, de-rated NRR, noise levels, and work process needs) for their HPD recommendations at least 75% of the time; after training, they identified only two factors (noise levels and work process needs) as basis at least 75% of the time. Before and after training, public health professionals (blue) identified the same four factors (availability, best fit, NRR, noise levels, and work process needs) serving as recommendation basis factors at least 75% of the time. Before training, safety officers identified three recommendation basis factors (availability, noise levels, and work process needs) contributing to their HPD recommendations at least 75% of the time; after training, they identified just one factor (noise levels). Across professional groups, noise levels appeared to serve as the most consistently frequent recommendation basis factor. Noise levels was consistently selected as a frequent (at least 75% of the time) recommendation basis factor by most professional groups before training, and by all groups after training.

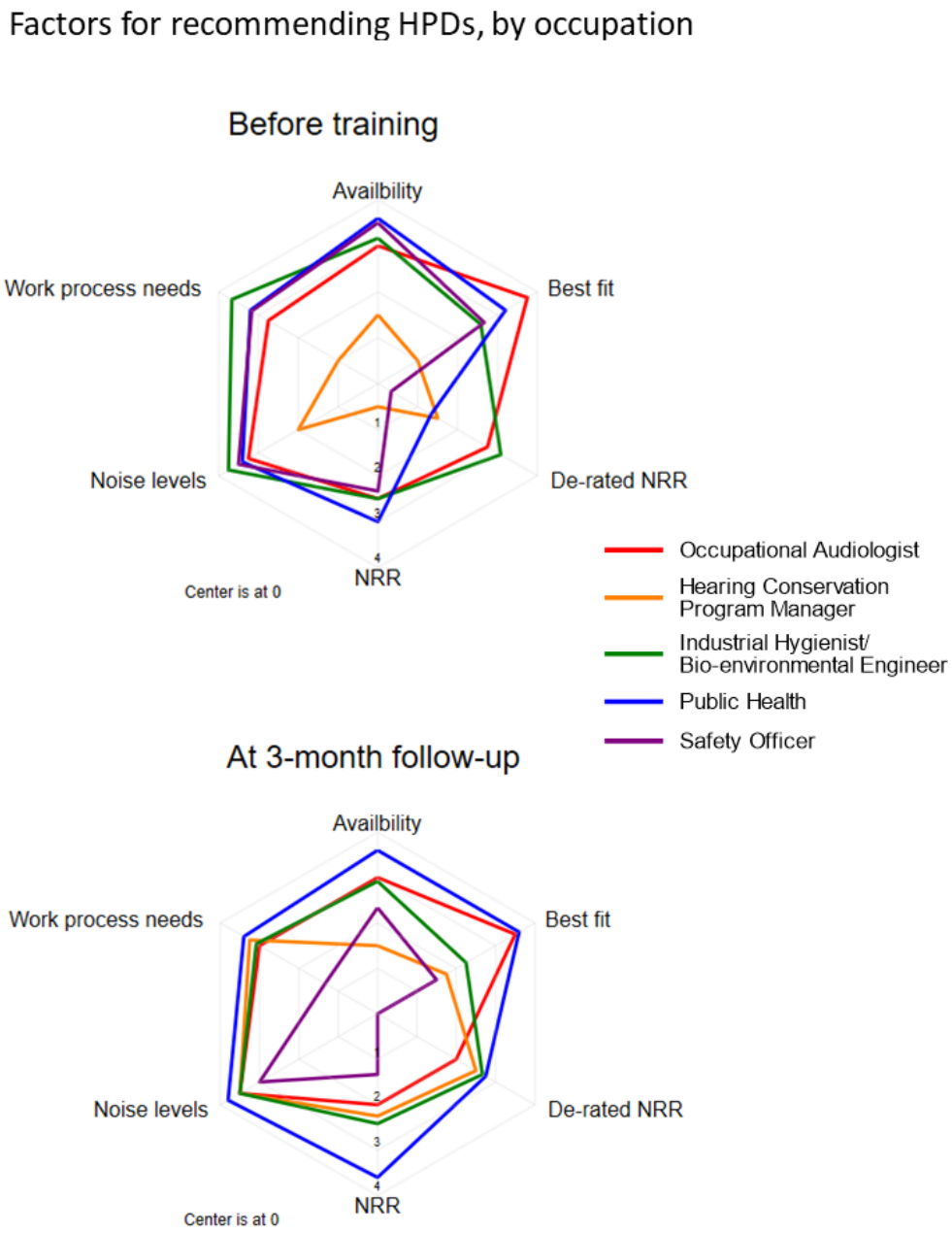

Figure 9. Participants were asked to indicate how often they recommend HPDs based upon several factors (noise level, NRR, de-rated NRR, availability of the HPD, work process needs, best fit). Response options included “Always (100% of the time)”, “Often (75% of the time)”, “About half the time (50% of the time)”, “Seldom (25% of the time)”, or “Never (0% of the time)”. These responses were assigned values from 0 (“Never”) to 4 (“Always”) and grouped by occupation. Radar plots represent the response averages for each occupational group before training and at 3-month follow-up.

Importance of Hearing Critical Tasks

At 3-month follow-up, participants were asked to rate the importance of evaluating work processes and missions for HCTs, and to consider HCTs and when making HPD recommendations. All participants responded that it is “somewhat important” or “very important” to evaluate work processes and missions for HCTs, and that it is “somewhat important” (n = 2) or “very important” (n = 27) to consider HCTs when making HPD recommendations.

Barriers to HPD Recommendation

Finally, as part of the 3-month follow-up questionnaire, participants were asked an open-ended question: “What barriers prevent you from recommending specific HPDs based on hearing critical tasks?” Fifteen (of 30) respondents named one or more specific barriers in response to this question. We grouped their responses into four categories: cost/availability, equipment, information/data, and/or user attributes (Table 1).

Barrier Type	Description
Cost	• Unit funding limitations • The price of the HPDs • Costs • Organizations often don't have funds for, or do not prioritize, purchasing recommended HPDs
Equipment	• Lack of equipment to perform fitting • Not being able to order certain hearing protection at my base • Availability of desired HPD in clinic
Information/data	• Passing along knowledge of different HPDs for unit-specific hearing critical tasks to shop-level supervisors • Lack of data such as attenuation ratings outside of S3.19 and lack of directionality data • The ability to provide easy to understand training materials to Marines and Sailors. Providing them a why and understanding of the importance of hearing • Choosing the correct HPD for specific roles can be challenging • I would benefit from a refresher course annually.
User attributes	• Wearer acceptance and use • Acceptance, comfort • The ability for employees to be able to hear when using the HPDs during training exercises • Prior STS in employees also limits the ability to recommend HPDs due to lowered ability to hear without HPDs • Patient not knowledgeable enough to state which are hearing critical tasks • Customer need

Table 1. Participants' self-reported barriers to recommending specific HPDs based on hearing critical tasks at 3-month follow-up.

CONCLUSIONS

The HCE's HPD EPL program began as a single poster and has since been developed into a training paradigm aimed at helping hearing health professionals provide U.S. military service members with recommendations for passive hearing protection under different circumstances. The concepts and teaching tools for this program were created by subject matter experts in military audiology, industrial hygiene, and bioenvironmental engineering. The information contained within the HPD EPL materials and courses was designed to educate occupational

audiologists, hearing conservation program managers, safety officers, and industrial hygienists, some of whom do not have any professional hearing health education but are required to provide service members with the most appropriate hearing protection for their military occupational specialties.

A QI project was performed, with limited scope and purpose, to provide HPD EPL course designers with early impressions from respondents concerning the impact of the training on their HPD knowledge and recommendation practices. As such, the project was limited by its reliance on self-reported data, and by the relatively small number of participants represented across multiple fields of practice.

Survey responses from the course takers suggested that the HPD EPL online training courses improved their knowledge of HPD options. Prior to taking the course, 24 participants self-rated their knowledge of HPDs as “average” to “well above average,” with the majority split between “average” and “above average.” After taking the course, 27 participants rated their knowledge as “average” to “well above average,” with most rating their knowledge as “above average”; two of these individuals had previously rated their pre-training knowledge as “below average” or “well below average.” Three participants rated their post-training knowledge as worse than before training. It is possible that through training, these individuals arrived at a more realistic understanding of their knowledge before taking the HPD EPL courses. In addition, when asked about how often they recommend any of 10 different HPDs, there was a dramatic shift from not knowing most of the HPDs listed to knowing what the devices were. Taken together, we can conclude that the training program educated course takers about the different types of HPDs available to service members.

When asked to identify factors they considered as basis for recommending different HPDs (availability, work process needs, noise levels, NRR, derated NRR, best fit), course takers in all occupations indicated that they consider noise levels at least 75% of the time. When choosing the best HPD to recommend for a specific user, it is always to consider what type of environment the user will be working in and what types of activities and tasks that user will need to perform. Different HPDs are appropriate for someone who must work and

communicate in a setting filled with continuous loud noise than for someone whose work involves occasional exposure to potentially hazardous impulse noise. To make appropriate recommendations, hearing health professionals must understand relevant differences between different work environments, work requirements, and the features and characteristics of different HPDs. As reported above, after taking the course, course takers in most occupations identified work process needs as HPD recommendation basis factors at least 75% of the time. All course takers also recognized evaluation of work processes, missions, and HCTs as important to inform HPD recommendations.

Providers identified issues relating to cost, equipment, information, and user attributes as barriers to recommending specific HPDs. Some of these concerns reflect a need for education and guidance based on best practice. We hope that the HPD EPL training courses will help to fill knowledge gaps concerning different types of HPDs and their selection and recommendation based on user needs and requirements. There is also a need for additional investment (unit funding, equipment) and policy changes to support better access to knowledge, resources, and implementation of best practices.

There is an opportunity to improve policy and practice in the surveillance and monitoring of hearing protection use in the Defense Occupational and Environmental Health Surveillance System – Industrial Hygiene (DOEHRS-IH) system. Currently, HPDs are recorded generically in the DOEHRS-IH system as “earplugs,” “earmuffs,” or both. If the system were updated to designate specific HPD types, it would support more meaningful hearing health surveillance, exposure monitoring, observations of work practices, and determinations about the reduction of noise-related threats.

The effectiveness of any hearing protection depends heavily on how well it fits, but fit varies based on individual anatomical differences and ability to insert and wear the HPD correctly with consistency. A procedure known as fit testing can be used to measure the amount of noise attenuation [personal attenuation rating (PAR)] provided by any given HPD for the individual who is wearing it (Hager, 2011; Voix & Hager, 2009). The PAR value is subtracted from known

noise exposure to estimate net noise exposure while wearing the fit-tested HPD. This procedure can be used to support the appropriate selection of an HPD, to provide an opportunity for training users about proper insertion and wear, and to determine if some other type of HPD would provide better protection. At the time of the QI project described in this report, hearing protection fit testing was not widely available across the DOD.

Hearing protection fit testing is recommended as a best practice in hearing conservation by the Occupational Safety and Health Administration (OSHA) in alliance with the National Hearing Conservation Association (OSHA Alliance Program, 2008). The HCE is leading efforts to increase HPD fit testing practice requirements across the DOD, for example through updates to DOD Instruction (DODI) 6055.12 Hearing Conservation Program (HCP) (DODI 6055.12; Barr, 2022). The current DODI 6055.12 requires that preformed (non-custom) earplugs be fit by trained personnel, and that custom-molded earplugs are optional when proper fit cannot be achieved or when needed to meet operational requirements or employment considerations. These requirements do not include fit testing. Currently, fit testing is recommended as best practice "when possible" for DOD personnel who experience a significant threshold shift (STS; a hearing change in one or both ears of 10 dB or more at 2–4 kHz frequencies).

The HCE proposed changes to DODI 6055.12, to make fit testing a DOD best practice requirement, rather than merely a recommendation. These changes are expected to be released within the next year; they will require initial fit testing for all personnel who are enrolled in an HCP when known noise exposure is ≥ 95 dBA[1] as an 8-hour time weighted average or when noise exposure levels are unknown, and for all DOD personnel who experience a temporary STS, permanent STS, or "early-warning" hearing threshold shift (15 dB at 1-4 kHz).

The HCE works in close collaboration with its scientific partners throughout the DOD and the federal research landscape to inform and strengthen DOD hearing conservation efforts. The objective of the HCE's HPD EPL training module is to support military hearing health

[1] A-weighted decibel (dBA) is the relative loudness of sounds as it is perceived by the human ear. A-weighting assigns relatively more value to frequencies in the middle range of human hearing.

professionals in their selection and recommendation of HPDs with best applicability to individual user characteristics, specific job requirements, and settings. Data from a QI survey of course takers indicates that these HPD EPL courses help to improve their overall knowledge of HPDs and awareness of factors relevant to their selection. Going forward, additional feedback from course takers will be used to update and enhance the training module. Possible enhancements to the training program might include the capability to issue specific HPD recommendations, addition of military occupational specialties (MOS) as a recommendation factor, and expansion of the training to address active hearing protection. Content presented through such a training program could be adapted as a mobile application to support HPD selection. Future research would be helpful to determine if completion of training by HCP personnel supports improved fit-testing outcomes among service members.

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ABBREVIATIONS AND ACRONYMS

A-weighted decibel (dBA)

Defense Health Agency (DHA)

Defense Occupational and Environmental Health Surveillance – Industrial Hygiene (DOEHRS-IH)

Department of Defense (DOD)

DOD Instruction (DODI)

Evaluated products list (EPL)

Government Accountability Office (GAO)

Hearing Center of Excellence (HCE)

Hearing conservation program (HCP)

Hearing critical task (HCT)

Hearing protection device (HPD)

National Academies of Sciences, Engineering, and Medicine (NASEM)

Noise reduction rating (NRR)

Occupational Safety and Health Administration (OSHA)

Personal attenuation rating (PAR)

Quality improvement (QI)

Significant Threshold Shift (STS)

Tactical communication and protection systems (TCAPS)

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APPENDICES

Appendix 1: Hearing Protection Devices Evaluated Product List

The “Evaluated Passive Hearing Protection Devices” poster was developed to promote the HPD EPL. For each HPD depicted, the poster includes assessment values for continuous and impulsive noise attenuation as well as spatial awareness. The full-size poster can be downloaded from: *https://hearing.health.mil/-/media/Images/HCE/Materials/Posters/Passive-Device-Poster.ashx*

Appendix 2: Hearing Protection Device Evaluated Products List (HPD EPL) Pre-Training Evaluation

Hearing Protection Device Evaluated Products List (HPD EPL) Training Evaluation: Pre-Traini

1. What is your professional status?

- ○ Active-Duty Military
- ○ Government Contractor
- ○ Government Civilian
- ○ National Guard / Reserves

2. Which branch are you affiliated with?

- ○ Army
- ○ Navy
- ○ Marine Corps
- ○ Air Force
- ○ Other (Please specify)

3. Please select your primary role:

- ○ Safety Officer
- ○ Industrial Hygienist/Bio-environmental Engineer
- ○ Occupational Audiologist
- ○ Public Health
- ○ Hearing Conservation Program Manager
- ○ Other (Please specify)

4. How many years of experience do you have in hearing conservation?

- ○ Less than 1 year
- ○ 1-5 years
- ○ 6-10 years
- ○ 11-15 years
- ○ 16-20 years
- ○ More than 20 years

5. How would you rate your knowledge of hearing protection devices (HPDs)?

- ◯ Well above average
- ◯ Above average
- ◯ Average
- ◯ Below average
- ◯ Well below average

6. How often do you use the following factors to recommend HPDs?

	Always (100% of the time)	Often (75% of the time)	About half the time (50% of the time)	Seldom (25% of the time)	Never (0% of the time)
Noise level	◯	◯	◯	◯	◯
Noise Reduction Rating (NRR)	◯	◯	◯	◯	◯
De-rated NRR	◯	◯	◯	◯	◯
Availability of HPD	◯	◯	◯	◯	◯
Work process needs	◯	◯	◯	◯	◯
Best fit HPD	◯	◯	◯	◯	◯
Other	◯	◯	◯	◯	◯

7. Please explain your answers to question 6.

8. In the last year, how often have you recommended hearing protection fit-testing?

- ◯ Always (100% of the time)
- ◯ Often (75% of the time)
- ◯ About half of the time (50% of the time)
- ◯ Seldom (25% of the time)
- ◯ Never (0% of the time)

9. During your career, how often have you recommended the following:

	Always	Often	About half the time	Seldom	Never	I don't know what this device is
Earplug, non-specific	○	○	○	○	○	○
Musician's earplug	○	○	○	○	○	○
Non-linear earplug	○	○	○	○	○	○
Pre-formed earplug	○	○	○	○	○	○
One-use disposable earplug	○	○	○	○	○	○
Earmuff	○	○	○	○	○	○
HPD with active noise cancellation	○	○	○	○	○	○
Communication HPD	○	○	○	○	○	○
Communication and situational awareness hearing protection	○	○	○	○	○	○
Custom-molded passive earplugs	○	○	○	○	○	○
Custom-molded electronic earplugs	○	○	○	○	○	○

10. In the times you recommended specific types of HPDs, why did you recommend them? (Select all that apply)

- ☐ Particular worker had problems with available hearing protection
- ☐ To address worker complaints
- ☐ HPDs did not provide adequate protection
- ☐ Other (Please specify)
- ☐ Hearing critical tasks being performed necessitated new HPDs
- ☐ Never recommended specific type of HPD.

Appendix 3: Hearing Protection Device Evaluated Products List (HPD EPL) 3-Month Follow-Up Evaluation

Hearing Protection Device Evaluated Products List (HPD EPL) Training Evaluation: 3-Month Follow-up

1. What is your professional status?

- ◯ Active-Duty Military
- ◯ Government Contractor
- ◯ Government Civilian
- ◯ National Guard / Reserves

2. Which branch are you affiliated with?

- ◯ Army
- ◯ Navy
- ◯ Marine Corps
- ◯ Air Force
- ◯ Other (Please specify)

3. Please select your primary role:

- ◯ Safety Officer
- ◯ Industrial Hygienist/Bio-environmental Engineer
- ◯ Occupational Audiologist
- ◯ Public Health
- ◯ Hearing Conservation Program Manager
- ◯ Other (Please specify)

4. How many years of experience do you have in hearing conservation?

- ◯ Less than 1 year
- ◯ 1-5 years
- ◯ 6-10 years
- ◯ 11-15 years
- ◯ 16-20 years
- ◯ More than 20 years

5. How would you rate your knowledge of hearing protection devices (HPDs) since completing the training?

- ◯ Well above average
- ◯ Above average
- ◯ Average
- ◯ Below average
- ◯ Well below average

6. How often do you refer to the training material?

- ◯ Daily
- ◯ A few times a week
- ◯ Weekly
- ◯ Monthly
- ◯ Never

7. What barriers prevent you from recommending specific HPDs based on hearing critical tasks?

8. Since completing the training, how often have you recommended HPDs based upon:

	Always (100% of the time)	Often (75% of the time)	About half the time (50% of the time)	Seldom (25% of the time)	Never (0% of the time)
Noise level	◯	◯	◯	◯	◯
Noise Reduction Rating (NRR)	◯	◯	◯	◯	◯
De-rated NRR	◯	◯	◯	◯	◯
Availability of HPD	◯	◯	◯	◯	◯
Work process needs	◯	◯	◯	◯	◯
Best fit HPD	◯	◯	◯	◯	◯
Other	◯	◯	◯	◯	◯

9. Please explain your answers for Question 8.

10. Since completing the training, how often have you recommended hearing protection fit-testing?

- ◯ Always (100% of the time)
- ◯ Often (75% of the time)
- ◯ About half of the time (50% of the time)
- ◯ Seldom (25% of the time)
- ◯ Never (0% of the time)

11. In my current role, I recommend hearing protection devices.

- ◯ Yes
- ◯ No

Hearing Protection Device Evaluated Products List (HPD EPL) Training Evaluation: 3-Month Follow-up

12. Since completing the training, how often have you recommended the following:

	Always	Often	About half the time	Seldom	Never	I don't know what this device is
Earplug, non-specific	◯	◯	◯	◯	◯	◯
Musician's earplug	◯	◯	◯	◯	◯	◯
Non-linear earplug	◯	◯	◯	◯	◯	◯
Pre-formed earplug	◯	◯	◯	◯	◯	◯
One-use disposable earplug	◯	◯	◯	◯	◯	◯
Earmuff	◯	◯	◯	◯	◯	◯
HPD with active noise cancellation	◯	◯	◯	◯	◯	◯
Communication HPD	◯	◯	◯	◯	◯	◯
Communication and situational awareness hearing protection	◯	◯	◯	◯	◯	◯
Custom-molded passive earplugs	◯	◯	◯	◯	◯	◯
Custom-molded electronic earplugs	◯	◯	◯	◯	◯	◯

13. In the times you recommended specific types of HPDs, why did you recommend them? (Select all that apply)

- [ ] Particular worker had problems with available hearing protection
- [ ] Hearing critical tasks being performed necessitated new HPDs
- [ ] To address worker complaints
- [ ] Never recommended a specific type of HPD
- [ ] HPDs did not provide adequate protection
- [ ] Other (Please specify)

Hearing Protection Device Evaluated Products List (HPD EPL) Training Evaluation: 3-Month Follow-up

14. If I receive complaints regarding hearing protection that I cannot solve, I have consulted with local, regional, or Service hearing conservation experts.

- ◯ Always (100% of the time)
- ◯ Often (75% of the time)
- ◯ About half of the time (50% of the time)
- ◯ Seldom (25% of the time)
- ◯ Never (0% of the time)

15. When I observe work processes, I have identified the associated hearing critical tasks.

- ◯ Always (100% of the time)
- ◯ Often (75% of the time)
- ◯ About half of the time (50% of the time)
- ◯ Seldom (25% of the time)
- ◯ Never (0% of the time)

16. When I recommend hearing protection, I have considered the noise environment and the mission/work process needs.

- ◯ Always (100% of the time)
- ◯ Often (75% of the time)
- ◯ About half of the time (50% of the time)
- ◯ Seldom (25% of the time)
- ◯ Never (0% of the time)

17. I have discussed hearing critical tasks in hearing conservation training.

- ◯ Always (100% of the time)
- ◯ Often (75% of the time)
- ◯ About half of the time (50% of the time)
- ◯ Seldom (25% of the time)
- ◯ Never (0% of the time)

18. I have discussed the relationship between good hearing and mission success in hearing conservation training.

- ◯ Always (100% of the time)
- ◯ Often (75% of the time)
- ◯ About half of the time (50% of the time)
- ◯ Seldom (25% of the time)
- ◯ Never (0% of the time)

Hearing Protection Device Evaluated Products List (HPD EPL) Training Evaluation: 3-Month Follow-up

19. I believe evaluating work processes and missions for hearing critical tasks is:

- ◯ Very important
- ◯ Somewhat important
- ◯ Neither important or unimportant
- ◯ Somewhat unimportant
- ◯ Very unimportant

20. I believe hearing critical tasks should be considered when making hearing protection device (HPD) recommendations.

- ◯ Very important
- ◯ Somewhat important
- ◯ Neither important or unimportant
- ◯ Somewhat unimportant
- ◯ Very unimportant

21. I believe making specific recommendations for HPDs is:

- ◯ Very important
- ◯ Somewhat important
- ◯ Neither important or unimportant
- ◯ Somewhat unimportant
- ◯ Very unimportant