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Boothless Audiometry Screening for Hearing Loss in a Diabetes Clinic: Lessons Learned

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14. ABSTRACT

People with diabetes are at increased risk for hearing loss. The Diabetes Center of Excellence (DCOE) and Defense Health Agency Hearing Center of Excellence (HCE) used boothless audiometry to explore the feasibility of a hearing test screening protocol during routine clinical appointments for diabetes. On average, the test took approximately 15 minutes. Staff members found the protocol easy and useful, said it had no negative impact on appointment time, and would recommend it for use in other clinics. Challenges and limitations included indistinct organizational responsibilities, staff turnover, and shifting priorities during the COVID pandemic.

15. SUBJECT TERMS

Boothless audiometry; diabetes mellitus; hearing loss; hearing screening

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INTRODUCTION

Diabetes mellitus (more commonly known as diabetes) affects an estimated 37.3 million Americans (11.4% of the population; Centers for Disease Control and Prevention, 2022). An additional 96 million American adults have prediabetes (i.e., blood glucose levels higher than normal but not high enough to be considered diabetic). The prevalence of diabetes increases significantly with age, affecting 25% of people over the age of 65 (Baiduc & Helzner, 2019). Although diabetes disqualifies individuals from joining the U.S. military, currently active service members who develop diabetes may be able to meet military medical standards for ongoing service and deployment (Choi & Cucura, 2018; Folaron et al., 2018, 2020). The prevalence of diabetes in military service members is relatively low (between less than 1% to 3%; Chao et al., 2013; Shrestha et al., 2019; Williams et al., 2017), but thousands of military members are newly diagnosed with diabetes while on active duty. Between 2008 and 2018, 12,582 active-duty service members were diagnosed with diabetes (Williams et al., 2020), with a 25% increase in the incidence of type 2 diabetes[1] and a 30% increase in prediabetes from 2018 to 2021 (Stiegmann et al., 2023).

People with diabetes are more likely than their non-diabetic counterparts to experience hearing loss, even when controlling for other factors that can affect hearing such as age, race, ethnicity, income level, noise exposure, and use of certain medications (Bainbridge et al., 2008; Mitchell et al., 2009; Samocha-Bonet et al., 2021; Agrawal et al., 2009; Austin et al., 2009; Horikawa et al., 2013; Kim et al., 2017; Mishra & Poorey, 2019; Vesperini et al., 2011). People with prediabetes also have a 30% higher incidence of hearing loss when compared to people with normal blood glucose levels (Samocha-Bonet et al., 2021; Centers for Disease Control and Prevention, 2022). Left untreated, hearing loss may be associated with social isolation,

[1] Type 2 diabetes involves resistance to insulin, usually diagnosed in mid-life. If caught early, type 2 diabetes may be reversed. By contrast, type 1 diabetes is an incurable autoimmune disorder, usually diagnosed early in life; in type 1 diabetes, the pancreas creates little or no insulin.

depression and anxiety, acceleration of cognitive and physical decline, increased incidence of all-cause dementia, and more significant whole-brain atrophy in patients with both hearing loss and dementia (Amieva et al., 2018; Huddle et al., 2017; Lin et al., 2013; Shukla et al., 2020). Therefore, the diabetic population should be evaluated for hearing loss as soon as possible after diabetes diagnosis, with continued monitoring thereafter.

Hearing healthcare professionals' current gold standard of care involves testing patients inside an audiometric booth. Audiometric booths have several limitations including cost, space requirements, requirement of highly-skilled providers, and a generally fixed location. Novel boothless audiometry technologies provide an opportunity for early audiometric evaluation outside of the audiology clinic in settings where testing has traditionally been limited or non-existent such as austere military environments, clinic waiting areas, schools, and nursing homes (Maclennan-Smith et al., 2013; Palmer, 2015; Saliba et al., 2017; Seren 2009; Swanepoel et al., 2015; Thompson et al., 2015; Zitelli & Palmer 2017). Boothless audiometry uses a tablet or personal computer (PC), audiometry software, and calibrated headphones or earphones to improve access, expand hearing health services, and reduce overall burden on patients and providers alike (Gates et al., 2021). By integrating a relatively quick, boothless hearing test into primary care and specialty clinic visits, healthcare providers can identify their patients' hearing loss early, allowing for earlier treatment, rehabilitation, and mitigation of further second-order effects of hearing loss. This aligns with the National Academy of Science's recommendation to promote hearing healthcare in wellness and medical visits (Blazer, 2016).

The Diabetes Center of Excellence (DCOE) is a U.S. Air Force Medical Service clinic with clinical, outreach, and research divisions dedicated to diabetes management, education, and prevention. Recognizing that its patients (primarily military dependents) were not receiving adequate screening or monitoring for hearing loss despite being at higher risk, the DCOE proposed collaboration with the Defense Health Agency Hearing Center of Excellence (HCE) to assess the feasibility of incorporating boothless hearing tests to screen for hearing loss during routine clinic appointments for patients with diabetes. The DCOE and HCE implemented a hearing test screening protocol to 1) explore the ease of access to hearing healthcare by

utilizing boothless technology, and 2) encourage the establishment of evidence-based models of audiology care in patients with diabetes. The long-term goal of this effort was to improve access to hearing healthcare and to ensure earlier diagnosis and management of hearing loss for patients with diabetes.

BOOTHLESS SCREENING PROTOCOL

The Quality Improvement and Process Improvement (QI/PI) protocol titled, "Diabetes and Hearing Loss within the Military Medical System: Characterizing the Problem and Proposing a Solution" was reviewed by the 59th Medical Wing (MDW) IRB and received a non-research determination (FWH20200076N; 3 March 2020) as defined by DOD regulation 32 CFR 219 and FDA regulation 21 CFR 56. The project was conducted at the DCOE specialty clinic at Wilford Hall Ambulatory Surgical Center (WHASC) by DCOE research staff with the support of HCE subject matter experts (SMEs).

Original objectives for the QI/PI protocol were to 1) determine the feasibility of a boothless audiometry test as part of routine clinical assessment at the DCOE, 2) assess patient awareness of their current hearing health status, and 3) collect DCOE staff feedback to better understand their perception of how the incorporation of boothless hearing testing impacted their clinical practice.

Prior to implementation, HCE SMEs gave DCOE providers and staff a summary briefing and related literature about hearing loss, its impact, common comorbidities, and goals of the QI/PI project. The HCE also trained DCOE staff to administer the boothless hearing test, advised them how best to communicate with patients who have hearing loss (e.g., enunciation, visual aids, asking the patient to repeat information/instructions), and supplied the DCOE with supplemental educational materials (brochures and flyers) that covered several topics including hearing loss, the importance of hearing, and communication strategies for patients to use in their everyday life. The supplemental educational materials were provided for the DCOE to give to their patients as information packets after completion of their hearing tests.

To meet the need for boothless audiometry, the HCE project team selected the Wireless Automated Hearing-Test System (WAHTS[2]; Figure 1; Creare®, Hanover, New Hampshire), designed to attenuate background noise with a comfortable headset (Figure 2; Meinke et al., 2017). The WAHTS headset includes high-quality ear seals that provide passive attenuation equal to or better than a single-walled booth that meets the American National Standards Institute (ANSI) S12.6 standard (American National Standard, 2020) and is configured to work with a tablet or PC running *TabSINT*[3] software to administer patient and provider questionnaires.

Figure 1. The Wireless Automated Hearing-Test System (WAHTS) was created by Creare© to assess hearing without the need for a soundproof room or audiometric booth. The system consists of a calibrated headset and a tablet or PC computer that administers the tests. The headset provides ambient noise attenuation and serves as the "boothless" aspect of the system. (Creare®, 2019). Image source: Edare Inc. Used with permission.

[2] The WAHTS boothless audiometry system met ANSI S3.6 and International Electrotechnical Commission (IEC) 60645-1 standards for Type 4 audiometers (American National Standards Institute, 2018; International Electrotechnical Commission, 2017).

[3] *TabSINT* is a mobile application for Android and iOS tablet devices; it interacts with the WAHTS device via bluetooth to retrieve WAHTS audiometric and test results (Shapiro et al., 2020). The software provides multiple test options including manual audiometry, manual or automated screening, speech-in-noise testing, and other tests for research purposes.

Figure 2. Composition of the wireless audiometric headset. (Meinke et al., 2017). Image source: Creare®. Used with permission.

To test the hearing screening protocol, the DCOE project team selected 32 TRICARE-eligible adults (18 years or older) referred to the DCOE due to a diabetes diagnosis. Patients attending the DCOE's new-patient orientation were asked to complete the hearing test screening protocol as part of their routine new patient assessments. The hearing test was completed in a quiet room and administered by the DCOE staff using the WAHTS system described above. Patients were first given a brief list of five pre-screening questions (Table 1) on the tablet to determine their eligibility and, if determined eligible, to assess their existing hearing knowledge and perceived hearing ability. Patients who indicated having received a hearing evaluation within the previous two years (Question 1) or worn hearing aids (Question 2) were excluded. Patients who answered "no" to these questions completed the remaining three questions, followed by boothless audiometry (auditory thresholds) testing at 500, 1000, 2000, 3000, 4000, 6000, and 8000 Hz (standard audiometric frequencies). Every patient who completed the screening received a packet of information (Appendix A) about hearing loss. Although the WAHTS system audiometry screening included higher frequency testing (6000 and 8000 Hz), only patients who failed the hearing screening in either ear from 500 to 4000 Hz (hearing loss of 25 dB or more) received a clinical referral for a complete diagnostic hearing evaluation. Primary speech

frequencies fall between 500 and 4000 Hz; hearing loss at frequencies above 4000 Hz is more common and difficult to treat (e.g., hearing aids cannot amplify these higher frequencies).

Q1: Have you had a hearing test in the last two years?
Q2: Do you currently wear hearing aids?
Q3: Do you believe that diabetes can impact your hearing?
Q4: Do you believe you have a problem with your hearing?
Q5: Has anyone ever told you that you have a hearing problem (friend, spouse, etc.)?

Table 1: A list of the pre-screening questions. The TabSINT software used to run the protocol included five pre-screening questions prior to the hearing test. The first two questions addressed the patient's eligibility to participate in the hearing screening test protocol, while the last three questions related to the patient's knowledge and perception of their hearing abilities. If the participant answered "yes" to either of the first two questions, they did not proceed with the hearing test.

After the protocol was implemented at the DCOE clinic, the HCE project team sent a survey to the DCOE project team members. The survey addressed various aspects of their experience (e.g., satisfaction, impact, perceived barriers) using the tablet-based hearing test to screen for hearing loss as part of the DCOE patient assessment (Appendix B). It was sent to all (8) DCOE staff members who performed the hearing screening at any point during the 7-month project period (May 2021 – November 2021, inclusive).

RESULTS

The objectives of this project were to explore the feasibility of boothless audiometry screening in a non-audiology clinic, assess patient awareness of their hearing health status, and capture clinic staff perception of how the hearing screening affected their clinical practice. To address these questions, we considered the time required for the hearing loss screening in the outpatient diabetes clinic setting (feasibility), patients' answers to the pre-screening questionnaire (awareness), and survey responses from participating DCOE staff after completion of the project (perception). Based on the nature of QI/PI projects and our limited goal of assessing the feasibility and utility of a clinical service, we do not present audiometric test findings in this report.

Time Required for Screening

The mean total elapsed time for screening, from initiation of the pre-screening questionnaire through completion of the hearing test, was 15 minutes 16 seconds (SD = 3 minutes 33 seconds). The shortest time was 9 minutes 30 seconds; the longest time was 24 minutes 48 seconds). Most (*n* = 21) patients completed the hearing screening, including the pre-screening questionnaire, in less than 16 minutes. Total time exceeded 20 minutes for only four of the 32 patients screened. Generally, less than one minute of the total elapsed screening time was attributable to time spent answering the pre-screening questionnaire. On average, patients completed the pre-screening questionnaire in less than 30 seconds (mean = 25.16 seconds; SD = 16 seconds). The shortest pre-screening time recorded was 8.5 seconds; the longest time recorded was 1 minute 23 seconds.

Pre-Screening Questionnaire (Patients)

The pre-screening questionnaire (Table 1) was completed by all 32 patients who were eligible to participate based on their "no" answers to Questions 1 and 2.

Most patients (*n* = 28, 88%) responded that they do believe diabetes can impact their hearing (Question 3). When asked if they believe they have a problem with their hearing, more than one-fourth (*n* = 9, 28%) of patients answered "yes" (Question 4). When asked if anyone had ever told them they had a hearing problem (Question 5), almost one-third (*n* = 10, 31%) of patients answered "yes." Four of the 23 patients who responded that they did not believe they had a problem with their hearing ("no" to Question 4) also responded that someone had told them they have a hearing problem ("yes" to Question 5).

Post-Project Survey (Staff)

The post-project survey was completed and returned by two DCOE staff members who had administered the tablet-based hearing screening for 2-4 months. One staff member described their role in the DCOE clinic as "research" and the other identified their role as "clinical." Both indicated that they were "satisfied" or "very satisfied" with the training and instructions they

had received from HCE research staff prior to implementing the hearing test screening protocol. Both also provided generally positive responses and comments regarding the overall idea, ease, and utility of the hearing screener itself. Both respondents indicated that they were "satisfied" with the overall performance of the screening and found its results "very helpful" for understanding each patient's hearing status and the need for hearing health education and/or intervention. One staff member remarked additionally that the screening was "easy to operate and [provided] immediate results." When asked if their clinic should provide hearing screening, both respondents replied "probably yes" and indicated that they would be likely or very likely to recommend the tablet-based hearing screening and patient education to colleagues in other clinics. One staff member remarked: "This is an essential need for many active-duty soldiers and veterans who may suffer from hearing loss due to other reasons besides diabetes." Both respondents observed that their patients' feedback during the hearing screening was "frequently" or "occasionally" positive, and "never" negative.

Concerning the impact of tablet-based hearing screening on appointments at the DCOE, both staff members rated the screening as having "no negative impact on the overall time of the clinical appointment." However, when asked to address the impact and potential barriers faced in providing the hearing screening and patient education, both respondents did identify time as a factor. One observed that "It actually didn't affect any of our diabetes management appointments as we were doing it as part of the education after the appointment; however, still takes a bit of time from staff" and noted that the screening presented "a manning issue to ensure the time and space to briefly explain and administer." Asked what impacts or barriers might be foreseen with this technology if it were implemented elsewhere, this same respondent suggested it would be better to have a centralized hearing screening location with dedicated personnel, to reduce burden on clinical staff who are "spread too thin." The other respondent noted only that "wifi connection trouble and data retrieval" could be issues in other settings.

LIMITATIONS AND LESSONS LEARNED

This project was challenged and slowed by several limitations, including indistinct organizational responsibilities, staff turnover, and shifting priorities. The project was originally conceived by a senior researcher. Subsequent changes in leadership and personnel resulted in this project becoming an inherited task. The HCE, a supporting collaborator, ultimately submitted the project protocol for IRB review. This may have introduced ambiguity concerning project ownership, roles and responsibilities, resourcing, and prioritization.

The HCE has since taken steps to ensure that its own roles and responsibilities are more clearly and specifically defined in collaborative projects such as this. Namely, the HCE has established an internal Executive Review Board, which reviews all proposed projects to assess and when necessary to enhance project resourcing, inter/intra-organizational coordination, clarity, transparency, leadership, and commitment. Lessons learned have also informed new efforts to incorporate boothless audiometry into clinics outside of the audiology clinic. For example, the new FY2022 Joint Incentive Fund (JIF) DoD/VA Boothless Audiometry Hearing Health project aims to increase earlier access to hearing health services by using boothless audiometry in non-audiology health clinics (i.e., aerospace medicine, primary care). In support of this new project, regional audiology clinics have agreed to provide expert support, assessments, and consultation; they will take on the project to expand their current mission, eliminating the need for additional project personnel.

Limitations arose from clinic procedural changes that were necessary to accommodate COVID-related clinical requirements. The COVID pandemic created a staffing shortage throughout the entire U.S. healthcare industry (Office of Health Policy, 2022). This was especially true for the military, where medical providers could be pulled away for other COVID-specific missions with little or no notice (Temin, 2022). Over the 7-month course of the screening project, there were numerous changes in staffing resources, training, roles, and availability. A potentially valuable lesson learned is the need for contingency planning, to anticipate and have a plan in place for staffing turnover, and the need for recurring protocol training in research and clinical settings.

Staff turnover is a foreseeable challenge in military settings, where key project personnel are commonly subject to permanent change of station moves every 2-3 years.

Administration of the hearing test screening protocol was seamless and flexible by necessity, to accommodate DCOE clinic flow and COVID management challenges. Order of events in a clinical setting can change daily, depending on factors such as staffing schedules, patient flow, and appointment volume. An obvious strength of this project was to demonstrate the inherent simplicity and flexibility of boothless audiometry. The portable and efficient WAHTS tablet-based system was used successfully in different rooms and by different staff members as needed in the DCOE clinical setting.

CONCLUSIONS

Hearing loss is often overlooked as a possible concern in general healthcare delivery (Cohen et al., 2005; McCullagh and Frank, 2013). Hearing health professionals can educate the larger medical community about the adverse effects of untreated hearing loss and the potential advantages of boothless audiometry to identify opportunities for early intervention. Boothless audiometry introduces opportunities to screen for hearing loss in settings where sound booth testing has traditionally been impossible. As an example, our project aimed to evaluate the feasibility of boothless hearing screening in a non-audiology clinic.

Based on their responses to pre-screening questions, most of the diabetes patients who underwent the hearing screening believed that diabetes could affect their hearing. About one in four of them believed they already had a hearing problem, and about one in three had been told by a friend or family member that they had a hearing problem. These numbers are not surprising, given previously reported estimates that between one- and two-thirds of diabetes patients may suffer from at least mild hearing impairment (Al-Rubeaan et al., 2021; Pemmaiah & Srinivas, 2011; Shafiepour et al., 2022). These patients received a boothless audiometric hearing test under an efficient (15-20 minute) protocol that involved hearing sensitivity testing across a standard range of audiometric test frequencies (500 – 8000 Hz). Staff members

surveyed about this protocol found it easy and useful, indicating that it had no negative impact on overall appointment times, and that they would recommend it for use in other clinics.

Although compromise of the auditory system was first considered a possible consequence of diabetes in 1857 (Jordao, 1857), auditory dysfunction remains an under-recognized diabetes complication, and clinical recommendations regarding hearing loss are lacking (Baiduc & Helzner, 2019). Consequently, most patients with diabetes are not medically monitored for hearing changes (Dowd, 2019). Healthcare providers may need more formal training about the implications and possible consequences of untreated hearing loss. Most people who suspect hearing loss do not seek treatment for five to 10 years (Saunders, 2015). When neither diabetic patients nor their providers identify or explore the question of possible hearing loss, nor recognize that it may be related to diabetes disease progression, they may not pursue referral and assessment. This can be a critical missed opportunity for early intervention. Moreover, patients with hearing loss may have difficulty understanding their diabetes treatment plans. Early identification and intervention for hearing loss may support patients' ability to understand and follow medical guidance. Patients who clearly understand their healthcare treatment plans are likelier to follow them, perhaps with reduced overall disease burden and hospitalization (Genther et al., 2013; Mormer et al., 2017).

Proper management of hearing loss in patients with diabetes will require a change in clinical practice guidelines and some form of implementation as part of clinical management. Despite the known elevated risk for hearing loss in patients with diabetes, the American Diabetes Association (ADA) does not acknowledge hearing impairment or hearing loss as a known comorbidity in its most recent "Comprehensive Medical Evaluation and Assessment of Comorbidities: Standards of Care in Diabetes" clinical practice recommendations, other than to include referral to "audiology, if indicated" as part of initial care management (ElSayed et al., 2023). The ADA's Standards of Care document does not address what patient information or clinical findings might serve as indication for such a referral. The joint VA/DOD's current clinical practice guideline for diabetes management also makes no mention of hearing loss as an

associated comorbidity, of screening for possible hearing loss, or of audiological referrals (Conlin et al., 2017; Tschanz et al., 2017; VA/DOD, 2017).

In their recommendations for the evaluation and management of patients with diabetes and hearing loss, Spankovich and Yerraguntla (2019) note that referral for audiological evaluation might be based on the patient's answers to a series of questions (e.g., "Do you or your family perceive any change in your hearing?", "Do you have hearing difficulty in quiet or noise?"). They also note, however, that such screenings may fail to identify subtle forms of hearing loss and can miss the opportunity to establish an early baseline for hearing function. Spankovich and Yerraguntla (2019) therefore recommend that all patients be given a comprehensive audiological evaluation upon their diabetes diagnosis.

Providers can give better-informed referrals and recommendations if they are well-educated about the importance of early hearing loss identification and how to refer their patients based on boothless audiometric screening. The hearing screening protocol reported here has the potential to educate non-audiological healthcare providers, identify hearing loss earlier, prevent over-referrals to audiologists for patients who do not have hearing loss, and educate patients on the risk of hearing loss as a possible comorbidity of diabetes. This approach has the potential for broader applicability and adoption.

Rapid advances in healthcare technology stand to benefit medical practice generally. For example, new developments in telemedicine, electronic health recordkeeping, diagnostic tools, and computerized decision support systems can improve access to care, efficiency of care, and accuracy of diagnoses and treatments. However, the adoption of new technologies and procedures into clinical practice also presents challenges, as practitioners and patients must learn to use, understand, and recognize the strengths and limitations of unfamiliar medical tools and systems. Healthcare providers may find it difficult to adapt their existing clinical processes and procedures to integrate new technologies; this can be especially difficult if new tools tend to disrupt or increase the time needed for patient evaluation (Webb et al., 2018; Wilson et al., 2007). Information and education are important to help medical providers

understand and communicate effectively with their patients about the purpose, utility, meaning, and value of new tools, procedures, and test results (Pals et al., 2015). Based on the limited observations available from the QI/PI project reported here, introduction of a tablet-based patient questionnaire and hearing test screening protocol had no reportable adverse impact on overall appointment times in the DCOE clinic, was well-supported by prior education and training of clinic staff, and was generally well-received by staff and patients alike. Patients' preference for the ease and efficiency of tablet-based (vs. paper-based) data collection strategies have been reported in other health care clinical settings (Abernethy et al., 2008; Fanning & McAuley, 2014; Kim et al., 2016; VanDenKerkhof et al., 2005).

Tablet-based data collection may introduce complexities with respect to data storage and extraction. The boothless audiometry hearing test protocol tested here did not allow for transfer of questionnaire or hearing test data to patient charts. Thus, only resulting referrals and follow-ups were preserved for review by healthcare providers in future clinical encounters. Currently, tablet-based data files are complex and cumbersome to extract for analysis. These limitations should be considered when planning technology enhancements and future research and clinical applications of the tablet-based boothless audiometry system.

Implementing a new protocol involving new technology and new collaborators can be challenging for any clinical practice. Compounded by the fast-changing demands of healthcare delivery during a global pandemic, these challenges were especially difficult to navigate in this project. The data and lessons learned from this effort, and its resulting observations, have been instrumental in guiding future HCE efforts that aim to increase hearing health awareness and deliver earlier access to hearing healthcare for service members and their families.

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ABBREVIATIONS AND ACRONYMS

American Diabetes Association (ADA)

American National Standards Institute (ANSI)

Code of Federal Regulations (CFR)

Decibels in Hearing Level (dB HL)

Diabetes Center of Excellence (DCOE)

Defense Health Agency (DHA)

Department of Defense (DOD)

U.S. Food and Drug Administration (FDA)

Hearing Center of Excellence (HCE)

Hertz (Hz)

International Electrotechnical Commission (IEC)

Institutional Review Board (IRB)

Joint Incentive Fund (JIF)

59th Medical Wing (MDW)

Personal Computer (PC)

Quality Improvement and Process Improvement (QI/PI)

Subject Matter Expert (SME)

Department of Veterans Affairs (VA)

Wireless automated hearing-test system (WAHTS)

Wilford Hall Ambulatory Surgical Center (WHASC)

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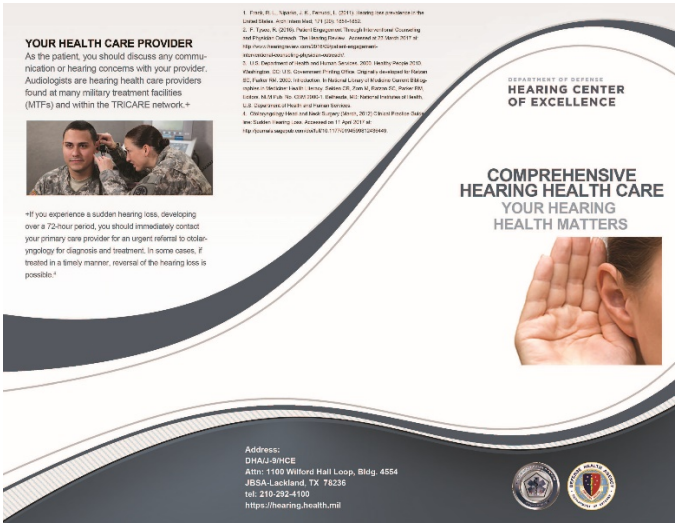
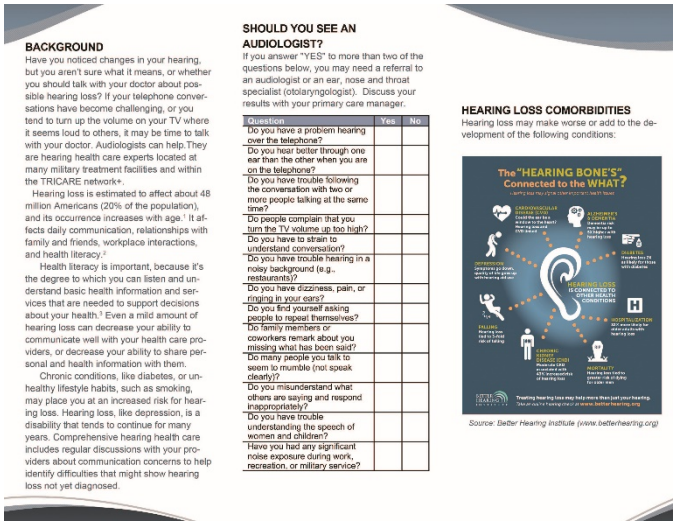
APPENDICES

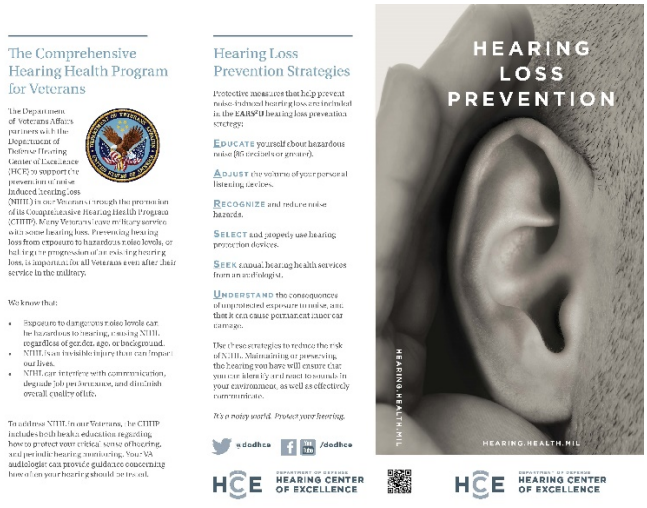
Appendix A: Supplemental Educational Materials

Comprehensive Hearing Health Care Patient Brochure
Download: https://hearing.health.mil/-/media/Files/HCE/Posters/Poster-Download-PDFs/HCE---853-Patient-Brochure.ashx

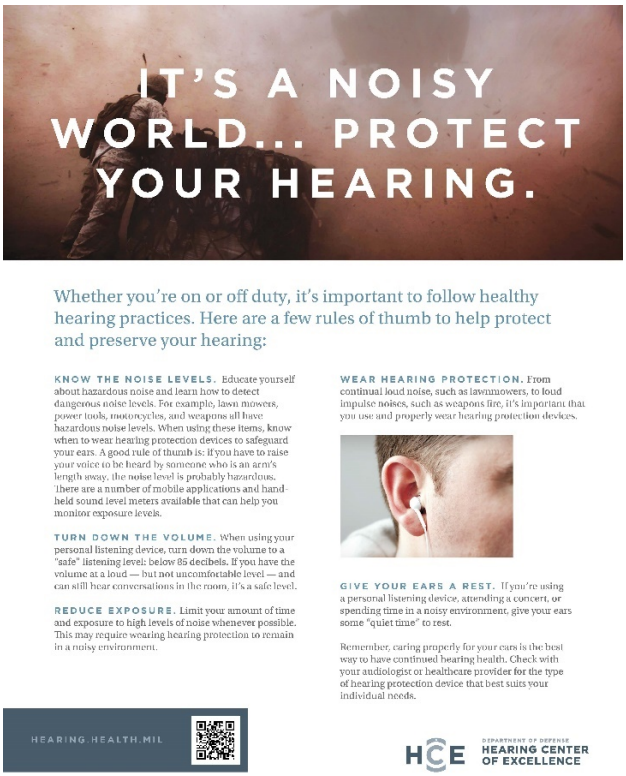


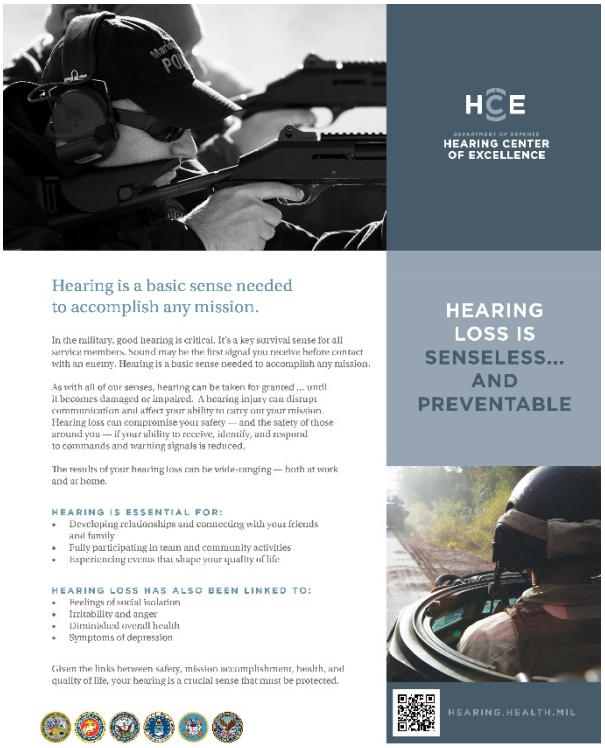


Hearing Loss Prevention Brochure
Download: https://hearing.health.mil/-/media/Files/HCE/Posters/Poster-Download-PDFs/HCE---840--Hearing-Loss-Prevention-Veterans---8_5-X-11-folded-in-three.ashx



It's a Noisy World. Protect Your Hearing (Hearing as Critical Sense)
Download: https://hearing.health.mil/-/media/Files/HCE/Posters/Poster-Download-PDFs/HCE---824---Hearing-as-Critical-Sense-8_5-x-11.ashx





It's a Noisy World (4 pages)
Download: https://hearing.health.mil/-/media/Files/HCE/Posters/Poster-Download-PDFs/HCE---841-Its-a-Noisy-World---Veterans.ashx

Appendix B: DCOE Staff Post-Project Survey

Tablet-based Hearing Screening Follow Up

This survey will help the Diabetes Center of Excellence (DCOE) and Hearing Center of Excellence (HCE) research team understand how the tablet-based hearing screening impacted your clinical practice.

1. What is your primary role in your clinic?

- ○ Clinical
- ○ Research

2. How long have you been using the tablet-based hearing screening?

- ○ Less than 2 months
- ○ 2-4 months
- ○ 5-8 months
- ○ 9-12 months
- ○ More than 13 months

3. Do you think that your clinic should provide a hearing screening to patients?

- ○ Definitely not
- ○ Probably not
- ○ Neutral
- ○ Probably yes
- ○ Definitely yes

4. How likely would you be to recommend the tablet-based hearing screening and patient education to colleagues in other clinics?

- ○ Very unlikely
- ○ Unlikely
- ○ Neither likely nor unlikely
- ○ Likely
- ○ Very likely

5. Why would you make this recommendation? (Question 4)

6. How was the overall process of implementing the tablet-based hearing screening into your clinic?

- ○ Very difficult
- ○ Difficult
- ○ Neither easy nor difficult
- ○ Easy
- ○ Very easy

7. Please rate your level of satisfaction with the following aspects of the tablet-based hearing screening:

	Very Satisfied	Satisfied	Neither Satisfied nor Dissatisfied	Dissatisfied	Very Dissatisfied	Not Applicable (N/A)
Overall performance	○	○	○	○	○	○
Ease of use	○	○	○	○	○	○
Information provided on the cover sheet of the information packet in deciding when to make referrals/provide education	○	○	○	○	○	○

8. How helpful were the results of the tablet-based hearing screening for understanding the patient's hearing status and need for hearing health education and/or intervention?

- ○ Not at all helpful
- ○ Not so helpful
- ○ Neither helpful nor unhelpful
- ○ Somewhat helpful
- ○ Very helpful
- ○ N/A

9. Please rate your satisfaction with the following steps required to prepare the tablet-based hearing screening for use:

Note: please report N/A if an activity was handled by another office.

	Very Satisfied	Satisfied	Neither Satisfied nor Dissatisfied	Dissatisfied	Very Dissatisfied	Not Applicable (N/A)
Training provided by the HCE research staff to prepare for the use of the tablet-based hearing screening	◯	◯	◯	◯	◯	◯
Instructions provided by the HCE research staff on the tablet for the hearing screening	◯	◯	◯	◯	◯	◯

10. Please rate how adequate the patient hearing health education materials provided were for the usage of tablet-based hearing screening program?

- ◯ Not at all adequate
- ◯ Slightly adequate
- ◯ Neither adequate nor inadequate
- ◯ Adequate
- ◯ Very Adequate
- ◯ N/A

11. What kind of feedback did you generally receive from patients during the tablet-based hearing screening?

	Never	Rarely	Occasionally	Frequently
Positive	◯	◯	◯	◯
Neutral	◯	◯	◯	◯
Negative	◯	◯	◯	◯

12. Please provide additional information about the feedback that you received from patients about the tablet-based hearing screening.

13. Please rate the impact that the implementation of tablet-based hearing screening had on the clinical appointment time:

- ◯ It had a major negative impact on the overall time of the clinical appointment.

- ○ It had a moderately negative impact the overall time of the clinical appointment.
- ○ It had a minor negative impact the overall time of the clinical appointment.
- ○ It had no negative impact the overall time of the clinical appointment.

14. Please explain the impact that the hearing screening had on the clinical appointment (Question 13).

15. What barriers did your clinic face in providing tablet-based hearing screenings and subsequent patient education?

16. What impacts or barriers do you foresee with this technology if it were to be implemented elsewhere?

17. Please describe aspects of the tablet-based hearing screening program that were successful:

18. Please use the space below to indicate any changes, improvements, or suggestions you would like to make regarding any of the topics rated above:

Thank you for participating in this survey and for providing your valuable feedback!