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14. ABSTRACT

Military service is more hazardous to hearing than almost any other occupation, and both the line and medical components of the Department of Defense (DoD) have a responsibility to protect Service Members from the harmful effects of noise exposure. Despite the best efforts of a comprehensive DoD-wide hearing conservation program, hearing loss and tinnitus continue to be the most frequent permanent injuries in the military; nearly 30% of service members experience a permanent threshold shift and just over 30% report tinnitus. These problems propagate to our veteran population, resulting in almost 1.5 million veterans receiving compensation for hearing loss and tinnitus. Of further concern is the increasing incidence of Service Members reporting hearing difficulty and/or tinnitus in the presence of normal hearing. These factors could have a significant impact on readiness and resilience in the Active-Duty population.

The goal of this research effort is to advance our understanding of the etiology and implications of noise- and blast-related hearing damage in our Active-Duty population with normal or near-normal audiograms, and obtain normative data for tests that could be used to efficiently assess these problems in DoD Audiology Clinics. This will be accomplished by three studies. The first study will be a direct evaluation of the relationship between objectively measured noise dosimetry and subjective noise surveys. This data will be used to improve the ability to obtain reliable self-reports of noise exposure. In the second study, auditory tests that are sensitive to objective differences in performance among Service Members with normal or near-normal thresholds and varying levels of noise and blast exposure will be identified, to establish normative data in those tests that will facilitate their direct transition to clinical use. Finally, auditory and functional tests that are sensitive to differences in performance among Service Members with normal or near-normal thresholds and various levels of bothersome and non-bothersome tinnitus will be identified, and normative data will be established to facilitate direct transition to clinical use.

15. SUBJECT TERMS None listed.

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1. INTRODUCTION:

The line and medical components of the Department of Defense (DoD) have a responsibility to protect Service Members from the harmful effects of noise exposure. Despite the best efforts of a comprehensive DoD-wide hearing conservation program, hearing loss and tinnitus continue to be the most frequent permanent injuries in the military; nearly 30% of Service members experience a permanent threshold shift and just over 30% report tinnitus. This study will address the current lack of knowledge regarding actual versus self-reported noise exposure and the functional impact of noise- and blast-exposure in Service members with normal hearing. This study will also address the lack of knowledge regarding the prevalence and incidence of tinnitus in military Service members as a function of noise- and blast-exposure, as well as the functional impact of tinnitus. The overarching goal of this effort is to better understand the relationship between noise exposure, blast exposure, tinnitus, and subjective and objective measures of hearing impairment in the military population with normal hearing thresholds. We believe the only way to make inferences about the complex interactions between these different factors is to collect data from a large number of volunteer participants from both military and civilian populations. This data will help us both 1) determine which standardized tests are most likely to be sensitive to the effects of blast and noise exposure; and 2) establish normative data on these standardized tests and transition the tests to the clinic for validation on individuals with clinical complaints of hearing difficulty or tinnitus.

2. KEYWORDS:

Provide a brief list of keywords (limit to 20 words).

Tinnitus, hidden hearing loss, hearing impairment, noise/blast exposure

3. ACCOMPLISHMENTS:

What were the major goals of the project?

- **(Year 1) Specific Aim 1:** Evaluate and Optimize Subjective Metrics for Assessing Noise History
    - **Major Task 1:** Improve our ability to obtain reliable self-reports of noise exposure by directly evaluating the relationship between objectively measured noise dosimetry and subjective noise surveys.
        - Subtask1: Submit documents for local IRB review. Local IRBs include Walter Reed and University of Texas, Dallas.
        - Subtask 2: Design and develop infrastructure to implement objective and subjective noise measurements.
        - Sub task 3: Collect data
- **(Year 2) Specific Aim 2**: Evaluate the influence that noise and blast exposure have on the performance and subjective hearing handicap of listeners with normal hearing thresholds.
    - **Major Task 2:** Identify auditory tests that are sensitive to objective differences in performance among Service Members with normal or near-normal thresholds and varying levels of noise and blast exposure and establish normative data in those tests that will facilitate their direct transition to clinical use.

        - Subtask1: Collect data at Walter Reed and at the University of Texas, Dallas (UTD) audiology clinic.
        - Subtask2: Analyze and begin to publish results from Aim 1.
        - Subtask 3: Begin developing infrastructure and collecting pilot data for major task 3.

- **(Year 3) Specific Aim 3**: Evaluate the non-bothersome and bothersome tinnitus in Service members
    - **Major Task 3:** Identify auditory and functional tests that are sensitive to differences in performance among Service Members with normal or near-normal thresholds and various levels of bothersome and non-bothersome tinnitus and establish normative data in those tests that will facilitate their direct transition to clinical use.
        - Subtask 1: Collect data at Walter Reed
        - Subtask 2: Analyze and begin to publish from Aim 2
        - Subtask 3: Analyze and publish data from Aim 3

What was accomplished under these goals?

- A no cost extension was approved on 19 FEB 2021, which will extend this work for an additional twelve months through 14 June 2022.

- **Specific Aim 1 Accomplishments:**
    - Established correspondence with new POCs at TBS as all prior POCs had a permanent change of station in June 2020. Study POCs were MAJ Clint Staschke (Assistant Operations Officer) and Scott Davis (Safety Officer).
    - Dr. Schurman traveled to Quantico on 19 OCT 2020 for an in-person meeting with MAJ Staschke and Mr. Davis. Dr. Schurman briefed them on the goals of the currently approved IRB protocol. However, MAJ Staschke has since left TBS.
    - The programming of the Tabsint protocol was tested, amended and completed.
    - CRADA was officially approved.
    - MHSRS abstract was submitted and accepted for a poster presentation.
    - **University of Texas, Dallas:** Data collection at the UTD was scheduled to begin during Year 2 Quarters 3 and 4. However, data collection has been on hold due to COVID-19. The approved IRB protocol at UTD proposed that students would attend concerts and measure their noise exposures. Then, one week later the students would be tested at the UTD clinic to assess their subjective noise exposure history and objectively measure any changes in hearing that occurred due to the loud noise exposure event. Due to the unforeseen changes to concert attendance and large gatherings we wrote a new the UTD protocol. The details of the new UTD protocol were outlined in the previous annual report. **The new UTD protocol, which does not include the requirement to attend a loud event was approved in June 2021.** Data collection will begin in the next reporting period.

    - **Data Collection Accomplishments/Updates:**
        - **Subjective Noise exposure portion of Aim 1:** Successful data collections were completed at The Basic School at Quantico in FEB and MAR 2021. Data was collected on the subjective noise exposure questionnaire of Aim

1. These Service Members were not told to pay attention to their noise exposures during training. See significant results section below.

- **Objective noise exposure portion of Aim 1:** Dr. Schurman has met with Ned Berg (Navy IH) on multiple occasions during this reporting period to discuss the possibility of obtaining exposure data for each of the ranges of TBS at Quantico. Navy IH has issued a mandate to collect this noise exposures on all ranges, but technical limitations and personnel changes have prevented data collection to this point. Walter Reed has provided some technical assistance to allow IH to make the measurements using the Lincoln Labs mNoise device, and they are interested in moving forward with data collection. Additional meetings have occurred between Walter Reed, Navy IH and the local Quantico IH department. The local Quantico IH department (POC: Matthew Young) would like to move forward with using the Lincoln Labs mNoise devices to catalog the noise levels for all training exercises at the TBS. The local Quantico IH department does not have access to a dosimeter that has the capability to measure impulse noise, therefore they were not interested in this effort during previous meetings. However, once it was established that Walter Reed will provide the mNoise devices and data collection support in conjunction with their local IH requirements Matthew Young expressed interest in this effort. There are no significant results to report at this time.

Significant Results Aim 1 (Subjective Noise Exposure):

Pilot data on the loudness matching procedure was collected via the TABsint platform on a tablet. Listeners were presented with several noise samples at different levels ranging from 40 to 85 dB SPL. Each participant was required to subjectively judge or match the loudness of each noise sample. The noise sample was judged based on a relative loudness scale (see Figure 1). Listeners were instructed to select the location on the scale that matched the level of a given noise sample. There were three trials in this testing paradigm. The first trial did not provide the listener with feedback. Participants simply selected a location on the loudness scale that matched the presented noise level. The second trial provided listeners with correct or incorrect feedback on their loudness judgements. The third trial did not provide feedback. The purpose of the second and third trials was to determine if listeners improved in the accuracy of their judgements after receiving feedback. Lastly, participants were asked to perform the loudness matching paradigm over two days, again to determine if listeners improved over time. Results of the loudness matching accuracy are shown in Figure 2.

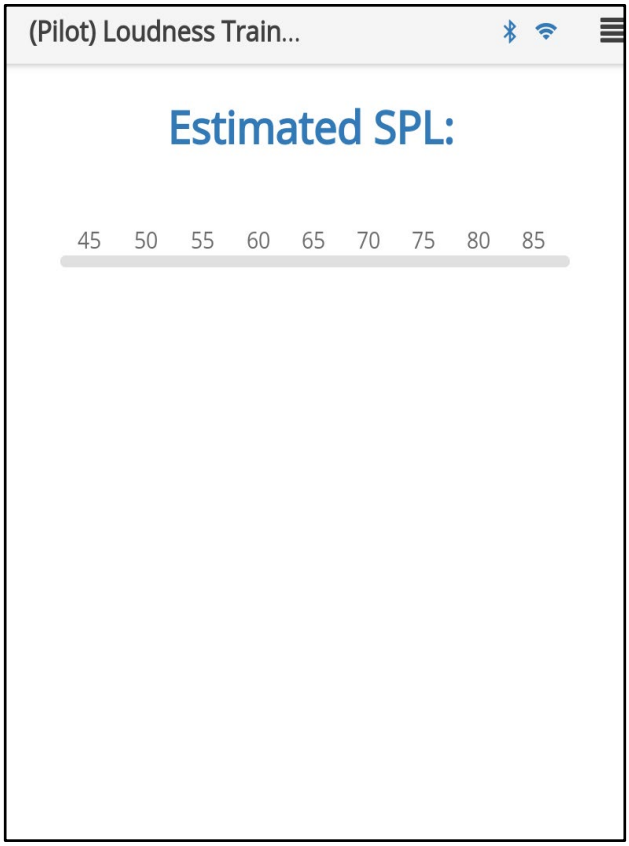


Figure 1. Screenshot of the loudness scale from the TABsint protocol. Listeners were tasked to select a location on the scale that matched the loudness of the presented noise sample.

Figure 2 shows data from 5 pilot participants. Data on the y-axis represents the loudness difference score in decibels (dB). The difference score represents the absolute difference in dB between the actual level of the presented noise and the subjective noise level selected by the participant. The x-axis indicates performance on Trial 1 and Trial 3 for Day 1 and Day 2 of data collection. The results show that listeners performed similarly before (Trial 1) and after (Trail 3) receiving feedback on Trial 2. Results also show that listeners were relatively similar when judging the loudness of the presented noise over two days of testing. These results suggested that there may be an absence of a learning effect on this task. Data collection at Quantico incorporated a similar loudness matching procedure. The UTD protocol will also utilize similar procedure.

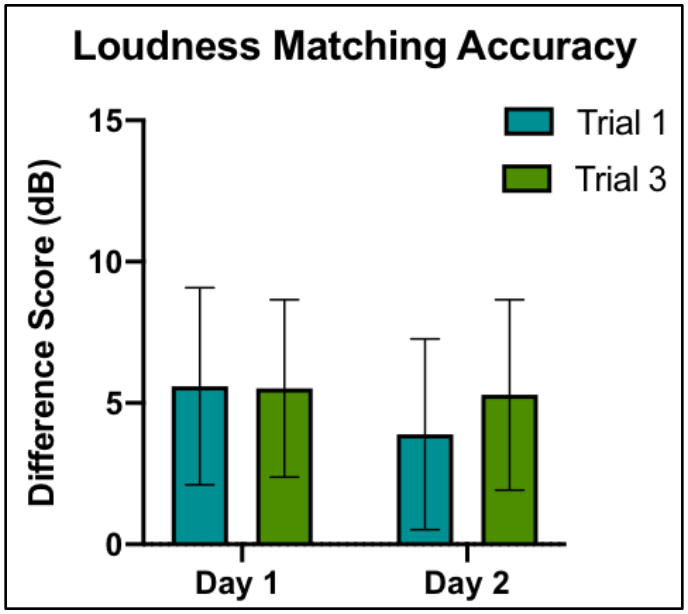


Figure 2. Difference score in dB between the presented level of the noise and the subjective noise selection plotted as a function of trial number and data collection day. Error bars represent standard deviation.

The pilot data that was collected during the first quarter of this year was transitioned into two successful data collections on 16 FEB and 12 MAR at The Basic School at Quantico.

Preliminary analyses on data from 227 students and instructors at The Basic School suggest that SMs ranked the noise exposure of each training scenario similarly across the different survey sections. For example, across the rank order section (Figure 3), the loudness scaling section (Figure 4) and the Likert scale section (Figure 5), the majority of SMs indicated that the 7-ton vehicle was the least hazardous to hearing and that the 0.50 caliber machine gun and M777 Howitzer were the most hazardous to hearing. In addition, within the Likert scale section SMs were asked to rate how loud or hazardous each scenario was with and without the use of hearing protection. Results show that listeners rated the hazard level to be lower with the use of hearing protection compared to without hearing protection (Figure 5). Although this result may not be surprising, it could indicate that SMs understand the benefit of hearing protection in reducing hazardous levels of noise exposure across multiple noise exposure scenarios, which may lead to increased use of hearing protective devices.

These results indicate that the text only surveys (i.e., Likert and rank order sections) and loudness scaling survey elicited similar responses related to the hazardousness of the noise exposure events. This result may suggest that SMs are reliable in their self-report of noise exposure across multiple assessment methods. Data was collected on the group of SMs that was not told to pay attention to noise at the beginning of their training. In the future we will also capture SMs that were told to pay attention to their noise exposures throughout training. In addition, we will compare the subjective rankings to the actual noise exposure levels using dosimeters collected through the Navy mandate. These data will provide insight into the accuracy and repeatability of participant self-report of each noise exposure event as they relate to dosimeter measures of the noise exposure event. Obtaining accurate noise exposure histories will eventually lead to the ability to better diagnose and mitigate the negative ramifications noise exposure may have on operational performance, long term resiliency, and quality of life.

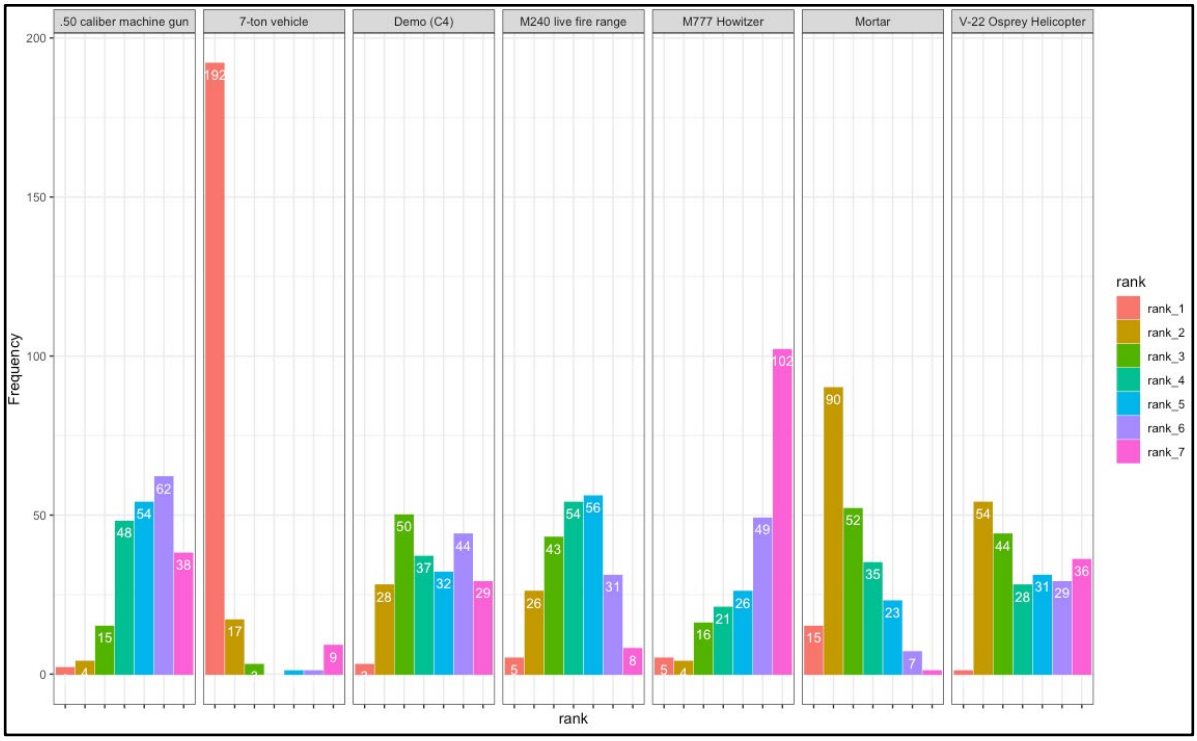


Figure 3. This figure shows the frequency at which each rank was selected for a given machine or noise exposure scenario. Frequency is shown on the y-axis and within each bar. Rank is shown in color on the x-axis. Participants were told to rank order the noise scenarios from softest to loudest. A rank of 1 indicates the softest sound and a rank of 7 indicates the loudest sound.

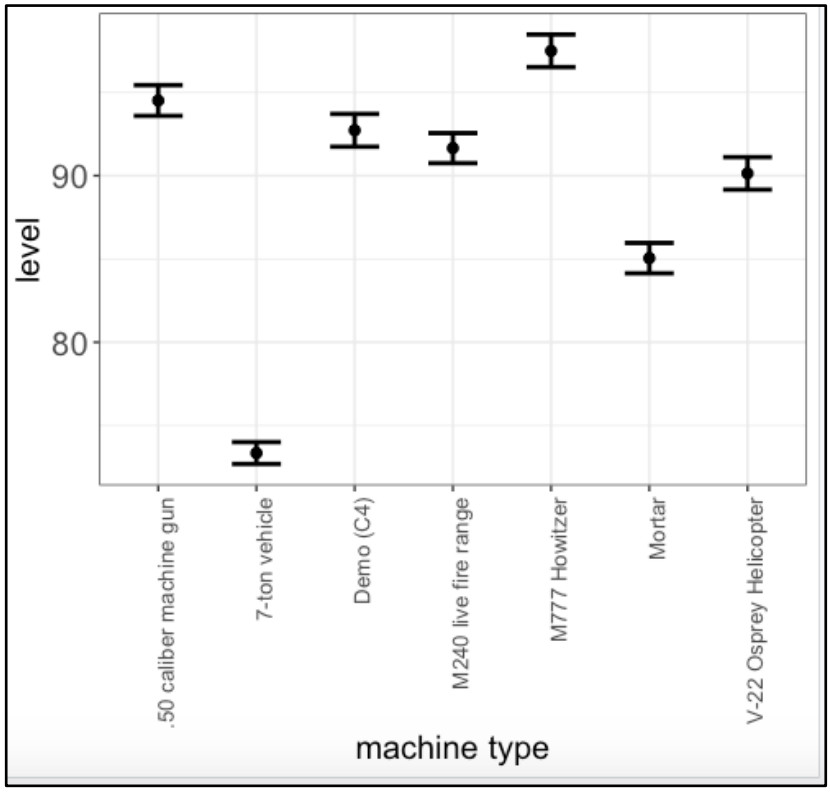


Figure 4. This figure shows the results for the loudness scaling section. Selected level is on the y-axis and machine type is on the x-axis. Listers saw a scale from 55 to 125, which represented a

range of loudness. Fifty-five represents the softest sound on the scale and 125 represents the loudest sound on the scale. Listeners were presented with 10 noise samples at different presentation levels. A green dot appeared to indicate the level of each presented sound on the scale. Then listeners were asked to indicate where on the scale they would place each noise exposure scenario they experienced during training.

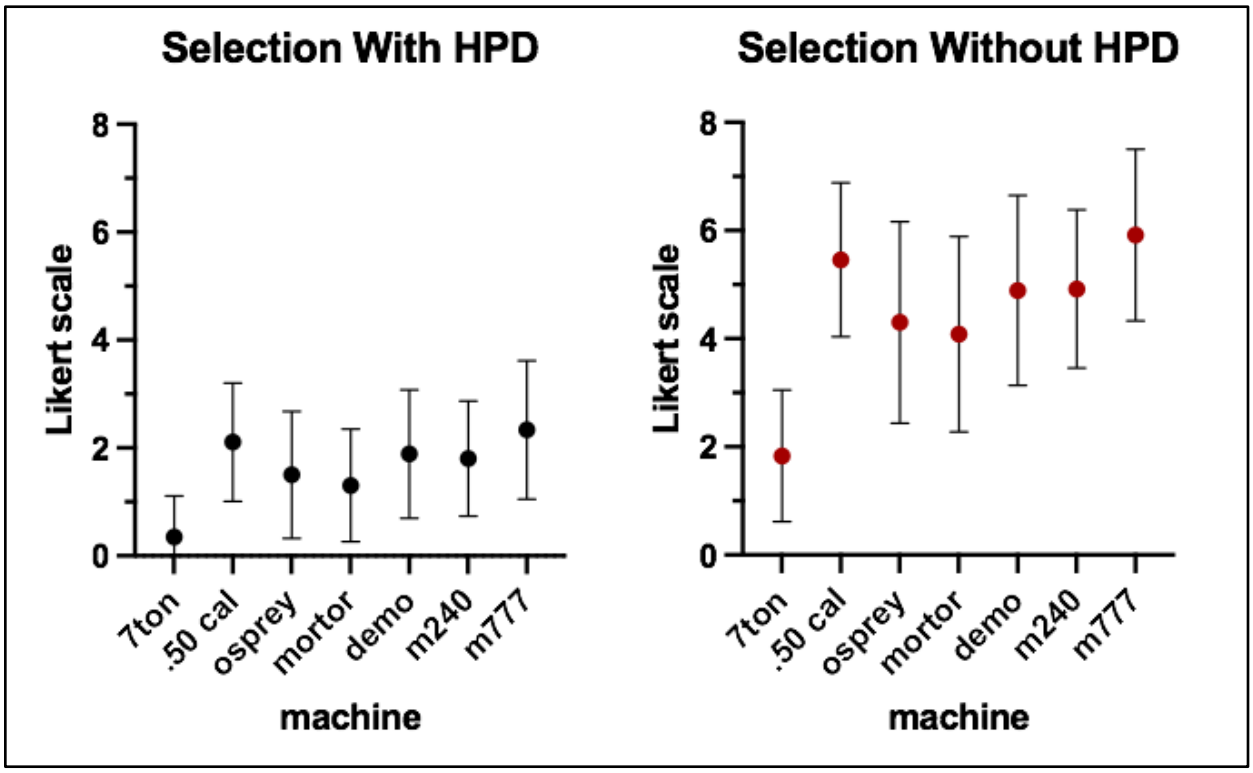


Figure 5. This figure shows how participants ranked each noise exposure scenario on a Likert scale. Participants were asked to rate how loud or hazardous each noise exposure was to their hearing on a scale of 1 (quiet) to 10 (loud enough that one exposure will cause permanent hearing damage). They were asked to rate the noise hazard with the use of hearing protection and without hearing protection for each noise exposure.

- **Specific Aim 2 Accomplishments:**
    - IRB at UTD was approved in June 2021.
    - We were able to complete testing on multiple versions of the Masking Level Difference (MLD) task as it relates to self-reported noise exposure history, temporary threshold shifts (TTS) and hearing thresholds.

Significant Results Aim 2:

A. This data was collected under MRMC IRB Protocol Log No. M-10386; HRPO Log No. A-20639. The goal of this work is to determine the relationship between the MLD, subjective complaints of hearing difficulty and reported noise/TTS questionnaires. In one

version of the MLD task we attempted to capture the listener's overall capacity to capitalize on a binaural phase difference across a range of relevant frequencies. Ideally, these data would allow us to stratify individuals based upon the highest frequency at which they are able to use the fine-timing information to detect the tone in the noise. Figure 6 shows the rolling average of proportion correct responses for a large cohort of listeners (n=697), with each thin, gray line representing data from an individual listener. Data was jittered vertically by 3 %-points to better illustrate data density. Data trends show that a considerable proportion of listeners are able to complete the task in favorable conditions, but do not perform better than chance (33%) at tone frequencies higher than 500 Hz. Due to the design of this MLD task, some information of sensitivity is captured as a function of level for stimuli with a tone frequency of 500 Hz, and some information is captured as a function of frequency for stimuli at a fixed level. Results confirm that the 500 Hz MLD is the most promising test frequency to measure differences between groups of normal or near normal hearing Service Members.

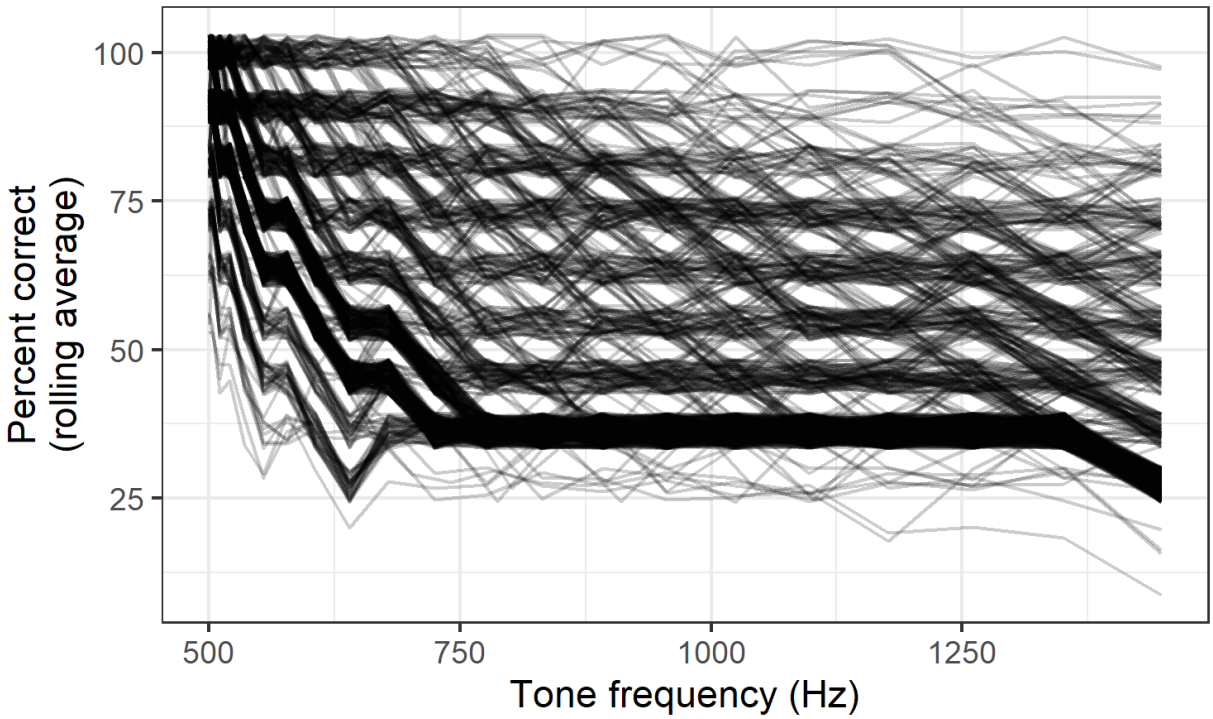


Figure 6: Rolling average of performance as tone frequency increases in the new MLD task. Each thin gray line shows data from a single subject. Data has been jittered vertically by 3% to demonstrate data density. Performance near 33% is indistinguishable from chance. Most listeners show better performance at 500 Hz and poorer performance at higher frequencies, consistent with theory-based predictions.

All data and figures below show the results from the 18-trial MLD task at 500 Hz developed at Walter Reed and the relationship with noise/blast history, TTS and subjective hearing complaints.

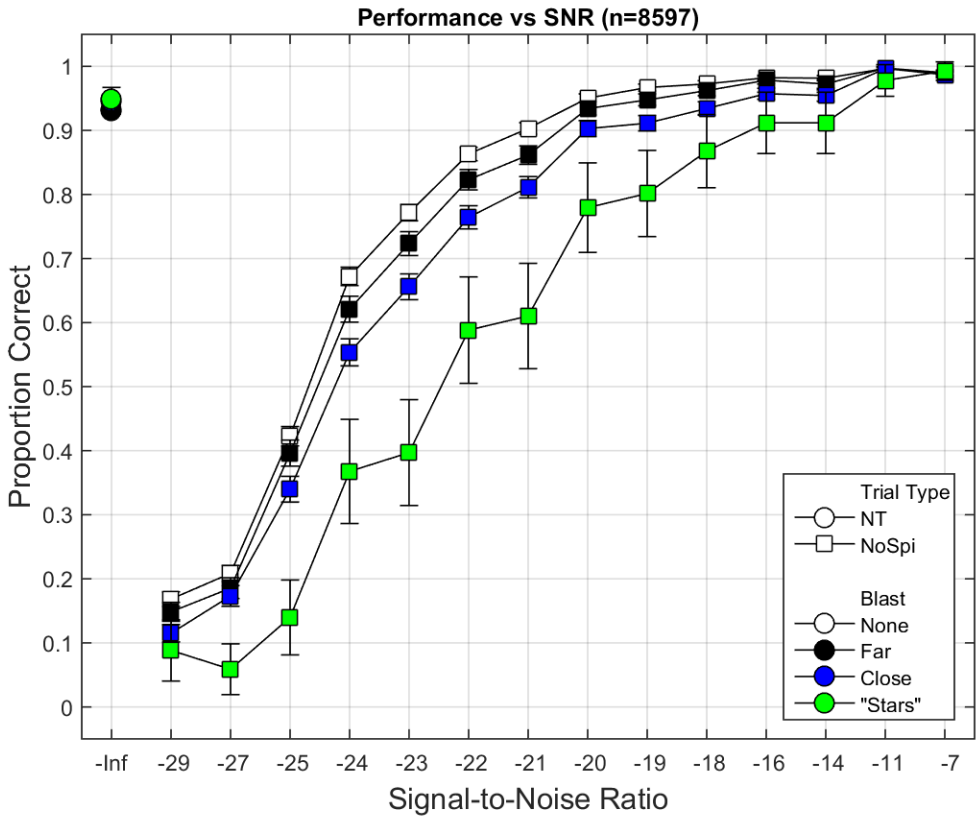


Figure 7: This figure shows proportion correct responses on the y-axis and signal-to-noise ratio on the x-axis. Participants were asked about their history of blast exposure and the different groups represent the responses. Listeners either reported no blast exposure (white = none), exposure to a far away blast (black= far), exposure close enough to feel the pressure from the blast (blue = close) and exposure leading to disorientation or seeing "stars" (green = "stars"). The data shows that participants who reported seeing "stars" preformed worse compared to the other three groups. This result suggests that a history of blast exposure may lead to a decline in auditory processing performance on the MLD task.

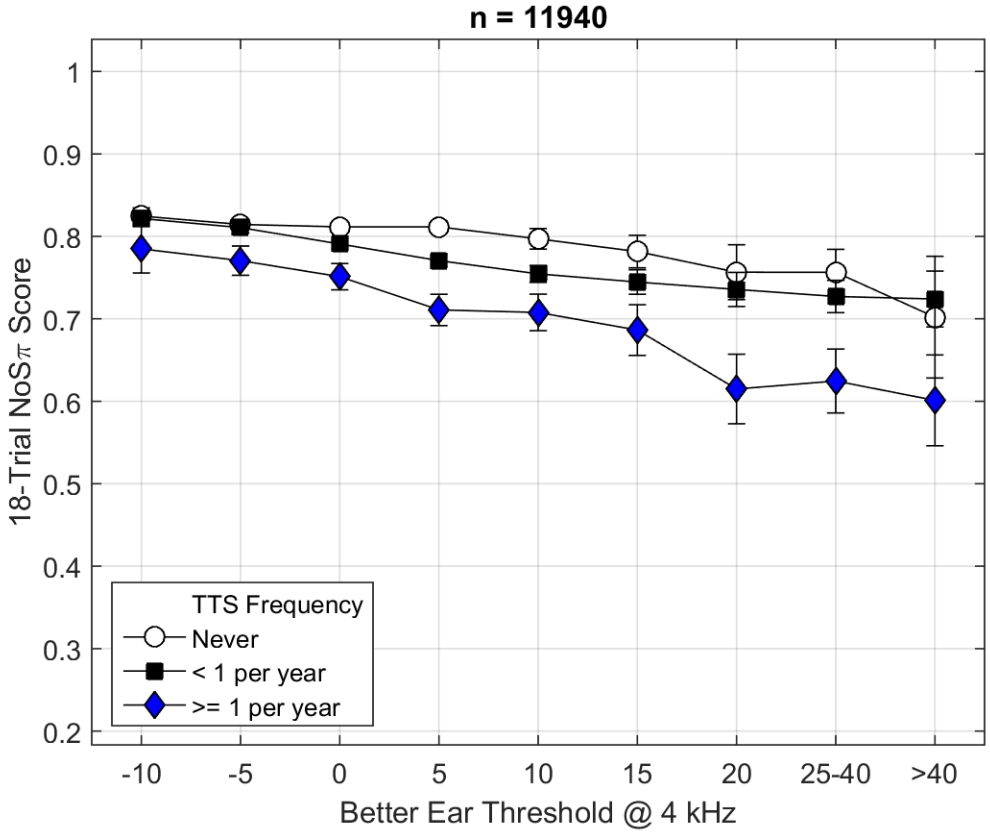
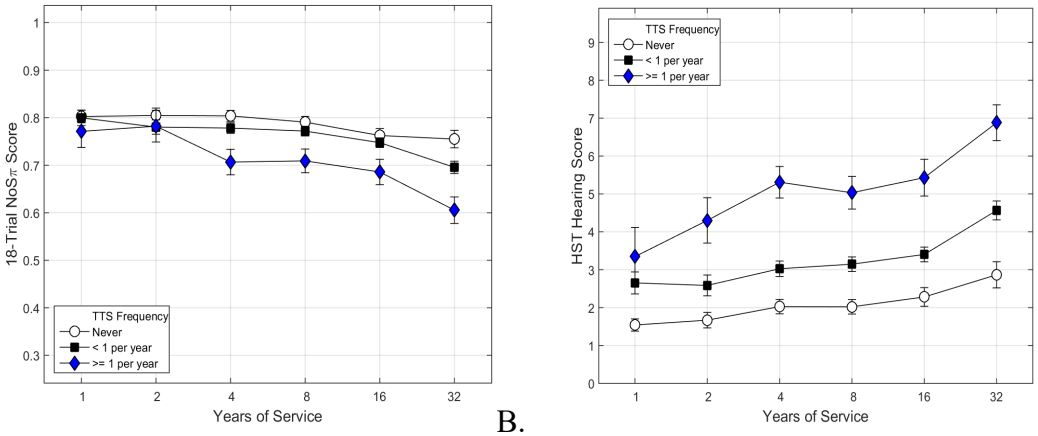


Figure 8: This figure shows the relationship between NoSpi performance (y-axis) and the better ear thresholds at 4,000 Hz (x-axis). Previous analyses showed that about 35% of SMs say they have never experienced a TTS. In this figure the group that indicates they have never experienced a TTS does best regardless of their threshold at 4,000 Hz. However, those who report TTS do poorly even when they have very good auditory thresholds. This figure provides new objective evidence that TTS is related to impaired auditory function, even when thresholds are "normal".



A. B.

Figure 9: Panel A shows the relationship between NoSpi threshold (y-axis) and years of service (x-axis). Panel B shows the relationship between report of subjective hearing difficultly (y-axis) and years of service (x-axis). Panel A shows that all individuals just entering the military (years of service = 1) perform similarly on the NoSpi task. However, after four years of service, individuals who report that they have had frequent TTS (blue diamonds) are much worse

compared to the groups that reported no TTS (white circles) or less than 1 TTS per year (black squares). This result may suggest that Service Members with multiple TTS are more susceptible to auditory function declines and that they acquire hearing damage over the first few years of military service. Panel B shows a similar result for subjective report of hearing difficulty over multiple years of military service. Individuals reporting multiple TTS also report an increase in difficultly hearing with an increase in years of service.

Taken together, these results suggest that the 18-trial MLD developed at Walter Reed is sensitive to differences in "normal hearing" individuals with varying degrees of blast exposure, TTS and subjective report of hearing difficulty.

- Specific Aim 3 Accomplishments:
  - Programming of the tablet protocol is nearly complete and data collection should begin in the upcoming quarter.
  - Data analysis has been underway on a previous data set that included a speech in noise assessment (triple digit task) and subjective report of tinnitus. This data has guided the specific triple digit task that we will use for data collection in the upcoming quarter.

Significant Results Aim 3:

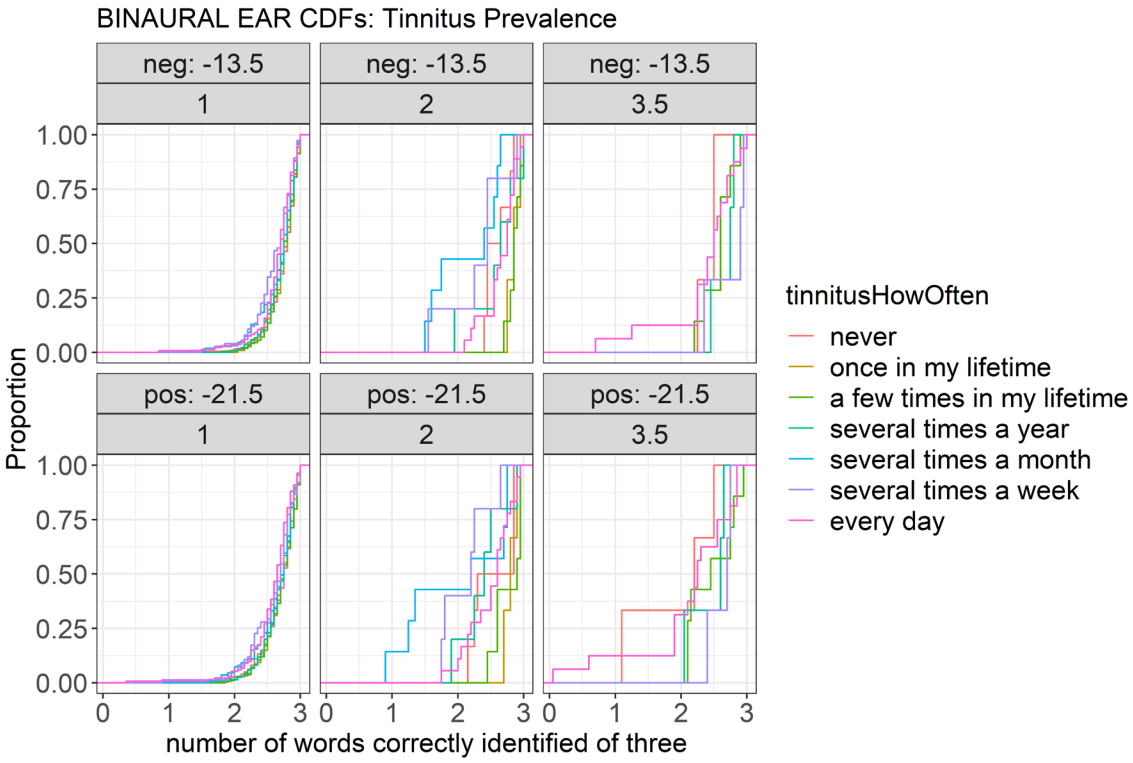


Figure 10: This figure shows a difference in performance between individuals that report experiencing tinnitus often and those who do not or rarely experience tinnitus. Individuals that report experiencing tinnitus several times per year or more perform poorly and report fewer correct digits compared to Service Members that experience less tinnitus. This result may suggest that individuals reporting tinnitus are at risk for a decline in the ability to understand speech in noise. This initial result will be explored further in the current study.

What opportunities for training and professional development has the project provided?

Nothing to report.

How were the results disseminated to communities of interest?

Please see "Products Section" below for more information. There are plans to present data from Aim 1 at MHSRS in AUG 2021. In addition, Dr. Brungart will be giving an update on the progress for this project at the Military Operational Medicine Research Program progress meeting on 21 JULY.

What do you plan to do during the next reporting period to accomplish the goals?

- **(Year 1) Specific Aim 1:** Evaluate and Optimize Subjective Metrics for Assessing Noise History
    - **Major Task 1:** Improve our ability to obtain reliable self-reports of noise exposure by directly evaluating the relationship between objectively measured noise dosimetry and subjective noise surveys.
        - Subtask1: UTD to get HRPO approval.
        - Subtask 2: Complete infrastructure and programming on the tablet protocols for UTD data collection.
        - Sub task 3: Collect data at UTD. Collaborate with and support the local IH department to collect the noise exposure levels for the training exercises at TBS.
- **(Year 2) Specific Aim 2**: Evaluate the influence that noise and blast exposure have on the performance and subjective hearing handicap of listeners with normal hearing thresholds.
    - **Major Task 2:** Identify auditory tests that are sensitive to objective differences in performance among Service Members with normal or near-normal thresholds and varying levels of noise and blast exposure and establish normative data in those tests that will facilitate their direct transition to clinical use.
        - Subtask1: Data collection will continue at Walter Reed and other DoD sites. We plan to submit a request to increase our recruitment numbers in order to answer our remaining research questions. Data collection will begin at UTD.
        - Subtask2: Further analyze and begin to publish and disseminate results from Aim 1.
        - Subtask 3: Complete programming for tablet protocol to be utilized in Aim 3.

- **(Year 3) Specific Aim 3**: Evaluate the non-bothersome and bothersome tinnitus in Service members
    - **Major Task 3:** Identify auditory and functional tests that are sensitive to differences in performance among Service Members with normal or near-normal

thresholds and various levels of bothersome and non-bothersome tinnitus and establish normative data in those tests that will facilitate their direct transition to clinical use.

- Subtask 1: Collect data at Walter Reed
- Subtask 2: Further analyze and begin to publish from Aim 2
- Subtask 3: Analyze and publish data from Aim 3

4. IMPACT:

What was the impact on the development of the principal discipline(s) of the project?

The subjective and objective measures of noise exposure developed in Aim 1 could be critical in improving the reliability of the individual noise exposure data in DOEHRS-HC, which could eventually lead to more accurate epidemiological studies of the relationship between noise and hearing impairment in the military. Similarly, the data we collect in Aims 2 and 3 will provide tests that could almost immediately be transitioned to the clinic as diagnostic tools for evaluating patients who have near-normal thresholds, but have subjective complaints about speech-in-noise difficulties and tinnitus.

What was the impact on other disciplines?

The results we are finding regarding NoSpi perception in blast and noise exposed service members has led to additional measures that appear to confirm the importance of binaural perception in this population. We have now seen evidence of similar effects in the chronic blast-exposed patient population at the National Intrepid Center of Excellence, and we are also finding evidence of short-term changes in binaural perception for noise exposed listeners who are tested pre- and post-exposure in the field.

What was the impact on technology transfer?

Nothing to Report.

What was the impact on society beyond science and technology?

Nothing to Report.

5. CHANGES/PROBLEMS:

Changes in approach and reasons for change

- A first time no cost extension was approved for this grant on 19 FEB 2021, which will extend this work for an additional twelve months through 14 June 2022.
- No changes to scope or approach to report for the upcoming performance period.

Actual or anticipated problems or delays and actions or plans to resolve them

1. All Aims: Data collection for all projects was put on hold due to COVID-19. We were granted a first time no cost extension, which will enable us to meet the goals of this project.

2. Our main POC at Quantico (MAJ Staschke) has since left TBS. Coordination between our team and Quantico to collect objective noise exposures through the Navy mandate or while supporting the local IH department remains a challenge. Dr. Schurman has recently made new contacts at the local Quantico IH department and these meetings have been encouraging for making progress towards the second part of Aim 1. However, if recent efforts to work with the Quantico IH department do not come to fruition it is possible that this data will remain unavailable by the end of the project in June 2022. In addition, TBS has reported that they cannot support an additional data collection for the questionnaire portion of Aim 1. Therefore, it is not likely that we will be able to collect data on a group of Service Members at TBS who were told to pay attention to their noise exposures throughout training. We will continue to communicate with TBS about the possibility of supporting this data collection in the future.

Changes that had a significant impact on expenditures

Nothing to report.

Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents

Significant changes in use or care of human subjects

Nothing to report.

Significant changes in use or care of vertebrate animals.

N/A

Significant changes in use of biohazards and/or select agents

N/A

6. PRODUCTS:

- **Publications, conference papers, and presentations**

Journal publications.

Brungart, D.S., Perry, T.T.E. Shub, D. Kulinski, B.M. Sheffield, S. Russell, M. Kokx-Ryan, R. Holtzman, L. Kubli, S. Phatak, K.W. Grant. (2020 October). *Evidence for NoSπ tone detection as an indicator of hearing damage in blast-exposed service members.* Presentation at ISL Battlefield Acoustics 2020, Virtual Conference.

Brungart, D.S., Perry, T.T.E. Shub, D. Kulinski, B.M. Sheffield, S. Russell, M. Kokx-Ryan, R. Holtzman, L. Kubli, S. Phatak, K.W. Grant. (2020 November). *Evidence for NoSπ tone detection as an indicator of hearing damage in blast-exposed service members.* Submitted Abstract to The Joint Defense Veterans Audiology Conference (JDVAC) 2021.

Sherlock, L. P., & Brungart, D. S. (2021). Functional impact of bothersome tinnitus on cognitive test performance. *International journal of audiology*, 1-9. The data for this paper was analyzed, prepared and published under the purview of the current grant. In addition, the results of the study have directly impacted the measures used in Aim 3 of this funding source.

Brungart, D.S. (In preparation). Developing a Military Auditory Fitness-for-Duty Standard Based on the 80-Word Modified Rhyme Test (MRT80) Speech-in-Noise Test. The data for this paper was analyzed and prepared under the purview of current grant.

Books or other non-periodical, one-time publications.

Nothing to report.

Other publications, conference papers, and presentations.

An abstract was submitted and accepted for a poster presentation at MHSRS in August 2021. This poster presentation will focus on the data collected in Aim 1 and will be presented in the next quarter.

Schurman, J and Brungart, D. Self-Report of Noise Exposure in Service Members. To be presented at the Military Health System Research Symposium, Orlando, FL.

Website(s) or other Internet site(s)

Nothing to report.

- **Technologies or techniques**

Nothing to report.

- **Inventions, patent applications, and/or licenses**

Nothing to report.

- **Other Products**

Nothing to report.

7. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

What individuals have worked on the project?

Name: Douglas Brungart, PhD
Project Role: PI
Researcher ID: NA
Nearest person month worked: 1 month (no change)
Contribution to Project: Principal Investigator

Name: Jaclyn Schurman, AuD
Project Role: Co-I
Researcher ID: NA
Nearest person month worked: No change
Contribution to Project: Research Audiologist

Name: Colleen LePrell, PhD
Project Role: PI at University of Texas, Dallas
Researcher ID: NA
Nearest person month worked: No change
Contribution to Project: Principal Investigator

Name: La Guinn Sherlock, AuD
Project Role: Co-I

Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?

Dr. Jaclyn Schurman is now a civilian employee in the Hearing and Speech department at Walter Reed National Military Medical Center. Although she is no longer charging billable hours towards this grant as an HJF employee she will still support the project to ensure completion.

What other organizations were involved as partners?

University of Texas, Dallas (Subaward)
800 W. Campbell Road Richardson, TX 75080
Colleen LePrell, PhD
Collaboration (e.g., partner's staff work with project staff on the project)

8. SPECIAL REPORTING REQUIREMENTS

COLLABORATIVE AWARDS:

QUAD CHARTS:

9. APPENDICES: