



US DEPARTMENT OF DEFENSE

BLAST INJURY RESEARCH PROGRAM COORDINATING OFFICE

Neurobehavioral and Psychological Health Outcomes Prevalence and Objective Verification of Central Auditory Processing Disorders in Blast-Exposed Warfighters

After the start of Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF), The Department of Defense (DoD) and Department of Veteran Affairs (VA) audiologists began seeing increasing numbers of blast-exposed Service Members with relatively normal audiograms, but who subjectively report difficulties understanding speech in noisy environments. However, estimates of the scope of this problem are unknown and there are reasons to believe the traditional hearing loss metrics based primarily on a pure-tone audiogram and standard speech tests may underestimate the degree of damage to the hearing system. Accurate comprehension of speech relies not only on an intact sensory system, but also on cognitive abilities such as attention and working memory. Therefore, researchers at the Walter Reed National Military Medical Center (WRNMMC), Naval Medical Center San Diego (NMCS), and Wilford Hall Ambulatory Surgical Center have established a multi-site infrastructure for large-scale data collection. This research addressed three major aims: 1) determine the prevalence of functional hearing difficulties among blast-exposed Service Members with normal to near-normal hearing as designated by the Army profiling system (H1 profile - AR40-501); 2) identify sensory and cognitive factors that may contribute to difficulty with speech communication; and 3) develop a clinically appropriate battery of tests to diagnose these deficits. To accomplish these three aims, the research team developed a tablet-based test environment that could be deployed and controlled remotely and that included both hearing and survey tests to determine functional hearing ability in a large population. In addition, a PC-based test battery for assessing functional hearing and communication deficits was developed, including test selection and hardware and software development for auditory and visual peripheral, central, and cognitive communication processing tests (Figure 1).

Hearing problems are among the top disabilities reported by returning Service Members. Concurrent injuries to the auditory system as a result of acute blast trauma and resultant traumatic brain injury (TBI) account for 25 percent of all war injuries.¹ DoD and VA have observed concomitant damage to the central auditory structures of the brain. The magnitude of the problem of auditory processing in returning Service Members is unknown. The results from this project are likely to influence regulations for auditory fitness for duty and accession and retention standards for individuals with and without normal audiograms. Current guidelines for retention and accession standards for individuals with normal audiograms are without limit, assuming that a finding of normal hearing thresholds indicates normal hearing. It is now known, as this study shows, that this assumption is false. The audiogram is a useful tool for measuring hearing but it is limited and does not measure understanding or processing of what has been heard. In military situations, the failure to adequately understand speech commands or to interpret environmental sounds correctly can be life-threatening to the Service Member and to those around him/her. Preliminary results suggest that

¹ Gondusky, J. S., & Reiter, M. P. (2005). Protecting military convoys in Iraq: an examination of battle injuries sustained by a mechanized battalion during Operation Iraqi Freedom II. *Military Medicine*, 170(6), 546–549.





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even the mildest hearing loss coupled with a history of blast exposure can render an individual's ability to hear and understand auditory input roughly five times worse than a non-blast-exposed Service Member. These results will likely influence policy standards regarding auditory fitness for duty.

FIGURE 1: PC-based Test Battery for Assessing Functional Hearing and Communication Deficits

