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Title: Rapid assessment methods for early detection of hearing impairment
MeSH Terms: Ototoxicity, ototoxicity monitoring, Hearing, OtoID

Objectives: This study is in response to a call for proposals from the Department of Defense Advanced Medical Technology Initiative (AAMTI) related to Telemedicine & Advanced Technology Research (TATRC). The goal of this project is the development of an efficient field-portable assessment tool for the rapid identification of small incremental changes in hearing acuity during military service. This project will use state-of-the-art techniques for measuring pure-tone audiometric thresholds and comparing these results with a series of novel speech perception tests. The hope is that this systematic pure-tone and speech assessment will allow the reliable detection of changes in hearing as small as, or possibly even smaller than, those that can be detected with current standard-of-care hearing conservation programs based on the periodic measurement of pure-tone audiograms in sound-attenuating listening booths. If we are able to achieve this goal, the system will have at least three important applications related to the prevention of permanent hearing loss in the military. It will provide 1) a way for assessing changes in hearing in forward military facilities where there is no access to an audiologist or a sound-treated listening booth, 2) an improved method for monitoring hearing in patients being treated with ototoxic drugs at military treatment facilities; and 3) an enabling technology for conducting field studies to evaluate the impact that specific noise exposures, hearing conservation strategies, or otoprotective pharmacological agents have on the amount of hearing loss experienced by military personnel in specific operational environments.

Plan: Only the engineering portion of this project will be carried out at the NCRAR. The OtoID device, a portable audiometer developed at the NCRAR, will be re-engineering for increased functionality and delivery to the DoD investigator.
Methods: The human subjects portion of this project will *not* be carried out at the PVAMC. Rather the OtoID device will be re-engineered by NCRAR specifically for this project. Soldiers with and without hearing loss will be recruited and tested from the WRNNMC community. Subjects will be tested using the OtoID device to define pure-tone hearing thresholds (0.5-20 kHz) and speech intelligibility scores (using novel speech stimuli) in each ear at three or more test intervals. Change in hearing thresholds and/or change in speech intelligibility will be monitored and compared with the baseline measurement. In addition, otoscopy and tympanometry will be done in each ear to rule out conductive hearing loss.

Relevance to VA's Mission: Noise-induced hearing loss sustained during military activities creates a tremendous need for audiological services both in the military and, following service, at the VA. Tinnitus and hearing loss are the number one and number two most frequent permanent injuries suffered by US military personnel. The DoD Hearing Center of Excellence reports that the VA identified more than 159,000 *new* cases of hearing loss and tinnitus in 2010 alone, representing a 17.6% increase. If more reliable measures of small amounts of hearing loss were available, it would be easier to determine the extent to which specific noise exposures might be contributing to the development of hearing loss in military personnel.