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Beyond the audiogram: Application of models of auditory fitness for duty to assess communication in the real world

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Abstract

This manuscript provides a Commentary on a paper published in the current issue of *Ear and Hearing* and the companion paper published in the *International Journal of Audiology* (Soli et al. 2018a, 2018b). These papers report background, rationale, and results of a novel modeling approach to assess “auditory fitness for duty” or an individual’s ability to perform hearing-critical tasks related to their job, based on their likelihood of effective speech communication in the listening environment in which the task is performed.

Keywords

Fit for duty; Real-world listening environments; Speech communication; Speech Intelligibility Index

The following Commentary discusses two new manuscripts by Soli and colleagues, one published in the current issue of *Ear and Hearing* (“Evidence-based occupational hearing screening I: Modelling the effects of real-world noise environments on the likelihood of effective speech communication”, Soli et al. 2018a) and the companion paper published in the *International Journal of Audiology* (“Evidence-based occupational hearing screening II: Validation of a screening methodology using measures of functional hearing ability”, Soli et al. 2018b). Each manuscript describes a novel approach to an important topic and addresses a timely scientific and clinical question: how does hearing loss contribute to the ability of employees or employee candidates to perform critical tasks associated with their occupations? The papers summarize results of a coordinated series of studies conducted in the United States, the Netherlands, and Canada over a 17-year period. These studies develop and validate a model approach to assess an individual’s ability to perform hearing-critical tasks related to their public-safety jobs, based on their likelihood of effective speech communication in the listening environment in which the task is performed. The authors describe their evidence-based approach and analysis as a form of occupational fitness or “auditory fitness for duty,” which takes into account environmental noise, speaker distance, and vocal effort. As such, these strategies may be expanded beyond public safety

employment to other hearing-critical occupations and more diverse environments, to provide a foundation for broader assessments of fitness for work.

As presented, the approach focuses on functional hearing abilities, defined by the authors as including features of detection, recognition, localization, and speech communication, with functional hearing being most directly related to speech communication. Although the goal of the Soli *et al.* 2018a, 2018b studies was narrowly defined to develop and validate a method of occupational hearing assessments for specific hearing-critical job tasks involving public safety, their rationale and approach raise important questions and provide novel tools for screenings or assessments of everyday communication in “hearing-critical” daily activities by all individuals, including those with hearing loss.

The proposed approach is in contrast to the most widely used “gold standard” measures of hearing. Most measures were developed several decades ago for diagnostic assessments of hearing impairment, such as pure-tone audiometry measured monaurally with headphones, rather than for assessment of functional hearing or communication abilities. Traditional diagnostic measures, even those that use speech signals, are not linked to, and may not directly reflect (1) specific hearing-critical activities undertaken by individuals in their daily lives, (2) the characteristics of the listening environments where individuals spend most of their time, or (3) individuals’ abilities to successfully complete hearing-critical tasks in those environments. As a result, current audiometric test batteries are not designed to assess “hearing handicap” that prevents an individual from efficiently and fully conducting the activities most important to them in typical environments (in the same way workers must successfully perform hearing-critical job tasks in occupational settings). Among other concerns, this has led to a disassociation between currently used diagnostic tools and the most common complaints of individuals with hearing loss (Soli *et al.* 2018a, 2018b).

To adopt empirical evidence from the Soli *et al.* 2018a, 2018b studies and broaden the approach from occupational hearing screening, procedures are needed to identify each individual’s everyday tasks, describe characteristics of listening environments in which they spend their time, and determine when and where effective speech communication is essential. Such an ecologically valid approach acknowledges that functional communication abilities and their assessments are not “one-size-fits-all,” but take into account individuals’ widely varying daily activities, real-world listening environments, and communication needs.

Many readers know that research is currently underway that addresses some of these questions and attempts to characterize natural listening and real-world environments that model their impact on effective speech communication, beyond listeners’ hearing sensitivity, processing abilities, cognitive skills, and motivation. The Soli *et al.* 2018a, 2018b studies are an important example of a more ecologically valid approach that assesses an individual’s ability to perform hearing-critical tasks in their occupational listening environments. Critically, they provide both the theoretical model as well as validation studies of that model. The validation studies suggest that the model can be used with a good deal of accuracy to predict effective speech communication capability in real world occupational noise environments. Building on this rationale and approach may inform the development and

validation of metrics and tools that better reflect individuals' real-world environments, daily tasks, and self-reported functional abilities beyond the workplace. Such an approach would likely be more relevant and understandable to patients/consumers and could lead to more accurate assessments and more effective interventions for people with hearing loss. Readers interested in this area of research and clinical application will find valuable information in these two new contributions to the literature and evidence base.

References

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