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Minimum Standards for Voice-Related Biomarkers in Speech and Singing

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Abstract

The absence of uniform procedures for clinical voice-quality assessment impedes cross-study comparisons and evidence synthesis. Building on the 2023 European Laryngological Society–Union of European Phoniatricians (ELS-UEP) Delphi consensus, minimum standards applicable to voice in speech and singing with clinical relevance are presented in a book of voice-related biomarkers. The Voice Handicap Index-30 (or VHI-10); auditory-perceptual judgement with the GRBAS scale; aerodynamic measurement of maximum phonation time; and acoustic analysis of a comfortable, sustained /a/ capturing mean fundamental frequency, percent jitter, percent shimmer, and noise-to-harmonic ratio are included. All recordings should be obtained with a calibrated microphone positioned 4 cm from the lips in a quiet room or sound booth and, at best, replicated at 60, 70, and 80 dB for longitudinal monitoring. It leaves space for additional modules such as high-speed video endoscopy or AI. In the book, routine collection of raw acoustic files is emphasized to facilitate machine learning and remote assessment. Harmonized assessment is expected to improve diagnostic accuracy, guide tailored intervention, and drive more robust outcome research across diverse voice users. It creates a stable reference against which emerging objective biomarkers, such as cepstral peak prominence or machine-learning voice prints, can be validated, accelerating translational research.

Introduction

In 1998, the National Institute of Health Definitions Working Group defined a biomarker as an indicator of normal biological processes, pathogenic processes, or pharmacological responses to a therapeutic intervention. [1]. This means that molecular, histologic, radiographic, or physiological measures are types of biomarkers. For the voice, this means that the biomarkers should fulfil certain conditions, which include specificity, effectiveness, and efficiency. There is a distinction between sound production, which takes place at the level of the vocal folds, and the audible end result, speech, where the sound undergoes abundant influences of resonators and articulatory aspects. The voice-related biomarkers focus on the level of the vocal folds in the glottis.

The purpose of this article was to describe concise minimum standards for clinical voice-quality assessment in both speech and singing contexts, thereby harmonising practice and facilitating multicentre comparison.

Method

A voice-related biomarkers committee of UEP was established in May 2023 with the aim of exploring possible biomarkers in phoniatrics and to start research into voice-related biomarkers. The voice-related biomarkers committee of the UEP was established based on earlier discussions and a consensus report of 2023 of UEP and ELS [2-5]. It was found that acoustics alone was not sufficient. And linguistics, semantics, and vocabulary do not reflect glottal function. Self-assessment, perception, and aerodynamics are important concerning voice, even in a multidisciplinary voice clinic. The final measurement suggestions were iteratively refined through 14 online meetings and discussions in various centers.

The online meetings are presented in a book in print [6].

Results

The resulting minimum battery covers 4 information domains. Core elements are the Voice Handicap Index-30 (or 10) parameters of subjective complaints, GRBAS auditory-perceptual rating, maximum phonation time as an air-flow parameter, and four acoustic metrics (F0, jitter, shimmer, noise-to-harmonic ratio). All recordings should be obtained with a calibrated microphone positioned 4 cm from the lips in a quiet room or sound booth and, at best, replicated at 60, 70, and 80 dB for longitudinal monitoring. It leaves space for additional modules such as high-speed video endoscopy or AI. The full assessment takes approximately 15–20 minutes and utilizes equipment already present in most otolaryngology-speech pathology teams.

Discussion

The results of the voice-related biomarkers committee confirm that multidimensional assessment remains essential because no single metric captures the complex perceptual and physiological determinants of voice quality. By limiting acoustics to universally available parameters and specifying straightforward recording conditions, the proposed standard overcomes resource disparities that have previously limited guideline uptake. The biomarkers are also considered a minimum in singing. And the measurements, usable in neurogenerative, multiple handicap disorders, and genetics, open new treatment perspectives as well. Future work should validate remote capture, smartphone implementations, and AI-assisted analyses against this benchmark. AI foundation models could be trained, which is an interesting AI aspect.

Conclusion

This overview distils international expert consensus into a practical tool for daily practice. Systematic adoption will enhance clinical decision-making, support outcome research, and ultimately improve voice care for speakers and singers by providing a shared evidentiary framework.

Conflicts of interest: No

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