# THE ACOUSTIC BREATHINESS INDEX (ABI): ACOUSTIC QUANTIFICATION OF BREATHINESS

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Introduction: The evaluation of voice quality is a major component of voice assessment. The concept of breathiness is auditory-perceptually based and it induces notable intra-rater and inter-rater variability by the listeners. There are many factors which influence the reliability and accuracy of the perceptual evaluation. To improve the validity and reliability in abnormal voice quality judgments, various kinds of instrumental methods have been developed to quantify abnormal voice quality. Acoustic measurements have the potential to offer an objective adjunct to existing perceptual assessments. In the present study we developed a new multivariate acoustic model for breathiness for clinical practice and research.

Method: In total 1042 out of 1058 concatenated voice samples (i.e., 34 syllables of continuous speech and 3 sec. sustained vowel [a:]) were used varying from normophonia to severe dysphonia. To meet acceptable reliability 4 out of 12 experts were chosen to rate the breathiness severity degree. A selection of 28 acoustic measures was used. To find the combination of the best acoustic predictors of breathiness, a stepwise multiple linear regression analysis was applied. The following statistics were used to measure validity: Spearman rank-order correlation coefficient ($r_s$), several estimates of its receiver operating characteristics (ROC) plus likelihood ratio (LR), and iterated internal cross-correlations.

Results: Stepwise multiple regression analysis yielded a nine-variable acoustic model (i.e., Acoustic Breathiness Index (ABI)), for the multiparametric measurement of breathiness. A strong correlation was identified between ABI and auditory-perceptual judgment ($r_s$= 0.840, p=0.000). The cross-correlations confirmed a high comparable degree of association. Additionally, the ROC- and LR results showed the best diagnostic outcome at a threshold of ABI=3.44 with a sensitivity of 82.4% and a specificity of 92.9%.

Conclusion: This study presents the development of an acoustic measurement for the evaluation of breathiness. The ABI model showed high robustness, ecological validity, concurrent validity, and diagnostic precision to objectify and quantify voice quality regarding breathiness.