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# **Advancements in early airway disease detection using vowel phonation with smartphone**

Lung function, Biomarkers, Diagnosis

**D. Ngo<sup>1</sup>, Y. Raykov<sup>1</sup>, M. Shaban<sup>1</sup>, D. Jarchi<sup>2</sup>, A. Gratiot<sup>1</sup>**

**<sup>1</sup>Eupnoos - London (United Kingdom), <sup>2</sup>University of Essex - Colchester (United Kingdom)**

## Background:

Addressing the critical need for accessible airway disease diagnostics, Eupnoos pioneers an audio-based phenotyping system, utilizing smartphone microphones. This approach analyzes vowel phonations to detect spectral patterns representing obstructive conditions like asthma and COPD, and restrictive diseases such as fibrosis. This technology offers a simpler, efficient proxy for spirometry measurements, which can be recorded seamlessly, in a home environment. Such accessible respiratory diagnosis can enable early intervention for obstructive and restrictive lung pathologies.

## Methods:

Our study included 31 participants who performed four vowel sounds of "a", "e", "o", and "u" into the microphone of a smartphone with durations ranging from 6 seconds to 59 seconds. These vowel recordings are then trimmed into 511 chunks of 6 seconds. Next, Continuous Wavelet transformation is applied to transform these chunked audios into a two-dimensional spectrogram where both spectral and temporal features are presented. Then, a Convolutional Neural Network is integrated to classify Normal (N), Restriction (R), and Obstruction (O). To assess system performance, we employed repeated K-fold cross-validation with non-overlapped participants between Train and Test set (60:40).

## Results:

Among four vowels, the performance from "u" demonstrated the best and excellent sensitivity, specificity, average score, and harmonic score in the classification of N, R, and O. The mean sensitivity, mean specificity, mean average score, and mean harmonic score are 81%, 84%, 82%, and 80%, respectively.

## Conclusion:

The results indicate promising performance of employing vowel "u" phonation for the diagnosis of airway diseases.