# WHEEZE DURATION IN COUGH SOUNDS FOR DISEASE CHARACTERIZATION

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Pulmonary physicians use auscultatory techniques to assist in the diagnosis and management of lung disorders. Wheezing is one characteristic that is heard in many types of lung disease. For example, wheezing may be a clinical sign of chronic obstructive pulmonary disease or an asthma episode. To optimize the utility of lung sound assessment, characterization of the wheeze by location, intensity, pitch, and duration in the respiratory cycle is essential. In this study, the duration of wheeze in different disease groups was examined.

A system was developed to record and analyze cough sounds. The system included a microphone positioned with its diaphragm tangent to the inner surface of a metal tube. A flexible 13-ft hose with 1-inch inner diameter was connected to the metal tube just past the microphone at the opposing end of the mouthpiece. Cough sound pressure waves generated were digitized at 12.8KHz and recorded using a sound analyzer. The signal was transferred to the computer for analysis.

The coughs were obtained from patients awaiting testing at the West Virginia University Hospital pulmonary function laboratory. Patients were diagnosed using a fuzzy logic technique that incorporated actual and predicted spirometry values of FEV1 and FVC within the fuzzy logic rule sets. Diagnosis led to the categorization of the patient in a particular disease group. Spectrograms were calculated from the patient's cough sound pressure waves. For each spectrogram, the number of wheezes and the duration of those wheezes were recorded and can be seen in Figure 1.

In the figure, the patients (n=31) were categorized according to the following disease type- 1) obstructive disease (n=9), 2) restrictive disease (n=4), 3) combination of obstructive and restrictive disease (n=10), and 4) control (n=8). Each patient had at least one nodal point (■,◆,▲, or ●). The number of nodal points and their positions describe the number of wheezes and their respective duration. The result for each patient is shown from longest to shortest wheeze duration per disease type. From the figure, it can be seen that the control group has less wheeze with shorter duration than the groups with pulmonary pathology. It also appears that of the groups with pulmonary pathology, the restrictive disease group has shorter wheeze duration. To better characterize the utility of this approach, statistical analysis will be forthcoming. Future studies will also include the recording of cough sounds from patients with diverse lung disorders of varying degrees of severity.

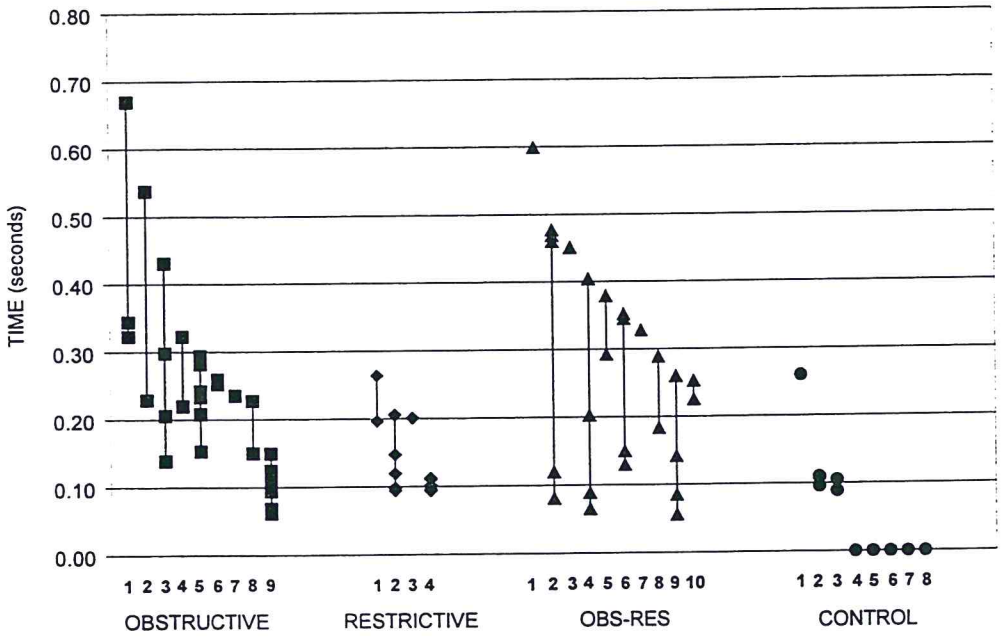


Figure 1: Disease Group and Patient Identification Number
For example, Obstructive Patient #3 was found to have four wheezes each with duration of 0.14, 0.21, 0.30, and 0.43 seconds.

# The 24th INTERNATIONAL CONFERENCE ON LUNG SOUNDS

Presented by

International Lung Sound Assocation

October 6-8, 1999

Marburg, Germany

## FINAL PROGRAM AND ABSTRACTS

# 24th INTERNATIONAL LUNG SOUNDS CONFERENCE

## MARBURG, GERMANY - OCTOBER 6 - 8, 1999

Conference Location: Institute of Physiology,

Deutschhausstr. 1, 35033 Marburg

## PROGRAM


Mit Unterstützung der Deutschen Forschungsgemeinschaft

und der

Deutschen Gesellschaft für Pneumologie