

# MEASURING THE LUNG FUNCTION CONTINUOUSLY AND UNOBTRUSIVELY

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**Background and Aims:** The conventional pulmonary function tests (PFTs) require respiratory maneuvers like forced maximal expiration, and only give snap shot information of the lung function. Our aim is to devise methodology for continuous unobtrusive assessment of the lung function using a wearable impedance pneumography (IP) system.

**Methods:** IP is based on the knowledge that the electrical impedance of the thorax is proportional to the lung volume. Thus, variation in the lung volume can be assessed by placing two or more measurement electrodes on the surface of the body to measure the impedance variations. Furthermore, the obtained signal can be used to produce diagnostic tidal breathing flow-volume loops. The shape of these loops change in a characteristic way when an airway obstruction occurs or is relieved (Beydon et al. 2011).

**Results:** We have conducted multiple measurements on healthy subjects and patients with obstructive airway diseases, assessing the agreement between the IP and a direct mouth airflow measurement. Thanks to our research on electrode locations and signal processing techniques, we have been able to produce highly accurate pulmonary flow-volume loops regardless of the subject body posture or presence of an obstructive airway disease. We also have produced a wearable cell phone size 24h IP recording device.

**Conclusions:** IP is accurate enough to produce diagnostic pulmonary flow-volume loops. It does not require any direct connection with the airways nor any proactivity from the measurement subject, unlike the conventional PFTs. This potentially enables continuous, long-term estimation of changes in lung function due to external agents and obstructive diseases like asthma. In combination with personal exposure monitors, IP could be used to assess the immediate real-time effects of air pollution on the lung function. This would be especially beneficial for preschool children and infants with whom the conventional PFTs cannot be used at all.

## References:

Beydon N, Davis SD, Lombardi E, Allen JL, Arets HGM, Aurora P, et al (2007) An Official American Thoracic Society/European Respiratory Society Statement: Pulmonary Function Testing in Preschool Children. *Am J Respir Crit Care Med* 175: 1304-1345.