NZ01

Monitoring lung mechanics during tidal breathing

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Background

Respiratory disease is a major public health problem. Globally more than 1 billion people[1] suffer from acute or chronic respiratory conditions.

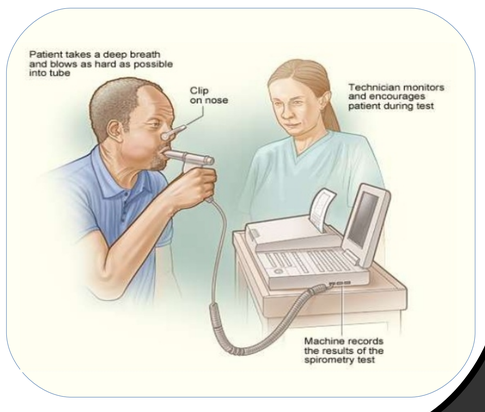
Spirometry is the current gold standard for assessing lung function in outpatient care. It analyses peak breathing effort.

Limitations:

-Needs full cooperation (elderly and young children often excluded)

-Labour intensive for clinician

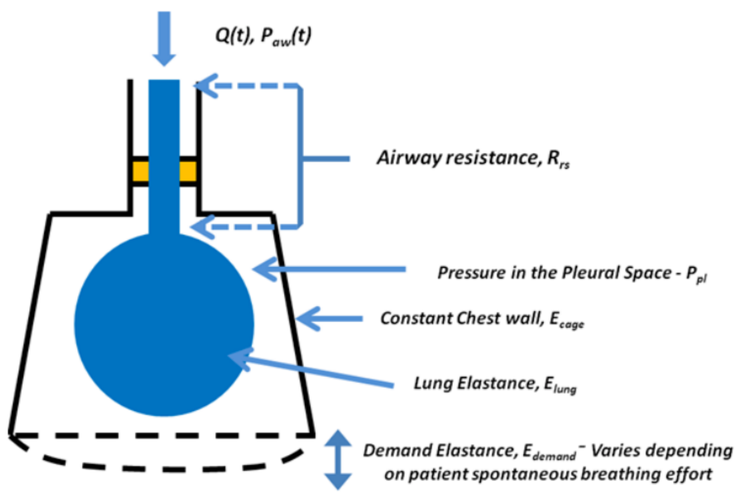
-Repeatability



Research goal:
Develop a method to measure lung function during normal, quiet breathing

Model

A very simple lung model, the Single Compartment Lung model[2], separates the lung into 2 components:
A **resistive airway** and an **elastic lung**

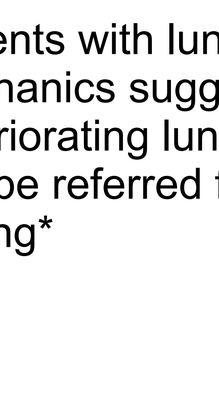


Changes in these lung mechanics reflect changes in lung health.

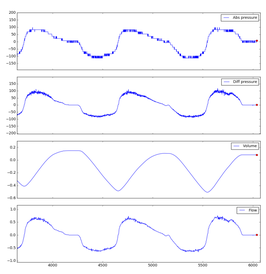
Abnormal **elastance** indicates **restrictive** disease
Abnormal **resistance** indicates **obstructive** disease

My research aims to measure lung mechanics during quiet breathing by applying this model to airflow measured using a mask or mouthpiece

Clinical application



A specialised mask or mouthpiece will record airflow

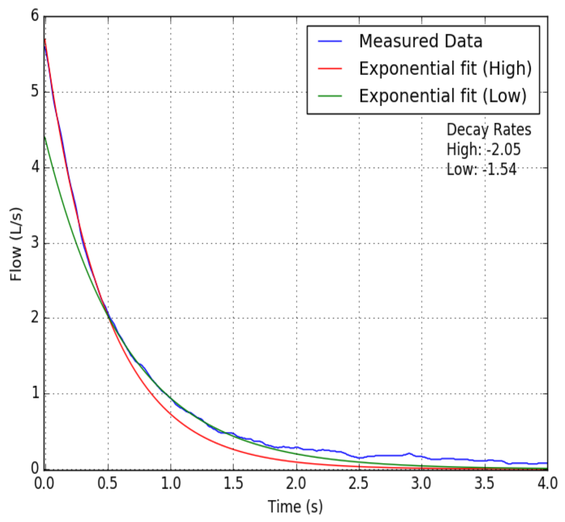


Lung mechanics will be calculated from the airflow data. Results will stored to be analysed by a clinician

Patients with lung mechanics suggesting deteriorating lung health can be referred for further testing*

*eg Spirometry, plethysmography, gas washout, X-ray, EIT, CT scans.

Early Results



- Lumped lung mechanics for healthy individuals able to be extracted from airflow data
- Lung mechanics shown to be separable from lumped value to within 5% of real value in artificial lung

Implications

- This test is low effort, allowing uncooperative subjects to participate
- This test would not require intensive coaching.
- Measurements could be made at home, allowing clinicians to observe trends.
- Lung mechanics measurements indicate disease type (restrictive/obstructive).

References

[1] Forum of International Respiratory Societies. *The Global Impact of Respiratory Disease - 2nd Edition*. Sheffield, European Respiratory Society, 2017

[2] J.H.T. Bates, *Lung Mechanics: an Inverse Modeling Approach*. Leiden: Cambridge University Press, 2009