Challenge 2: Using data collected from Structured Light Plethysmography to differentiate Breathing Pattern Disorder from normal breathing

Presented by Dr Emily Fraser and Mathew Bulpett, Oxford University Hospital

Background: Breathlessness is a common problem. In non-hospitalised Long Covid (LC) patients, lung function tests and imaging are usually normal. Patients with LC and breathlessness are often found to have a breathing pattern disorder (BPD) where the muscles that support breathing, such as the diaphragm, appear to be used less efficiently. Specialist respiratory physiotherapists make this diagnosis based on clinical history and examination, and when identified, breathing retraining exercises can help restore a healthy breathing pattern and dramatically alleviate symptoms.

The Problem: The identification of BPD is subjective with significant inter-observer variability. Therefore, there is an opportunity to develop a more objective way to assess BPD to improve diagnosis and management and focus additional investigations appropriately. Structured Light Plethysmography (SLP), is a non-invasive, motion capture device used to study chest and abdominal movement during breathing and can identify abnormalities. We have been using SLP within the LC clinic and in patients with unexplained breathlessness to see if BPD can be detected, and if so, how measurements compare to physiotherapist-based assessments, and how these are altered following successful breathing retraining. We also wish to evaluate the practical utility and value of this technology within the clinical setting.

The Challenge: We invite the BIOREME study group participants to analyse the data we have collected to determine whether there is a metric that can be used to differentiate normal breathing from BPD and to better understand the range of "normality". This will allow us to understand whether selective parameters obtained from SLP could provide a more sensitive way of identifying BPD. We are also open to the participants exploring the data further to better understand lung mechanics, diaphragmatic movement and predict determinants from SLP for BPD diagnosis. We hope this study group will help us to better understand and more accurately identify BPD in the clinical setting.

Data available: We have two highly specialised physiotherapists trained in the identification and management of BPD. Clinical evaluation, selected investigations and physiotherapist-assessment are used to define/identify BPD and serve as the reference standard in this study. To date, we have gathered preliminary data from the SLP from healthy controls and patients with BPD both at rest and after exercise (1-minute sit-to-stand test - STST). We have also collected breathlessness scores contemporaneously (mBORG pre and post STST and Dyspnoea-12). The following parameters from the SLP have been calculated:

1) Ratio of thoracic to abdominal movement during tidal breathing and following exercise

2) Regularity of breathing pattern

3) Inspiratory to expiratory ratio

4) Respiratory rate

We will provide anonymised data from control and BPD study participants and also hope to provide the raw SLP data in addition to the parameters outlined above.

Relevant Expertise: This challenge will likely require a range of expertise in working with medical data, lung imaging, spectral analysis and more broadly, computational and biophysical modelling.