2022 advocates for an assessment based on an algorithm that uses routine clinical data to risk-stratify patients planning commercial flights. The possible outcomes are as follows: ‘no in-flight oxygen required’, ‘consider Hypoxic Challenge Test’ (HCT), ‘consider in-flight oxygen at 2 L/min greater than the long-term oxygen therapy prescription (LTOT)’, or ‘consider in-flight oxygen at 2 L/min’.

**Methods** We evaluated the accuracy of the pre-flight assessment algorithm for patients with restrictive lung disease who had undergone a Hypoxic Challenge Test (HCT) prior to the implementation of the current clinical statement.

**Results** Seventy-four patients, comprising of 49 males, with a mean age of 70 years, were included in the study. The mean, standard deviation, and percent predicted values for various respiratory parameters were as follows: forced expiratory volume in 1 second (FEV₁) of 2.05 litres (0.81), 77% predicted; forced vital capacity (FVC) of 2.52 litres (0.80), 72% predicted; total lung capacity (TLC) of 4.01 litres (1.12), 67% predicted; and transfer factor of 3.93 ml/min/kPa (1.00), 51% predicted.

Among the patients identified as not requiring in-flight oxygen, eleven individuals failed the hypoxic challenge test (HCT). Twelve patients who were considered to require in-flight oxygen were able to maintain adequate oxygen levels (PaO₂ > 6.6 kPa) while breathing the hypoxic mixture (table 1).

**Conclusions** The algorithm is a useful and pragmatic tool in identifying patients requiring HCT/oxygen during air travel. However, clinicians need to be aware that some patients advised not to use oxygen may fail an HCT and others in whom oxygen is recommended but not needed may unnecessarily be deterred from travelling. It is important to conduct studies with larger patient cohorts to further investigate these aspects.

**Abstract P100**

**EXAMINING THE RELATIONSHIP BETWEEN EXHALED AEROSOL AND CARBON DIOXIDE ACROSS HUMAN ACTIVITIES**

1BP Moseley, 1JA Archer, 1CM Orton, 2HE Symons, 3NA Watson, 1KE Philip, 1JH Hull, 4D Costello, 1JD Calder, 1PL Shah, 5BR Bzdek, 1JP Reid. 1Royal Brompton Hospital, London, UK; 2University of Bristol, Bristol, UK; 3Imperial College London, London, UK; 4Wexham Park Hospital, Slough, UK

**Background** The COVID-19 pandemic caused >750 million infections and just under 7 million deaths worldwide, along with shutdowns in social and economic activities. Respiratory particles produced during non-vocalised activities such as breathing, and vocal activities including singing...
serve as a major route for respiratory viral disease transmission.

Methods This work reports concomitant measurements of the exhaled volume of carbon dioxide (VCO₂) and minute ventilation (VE), along with respiratory aerosol emitted during breathing, exercising, speaking, and singing, across 33 healthy adult participants.

Results VCO₂ and VE appear to follow a similar trend to aerosol number concentration during the non-vocalised, exercise activities. Vigorous and very vigorous exercises generated 6 and 10 times more exhaled CO₂ (L/min) than breathing at rest (p<0.001), respectively. And both vigorous and very vigorous exercise generated significantly more aerosol particles than breathing (p<0.001). When considering non-vocalised activities (breathing at rest, vigorous exercise, and very vigorous exercise), a strong correlation (R² = 0.71) between exhaled CO₂ production (in mL/s) and mean aerosol mass emission rates is evident. During vocalisation the amount of exhaled CO₂ when breathing at rest was similar to that exhaled while speaking (p=0.27) and singing at 70–80 dB (p=0.23) and only modestly different to that emitted when singing at 90–100 dB (p=0.02). Conversely, speaking and singing at 70–80 dB, and singing at 90–100 dB, generated significantly more aerosol particles than breathing (p<0.001). Consequently, a relatively poor correlation (R² = 0.02) was observed between exhaled CO₂ production in (mL/s) and mean aerosol mass emission during vocalization.

Conclusion The correlation between the aerosol mass exhalation and VCO₂ is only observed across activities that do not involve vocalisation, i.e. from breathing at rest through to vigorous exercise. Subsequently, using CO₂ as a surrogate measure of respirable aerosol in, for example, an indoor space provides and underestimation of the amount of airborne respiratory pathogen exhaled by an infected individual when they are vocalising. Therefore, additional surrogate measures are needed for vocalising.

P102 SYMMETRIC PROJECTION ATTRACTOR RECONSTRUCTION (SPAR): WHOLE-WAVEFORM ANALYSIS OF ABDOMINAL RESPIRATORY MOVEMENT PROVIDES A NEW BIOMARKER OF OBSTRUCTIVE SLEEP APNOEA


Background Obstructive Sleep Apnoea (OSA) is conventionally quantified by the Apnoea-Hypopnea Index (AHI), used to classify disease severity. Automation of AHI detection relies on identification of singular data points in long, multi-channel polysomnography (PSG) recordings. This can be easily compromised by signal noise. We present a novel mathematical method, the Symmetric Projection Attractor Reconstruction (SPAR), that may overcome this problem by transforming whole cyclic physiological recordings into corresponding ‘attractor’ images ('attractors') which capture all available waveform morphology information, without relying on single point detection. Attractor quantification may provide a more rapid and robust means of quantifying the number and duration of overnight apnoeic and hypopneic events.

Aim To test whether SPAR can categorize overnight obstructive sleep apnoea recordings according to severity classifications informed by expert-annotated AHI.

Methods 74 PSG recordings were analysed (52 non-OSA subjects/22 severe-OSA patients, 43.0/27.3% female, 37.4/48.9 second) ≥50% predicted) in primary care. Relationships between NRD and measures of quality of life, lung function and breathlessness were assessed.

Methods Patients with stable mild/moderate COPD were recruited from general practices. Second intercostal space NRD (EMGpara; NRDI), spirometry, measures of breathlessness and quality of life (CRQ-SAS, mBorg, CAT, mMRC) were recorded at baseline, 3 and 6-month follow-up. Intraclass correlation coefficients were calculated for each of the variables and Bland-Altman plots generated.

Results 40 COPD patients with mild/moderate airflow limitation were recruited. There was high intra-rater and inter-rater agreement in each of the measures of NRD, including EMGpara & NRDI (ICC > 0.9). There were moderate correlations between EMGpara and FEV₁% predicted (Pearson’s of r = -0.42; p=0.01) and between NRDI and FEV₁% predicted (Pearson’s of r = -0.35; p=0.04). Consistent correlation was not seen between either EMGpara or NRDI and any CAT, CRQ domain, mBorg, or mMRC scores across the assessments.

Conclusions Assessment of NRD using surface electromyography had a moderate correlation with FEV₁ but was not found in this study to be a sensitive measure of breathlessness in COPD patients with mild or moderate airflow limitation. The reliability of the recording in these patients and its established usefulness in assessing breathlessness in severe and very severe airflow limitation suggests that if the measurement can be made more sensitive it will be useful in interventional studies in primary care settings.

Please refer to page A289 for declarations of interest related to this abstract.