Title	Air Travel Assessment
Version	3.0

1. Introduction

The risks associated with air travel are greater for those with CF in adults and children than for healthy individuals. This is despite the fact that people with CF have been shown to tolerate PaO2 values below 6.6 kPa (50 mm Hg) for several hours without cardiac decompensation or cerebral symptoms, do not usually have cardiovascular comorbidities, and are generally younger than patients with other respiratory conditions. Hypoxaemia results mainly from ventilation/perfusion mismatch attributable to chronic inflammation and mucus plugging. It is not clear which physiological values measured at sea level best predict hypoxaemia or complications during flight. The 2022 British Thoracic Society (BTS) statement regarding air travel for passengers with respiratory disease provides an update to the previous guidelines 'Managing passengers with stable respiratory disease planning air travel' which reviewed the safety of passengers with lung disease when flying, the incidents of respiratory complications and how to reduce their occurrence. The use of **hypoxic challenge testing (HCT)** is advocated in children with conditions such as cystic fibrosis and neonatal lung conditions to determine whether supplementary oxygen should be provided when they fly. Users of long-term oxygen therapy should double up their flow for the flight and do not require a HCT.

Neither oxygen saturation levels in the blood measured at sea level nor lung function results are reliable in predicting the chances of complications or hypoxaemia during air travel of patients with respiratory conditions. At high altitude the partial pressure of oxygen is reduced to a pO2 equivalent to that found in FiO_2 of 15% at sea level. Therefore, passengers in airplanes at high altitude (8000ft or 2438m) receive a lower pO2 (not FiO2 which is still 0.21) during their flight. Patients with reduced arterial pO_2 or chronic lung disease are at risk of severe hypoxia unless they receive supplemental oxygen during the flight.

2. When to Request a Hypoxic Challenge Test

The hypoxic challenge test assesses the risk of hypoxaemia during routine commercial airline flights. Lung function, resting oxygen saturation and resting pO_2 measurements do not accurately predict all patients at risk of developing in flight hypoxaemia.

Recommendation: All patients with cystic fibrosis with:

- FEV_1 <50%
- baseline hypoxemia
- Recent clinical deterioration
- Previous problems during flights
- Young children unable to perform spirometry with moderate–severe disease based on clinical assessment

3. Hypoxic Challenge Test Procedure

- The HCT aims to determine the level of hypoxia that would occur in a patient when flying.
- Patients are given high flow (10-15 litres/minute) FiO2 15% O2 (special cylinder from BOC) via a mask with reservoir bag for 20 minutes during which time SpO2 is continuously monitored.
- If desaturations (SpO2 <90%) occur for >2 minutes then the patient is advised to fly with supplemental oxygen.
- To establish the amount of oxygen required, at the end of HCT O2 is delivered via nasal cannulae and the flow adjusted to achieve SpO2 >90% for 2 minutes.
- Oxygen should be titrated during HCT to find the minimum effective flow.

- Most CF patients requiring oxygen will need 1–2 L/min continuous flow.
- All HCTs for the NWM CF Centre are undertaken at the Royal Stoke University Hospital.

4. Use of Portable Oxygen Concentrators (POCs) in CF

- Many POCs provide pulse-dose oxygen only, which is not suitable for most children under 12 years due to low tidal volumes and irregular breathing patterns.
- Pulse-dose delivery may also be ineffective during sleep or with rapid, shallow breathing.
- Where possible, HCT titration should be performed using the same POC model intended for travel.
- Continuous-flow POCs typically provide up to 3 L/min; patients requiring higher flows may need alternative arrangements such as airline-supplied oxygen cylinders.
- Sufficient batteries should be carried to last 1.5 times the total duration of travel, including delays.

5. Other considerations

- Many airlines now provide pulsed oxygen during the flight and there is no data on how this might differ from continuous flow in children <12 years old
- Good advanced planning should be made when there is an intention to fly, ie starting 3 months in advance if possible. Different airlines have different practices with regards to supply of oxygen (free, or at cost, or not at all), flow rates (usually fixed eg at 2 or 4 litres/min) and allowing POCs and even cylinders on board now.
- Passengers with CF should practise good hand hygiene using soap and water or an alcohol-based hand gel, and avoid touching their face, particularly after touching arm rests, food trays or toilet doors to minimise risk of infection. These measures are included within recommendations from the European Centres of Reference Network for Cystic Fibrosis project, endorsed by the European Cystic Fibrosis Society. These also advise checking the relevant airline policy and levels of CF healthcare provision at the proposed destination before travel.
- All medications and spacer devices should be carried in hand luggage to mitigate the risk of missing hold baggage.
- Patients with CF under the age of 6 years are likely to be well enough to fly at the paediatrician's discretion.
- Children who are too young to reliably perform spirometry should have a clinical assessment of disease severity and their likely tolerance of hypoxia (most young children with CF do not have disease severe enough to significantly compromise lung function).
- An online resource useful for researching specific airline policies and oxygen providers is found at the European Lung Foundation website in the Air Travel section: https://europeanlung.org/en/information-hub/air-travel/

6. References

a. BTS Clinical Statement on air travel for passengers with respiratory disease. Coker RK, et al. Thorax 2022;0:1–22. doi:10.1136/thoraxjnl-2021-218110

b. https://europeanlung.org/en/information-hub/air-travel/