A fresh look at flight safety and travel to altitude for patients with COPD

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Travel is generally safe for patients with chronic obstructive pulmonary disease, but careful planning is crucial to minimise risks associated with flight and altitude. Key considerations include optimising medications, ensuring adequate oxygen levels and understanding the impact of altitude on breathing and exercise capacity. Patients with comorbidities, such as pulmonary hypertension or heart failure, may face additional challenges, making pre-travel consultations and personalised advice essential for a safe journey.

Key points

- **Patients with chronic obstructive pulmonary disease (COPD) should consult their GP six to 12 weeks prior to travel, especially if they are on long-term oxygen therapy, to ensure optimal health and flight clearance.**
- **Although commercial flight altitudes generally pose minimal risk for patients with stabilised COPD, supplemental oxygen may be required for those with a lower resting oxygen saturation level.**
- **Patients with conditions such as pulmonary hypertension, heart failure or coronary artery disease are at higher risk when travelling and may require specialised assessment and management.**
- **High-altitude destinations or physical exertion during travel can exacerbate breathlessness; therefore, patients should plan their itinerary with flexibility and consider potential limitations in exercise capacity.**

Travel, including by commercial aircraft, is common among patients with chronic obstructive pulmonary disease (COPD) and is generally very safe. This article includes a brief summary of the physiological effects of flight travel and advice for rarer circumstances.

General travel advice for patients with COPD

The focus of general travel advice for patients with COPD is on safety during longer flights and overseas travel. The period of low oxygen exposure during short-haul flights (i.e. those of <2 hours' duration, e.g. within the Brisbane, Sydney, Melbourne and Adelaide circuit) is brief and the associated risks are low.

All patients planning overseas travel should be advised to have a pre-travel consultation with their GP at least six to 12 weeks prior to departure. Patients on long-term oxygen therapy are advised to also seek timely review with their respiratory physician to discuss their travel plans. The airline may also request that a Travel Clearance Form is completed before boarding. Different airlines may have different policies, from paying for oxygen on the flight to the concentrators that may or may not be carried on board.

Most importantly, patients with COPD should be clinically stable at the time of travel. Patients recovering from an exacerbation are particularly at risk of future adverse events, such as myocardial infarction. Many travel arrangements (e.g. accommodation, airfares and organised tours) can be highly restrictive in terms of late changes to an itinerary; therefore, travel plans and bookings should be made with flexibility in mind. Low costs and 'flash deals' can generate temptation to travel when unwell, which is not recommended. Travellers with COPD and their companions should clarify insurance coverage and evacuation insurance, if needed.

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Table 1. General guidance for the evaluation of flight safety in patients with chronic lung disease[4]

Patient group	Recommendation
Patients on long-term oxygen – hypoxaemia does not correct with oxygen – PaO_2 <55 mmHg or SaO_2 <88% at sea level	Should not fly on commercial aircraft, even with supplemental oxygen
Patients on long-term oxygen – hypoxaemia corrects with oxygen	Risk of symptomatic in-flight events without supplemental oxygen is very high. Fly with oxygen and increase the flow rate by 1–2 L/min
Resting SpO_2 <92% or unable to walk 50 m without stopping	Very likely to require supplemental oxygen to maintain what would generally be regarded as reasonable oxygenation, but the risks of flying without oxygen are uncertain. Hypoxia challenge test may be useful
Impaired exercise capacity – SpO_2 92–95% (e.g. unable to walk up two flights of stairs without stopping)	Consider specialist referral for hypoxia challenge test. Interpretation of this result should take into account the degree of hypoxaemia seen and associated symptoms
Good exercise capacity – SpO_2 92–95%	Flight is almost certainly safe. Consider a detailed evaluation in some cases where there is significant cardiac or other comorbidity
Good exercise capacity – SpO_2 >95%	Flight is safe. No further evaluation is needed

Abbreviations: PaO_2 = partial pressure of oxygen in arterial blood; SpO_2 = peripheral oxygen saturation (as calculated using a pulse oximeter).

When choosing a travel destination, access to health care should be considered, as there can be significant variations in the availability, expertise and cost of health care in other countries. Advice about travel safety and health advice based on the intended country of travel can be obtained from the Department of Foreign Affairs and Trade (www.smartraveller.gov.au). There are clear advantages in restricting travel to countries in which Australia has a reciprocal health care agreement (https://www.humanservices.gov.au/individuals/services/medicare/reciprocal-health-care-agreements). Additionally, the destination is important when one considers that travel can involve significant levels of physical activity and challenging weather conditions (e.g. heat, humidity, high altitude, snow, ice), which may not be tolerated well by people with respiratory symptoms.

Optimisation of COPD management is important at any time and especially in the context of travel planning.[1] This includes:

- smoking and vaping cessation
- proactive review and optimisation of medications
- ensuring vaccinations are up to date (including influenza, pneumococcal, pertussis, respiratory syncytial virus and COVID-19 vaccinations, as recommended in the *Australian Immunisation Handbook*)[2]
- management and stabilisation of comorbidities, especially any cardiac impairment (e.g. heart failure, ischaemic heart disease and/or atrial fibrillation or other arrhythmias)
- correction of anaemia.

People with COPD gain benefit from attending pulmonary rehabilitation to optimise their respiratory condition, improve their exercise tolerance and learn to manage bothersome symptoms, such as breathlessness, effectively.[1] Improving muscle bulk through pulmonary rehabilitation can lessen the adverse impact of travel to destinations of moderate altitude on oxygen uptake. The *COPD Clinical Care Standard* recommends that all patients with COPD should have a COPD action plan that outlines how to recognise and manage worsening symptoms and flare-ups.[3] Hence, travellers with COPD are advised to not only have their action plan readily accessible but also have their additional medications on hand at all times during travel in the event of a flare-up. All travellers should carry a letter, ideally on official letterhead, that lists their medical conditions, medications and any medical supplies, such as oxygen or continuous positive airway pressure (CPAP) machines or mucus clearance devices. Travellers should pack sufficient medications for the trip (plus extras in the event of delays), and carry medications in their original containers in carry-on luggage and a copy of their prescriptions. Australians can also access their My Health Record (https://www.digitalhealth.gov.au/initiatives-and-programs/my-health-record), including their prescribed medication list and Health Summary (if it has been uploaded) while overseas if they have not opted out and provided they have internet access. Access to the record is available through the myGov website and may require two-factor authentication via SMS to their Australian mobile number, if enabled, or through the myGovID app (https://www.digitalhealth.gov.au/initiatives-and-programs/my-health-record/getting-started/how-to-access-my-health-record). Managing clinicians could check that the most recent Health Summary has been uploaded to My Health Record and also consider uploading the patient's COPD Action Plan and the results of other relevant tests (e.g. pulmonary function tests and ECG/echocardiogram) that may not have been automatically uploaded by other services.

People with COPD are advised to avoid sedatives, alcohol and overeating (to avoid abdominal distension) while in flight and in transit. A pragmatic approach for evaluating flight safety in patients with COPD is described in Table 1.[4] Beyond these considerations, the specific risks associated with COPD are related to changes in atmospheric pressure and oxygen availability at moderate altitude destinations and in aircraft cabins where the ambient pressure always falls during flight.

COPD, gas expansion and risks associated with changes in atmospheric pressure

The typical cruising altitude for a commercial aircraft is between 9000 and 13,000 m above sea level (ASL). The cabin is pressurised such that the ambient pressure is not lower than that seen at 2438 m ASL. This is comfortable and safe for passengers and is strictly adhered to by airlines. In practice, on modern long-haul aircrafts, this is closer to 1800 to 2100 m ASL.

Aircraft air is extremely dry, with a humidity level typically around 15%. This may lead to dehydration of airway secretions and,

1. Suggested indications for in-flight oxygen therapy on long-haul flights*

Absolute

- Long-term oxygen therapy
- Resting PaO_2 <50 mmHg at sea level
- PaO_2 <50 mmHg with distress during an altitude simulation test or breathlessness or distress during a previous flight
- PaO_2 <50 mmHg during an altitude simulation test in patients with concurrent cardiac disease

Relative

- PaO_2 <50 mmHg without distress during an altitude simulation test or without distress during a previous flight
- Severe COPD with concurrent significant cardiac disease regardless of oxygen levels

Abbreviations: COPD = chronic obstructive pulmonary disease; PaO_2 = partial pressure of oxygen in arterial blood.

* This list is not exhaustive and the evidence base around risks of flight and need for oxygen in flight to reduce risk is generally of poor quality.

for patients with regular productive cough, instruction on sputum clearance can be useful.

In the lower-pressure environment at 2400 m ASL, any trapped gas can expand by about 33% in volume. Patients with generalised or bullous emphysema are at low risk of cyst rupture because intra- and interlobar collateral ventilation causes even poorly ventilated lung units to decompress. Large, thin-walled cysts are at some risk of rupture with pneumothorax development, which can be catastrophic.[5] This risk is not reduced by supplemental oxygen therapy that may be administered during the flight (Box 1). Reported cases of safe air travel in individuals with large thick-walled cysts or a chronic pneumothorax suggest that these cavities can withstand an increase in pressure relative to that in the adjacent lung.[6]

A common myth regarding cabin air and infection risk is dispelled in Box 2.

2. Cabin air and infection risk

Myth: The air in an aircraft cabin creates an infection risk.

Fact: Cabin air consists of an element of recycled cabin air that passes through high-efficiency particulate air (HEPA) filters supplemented by external air that is extremely cold and then superheated before intake within the air conditioning system. Air is exchanged every 2–3 minutes and the potential for airborne pathogen transmission is low and much lower than in the airport terminal before and after a flight and while on the ground (i.e. while boarding), where ventilation often relies on the auxiliary power unit (APU) or ground units, which may not provide the same level of filtration and air exchange. Spread of infection by droplet contamination of surfaces is a significant risk as in any public place, and good hand hygiene is important.

COPD, altitude, hypoxaemia and issues associated with impaired tissue oxygen delivery

At the usual cruising altitude, the alveolar partial pressure of oxygen (PAO_2) for healthy individuals decreases from 103 mmHg (13.7 kPa) to 64 mmHg (8.5 kPa) and the oxygen saturation level declines from 97% to 93%.[3,7] These changes are inevitable but not dangerous for the great majority. Normal adaptive mechanisms include a small increase in ventilation, increased cardiac output with the resting heart rate typically being higher by 1 beat/min/300 m altitude gained and peripheral vasodilatation.[8] In addition, tissue oxygen extraction in peripheral tissues is more complete.[9] Together, these processes preserve tissue oxygen delivery, despite the lower PAO_2. These adaptive mechanisms explain why laboratory altitude simulation testing may produce saturation levels lower than 90% in patients who have travelled safely previously. As a general rule, supplemental oxygen is unlikely to be required if the resting oxygen saturation level is 95% or higher, whereas it is likely to be required if the oxygen saturation level is 88% or lower. Patients with oxygen saturation levels between these values might require specialist assessment.[3]

It follows from this that the greatest travel risk will be seen in patients who also have pulmonary hypertension or impaired cardiac function (e.g. heart failure), in whom the ability to increase cardiac output is compromised. Additionally, those with coronary or cerebral artery disease may experience impaired adaptation due to localised perfusion abnormalities, leading to tissue hypoxia and the accumulation of anaerobic metabolic byproducts. Tissue oxygen delivery may be further compromised by anaemia and oxygen utilisation by iron deficiency.

COPD, altitude and limitations to exercise capacity

Exercise capacity declines progressively with altitude, and many high-altitude tourist destinations are readily accessible and popular among travellers (Table 2). One of the reasons that flight is generally well tolerated is that exercise demand is minimal. In a study of patients with COPD performed at Mt Hutt in New Zealand (altitude: 2086 m), a significant number of individuals were comfortable at rest but could not complete even a light exercise task.[10] Therefore, sitting and relaxing in an aircraft flying at 2400 m equivalent altitude may be well tolerated, whereas travel-related tasks (e.g. dragging suitcases, walking, coping with inclines and stairs [as not all accommodations have lifts]) can generate troubling breathlessness or be impossible. However, those already on long-term oxygen therapy may need an increase in flow rate of 1 to 2 L/min during the flight and should be aware that exertion during the flight (e.g. walking to the toilet) will exacerbate hypoxaemia.

Other considerations for travel safety

When assessing flight travel safety for individuals with chronic lung disease, a variety of factors need to be taken into account, which may impact the safety and wellbeing of the traveller. In addition to the factors outlined in this article, the role of continuous positive airway pressure and other types of noninvasive ventilation should be considered. Additionally, evaluating whether hypercapnia is a concern should be part of the travel preparation process. These considerations are vital as they directly influence travel safety for individuals with COPD. Further discussion of these factors is needed to ensure that all potential risks are thoroughly addressed before embarking on a journey.

For some patients, altitude simulation or oxygen challenge testing can be an important part of assessing their readiness for travel to higher altitudes, but access to this test and a respiratory specialist may be limited. In some regions, it may take several months to secure an

Table 2. Examples of travel locations and altitudes

Location	Altitude
Blue Mountains, NSW (Mt Victoria)	1052 m
Commercial turbo-prop aircraft	1200–1500 m
Thredbo, NSW (base/highest lift)	1365/2037 m
Perisher Ski Resort, Perisher Valley, NSW (base/highest lift)	1720/2054 m
Mount Hutt, New Zealand	2086 m
Aircraft cabin (maximum permissible altitude)	2438 m
Cusco, Peru (access to Machu Picchu)	3300 m
Lhasa, Tibet	3600 m
Mount Evans, Colorado, USA (highest driveable road in continental USA)	4300 m
Beijing–Lhasa railway peak	5074 m

appointment at a public specialist clinic. In such cases, if the patient's symptoms, comorbidities and oxygen saturation levels suggest the need for specialist referral, then GPs may wish to directly contact a respiratory physician to discuss further.

Patients with COPD considering travel to destinations of high altitude may also require specialist travel medicine advice about the prevention and management of altitude sickness.

Conclusion

The three factors to consider when faced with questions regarding travel safety for people with COPD are:

- the functional state at sea level
- the altitude to be visited
- the anticipated additional workload from physical activity while travelling.

Most patients with COPD can travel without adverse events but there should be limits – not only for safety but also for circumstances where a traveller with COPD ascends to an altitude at which they are so limited by breathlessness they cannot enjoy the travel experience. Comorbidities should be considered when planning travel and in decisions associated with the need for supplementary in-flight oxygen therapy. Selected patients may benefit from referral to a respiratory physician and, in some cases, altitude simulation testing (Box 3). Resources for patients are listed in Box 4. **RMT**

3. Selected indications to consider respiratory physician referral for patients with chronic lung disease

- Previous acute respiratory distress during a flight, even if thought to be associated with anxiety
- Markers of COPD severity; FEV_1 <40%, resting hypoxaemia; frequent exacerbations
- Taking short-haul flights where safety is not a concern but seeking further reassurance
- Impaired cardiac function or pulmonary hypertension – NYHA class III or IV
- Concurrent significant macrovascular or microvascular disease that may impair coronary or cerebral perfusion
- Recent pneumothorax
- Chronic pneumothorax or large lung cyst(s)

Abbreviations: COPD = chronic obstructive pulmonary disease; FEV_1 = forced expiratory volume in one second; NYHA = New York Heart Association.

4. Resources for patients with lung disease who plan on travelling

- **Lung Foundation Australia:** https://lungfoundation.com.au/support-and-resources/living-with-a-lung-disease/going-on-holiday and 1800 654 301 (free support line)
- **Department of Foreign Affairs and Trade:** www.smartraveller.gov.au
- **Services Australia:** https://www.humanservices.gov.au/individuals/services/medicare/reciprocal-health-care-agreements
- **My Health Record:** https://www.digitalhealth.gov.au/initiatives-and-programs/my-health-record/getting-started/how-to-access-my-health-record

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