

Title: Use of Supplementary Oxygen in Patients with Chronic Respiratory or Cardiac Disease During Air Travel

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Clinical question: What are the benefits and harms of supplementary oxygen in patients with chronic respiratory or cardiac disease during air travel?

Author recommendations:

For patients with diagnosed chronic cardiac (e.g., New York Heart Association [NYHA] Stage II or greater for heart failure) or respiratory (e.g., GOLD Stage II or greater for chronic obstructive pulmonary disease [COPD]) conditions requiring ongoing treatment before air travel, clinicians should prescribe in-flight oxygen for those who have pre-existing requirements for oxygen or those who cannot walk 50 meters or go up a flight of stairs on room air at a normal pace without breathlessness. Flow rates should be determined on a case-by-case basis, depending on the level of hypoxia at ground level.

Evidence and recommendations:

Quality of Evidence ^a	Strength of Recommendations ^b	Conclusion
Very low	Strong	Guideline recommendations favor intervention

^aQuality of evidence scale (GRADE): high, moderate, low, and very low.

^bStrength of recommendations scale (GRADE): strong, weak, or no recommendation. For more information on the GRADE rating system, see <http://www.gradeworkinggroup.org/index.htm>.

PICO:

Population	Adults 18 years of age or older with diagnosed chronic cardiac (e.g., NYHA Stage II or greater for heart failure) or respiratory (e.g., GOLD Stage II or greater for COPD) conditions requiring treatment before air travel; duration of air flight, altitude
Intervention	Oxygen (in addition to current therapy) Oxygen flow rate Time initiated before travel
Comparator	No oxygen Different flow rates
Primary outcome(s)	Respiratory or cardiac decompensation as manifested by need for acute medical care All harms

Basis for and determinants of the strength of recommendations

Patients or population: Adults 18 years of age or older with diagnosed chronic cardiac (e.g., NYHA Stage II or greater for heart failure) or respiratory (e.g., GOLD Stage II or greater for COPD) conditions requiring treatment before air travel

Setting: Air travel

Intervention: In-flight medical oxygen

Comparison: No in-flight medical oxygen

There is no evidence comparing the intervention and comparators.

Guidelines and performance measures:

1. **Managing passengers with stable respiratory disease planning air travel: British Thoracic Society recommendations, 2011.**¹ British Thoracic Society Standards of Care Committee. Recommendations graded using SIGN grading system at <http://www.sign.ac.uk/methodology/index.html>. Note that in 2013, SIGN changed its grading system to GRADE.

COPD

- In-flight oxygen is prescribed at a rate of 2 L/min or 4 L/min and should be given by nasal cannula; it should be used according to the airline's instructions (No recommendation level)

Cyanotic congenital heart disease

- Those in NYHA functional class IV should avoid air travel unless essential. If flying cannot be avoided, they should receive in-flight oxygen at 2 L/min (Recommendation level D).

Pulmonary hypertension

- Those in NYHA functional class III or IV should receive in-flight oxygen (Recommendation level D).

Heart failure

- Patients in NYHA functional class I-III (without significant pulmonary hypertension) can fly without oxygen. (Recommendation level C. This recommendation is based on a body of evidence from well-conducted case-control or cohort studies with low risk of confounding or bias and a moderate probability that the relationship is causal and directly applicable to the target population and demonstrating overall consistency of results; or extrapolated evidence from high-quality systematic reviews of case-control or cohort studies, or high-quality case-control studies with a very low risk of confounding bias and a high probability that the relationship is causal).
- Patients with severe disease in NYHA functional class IV should not fly unless essential. If air travel cannot be avoided, they should have in-flight oxygen at 2L/min (Recommendation level C).

2. **International Air Transport Association Medical Manual, 2013.**² The manual is based on the expert opinion of medical directors of 12 airlines. There is no other discussion about methods or grading of recommendations.

- Cardiac failure: Accept for flight if cardiac failure is controlled and condition is stable. Adequate control is someone who can walk 50 meters or go up a flight of stairs on room air at a normal pace without breathlessness. Otherwise, in-flight oxygen needs to be considered.
- Cyanotic congenital heart disease: In-flight oxygen needs to be considered in all cases.

3. **Assessing fitness to fly: guidelines for health professionals from the Aviation Health Unit, 2012.**³ UK Civil Aviation Authority. There is no other discussion about methods or grading of recommendations.

- Cardiovascular indications for medical oxygen during commercial airline flights: Use of oxygen at baseline altitude; congestive heart failure NYHA class III-IV or baseline PaO₂ less than 70 mmHg; angina Canadian Cardiovascular Society class III-IV; cyanotic congenital heart disease; primary pulmonary hypertension; other cardiovascular diseases associated with known baseline hypoxemia.

- “The single and most practical fitness to fly test, is to assess whether the patient can walk 50 yards/meters at a normal pace or climb one flight of stairs without severe dyspnea. If this can be accomplished, it is likely that the patient will tolerate the normal aircraft environment.”
4. **Fitness to fly for passengers with cardiovascular disease, 2010.**⁴ British Cardiovascular Society. The guideline developers did not use any indication of “level of importance” or the “level of supporting evidence that justifies it.”
- Chronic heart failure: “With chronic heart failure ... those with NYHA III and IV should consider airport assistance and request the availability of in-flight oxygen.”

Author commentary: There is a dearth of high-quality studies on the use of supplementary oxygen during air travel, whether randomized controlled trials or observational studies. Consequently, the current management strategies are based almost entirely on expert opinion.

The United States Federal Aviation Administration regulations require airlines to maintain a cabin pressure altitude of not more than 8000 feet under normal operating conditions, with higher limits (10,000 feet) during unusual circumstances.^{5,6} Flights longer than 750 miles maintain peak cabin altitude at 7085±801 feet.⁷ This translates into an average concentration of 78% (±2%) of available oxygen at sea level. Consequently, arterial oxygen tension decreases in all airline travelers, and they are exposed to prolonged states of hypobaric or altitude hypoxia; those with compromised respiratory or cardiac function may develop adverse reactions. Conditions that place travelers at risk include pulmonary and cardiac conditions, such as COPD, pulmonary hypertension, acute myocardial infarction, heart failure, and acute coronary syndrome.⁸⁻¹⁵ For example, in one adjusted observational study, travelers with COPD manifested symptoms almost seven times more frequently than those without COPD; adjusted odds ratio 6.6 (95% CI 2.5-17.3, $P < .001$).¹⁶ In these situations, travelers may need in-flight oxygen.

Update alerts: Important new citations relevant to this topic are added here as they become available.

Glossary: CI, Confidence interval; COPD, chronic obstructive pulmonary disease; GRADE, Grading of Recommendations Assessment, Development and Evaluation; NYHA, New York Heart Association.

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