Dr Graham Denyer

Chief Medical Officer
First Assistance
Auckland

Sunday, June 11, 2017 (Room 5)

8:30 - 9:25 WS #186: Respiratory Assessment of Fitness to Fly

9:35 - 10:30 WS #198: Respiratory Assessment of Fitness to Fly (Repeated)

Blue Skies, Blue Lips

Assessing Respiratory Fitness to Fly

Graham Denyer
FACRRM, FRNZCGP, PGDip AeroRT

Chief Medical Officer
First Assistance

first ASSISTANCE

- 200 full time staff
- Travel experts, security specialists, medical specialists
- Emergency operations centres in Auckland, Sydney, UK

25 year old NZ headquartered company

7 doctors, 10 nurses, 50+ medical case managers/logisticians

Manage cases in 120+ countries annually

Manage 10,000+ assistance cases annually

24/7 365 Operation

Manage 1,500+ air evacuations and repatriations annually

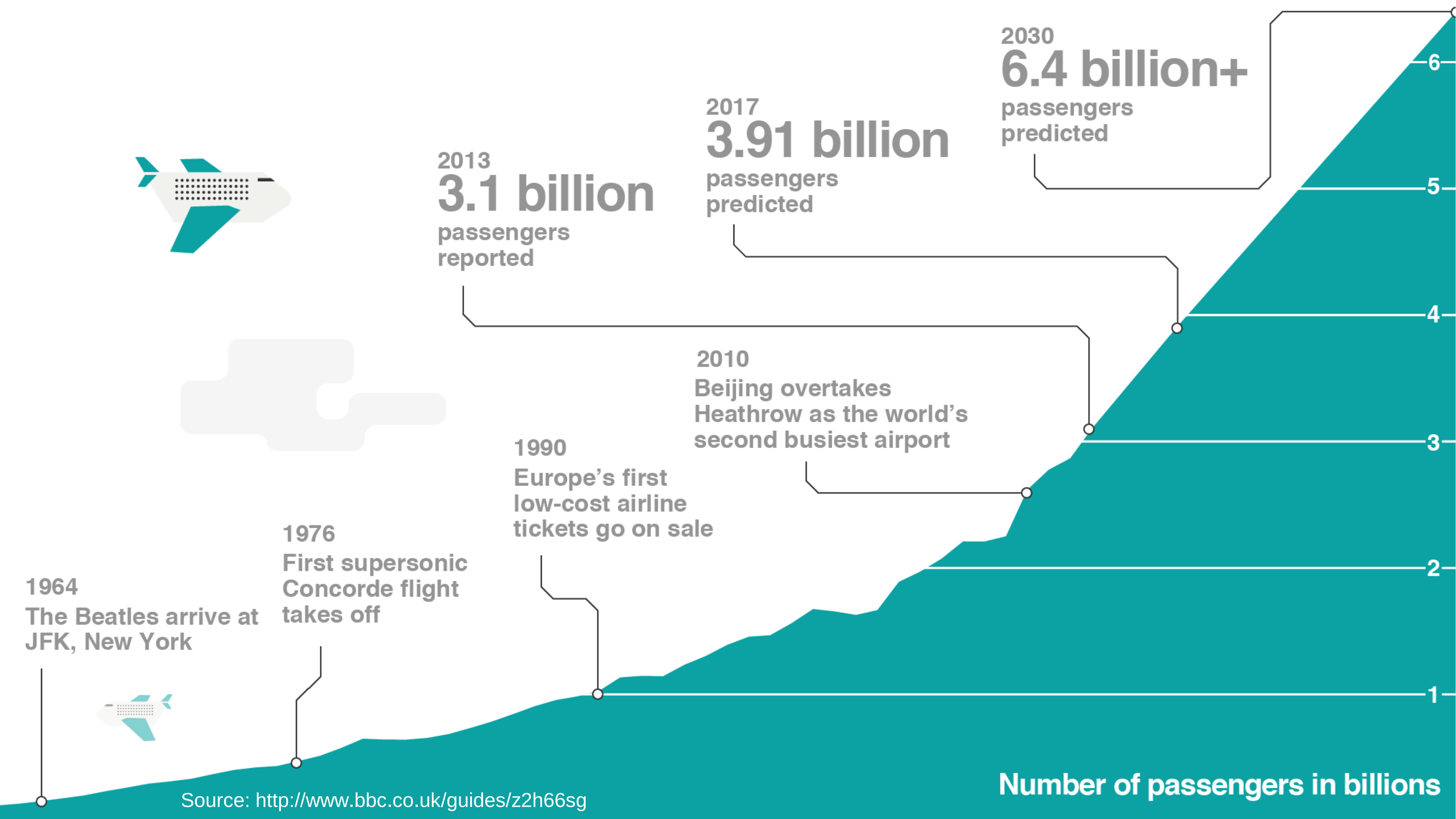
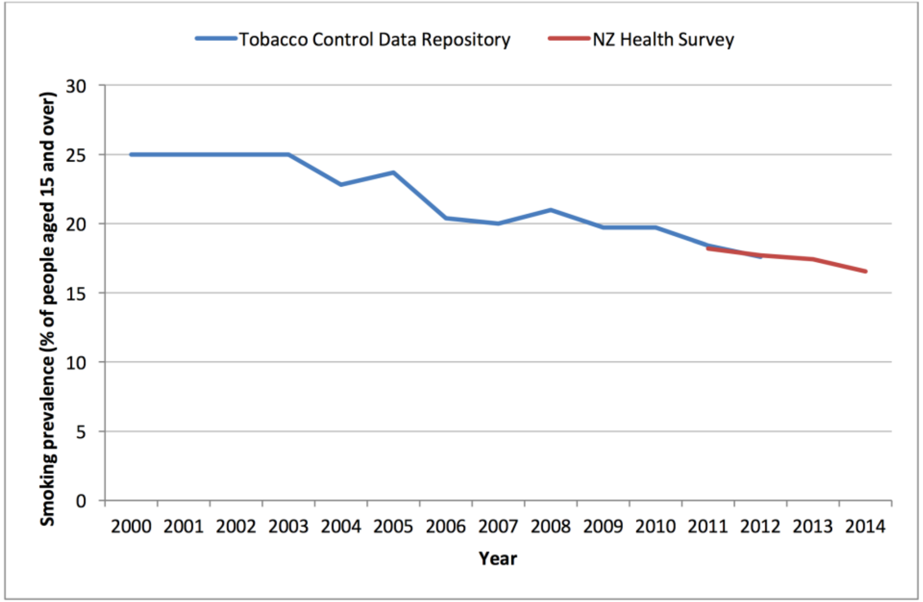

2030
6.4 billion+
passengers
predicted
2017
3.91 billion
passengers
predicted
2013
3.1 billion
passengers
reported
2010
Beijing overtakes
Heathrow as the world's
second busiest airport
1990
Europe's first
low-cost airline
tickets go on sale
1976
First supersonic
Concorde flight
takes off
1964
The Beatles arrive at
JFK, New York
6
5
4
3
2
1
Number of passengers in billions
Source: http://www.bbc.co.uk/guides/z2h66sg

Figure 54. COPD hospitalisations in adults aged 40+, per 100,000 people per year, 2000-2015.

Figure 69. New Zealand smoking prevalence 2000-2014/15.

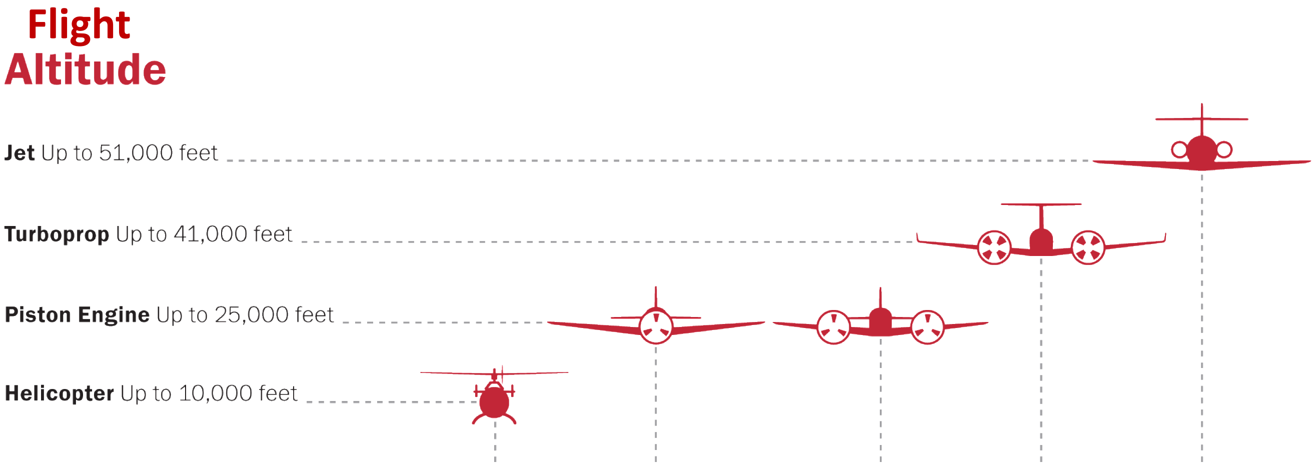


Chronic Respiratory Disease in NZ

Source: Asthma Foundation: The impact of respiratory diseases in New Zealand 2016

Cabin Altitude

What is the typical cabin altitude of a commercial passenger aircraft?



Cabin Altitude

6000 – 8000 ft

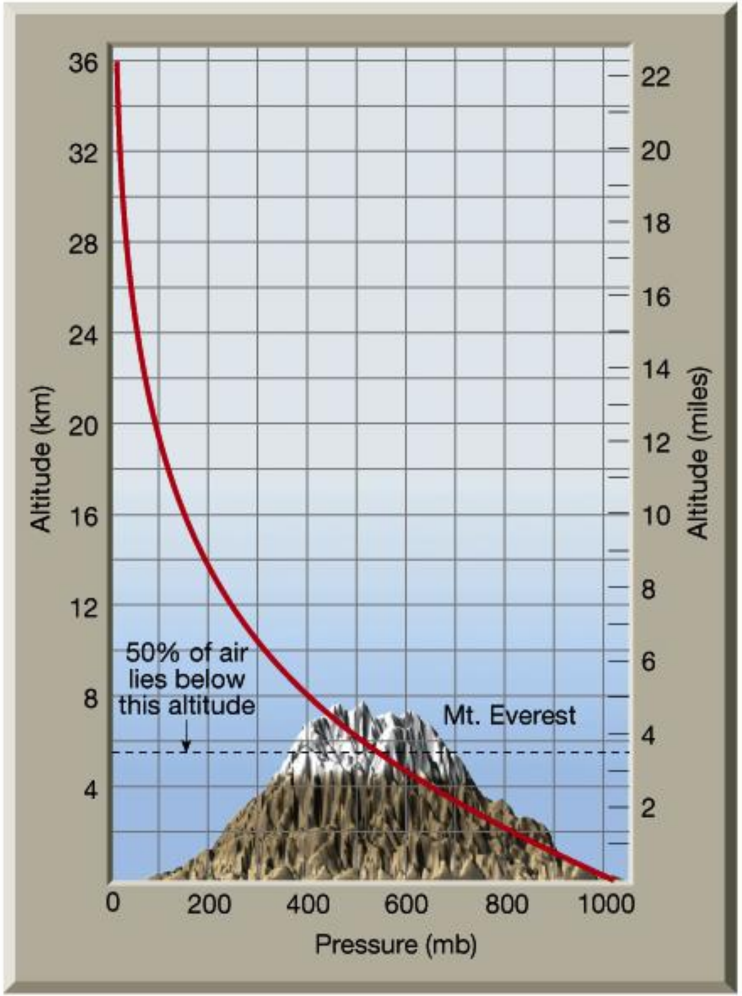
(1800 – 2400 m)

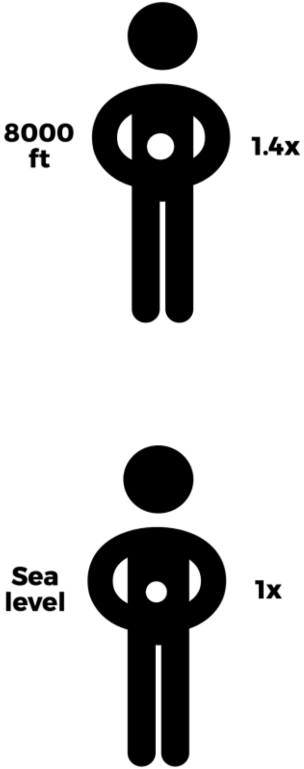
Boyle's Law

PV = *k*

Volume of a gas is inversely proportional to pressure (at a constant temperature)

V = 1/P





Dalton’s Law

of Partial Pressure

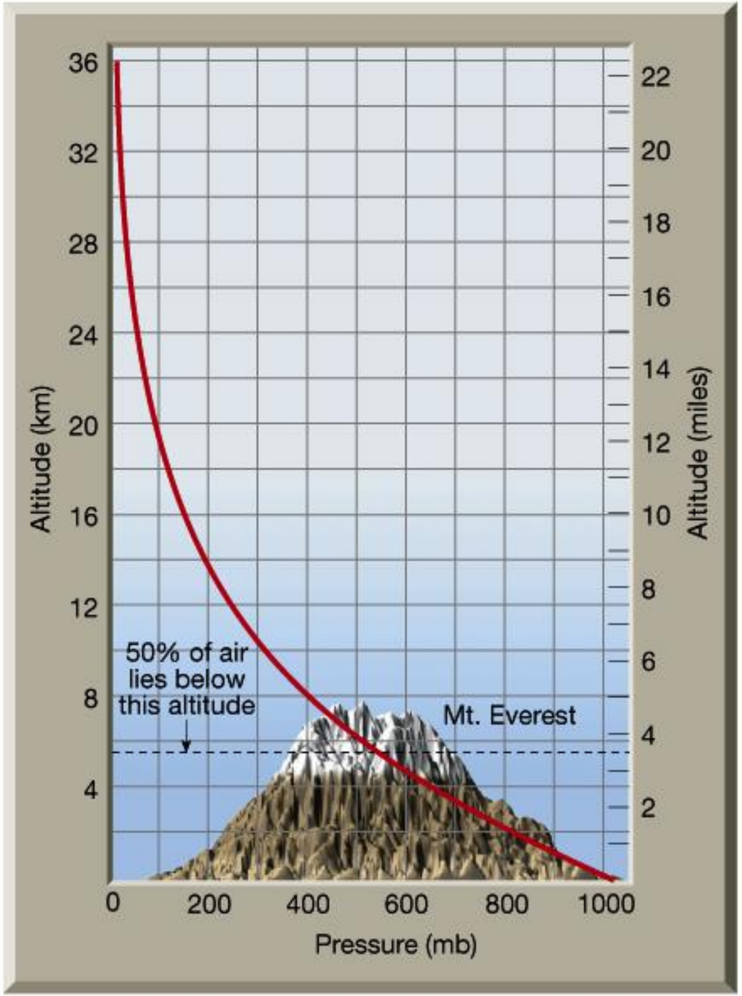
In a mixture of gases each gas exerts the same pressure it would exert if it occupied the volume alone.

$PO_2 = FO_2 \text{ x } PB$

At sea level PO_2 :
$= FO_2 \text{ x } PB$
$= 0.21 \text{ x } 760 \text{ mmHg}$
$= 160 \text{ mmHg}$

At 8000ft PO_2 :
$= FO_2 \text{ x } PB$
$= 0.21 \text{ x } 574 \text{ mmHg}$
$= 121 \text{ mmHg}$

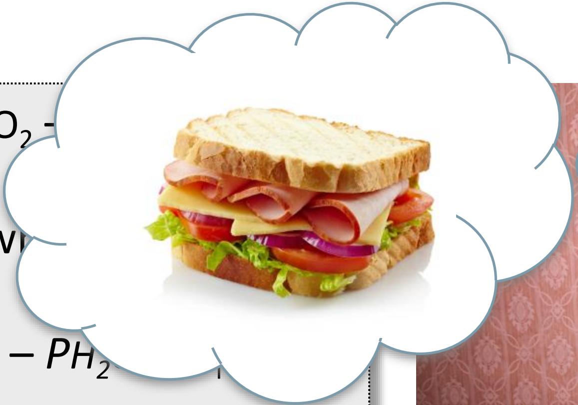
(160-121)/160 = 24%



$P_AO_2 = P_IO_2$ –

wh

$P_IO_2 = (P_B – PH_2$



At sea level P_AO_2 :

$= ((P_B – PH_2O) \times F_IO_2) – (P_ACO_2/R)$

$= ((760 – 47) \times 0.21) – (40/0.8)$

= 100 mmHg

At 8000ft cabin altitude P_AO_2 :

$= ((P_B – PH_2O) \times F_IO_2) – (P_ACO_2/R)$

$= ((574 – 47) \times 0.21) – (40/0.8)$

= 60 mmHg

Alveolar Gas Equation

Takes into account humidification (saturated vapour pressure of water), alveolar carbon dioxide levels, and the respiratory quotient.

PAO_2 approximates PaO_2 in the normal lung – i.e. if diffusion is normal and there is no V/Q shunt.

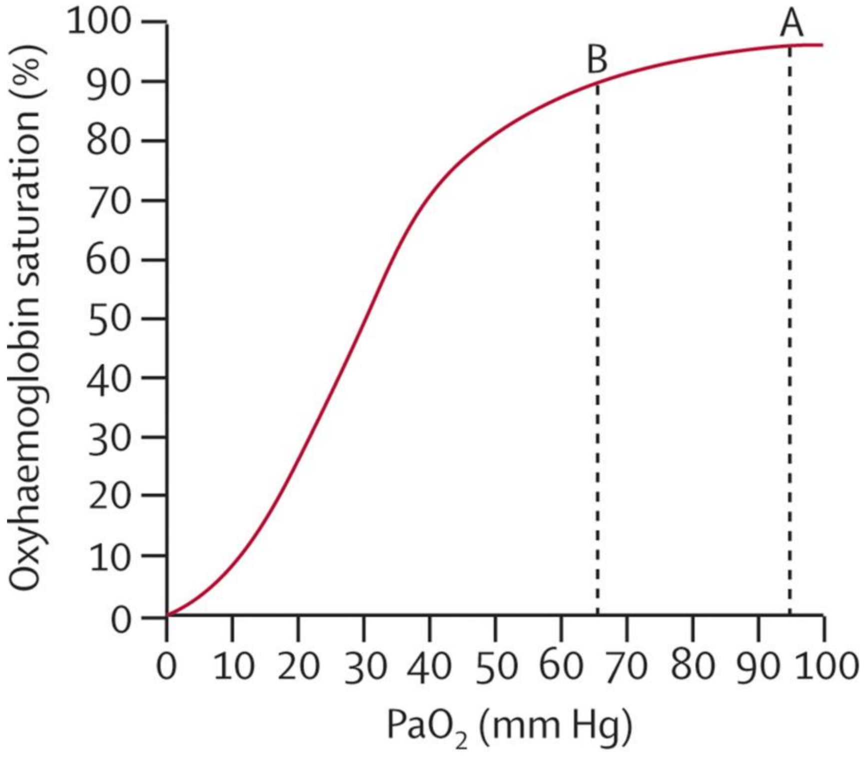
Alveolar Gas Equation

Up to 40% decrease in alveolar oxygen partial pressure at cabin altitude.

Oxygen Haemaglobin Disassociation Curve

In a healthy individual S_aO_2 can be expected to decrease only 5-10% at cabin altitude

Those patients with a P_aO_2 less than ~65mmHg can be expected to have a precipitous drop in S_aO_2 (and therefore arterial oxygen content)



Help?

The British Thoracic Society 2011 Guidelines are currently the most comprehensive and practical tool available.

September 2011 Volume 66 Supplement 1

Thorax

AN INTERNATIONAL JOURNAL OF RESPIRATORY MEDICINE

Managing passengers with stable respiratory disease planning air travel: British Thoracic Society recommendations

British Thoracic Society
Air Travel Working Group

Prim Care Respir J 2013; 22(2): 234-238

Primary Care
RESPIRATORY JOURNAL
www.thepcrj.org

GUIDELINE SUMMARY

Managing patients with stable respiratory disease planning air travel: a primary care summary of the British Thoracic Society recommendations

*Lynn K Josephs[1], Robina K Coker[2], Mike Thomas[1], on behalf of the BTS Air Travel Working Group

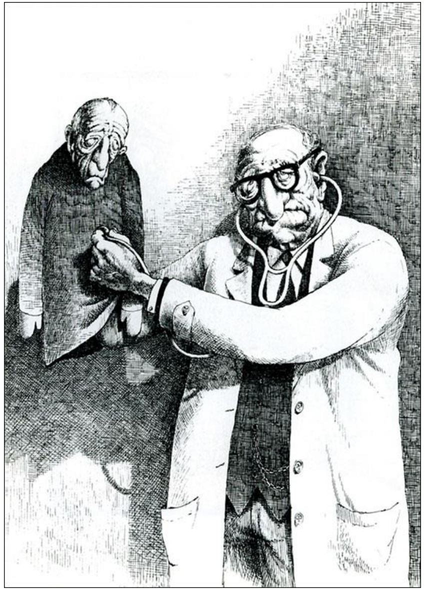
[1] Primary Care Research, Aldermoor Health Centre, University of Southampton, Southampton, UK
[2] Department of Respiratory Medicine, Hammersmith Hospital, du Cane Road, London, UK

Received 28th February 2013; revised 11th April 2013; accepted 14th April 2013; online 29th May 2013

Abstract

Air travel poses medical challenges to passengers with respiratory disease, principally because of exposure to a hypobaric environment. In 2002 the British Thoracic Society published recommendations for adults and children with respiratory disease planning air travel, with a web update in 2004. New full recommendations and a summary were published in 2011, containing key recommendations for the assessment of high-risk patients and identification of those likely to require in-flight supplemental oxygen. This paper highlights the aspects of particular relevance to primary care practitioners with the following key points: (1) At cabin altitudes of 8000 feet (the usual upper limit of in-flight cabin pressure, equivalent to 0.75 atmospheres) the partial pressure of oxygen falls to the equivalent of breathing 15.1% oxygen at sea level. Arterial oxygen tension falls in all passengers; in patients with respiratory disease, altitude may worsen pre-existing hypoxaemia. (2) Altitude exposure also influences the volume of any air in cavities, where pressure x volume remain constant (Boyle's law), so that a pneumothorax or closed lung bulla will expand and may cause respiratory distress. Similarly, barotrauma may affect the middle ear or sinuses if these cavities fail to equilibrate. (3) Patients with respiratory disease require clinical assessment and advice before air travel to: (a) optimise usual care; (b) consider contraindications to travel and possible need for in-flight oxygen; (c) consider the need for secondary care referral for further assessment; (d) discuss the risk of venous thromboembolism; and (e) discuss forward planning for the journey.

LK Josephs *et al. Prim Care Respir J* 2013; **22**(2): 234-238
http://dx.doi.org/10.4104/pcrj.2013.00046



- History a poor predictor of inflight hypoxia but identifies absolute contraindications to flight and identifies those at risk of hypoxia

- Past history of symptoms in flight
- Duration of planned flight
- Time since last exacerbation

Patient History

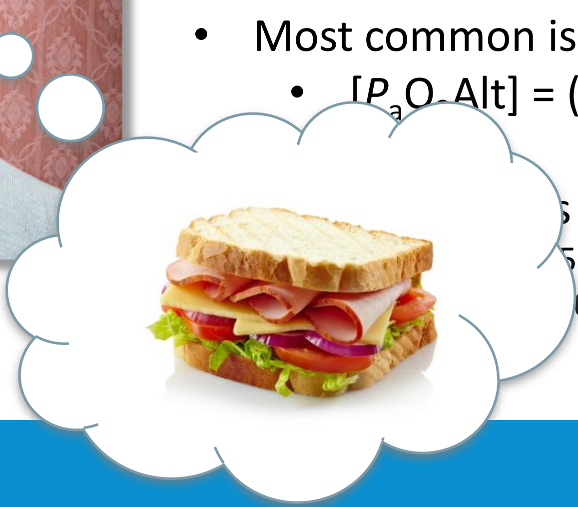
- Poor predictor of in flight hypoxia

- FEV1 < 30% (severe COPD)
- VC < 1L (severe restrictive disease)

Spirometry

- Poor predictor of in flight hypoxia
- Resting saturations <95% at risk

Resting SpO_2



- Poor predictor of in flight hypoxia
- Most common is Dillard:
  - [P_aO_2 Alt] = (0.410 x [P_aO_2 Ground] x 17.802)
- Billings:
  - 559496 x [P_aO_2 Ground]) – (0.001319 x [P_aO_2
  - 000189 x [P_aCO_2 Ground]^3 + 0.799106 x [P_aCO_2

Predictive equations

- Possibly a reasonable predictor of inflight hypoxia!

- Simulates 8000 ft cabin altitude with 15.1% F_IO_2 at sea level
- 15.1% oxygen/nitrogen mix
- 100% nitrogen via 40% venturi mask

Hypoxia Altitude Simulation Testing

- BTS guidelines promote HAST
- Inaccessible to primary care
- Evidence for relationship between positive HAST and symptoms or recorded hypoxia in flight is poor

Hypoxia Altitude Simulation Testing

A Pragmatic Approach

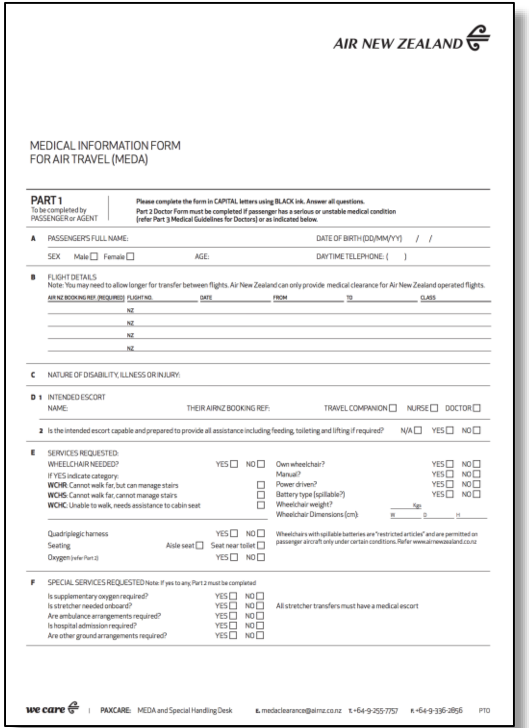
- Past history of SOB in flight
- Sats <92% at rest
- PaO_2 < 65 mmHg
- FEV1 < 30% predicted
- VC < 1L

Arrange Oxygen
(or refer for HAST)

If in doubt, phone a friend.

Arranging Oxygen

(and MEDA Clearance)



AIR NEW ZEALAND

MEDICAL INFORMATION FORM
FOR AIR TRAVEL (MEDA)

PART 1
To be completed by PASSENGER or AGENT

Please complete the form in CAPITAL letters using BLACK ink. Answer all questions.
Part 2 Doctor Form must be completed if passenger has a serious or unstable medical condition (refer Part 3 Medical Guidelines for Doctors) or as indicated below.

A PASSENGER'S FULL NAME: DATE OF BIRTH (DD/MM/YY) / /

SEX Male ☐ Female ☐ AGE: DAYTIME TELEPHONE: ( )

B FLIGHT DETAILS
Note: You may need to allow longer for transfer between flights. Air New Zealand can only provide medical clearance for Air New Zealand operated flights.

AIR NZ BOOKING REF. (REQUIRED)	FLIGHT NO.	DATE	FROM	TO	CLASS
	NZ				
	NZ				
	NZ				
	NZ				

C NATURE OF DISABILITY, ILLNESS OR INJURY:

D 1 INTENDED ESCORT
NAME: THEIR AIRNZ BOOKING REF: TRAVEL COMPANION ☐ NURSE ☐ DOCTOR ☐

2 Is the intended escort capable and prepared to provide all assistance including feeding, toileting and lifting if required? N/A ☐ YES ☐ NO ☐

E SERVICES REQUESTED:
WHEELCHAIR NEEDED? YES ☐ NO ☐
If YES indicate category:
WCHR: Cannot walk far, but can manage stairs ☐
WCHS: Cannot walk far, cannot manage stairs ☐
WCHC: Unable to walk, needs assistance to cabin seat ☐

Own wheelchair? YES ☐ NO ☐
Manual? YES ☐ NO ☐
Power driven? YES ☐ NO ☐
Battery type (spillable?) YES ☐ NO ☐
Wheelchair weight? Kgs
Wheelchair Dimensions (cm): W D H

Quadriplegic harness YES ☐ NO ☐
Seating Aisle seat ☐ Seat near toilet ☐
Oxygen (refer Part 2) YES ☐ NO ☐

Wheelchairs with spillable batteries are "restricted articles" and are permitted on passenger aircraft only under certain conditions. Refer www.airnewzealand.co.nz

F SPECIAL SERVICES REQUESTED Note: If yes to any, Part 2 must be completed
Is supplementary oxygen required? YES ☐ NO ☐
Is stretcher needed onboard? YES ☐ NO ☐
Are ambulance arrangements required? YES ☐ NO ☐
Is hospital admission required? YES ☐ NO ☐
Are other ground arrangements required? YES ☐ NO ☐

All stretcher transfers must have a medical escort

we care | **PAXCARE:** MEDA and Special Handling Desk **E.** medaclearance@airnz.co.nz **T.** +64-9-255-7757 **F.** +64-9-336-2856 PTO


first
ASSISTANCE
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