Committee Secretary Senate Standing Committees on Rural Affairs and Transport PO Box 6100 Parliament House Canberra ACT 2600 Australia
Re: Inquiry: Pilot training and airline safety including consideration of the Transport Safety Investigation Amendment (Incident Reports) Bill 2010

Dear Senators,
Commercial aircraft operate at a potentially dangerous low oxygen level.
All commercial passenger aircraft should be equipped with a pulse oximeter, in order to detect dangerous drops in oxygen levels of passengers and crew.
I am concerned at reports to your inquiry of fatigue in airline staff- these could represent low air pressure with subsequent lack of oxygen.
I read with interest of your inquiry in the media. I have long been concerned about the low level of oxygen in commercial passenger aircraft, which verges on the edge of safety for a healthy person, and I have no doubt is unsafe for many people with chronic illness of lung or heart (a population which is not only expanding rapidly, but also a larger percentage of them are travelling far more than ever).
The common stories of elderly passengers becoming confused during flights, or of passengers becoming irrational and argumentative are most likely largely explained by drops in their oxygen level, in addition to other factors.
As a young doctor in late 1985, I was one of the first people to use a new generation pulse oximeter and I spent 3 months testing a device to ascertain its accuracy. It was extremely accurate and simple to use. It is one of the most effective simple medical devices ever. All one does is stick a finger into it, and it measures the oxygen level every 6 seconds, no pain, minimal training. Shortly after, the hospital concerned purchased 6 oximeters. 18 months later it was illegal to have a general anaesthetic without one. Oximetry is credited with a massive plummet in worldwide anaesthetic mortality. These devices are cheap, simple to operate, and are found in every ambulance.
Today I am a general practitioner, practicing in a middle class suburban area. I have no conflicts of interest to declare. I am also trained in scuba diving medicine which covers some similar areas to aviation medicine, but is generally a separate field.
Aircraft fly at high altitudes where there is not enough oxygen to breath, therefore cabins are pressurised. For engineering and other reasons, they are not pressurised to ground pressure but to lower pressure which is expressed as equivalent to an altitude of so many feet or metres. The higher the “cabin altitude” the lower the pressure, and lower the oxygen level. Typically they are pressurised to a maximum cabin altitude (minimum pressure) of 8,000 feet (2,440 metres), providing around 75% atmospheric pressure, and 75% of usual oxygen content. These cabin altitudes were probably determined in the 1940’s and 1950’s.
The cabin altitude is lower (i.e. higher air pressure) in some newer commercial aircraft such as the Airbus A380.
It is generally held that altitude sickness occurs above 8,000 feet (2,440 metres), even in fit healthy people, so the standard cabin altitude of 8,000 feet cuts a very fine line of safety. Obviously enough people with chronic diseases such as lung disease and heart disease, chronic anaemia, etc are at greatly increased risk when subjected to low oxygen. Human physiology has several mechanisms that help keep the oxygen concentration of blood (its saturation) close to normal even when one is breathing reduced oxygen at 75%

of normal pressure. Once the oxygen level does actually start to drop, it plummets rapidly, rather like a slippery dip ride. This is termed hypoxia, i.e. lack of oxygen which can cause tiredness, confusion, irrational behaviour, unconsciousness and death. It is well known that during training, commercial pilots are shown the effects of hypoxia and how it eventually leads to severely irrational behaviour, and even death. Air force pilots have further training in this area. (See YouTube clip Pilot training. Recognition of hypoxia. People don't necessarily feel short of breath with low oxygen intake, as they are able to keep their carbon dioxide level quite normal. Carbon dioxide accumulation is the usual driver for shortness of breath, and hypoxia kicks in later.

Normal haemoglobin oxygen saturation is 95 to 100%. Which is to say your blood usually carries oxygen at nearly full capacity. This is easily measured with a pulse oximeter, readings below 90% are always abnormal and get more dangerous rapidly as they go further down. Lower readings can cause the above-noted effects, and can precipitate confusion, angina and other heart conditions. The low level of oxygen in flying stresses the body causing a release of clotting proteins, which is one major reason why flying is associated with DVT/PE (deep venous thrombosis and pulmonary embolism).

A few studies have been done with oximetry of passengers, though not nearly enough for such a common and risky undertaking. Some of these are noted below

A study of patients with lung disease showed massive drops in oxygen saturation as low as 78% during flying.

A recent study of HEALTHY subjects found that oxygen levels drop as low as 88% during air travel. (Appendix 2)

All commercial passenger aircraft should be equipped with a pulse oximeter, in order to detect dangerous drops in oxygen levels of passengers and crew. It is the most simple medical instrument to use, just turn it on and stick your finger in. They can be purchased from $100 to $1300 retail for most units.Imagine a typical case where an elderly passenger becomes confused. The cabin crew find a doctor on board, who finds apparently normal vital signs. If the doctor decides the patient has early dementia, they might sedate the patient. However, a pulse oximeter would rapidly identify the correct diagnosis- hypoxia. The treatment for hypoxia always includes oxygen (and usually that is all that is required). The patient would then recover. Footnote- if the patient were sedated the oxygen level would drop even more, and they could perish.

Another patient has chest pain. Again this patient has hypoxia. They are given oxygen. This saves their life as they have a clot on the lung. They survive the flight, rather than dying on board and then are transferred to hospital with a fighting chance of living.

What of a case similar to the 2007 tragic case of the Australian child who died of croup on Thai Airways? Again a pulse oximeter could rapidly identify hypoxia, and lead to the correct treatment of oxygen.

There you have it, a pulse oximeter can be cheaper than a fire extinguisher or a GPS, and is the number one, if not the only, simple instrument that can save a life on a plane. I suspect nobody has even thought of putting them on planes. It is ridiculously simple. There are no down sides (other than the limitations of the device which has some minor subtleties).

I am concerned at reports to your inquiry of fatigue in airline staff- these could represent low air pressure with subsequent lack of oxygen. It may be worth enquiring to ensure the cabin altitude does not go above 8,000 feet in that company's aircraft. (Such a measure does save some money).

Further, there is a desperate need for significant funding for Australian research and monitoring of these issues.

Yours faithfully
Dr Name and Address Supplied,
Registered Medical Practitioner, in general practice.

Please see appendices
Appendix 1of 2

2009 May;14(4):567-73. Epub 2009 Apr 5.
Predicting the response to air travel in passengers with non-obstructive lung disease: are the current guidelines appropriate?
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Abstract
BACKGROUND AND OBJECTIVE: Air travel guidelines recommend using baseline arterial oxygen levels and the hypoxic challenge test (HCT) to predict in-flight hypoxaemia and the requirement for in-flight oxygen in patients with lung disease. The purpose of the present study was to (i) quantify the hypoxaemic response to air travel and (ii) identify baseline correlate(s) to predict this response in passengers with non-obstructed lung disease.
METHODS: Fourteen passengers (seven women) with chronic non-obstructed lung disease volunteered for this study. The study involved three phases: (i) respiratory function testing; (ii) in-flight measures (SpO(2), cabin pressure and dyspnoea); and (iii) a HCT. The in-flight hypoxaemic response was compared with the baseline arterial oxygen level, respiratory function and the HCT.
RESULTS: All subjects flew without oxygen and no adverse events were recorded in-flight. Mean cabin pressure was 593 +/- 16 mm Hg. Pre-flight SpO(2) was 95 +/- 3% and significantly decreased to 85 +/- 9% in-flight, with further significant falls in subjects who walked during the flight (nadir SpO(2) 78 +/- 11%). The pre-flight SpO(2) showed the strongest correlation with in-flight SpO(2) (r = 0.91, P < 0.001). The HCT SpO(2) was moderately correlated to the in-flight SpO(2) (r = 0.58, P < 0.05). Spirometry, D(L,CO) and TLC measurements did not correlate with in-flight SpO(2).
CONCLUSION: Significant in-flight desaturation can be expected in passengers with non-obstructive lung disease. Respiratory function did not predict in-flight desaturation. We found a good relationship between pre-flight SpO(2) and in-flight SpO(2) which supports the role of pre-flight oximetry for predicting in-flight hypoxaemia in passengers with non-obstructed lung disease.
PMID: 19386067 [PubMed - indexed for MEDLINE]

Appendix 2 of 2 http://www.ncbi.nlm.nih.gov/pubmed/17086767

2006 Nov;77(11):1143-7.

Normobaric hypoxia inhalation test vs. response to airline flight in healthy passengers.

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Comment in:

Abstract

INTRODUCTION: There is little data available to determine the normal response to normobaric hypoxia inhalation testing (NHIT) and air travel. Quantifying a healthy response may assist in the evaluation of passengers considered at risk for air travel. The aims of this study were: (1) to quantify the degree of desaturation in healthy subjects during a NHIT and air travel; and (2) assess the validity of the NHIT when compared with actual in-flight responses.

METHODS: There were 15 healthy adults (age 23-57; 10 women) who volunteered for this study. Preflight tests included lung function, arterial blood gas, pulse oximetry (SpO2), and NHIT (inspired oxygen 15%). SpO2 and cabin pressure were measured continuously on each subject during a commercial air flight (mean cabin altitude 2178 m; range 1719-2426 m). In-flight oxygenation was compared with the preflight NHIT.

RESULTS: Lung function testing results were normal. There was significant desaturation (SpO2) during the NHIT (pre: 98 +/- 2%; post: 92 +/- 2%) and at cruising altitude (pre: 97 +/- 1%; cruise: 92 +/- 2%). There was no difference between the final NHIT SpO2 and the mean in-flight SpO2. There was a significant difference between the lowest in-flight SpO2 (88 +/- 2%) vs. the lowest NHIT SpO2, (90 +/- 2%).

DISCUSSION: Oxygen saturation decreases significantly during air travel in normal individuals. In this group of healthy passengers the NHIT approximates some, but not all, aspects of in-flight oxygenation. These results can be used to describe a normal response to the NHIT and air-travel.

PMID: 17086767 [PubMed - indexed for MEDLINE]