

Travel by air: health considerations

This chapter was prepared in collaboration with the International Civil Aviation Organization and the International Air Transport Association. To facilitate use by a wide readership, technical terms have been used sparingly. Medical professionals needing more detailed information are referred to the website of the Aerospace Medical Association: www.asma.org.

The volume of air traffic has risen steeply in recent years and the number of long distance flights has greatly increased. With modern long range aircraft the need for “stop-overs” has been reduced so the duration of flights has also increased. The passenger capacity of long distance aircraft is also increasing, so larger numbers of people travel aboard a single aircraft. “Frequent flyers” now form a substantial proportion of the travelling public. According to the International Civil Aviation Organization, the annual number of flight passengers exceeded 1647 million in 2000 and although the numbers dropped the following years because of security concerns and the outbreak of severe acute respiratory syndrome (SARS), numbers are again rising and are forecasted to grow by 4.4 per cent annually until 2015.

Air travel, in particular over long distances, exposes passengers to a number of factors that may have an effect on their health and well-being. Passengers with pre-existing health problems are more likely to be affected and should consult their doctor or a travel medicine clinic in good time before travelling. Those receiving medical care and intending to travel by air in the near future should tell their medical adviser. Health risks associated with air travel can be minimized if the traveller plans carefully and takes some simple precautions before, during, and after the flight. An explanation of the various factors that may affect the health and well-being of air travellers follows.

Cabin air pressure

Although aircraft cabins are pressurized, cabin air pressure at cruising altitude is lower than air pressure at sea level. At typical cruising altitudes in the range 11 000–12 200 metres (36 000–40 000 feet) air pressure in the cabin is equivalent

to the outside air pressure at 1800–2400 metres (6000–8000 feet) above sea level. As a consequence, less oxygen is taken up by the blood (hypoxia) and gases within the body expand. The effects of reduced cabin air pressure are usually well tolerated by healthy passengers.

Oxygen and hypoxia

Cabin air contains ample oxygen for healthy passengers and crew. However, because cabin air pressure is relatively low, the amount of oxygen carried in the blood is reduced compared to sea level. Passengers with certain medical conditions, in particular heart and lung disease, and blood disorders such as anaemia, may not tolerate this reduced oxygen level (hypoxia) very well. Such passengers are usually able to travel safely if arrangements are made with the airline for the provision of an additional oxygen supply during flight.

Gas expansion

As the aircraft climbs, the decreasing cabin air pressure causes gases to expand. Similarly, as the aircraft descends, the increasing pressure in the cabin causes gases to contract. These changes may have effects where gas is trapped in the body.

Gas expansion during the climb causes air to escape from the middle ear and the sinuses, usually without causing problems. This airflow can sometimes be perceived as a “popping” sensation in the ears. As the aircraft descends, air must flow back into the middle ear and sinuses in order to equalize pressure differences. If this does not take place, the ears or sinuses may feel as if they were blocked and, if the pressure is not relieved, pain can result. Swallowing, chewing, or yawning (‘clearing the ears’) will usually relieve any discomfort. If the problem persists, a short forceful expiration against a pinched nose and closed mouth (Valsalva manoeuvre) will usually help. For infants, feeding or giving a pacifier (dummy) to stimulate swallowing may reduce the symptoms.

Individuals with ear, nose, and sinus infections should avoid flying because pain and injury may result from the inability to equalize pressure differences. If travel cannot be avoided, the use of decongestant nasal drops shortly before the flight and again before descent may be helpful.

As the aircraft climbs, expansion of gas in the abdomen can cause discomfort, although this is usually mild.

Some forms of surgery, other medical treatments, or diagnostic tests, may introduce air or other gas into a body cavity. Examples include abdominal surgery

or eye treatment for a detached retina. Passengers who have recently undergone such a procedure should ask a travel medicine physician or their treating physician how long they should wait before undertaking air travel.

Cabin humidity and dehydration

The humidity in aircraft cabins is low, usually less than 20% (humidity in the home is normally over 30%). Low humidity may cause skin dryness and discomfort of the eyes, mouth, nose and exposed skin but presents no risk to health. Using a skin moisturizing lotion, saline nasal spray to moisturize the nasal passages, and wearing spectacles rather than contact lenses can relieve or prevent discomfort. The low humidity does not cause dehydration and there is no need to drink extra water.

Ozone

Ozone is a form of oxygen (with three, rather than two, atoms to the molecule) that occurs in the upper atmosphere and may enter the aircraft cabin together with the fresh air supply. In older aircraft, it was found that the levels of ozone in cabin air could sometimes lead to irritation of the lungs, eyes and nasal tissues. Ozone is broken down by heat and most ozone is removed by the compressors (in the aircraft engines) that provide pressurized air for the cabin. In addition, most modern long-haul jet aircraft are fitted with equipment (catalytic converters) that breaks down any remaining ozone.

Cosmic radiation

Cosmic radiation is made up of radiation that comes from the sun and from outer space. The earth's atmosphere and magnetic field are natural shields and therefore cosmic radiation levels are lower at lower altitudes. Cosmic radiation is more intense over polar regions than over the equator because of the shape of the earth's magnetic field and the "flattening" of the atmosphere over the poles.

The population is continually exposed to natural background radiation from soil, rock and building materials as well as from cosmic radiation that reaches the earth's surface. Although cosmic radiation levels are higher at aircraft cruising altitudes than at sea level, research so far has not shown any significant health effects for either passengers or crew.

Motion sickness

Except in the case of severe turbulence, travellers by air rarely suffer from motion (travel) sickness. Those who do suffer should request a seat in the mid-section

of the cabin where movements are less pronounced, and keep the motion sickness bag, provided at each seat, readily accessible. They should also consult their doctor or travel medicine physician about medication that can be taken before flight to help prevent problems.

Immobility, circulatory problems and Deep Vein Thrombosis (DVT)

Contraction of muscles is an important factor in helping to keep blood flowing through the veins, particularly in the legs. Prolonged immobility, especially when seated, can lead to pooling of blood in the legs, which in turn may cause swelling, stiffness, and discomfort.

It is known that immobility is one of the factors that may lead to the development of a blood clot in a deep vein, so-called “deep vein thrombosis”, or DVT. Research has shown that DVT can occur as a result of prolonged immobility, for instance during long distance travel, whether by car, bus, train or air. The World Health Organization (WHO) has set up a major research study to find out if there are any factors that might lead to the risk of DVT being higher for air travel than for other causes of immobility.

In most cases of DVT, the clots are small and do not cause any symptoms. The body is able to gradually break down the clot and there are no long-term effects. Larger clots may cause symptoms such as swelling of the leg, tenderness, soreness and pain. Occasionally a piece of the clot may break off and travel with the bloodstream to become lodged in the lungs. This is known as pulmonary embolism and may cause chest pain, shortness of breath and, in severe cases, sudden death. This can occur many hours or even days after the formation of the clot.

The risk of developing DVT when travelling is very small unless one or more other risk factors are present. These include:

- Previous DVT or pulmonary embolism
- History of DVT or pulmonary embolism in a close family member
- Use of oestrogen therapy–oral contraceptives (“the Pill”) or hormone replacement therapy (HRT)
- Pregnancy
- Recent surgery or trauma, particularly to the abdomen, pelvic region or legs
- Cancer
- Some inherited blood-clotting abnormalities.

It is advisable for people with one or more of these risk factors to seek specific medical advice from their doctor or a travel medicine clinic in good time before embarking on a flight of three or more hours.

DVT occurs more commonly in older people. Some researchers have suggested that there may be a risk from smoking, obesity and varicose veins.

Precautions

The risk of a passenger who does not have any of the risk factors above developing DVT as a consequence of flying is small and the benefits of most precautionary measures in such passengers are unproven and some might even result in harm. Some common-sense advice for such passengers is given below.

Moving around the cabin during long flights will help to reduce any period of prolonged immobility. However, this may not always be possible and any potential health benefits must be balanced against the risk of injury that could occur if the aircraft encounters sudden and unexpected turbulence. A sensible compromise is to walk around in the cabin, e.g. go to the bathroom, once every 2–3 hours. Many airlines also provide helpful advice on exercises that can be carried out in the seat during flight. It is thought that exercise of the calf muscles can stimulate the circulation, reduce discomfort, fatigue and stiffness, and it may reduce the risk of developing DVT. Hand luggage should not be placed where it restricts movement of the legs and feet, and clothing should be loose and comfortable.

Wearing properly fitted graduated compression stockings may be helpful. These compress the calf muscles and improve the flow of blood in the deep veins. They may also help prevent the swollen ankles that are quite common on long flights. However, they need to be the correct size to be effective and passengers should therefore ask their doctor or a travel medicine clinic which type would be appropriate for them.

In view of the clear risk of significant side effects and absence of clear evidence of benefit, passengers are advised not to use aspirin just for the prevention of travel-related DVT.

Those travellers who are at most risk of developing DVT may be prescribed specific treatments, such as injections of heparin. Cabin crew are not trained to give injections and travellers who have been prescribed these must either be taught to give the injections themselves or make other arrangements to have them given by a qualified person.

Diving

Divers should not fly too soon after diving because of the risk that the reduced cabin pressure may lead to decompression sickness (the bends). It is recommended that they do not fly until at least 12 hours after their last dive and this period should be extended to 24 hours after multiple dives or after diving that requires decompression stops during ascent to the surface. Passengers undertaking recreational diving before flying should seek specialist advice from diving schools.

Jet lag

Jet lag is the term used for the symptoms caused by the disruption of the body's internal clock and the approximate 24-hour (circadian) rhythms it controls. Disruption occurs when crossing multiple time zones i.e. when flying east to west or west to east. Jet lag may lead to indigestion and disturbance of bowel function, general malaise, daytime sleepiness, difficulty in sleeping at night, and reduced physical and mental performance. Its effects are often combined with tiredness due to the journey itself. Jet lag symptoms gradually wear off as the body adapts to the new time zone.

Jet lag cannot be prevented but there are some ways to reduce its effects (see below). Travellers who take medication according to a strict timetable (e.g. insulin, oral contraceptives) should seek medical advice from their doctor or a travel medicine clinic before their journey.

General measures to reduce the effects of jet lag

- Be as well rested as possible before departure, and rest during the flight. Short naps can be helpful.
- Eat light meals and limit consumption of alcohol. Alcohol increases urine output which can result in disturbed sleep by causing awakenings in order to urinate. Whilst it can accelerate sleep onset, it reduces sleep quality, making sleep less recuperative. The after effects of alcohol (hangover) can exacerbate the effects of jet lag and travel fatigue. Alcohol should therefore be consumed in moderation, if at all, before and during flight. Caffeine should be limited to normal amounts and avoided within a few hours of an anticipated period of sleep.
- Try to create the right conditions when preparing for sleep. When taking a nap during the day, eyeshades and earplugs may help. Regular exercise during the day may help to promote sleep, but avoid strenuous exercise immediately before sleep.

- At the destination, try to get as much sleep in every 24 hours as normal. A minimum block of 4 hours sleep during the local night – known as “anchor sleep” – is thought to be necessary to allow the body’s internal clock to adapt to the new time zone. If possible, make up the total sleep time by taking naps at times when feeling sleepy during the day.
- The cycle of light and dark is one of the most important factors in setting the body’s internal clock. Exposure to daylight at the destination will usually help adaptation.
- Short-acting sleeping pills may be helpful. They should be used only in accordance with medical advice and should not normally be taken during the flight, as they may increase immobility and therefore the risk of developing DVT.
- Melatonin is available in some countries and can be used to help resynchronize the body’s internal clock. It is normally sold as a food supplement and therefore is not subject to the same strict control as medications (for example, it has not been approved for use as a medication in the United States, but can be sold as a food supplement). The timing and effective dosage of melatonin have not been fully evaluated and its side effects, particularly if used long term, are unknown. In addition, manufacturing methods are not standardised and therefore the dose in each tablet can be very variable and some harmful compounds may be present. For these reasons, melatonin cannot be recommended.
- It is not always appropriate to adjust to local time for short trips of 2–3 days or less. If in doubt, seek specialist travel medicine advice.
- Individuals react in different ways to time zone changes. Frequent flyers should learn how their own body responds and adopt habits accordingly. Advice from a travel medicine clinic may be beneficial in determining an effective coping strategy.

Psychological aspects

Travel by air is not a natural activity for humans and many people experience some degree of psychological difficulty when flying. The main problems encountered are stress and fear of flying. These may occur together or separately at different times before and during the period of travel.

Stress

All forms of travel generate stress. Flying can be particularly stressful because it often involves a long journey to the airport, curtailed sleep and the need to walk

long distances in the terminal building. Most passengers find their own ways of coping, but passengers who find air travel particularly stressful should seek medical advice in good time. Good planning (passports, tickets, medication, etc) and allowing plenty of time to get to the airport helps relieve stress.

Flight phobia (fear of flying)

Fear of flying may range from feeling slightly anxious to being unable to travel by air at all. It can lead to problems at work and leisure.

Travellers who want to travel by air but are unable to do so because of their fear of flying should seek medical advice before the journey. Medication may be useful in some cases but the use of alcohol “to steady the nerves” is not helpful and may be dangerous if combined with some medicines. For a longer-term solution, travellers should seek specialized treatment to reduce the psychological difficulties associated with air travel. There are many courses available that aim to reduce or cure, fear of flying. These typically include advice on how to cope with the symptoms of fear, information about how an aircraft flies, how controls are operated during a flight and, in most cases, a short flight.

Air rage

In recent years, air rage has been recognized as a form of disruptive behaviour associated with air travel. It appears to be linked to high levels of general stress but not specifically to flight phobia. It is frequently preceded by excessive consumption of alcohol.

Travellers with medical conditions or special needs

Airlines have the right to refuse to carry passengers with conditions that may worsen, or have serious consequences, during the flight. Airlines may require medical clearance from their medical department/adviser if there is an indication that a passenger could be suffering from any disease or physical or mental condition that:

- May be considered a potential hazard to the safety of the aircraft
- Adversely affects the welfare and comfort of the other passengers and/or crew members
- Requires medical attention and/or special equipment during the flight
- May be aggravated by the flight.

If cabin crew suspect before departure that a passenger may be ill, the aircraft's captain will be informed and a decision taken as to whether the passenger is fit to travel, needs medical attention, or presents a danger to other passengers and crew or to the safety of the aircraft.

Although this chapter provides some general guidelines on conditions that may require medical clearance in advance, airline policies do vary and the requirements should always be checked at the time of, or prior to, booking the flight. A good place to find information is often the airline's own web site.

Infants

Air travel is not recommended for infants less than seven days old. If travel is absolutely necessary for babies who are over seven days, but were born prematurely, medical advice should be sought in each case. Changes in cabin air pressure may upset infants; this can be helped by feeding or giving a pacifier to stimulate swallowing.

Pregnant women

Pregnant women can normally travel safely by air, but most airlines restrict travel in late pregnancy. Typical guidelines for those who have an uncomplicated pregnancy are:

- after the 28th week of pregnancy a letter from a doctor or midwife should be carried, confirming the expected date of delivery and that the pregnancy is normal
- for single pregnancies, flying is permitted up to the end of the 36th week
- for multiple pregnancies, flying is permitted up to the end of the 32nd week.

Pre-existing illness

Most people with medical conditions are able to travel safely by air, provided that necessary precautions, such as the need for additional oxygen supply, are considered in advance.

Those who have underlying health problems such as cancer, heart or lung disease, anaemia, diabetes, are on any form of regular medication or treatment, have recently had surgery or have been in hospital, or who are concerned about their fitness to travel for any other reason, should consult their doctor or a travel medicine clinic before deciding to travel by air.

Medication that may be required during the journey, or soon after arrival, should be carried in the hand luggage. It is also advisable to carry a copy of the

prescription in case the medication is lost, additional supplies are needed or security checks require proof of purpose.

Frequent travellers with medical conditions

Frequent travellers who have a permanent and stable underlying health problem may obtain a frequent traveller's medical card from the medical or reservation department of many airlines. This card is accepted, under specified conditions, as proof of medical clearance and for identification of the holder's medical condition.

Security Issues

Security checks can cause concerns for travellers who have been fitted with metal devices such as artificial joints, pacemakers or internal automatic defibrillators. Some pacemakers may be affected by modern security screening equipment and travellers with these should carry a letter from their doctor. Travellers who need to carry other medical equipment in their hand luggage, particularly sharp items such as hypodermic needles, should also carry a letter from their doctor.

Smokers

Almost all airlines now ban smoking on board. Some smokers may find this stressful, particularly during long flights, and should discuss this with their doctor before travelling. Nicotine replacement patches or chewing gum containing nicotine may be helpful during the flight and the use of other medication or techniques may also be considered.

Travellers with disabilities

A physical disability is not usually a contraindication for travel. Passengers who are unable to look after their own needs during the flight (including use of the toilet and transfer from wheelchair to seat and vice versa) will need to be accompanied by an escort able to provide all necessary assistance. The cabin crew are generally not permitted to provide such assistance and a traveller who requires it and does not have a suitable escort may not be permitted to travel. Travellers confined to wheelchairs should be advised against deliberately restricting their fluid intake before or during travel as a means of avoiding use of toilets during flights as this might detrimentally affect their general health.

Airlines have regulations on conditions of travel for passengers with disabilities. Disabled passengers should contact the airline in advance of their travel for guidance (the airline's own web site often gives useful information).

Communicable diseases

Research has shown that there is very little risk of any infectious disease being transmitted on board the aircraft.

The quality of aircraft cabin air is carefully controlled. Ventilation rates provide a total change of air 20–30 times per hour. Most modern aircraft have recirculation systems, which recycle up to 50% of cabin air. The recirculated air is usually passed through HEPA (high-efficiency particulate air) filters, of the type used in hospital operating theatres and intensive care units, which trap particles, bacteria, fungi and viruses.

Transmission of infection may occur between passengers who are seated in the same area of an aircraft, usually as a result of the infected person coughing or sneezing or by touch (direct contact or contact with the same parts of the aircraft cabin and furnishings that other passengers touch). This is no different from any other situation where people are close to each other, such as on a train, bus or at a theatre. Highly infectious conditions, such as influenza, are more likely to be spread to other passengers in situations when the aircraft ventilation system is not operating. A small auxiliary power unit is normally used to provide ventilation when the aircraft is on the ground, before the main engines are started, but occasionally this is not operated for environmental (noise) or technical reasons. In such cases, when associated with a prolonged delay, passengers may be temporarily disembarked.

In order to minimise the risk of passing on infections, passengers who are unwell, particularly if they have a fever, should delay their journey until they have recovered. Airlines may deny boarding to passengers who appear to be infected with a communicable disease.

Aircraft disinsection

Many countries require disinsection of aircraft (to kill insects) arriving from countries where diseases that are spread by insects, such as malaria and yellow fever, occur. There have been a number of cases of malaria affecting individuals who live or work in the vicinity of airports in countries where malaria is not present, thought to be due to the escape of malaria-carrying mosquitoes transported on aircraft. Some countries, e.g. Australia and New Zealand, routinely require disinsection be carried out in order to prevent inadvertent introduction of species that may harm their agriculture.

Disinsection is a public health measure that is mandated by the current International Health Regulations (see Annex 3). It involves treatment of the

interior of the aircraft with insecticides specified by WHO. The different procedures currently in use are as follows:

- treatment of the interior of the aircraft using a quick-acting insecticide spray immediately before take-off, with the passengers on board;
- treatment of the interior of the aircraft on the ground before passengers come on board, using a residual insecticide aerosol, plus additional in-flight treatment with a quick-acting spray shortly before landing;
- regular application of a residual insecticide to all internal surfaces of the aircraft, except those in food preparation areas.

Travellers are sometimes concerned about their exposure to insecticide sprays while travelling by air. Some people have reported that they feel unwell after spraying of aircraft for disinsection. However, WHO has found no evidence that the specified insecticide sprays are harmful to human health when used as prescribed.

Medical assistance on board

Airlines are required to provide minimum levels of medical equipment on aircraft and to train all cabin crew in first aid. The equipment carried varies, with many airlines carrying more than the minimum level of equipment required by the regulations. Equipment carried on a typical international flight would include:

- one or more first-aid kits, to be used by the crew;
- a medical kit, normally to be used by a doctor or other qualified person, to treat in-flight medical emergencies;
- an automated external defibrillator (AED) to be used by the crew in case of cardiac arrest.

Cabin crew are trained in the use of first-aid equipment and in carrying out first-aid and resuscitation procedures. They are usually also trained to recognize a range of medical conditions that may cause emergencies on board and to act appropriately to manage these.

In addition, many airlines have facilities to enable crew to contact a medical expert at a ground-based response centre for advice on how to manage in-flight medical emergencies.

Contraindications to air travel

Travel by air is normally contraindicated in the following cases:

- Infants less than 7 days old;

- Women after the 36th week of pregnancy (after 32nd week for multiple pregnancies) and until seven days after delivery;
- Those suffering from:
 - angina pectoris or chest pain at rest
 - any serious or acute infectious disease
 - decompression sickness after diving
 - increased intracranial pressure due to haemorrhage, trauma or infection
 - infections of the sinuses or infections of the ear and nose, particularly if the Eustachian tube is blocked
 - recent myocardial infarction and stroke (time period depending on severity of illness and duration of travel)
 - recent surgery or injury where trapped air or gas may be present, especially abdominal trauma and gastrointestinal surgery, cranio-facial and ocular injuries, brain operations, and eye operations involving penetration of the eyeball
 - severe chronic respiratory disease, breathlessness at rest, or unresolved pneumothorax
 - sickle-cell disease
 - psychotic illness, except when fully controlled.

The above list is not comprehensive and fitness for travel should be decided on a case-by-case basis.

Further reading

Aerospace Medical Association, *Medical Guidelines Task Force, Medical guidelines for airline travel, 2nd edition*, 2003, <http://www.asma.org>

British Medical Association, Board of Science and Education, *The impact of flying on passenger health: a guide for healthcare professionals*, 2004, <http://www.bma.org>