

Mode of travel: health considerations

The mode of travel is an integral part of the travel experience. According to the World Tourism Organization (UNWTO), of the 922 million international tourist arrivals in 2008, air transport accounted for about 52% of arrivals and marine transport 6%. This chapter deals with travel by air and by sea. Travel by air and by sea expose passengers to a number of factors that may have an impact on health. To facilitate use by a wide readership, technical terms have been used sparingly. Medical professionals needing more detailed information are referred to the web site of the Aerospace Medical Association (www.asma.org) and the web site of the International Maritime Health Association (www.imha.net/).

Travel by air

The volume of air traffic has risen steeply in recent years and “frequent flyers” now make up a substantial proportion of the travelling public. The number of long-distance flights has increased. According to the International Civil Aviation Organization, passenger traffic is projected to double between 2006 and 2020.

Air travel, particularly 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 and those receiving medical care are more likely to be affected and should consult their doctor or a travel medicine clinic in good time before travelling. 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 m (36 000–40 000 feet), air pressure in the cabin is equivalent to the outside air pressure at 1800–2400 m (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 with sea level. Passengers with certain medical conditions, particularly heart and lung diseases and blood disorders such as anaemia (in particular sickle-cell anaemia), may not tolerate this reduced oxygen level (hypoxia) very well. Some of these passengers are able to travel safely if arrangements are made with the airline for the provision of an additional oxygen supply during flight. However, because regulations and practices differ from country to country and between airlines, it is strongly recommended that these patients, especially those who want to carry their own oxygen, contact the airline early in their travel plan. An additional charge is often levied on passengers who require supplemental oxygen to be provided by the airline.

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 happen, the ears or sinuses may feel as if they are blocked and, if the pressure is not equalized, pain can result. Swallowing, chewing or yawning (“clearing the ears”) will usually relieve any discomfort. As soon as it is recognized that the problem will not resolve, a short forceful expiration against a pinched nose and closed mouth (Valsalva manoeuvre) should be tried and 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 and other medical treatments or diagnostic tests may introduce air or other gas into a body cavity. Examples include abdominal surgery and 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 spectacles rather than contact lenses can relieve or prevent discomfort. The available evidence has not shown the low humidity to cause internal dehydration and there is no need to drink more than useful. However, since caffeine and alcohol can themselves contribute to dehydration, it is wise to limit consumption of such products during long flights (also see sections on motion sickness and jet lag).

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 a significant amount of 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 cosmic radiation levels are therefore 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 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 flying to help prevent problems, and should avoid drinking alcohol during the flight and for 24 h beforehand.

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. WHO set up a major research study, WHO Research Into Global Hazards of Travel (WRIGHT), in order to establish whether the risk of venous thromboembolism (VTE) is increased by air travel, to determine the magnitude of the risk and the effect of other factors on the risk, and to study the effect of preventive measures. The findings of the epidemiological studies indicate that the risk of venous thromboembolism is increased 2 to 3-fold after long-haul flights (>4 h) and also with other forms of travel involving prolonged seated immobility. The risk increases with the duration of travel and with multiple flights within a short period. In absolute terms, an average of 1 passenger in 4500 will suffer from venous thromboembolism after a long-haul flight.

In most cases of DVT, the clots are small and do not cause any symptoms. The body is able to gradually break down the clots 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 a 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 in the leg.

The risk of developing DVT when travelling is increased in the presence of other risk factors, including:

- previous DVT or pulmonary embolism
- history of DVT or pulmonary embolism in a close family member
- use of estrogen therapy – oral contraceptives (“the pill”) or hormone-replacement therapy (HRT)
- pregnancy
- recent surgery or trauma, particularly to the abdomen, pelvic region or legs
- cancer
- obesity
- some inherited blood-clotting abnormalities.

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

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 four or more hours.

Precautions

The benefits of most precautionary measures in passengers at particular risk for DVT are unproven and some might even result in harm. Further studies to identify effective preventive measures are ongoing. However, some general advice for such passengers is given here.

- Moving around the cabin during long flights will help to reduce any period of prolonged immobility, although this may not always be possible. Moreover, any potential health benefits must be balanced against the risk of injury if the aircraft were to experience sudden turbulence. A regular trip to the bathroom, e.g. every 2–3 h, is a reasonable measure.
- Many airlines provide helpful advice on exercises that can be carried out in the seat during flight. Exercise of the calf muscles can stimulate the circulation, alleviate discomfort, fatigue and stiffness, and 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.

- In view of the clear risk of significant side-effects and absence of clear evidence of benefit, passengers are advised not to use aspirin specifically for the prevention of travel-related DVT.
- Those travellers at greatest risk of developing DVT may be prescribed specific treatments and should consult their doctor for further advice.

Diving

Divers should avoid flying soon after diving because of the risk that the reduced cabin pressure may lead to decompression sickness (more commonly called “the bends”). It is recommended that they do not fly until at least 12 h after the last dive; this period should be extended to 24 h after multiple dives or after diving that requires decompression stops during ascent to the surface. Passengers who undertake recreational diving before flying should seek specialist advice from diving schools. Divers Alert Network is an excellent source of information with a good Frequently Asked Questions section (www.diversalertnetwork.org/medical/faq/Default.aspx) as well as an emergency hotline number.

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 caused by 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 ways of reducing 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. Depending on the time of day you may be able to rest during the flight. Short naps (less than 20 mn) can be helpful.
- Eat light meals and limit consumption of alcohol. Alcohol increases urine output, with the result that sleep may be disturbed by the need to urinate. While it

can accelerate the onset of sleep, alcohol impairs the quality of sleep, making it less restful. The after-effects of excessive consumption 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 the flight. Caffeine should be limited to normal amounts and avoided within a few hours of an expected period of sleep. If coffee is drunk during the daytime, small amounts every two hours or so are preferable to a single large cup.

- At the destination, try to create the right conditions when preparing for sleep and to get as much sleep in every 24 h as normal. A minimum block of 4 h’ 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 during the day in response to feelings of sleepiness. When taking a nap during the day, eyeshades and earplugs may help. Exercise during the day may help to promote sleep, but avoid strenuous exercise immediately before trying to sleep.
- The cycle of light and dark is one of the most important factors in setting the body’s internal clock. Exposure to daylight, preferably bright sunlight, at the destination will usually help adaptation. When flying west, exposure to daylight in the evening and avoidance in the morning (e.g. by using eye shades or dark glasses) may be helpful; flying east, exposure to light in the morning and avoidance in the evening are to be recommended.
- Sleep patterns may also be helped by temperature control. When flying west, a warm shower in the evening helps with staying awake; when flying east, a cool shower in the evening is recommended to facilitate sleep.
- 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. 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 in long-term use, are unknown. Moreover, manufacturing methods are not standardized: the dose per tablet can be very variable and some harmful compounds may be present. For these reasons, melatonin cannot be recommended.
- Trying to adjust to local time for short trips of up to 2–3 days may not be the best coping strategy, because the body clock may not have an opportunity to

synchronize to the new time zone, and re-synchronization to the home time zone may be delayed after the return flight. If in doubt, seek specialist travel medicine advice.

- Individuals react in different ways to time zone changes. Frequent flyers should learn how their own bodies respond and adopt habits accordingly. Advice from a travel medicine clinic may help in formulating an effective coping strategy.

Psychological aspects

Stress, fear of flying (flight phobia), air rage and other psychological aspects of air travel are detailed in Chapter 10.

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. They 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 vary and requirements should always be checked at the time of, or before, booking the flight. A good place to find information is often the airline's own web site.

Infants

A fit and healthy baby can travel by air 48 h after birth, but it is preferable to wait until the age of 7 days. Until their organs have developed properly and stabilized, premature babies should always undergo a medical clearance before travelling by air. Changes in cabin air pressure may upset infants; this can be helped by feeding or giving a pacifier (dummy) to stimulate swallowing.

Pregnant women

Pregnant women can normally travel safely by air, but most airlines restrict travel in late pregnancy. Typical guidelines for a woman with 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.

Each case of complicated pregnancy requires medical clearance.

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 and diabetes, who are on any form of regular medication or treatment, who have recently had surgery or 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 (Chapter 1).

Frequent travellers with medical conditions

A frequent traveller who has a permanent and stable underlying health problem may obtain a frequent traveller's medical card (or equivalent) 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.

Dental/oral surgery

Recent dental procedures such as fillings are not usually a contraindication to flying. However, unfinished root canal treatment and dental abscesses are reasons for

caution, and it is recommended that each individual seek advice with regard to travel plans from the surgeon or dental practitioner most familiar with their case.

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 any traveller with a pacemaker should 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 the issue with a 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. A passenger who is unable to look after his or her 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 but does not have a suitable escort may not be permitted to travel. Travellers confined to wheelchairs should be advised against deliberately restricting fluid intake before or during travel as a means of avoiding use of the toilet during flights, as this may be detrimental to overall health.

Airlines have regulations on conditions of travel for passengers with disabilities. Disabled passengers should contact airlines for guidance in advance of travel; the airlines' own web sites often give useful information.

Transmission of communicable diseases on aircraft

Research has shown that there is very little risk of any communicable disease being transmitted on board an 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 dust 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 in which people are close to each other, such as on a train or bus or in a theatre. Highly contagious conditions, such as influenza, are more likely to be spread to other passengers in situations where the aircraft ventilation system is not operating. An auxiliary power unit is normally used to provide ventilation where 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.

Transmission of tuberculosis (TB) on board commercial aircraft during long-distance flights was reported during the 1980s, but no case of active TB disease resulting from exposure on board has been identified subsequently. Nevertheless, increasing air travel and the emergence of drug-resistant TB require continuing vigilance to avoid the spread of infection during air travel. Further information on TB and air travel may be found in the 2008 edition of the WHO publication *Tuberculosis and air travel: guidelines for prevention and control*.

During the outbreak of severe acute respiratory syndrome (SARS) in 2003, the risk of transmission of the disease in aircraft was very low.

To minimize the risk of passing on infections, passengers who are unwell, particularly if they have a fever, should delay their journey until they have recovered. Passengers with a known active communicable disease should not travel by air. 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 carry out

disinsection to prevent the inadvertent introduction of species that may harm their agriculture.

Disinsection is a public health measure that is mandated by the International Health Regulations (Annex 2). 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 during air travel, and some have reported feeling 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 recommended.

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, is also carried by several airlines.

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 48 h old.
- Women after the 36th week of pregnancy (32nd week for multiple pregnancies).
- Those suffering from:
 - angina pectoris or chest pain at rest;
 - any active communicable disease;
 - decompression sickness after diving;
 - increased intracranial pressure due to haemorrhage, trauma or infection;
 - infections of the sinuses or of the ear and nose, particularly if the Eustachian tube is blocked;
 - recent myocardial infarction and stroke (elapsed time since the event 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, craniofacial 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 anemia;
 - 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.

Travel by sea

This section was prepared in collaboration with the International Society of Travel Medicine.

The passenger shipping industry (cruise ships and ferries) has expanded considerably in recent decades. In 2008, 13 million passengers worldwide travelled on cruise ships. Cruise itineraries cover all continents, including areas that are not easily accessible by other means of travel. The average duration of a cruise is about seven days, but cruise voyages can last from several hours to several months. A typical cruise ship now carries up to 3000 passengers and 1000 crew.

The revised International Health Regulations address health requirements for ship operations and construction. There are global standards regarding ship and

port sanitation and disease surveillance, as well as response to infectious diseases. Guidance is given on provision of safe water and food, on vector and rodent control, and on waste disposal. According to Article 8 of the International Labour Organization Convention (No. 164) “Concerning Health Protection and Medical Care for Seafarers” (1987), vessels carrying more than 100 crew members on an international voyage of 3 days or longer must provide a physician for care of the crew. These regulations do not apply to passenger vessels and ferries sailing for less than 3 days, even though the number of crew and passengers may exceed 1000. Ferries often do not have an emergency room but a ship’s officer or a nurse is designated to provide medical help. The contents of the ship’s medical chest must be in accordance with the international recommendations and national laws for ocean-going trade vessels, but there are no special requirements for additional drugs for passenger ships.

The average traveller on a cruise line is 45–50 years of age. Senior citizens represent about one-third of passengers. Cruises of longer duration often attract older travellers, a group likely to have more chronic medical problems, such as heart and lung disease. More than half of all emergency visits to health clinics on board are made by passengers who are over 65 years of age; the most common health problems are respiratory tract infection, injuries, motion sickness and gastrointestinal illness. Extended periods away from home, especially days at sea, make it essential for passengers to stock up with sufficient medical supplies. Prescription medicines should be carried in the original packages or containers, together with a letter from a medical practitioner attesting to the traveller’s need for those medicines. Cruise ship travellers who may require particular medical treatment should consult their health-care providers before booking.

It is important to view a ship’s medical facility as an infirmary and not as a hospital. Although most of the medical conditions that arise aboard ship can be treated as they would be at an ambulatory care centre at home, more severe problems may require the patient to be treated in a fully staffed and equipped land-based hospital after stabilization on the ship. Knowledge of the type and quality of medical facilities along the itinerary is important to determine whether travellers or crew members can be sent ashore for additional care or need to be evacuated by air back to the home port. Most cruise vessels do not have assigned space for a dental office, and very few have a resident dentist.

The rapid movement of cruise ships from one port to another, with the likelihood of wide variations in sanitation standards and infectious disease exposure risks, often results in the introduction of communicable diseases by embarking passengers and crew members. In the relatively closed and crowded environment of

a ship, disease may spread to other passengers and crew members; diseases may also be disseminated to the home communities of disembarking passengers and crew members. More than 100 disease outbreaks associated with ships have been identified in the past 30 years. This is probably an underestimate because many outbreaks are not reported and some may go undetected. Outbreaks of measles, rubella, varicella, meningococcal meningitis, hepatitis A, legionellosis, and respiratory and gastrointestinal illnesses among ship travellers have been reported. Such outbreaks are of concern because of their potentially serious health consequences and high costs to the industry. In recent years, influenza and norovirus outbreaks have been public health challenges for the cruise industry.

Communicable diseases

Gastrointestinal disease

Most of the detected gastrointestinal disease outbreaks associated with cruise ships have been linked to food or water consumed on board ship. Factors that have contributed to outbreaks include contaminated bunkered water, inadequate disinfection of water, potable water contaminated by sewage on ship, poor design and construction of storage tanks for potable water, deficiencies in food handling, preparation and cooking, and use of seawater in the galley.

Norovirus is the most common pathogen implicated in outbreaks. Between 1 January and 5 July 2006, 42 reported outbreaks of gastroenteritis on 13 different cruise ships sailing in

European waters were confirmed or suspected to be caused by norovirus. Symptoms often start with sudden onset of vomiting and/or diarrhoea. There may be fever, abdominal cramps and malaise. The virus can spread in food or water or from person to person; it is highly infectious and in an outbreak on a cruise ship, more than 80% of the passengers can be affected. To prevent or reduce outbreaks of gastroenteritis caused by norovirus, ships are enhancing food and water sanitation measures and disinfection of surfaces; more ships are providing hand gel dispensers at strategic locations throughout the ship and passengers and crew are urged to use them. Some cruise companies ask that those who present with gastrointestinal symptoms at on-board medical centres are put into isolation until at least 24 h after their last symptoms, and some ships also isolate asymptomatic contacts for 24 h.

Influenza and other respiratory tract infections

Respiratory tract infections are frequent among cruise-ship travellers. Travellers from areas of the world where influenza viruses are in seasonal circulation may introduce such viruses to regions of the world where influenza is not in seasonal circulation. Crew members who serve passengers may become reservoirs for influenza infection and may transmit disease to passengers on subsequent cruises.

Legionellosis

Legionellosis (legionnaires' disease) is a potentially fatal form of pneumonia, first recognized in 1976. The disease is normally contracted by inhaling *Legionella* bacteria deep into the lungs. *Legionella* species can be found in tiny droplets of water (aerosols) or in droplet nuclei (the particles left after water has evaporated). More than 50 incidents of legionellosis, involving over 200 cases, have been associated with ships during the past three decades. For example, an outbreak of legionellosis occurred on a single cruise ship in 1994, resulting in 50 passengers becoming affected on nine separate cruises, with one death. The disease was linked to a whirlpool spa on the ship. Other sources have been potable water supplies and exposures during port layovers.

Prevention and control depend on proper disinfection, filtration and storage of source water, designing piping systems without dead ends. Regular cleaning and disinfection of spas are required to reduce the risk of legionellosis on ships.

Other communicable diseases

The outbreaks of varicella and rubella that have occurred underscore the need for passengers to make sure that they are up to date with routine vaccinations; major cruise ship companies are requesting that their crew be vaccinated against varicella and rubella.

Noncommunicable diseases

Because of temperature and weather variations, changes in diet and physical activities, the cruise ship traveller – particularly the elderly traveller – may experience worsening of existing chronic health conditions. Cardiovascular events are the most common cause of mortality on cruise ships. Motion sickness can occur, especially on smaller vessels. Injuries and dental emergencies are also frequently reported.

Precautions

The risk of communicable and noncommunicable diseases among cruise ship passengers and crew members is difficult to quantify because of the broad spectrum of cruise ship experiences, the variety of destinations and the limited available data. In general, cruise ship travellers should:

- Consult their health-care provider, a physician or travel health specialist before embarking. This may provide prevention guidelines and immunizations, specifically taking into account:
 - the health status of the cruise ship traveller, the duration of travel, the countries to be visited and likely activities ashore;
 - all routinely recommended age- and medical condition-specific immunizations;
 - influenza vaccination as available regardless of season, particularly if the traveller belongs to one of the groups for whom annual vaccination against influenza is routinely recommended (Chapter 6); the need to provide a prescription for anti-influenza medication, for treatment or prophylaxis can then be discussed;
 - immunization and other (e.g. malaria) recommendations that apply to each country on the itinerary;
 - medication against motion sickness, particularly if the traveller is prone to motion sickness.
- See a dentist to make sure they have good oral health and no active problems.
- Consider purchasing a special health insurance policy for trip cancellation, additional medical coverage and/or medical evacuation if necessary.
- Abstain to embark on their cruise if they are symptomatic with acute illness.
- Carry all prescription medicines in the original packet or container, together with a physician's letter (Chapter 1).
- Carry out frequent hand-washing, either with soap and water or using an alcohol-based hand sanitizer.
- Avoid self-medication in the case of diarrhoea or high fever while on board, but report immediately to the ship's medical service.

Further reading

Travel by air

General information related to air travel may be found on the web site of the International Civil Aviation Organization (www.icao.int).

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Travel by sea

General information related to travel by seas may be found at the following web sites:

American College of Emergency Physicians: www.acep.org/ACEPmembership.aspx?id=24928

International Council of Cruise Lines: www.cruising.org/index2.cfm

International Maritime Health Association: www.imha.net

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WHO International medical guide for ships: including the ship's medicine chest, 3rd ed. Geneva, World Health Organization, 2007 (available at: whqlibdoc.who.int/publications/2007/9789241547208_eng.pdf).