CHAPTER 4

Jet Health

Elaine C. Jong

Access evidence synopsis online at ExpertConsult.com.

Once onboard a commercial jet aircraft headed to destination, the traveler faces the novel environment of the airplane cabin, in which a passenger's health may be impacted by the air quality and pressurization, among other prevailing conditions. Chronic health concerns may be exacerbated and new health issues may arise after spending hours sitting with limited mobility in the company of strangers and in contact with potentially contaminated surfaces and furnishings. Trauma associated with air turbulence, and syncope due to medication effects or other factors may lead to serious sequelae among aircraft passengers. Mental health issues may arise due to confined surroundings, overindulgence in alcoholic beverages, or taking new travel medications. The purpose of this chapter is to identify potential health risks associated with air travel and to discuss guidelines and optimal approaches to prevention. Over the past decade, enhanced emergency medical kits and automatic external defibrillators (AEDs) onboard some commercial airlines have allowed for successful resuscitation in cases of sudden cardiac death and other in-flight emergencies.

CABIN AIR QUALITY

Regarding cabin air quality, there exist several well-known myths that supposedly contribute to poor air quality, including the beliefs that aircraft ventilation systems cause build-up of contaminants and pathogens and that decreased O_2 levels and increased CO_2 levels in the cabin result in adverse symptoms. These beliefs will be shown to be untrue as the determinants of cabin air quality are reviewed in detail below. **Table 4.1** shows the five variables contributing to cabin air quality. Cabin air quality turns out to be relatively good when aircraft cabin ventilation systems are operating as designed and passengers have no cardiopulmonary co-morbidities.

Pressurization

Without major exception, the cabin environment is kept pressurized to 8000 ft (2400 m) above sea level. This is not an arbitrary flight level. It was chosen through research performed on pilots in early NASA (National Aeronautical and Space Agency, U.S.A.) studies and is felt to be the altitude that most of the general public can tolerate without exhibiting signs or symptoms of altitude sickness. This altitude maintains the average individual on the upper flat part of the oxygen dissociation curve (**Fig. 4.1**).

Most healthy individuals will tolerate this altitude very well. However, literature on altitude sickness reveals a subset of the population who will be symptomatic. While the percentage of O_2 remains the same at normal flight altitude as it does at sea level (21%), the partial pressure of O_2 decreases from 103 mmHg to 69 mmHg at 8000 ft. This pressure will ensure that about 90% of all hemoglobin will be saturated in the healthy individual.

Despite that, those individuals with significant pathology such as chronic obstructive pulmonary disease (COPD), recent myocardial infarction (MI), or unstable angina might

TABLE 4.1 Variables Contributing to Cabin Air Quality
Pressurization
Ventilation
Contamination
Humidity
Temperature

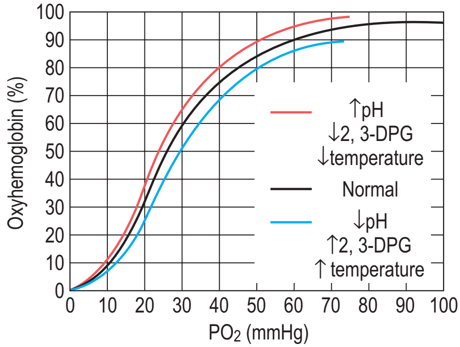

Fig. 4.1 O_2 dissociation curve. Note: 2,3-DPG (2,3-diphophoglycerate) in red blood cells facilitates O2 release to tissues; high altitude increases 2,3-DPG, shifting the normal OCD to the right (blue line).

suffer significant decompensation from even minor alterations in their O_2 dissociation curve. It is important for clinicians to consider this before allowing their patients to embark on a long voyage without supplemental oxygen. See the section below "Supplemental Oxygen during Air Travel." It is interesting to note that some of the next generation passenger aircraft, such as the Boeing 787 Dreamliner, are able to operate at the lower cabin altitude of 6000 ft due to the extensive use of composite materials in the fuselage, which are able to tolerate the higher pressurization.

Ventilation

The myth that aircraft ventilation contributes to poor quality of cabin air is completely unfounded. Depending on the type of aircraft, about half of the cabin air is recirculated. The other half is fresh air that is supplied by engine compressors, cooled by air-conditioning packs, and then blended with recirculated air. As a reference point, an office building may recirculate between 65 and 95% of its air. Older aircraft such as the Boeing 727 and McDonald-Douglas DC-9 do not recirculate air. It is only with the fuel crisis in the 1970s that modifications were made to newer aircraft to decrease the amount of fresh air brought into the cabin by the engines, thereby decreasing fuel consumption. It is of note that the fresh air brought into the cabin is virtually sterile.

Despite these modifications to newer aircraft, cabin air is exchanged in its entirety quite frequently. Consider the Boeing 767 used in both domestic and long-haul international versions. The cabin air is exchanged entirely every 2-3 minutes. Thus cabin air is exchanged approximately 20-30 times per hour. Compare that with the average household, which exchanges its volume only about five times per hour.

Clearly a very large volume of air enters and exits the cabin in a very short time. Without very precise modifications, passengers would experience severe drafts. Engineering

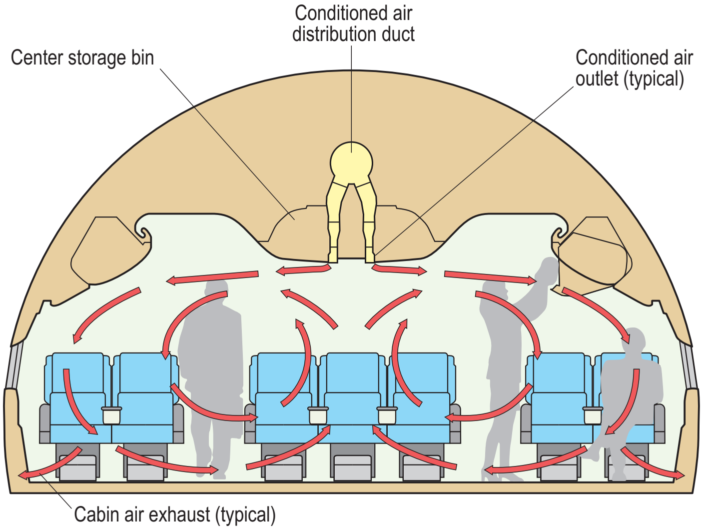

Fig. 4.2 Cabin picture demonstrating air flow.

modifications have reduced this "wind tunnel effect" by using laminar flow. Cabin air enters from air ducts running the length of the cabin overhead. Air supplied then exits at approximately the same row, thereby reducing airflow in fore and aft directions. This effectively limits the spread of passenger-generated contaminants (**Fig. 4.2**).

Contamination

While the laminar flow serves to minimize spread of passenger-generated contaminants, the major barrier to particulate matter on all modern aircraft is the high-efficiency particulate air (HEPA) filter. This is the standard filter used in most hospital intensive care units, operating rooms, and industrial clean rooms. A rating is given on efficiency based on the ability of the filter to remove particles greater than 0.3 microns. For reference, bacteria and fungi are on the order of greater than 1 micron in size. Viruses, however, may range on the order of 0.003-0.05 microns. Less data exist on these organisms, but it is known that clumping of virus particles facilitates their removal via HEPA filters.

Studies have been done collecting air samples from various locations and assaying for microorganisms. Locations included municipal buses, shopping malls, sidewalks, downtown streets, and airport departure lounges. It was found that microbial aerosols in the aircraft cabin were much less than in other public locations. While there does exist a risk of disease transmission simply based on the number of passengers and the close proximity, it does not appear to be any greater aboard aircraft than that for any of the other modes of public transportation. Interestingly, aircraft cabin microbial aerosols were reported lower during night flights when presumably there was less passenger activity and were higher during daytime flights when passengers were more likely to get out of their seats to walk up and down the airplane aisle.

In addition to pathogenic organisms, the concern over other contaminants exists as well, including carbon dioxide, carbon monoxide, and ozone. Carbon dioxide levels have been equated with poor air quality in buildings and other public spaces. However, data collected on 92 different US flights found carbon dioxide, carbon monoxide, and ozone levels well below maximum Federal Aviation Administration (FAA) and Occupational Safety and Health Administration standards. Thus passenger symptoms of fatigue, headache, nausea, and upper respiratory tract irritation are likely to stem from other factors, including flight duration, noise levels, dehydration, and circadian dysrhythmia. The American Society of Heating Refrigeration and Air Conditioning Engineers has recently proposed Standard 161P, which makes recommendations for cabin air quality for all commercial passenger aircraft carrying 20 or more passengers.

Humidity and Temperature

In addition to the previously discussed factors that affect cabin air quality, no discussion would be complete without mentioning humidity and temperature. The cabin milieu is much like that of a desert environment (12-21% humidity). Relative humidity can be between 5 and 35% on most aircraft. The low humidity is caused by the frequent renewal of cabin air with outside air. With outside air temperatures being well below 0° F (−18° C), little appreciable moisture or heat is brought into the cabin. Air bled off the engines must be circulated and warmed to bring it to a comfortable range. Exposure to this environment for prolonged periods is known to cause dehydration due to insensible water loss as well as to exacerbate respiratory conditions. It is of interest to note, however, that the low humidity can actually inhibit bacterial and fungal growth.

TRANSMISSION OF COMMUNICABLE DISEASES ON AIRCRAFT

Seasonal viral influenza, measles, chickenpox, meningococcal meningitis, and the common cold are examples of communicable diseases that can be transmitted from person to person in close proximity within enclosed spaces such as the aircraft cabin. Transmission is usually through aerosols of infected respiratory secretions resulting from coughing and sneezing by infected individuals or by direct contact items and furnishings contaminated with infectious secretions. In response to heightened public health concerns over global transmission and spread of emerging agents such as pandemic flu virus strains (avian influenza H5N1, H7N9), severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS-CoV), multidrug-resistant tuberculosis, and hemorrhagic fever viruses such as Lassa, Ebola, and others, the International Air Transport Association (IATA) and the International Civil Aviation Organization work closely with the World Health Organization (WHO) and national public health authorities such as the Centers for Disease Control and Prevention (CDC) to develop and implement guidelines to minimize the spread of disease through air travel and transport.

Despite the policy of most major airlines to reduce exposure to infectious diseases during air travel through denial of boarding to individuals perceived to be ill, exposure does nonetheless occur. Some individuals are contagious before overt symptoms are manifested and recognized. (See further considerations in the section below entitled “The Air Carrier Access Act 1986.”)

When a contagious source passenger is identified, usually days after the flight has been completed, public health authorities and the airline carrier must work together to notify and screen all passengers who traveled with the source passenger and have been assessed to be at risk of exposure. It is important to document the level of infectiousness of the source passenger. In the case of *Mycobacterium tuberculosis*, factors such as anatomic involvement, positive acid-fast bacilli smears, history of transmission, and prior treatment of the source case must be considered. Further, the proximity to the source case and duration of exposure all figure into the post-exposure notification algorithm. Literature clearly reflects that proximity to the source case is one of the most important variables in the transmission of infectious disease. Thus, a passenger traveling in first class need not necessarily be notified of a source case seated in the rear of the aircraft in the coach section. Similarly, those whose exposure was limited to less than 8 hours are very unlikely to need notification.

Exceptions to this rule clearly exist, however. Consider the case of a jet delayed on the ground for 3 hours due to engine problems with 54 passengers on board. The ventilation system on board the aircraft was apparently inoperative. Of those on board, 72% became infected with influenza. The attack rate varied linearly with time spent on board the aircraft. This would demonstrate that any alteration from standard boarding, taxi, and takeoff protocols might be significant in determining infectivity of a source case and the need to notify other passengers.

The worldwide spread of SARS in 2003 illustrated to public health authorities the need to develop reliable methods to quickly locate and notify passengers who may have been exposed in-flight to communicable diseases. Because of passenger data privacy concerns, airlines have traditionally performed passenger notifications when alerted by public health authorities to do so. However, US public health agencies led by the CDC have taken a more active role and now may require airlines to release electronic passenger data by issuing a Directive Order in the event of a confirmed possible exposure in-flight. In addition, there is now a requirement for the commander of an aircraft destined for a US airport to report immediately to the nearest CDC Quarantine Station any death or illness among passengers or crew, *prior to* arrival. Reportable illnesses include high or persistent fevers, particularly if accompanied by a rash or jaundice, as well as moderately severe diarrhea.

Avian flu H5N1 virus causes outbreaks of serious disease in poultry and wild birds in countries around the world. Although it is not easily transmitted to humans, more than 500 human cases have been reported since 2003 in parts of Asia, Africa, Eastern Europe, and the Middle East, with a case mortality rate of about 60%. Transmission of avian flu H5N1to humans usually involves direct contact with infected birds, but if the virus mutates and becomes more easily spread from human to human (e.g., airborne by the respiratory route), this could start an influenza pandemic or worldwide outbreak of disease. Avian influenza H7N9 virus continues to cause severe outbreaks of disease on poultry farms in China, in other Asian countries, and in the US. So far, human cases reported from Asia have not led to sustained human-to-human transmission. Considering the possibility of an avian flu pandemic in the future, IATA in cooperation with the CDC developed guidelines for airline personnel meeting passengers arriving from known outbreak areas, as well as for airline cleaning and maintenance crews who may potentially be exposed. All guidelines emphasize basic hygiene practices to prevent becoming ill, such as hand washing with soap and water or an alcohol-based hand gel, separation of any ill passengers and providing them with a surgical mask or tissues to cover the mouth and nose, use of disposable gloves when handling blood or body fluids, and prompt reporting of the illness to public health authorities. Specialized personal protective equipment such as respirators or gowns is not recommended except in direct patient-care situations, although the use of surgical masks when around symptomatic individuals in public areas may be considered. Specialized passenger screening techniques such as thermal screening to identify febrile passengers when pre-boarding that were utilized during the SARS epidemic in some international locations are not being recommended at this time.

Following the 2014 Ebola virus disease (EVD) outbreak in West Africa, a new "Traveler Public Health Declaration Form" (www.iata.org) was developed for use by public health officials to pre-screen travelers departing from the outbreak areas. The WHO published "Travel and Transport Risk Assessment: Interim Guidance for Public Health Authorities and the Transport Sector" in September 2014 with regard to EVD control. This document may be accessed online at www.who.int.

SUPPLEMENTAL OXYGEN DURING AIR TRAVEL

For the travel advisor encountering with a patient requiring oxygen during air travel, it is essential that the following be considered. Oxygen is considered by the FAA to be hazardous cargo. Oxygen, as well as any other oxidizing agents, can pose serious hazards to the safety of the aircraft and passengers. Consider the downing of an airliner when oxygen-generating cylinders were inappropriately stored in the cargo hold, killing all on board. Due to the inherent dangers of transporting oxygen, strict regulations surrounding its transport exist.

For the passengers who will require supplemental oxygen during air travel, it is imperative to be acquainted with each carrier's policy regarding supplemental oxygen. While passengers cannot bring their own oxygen on board, most air carriers can provide oxygen with adjustable or non-adjustable flow meters to passengers who require it. There is a fee for this service, and advance notice is required, 24-48 hours or longer. Further, a physician's statement is necessary attesting to the ability of the patient to be medically cleared to an altitude of 8000 ft with supplemental oxygen. The statement must include flow rates, continuous or intermittent usage, and type of delivery system (mask vs. nasal cannula). Additionally, the need for oxygen supplies on the ground during layovers or transfers must be considered. Typically such service is not available from the airline and must be arranged in advance through a local supplier in the layover city or through the home oxygen service.

In the late 2000s, the FAA began allowing passengers who require supplemental oxygen in-flight to use a portable oxygen concentrators (POCs). Only specified models of POCs have received FAA approval (www.faa.gov/about/initiatives/cabin_safety/portable_oxygen). In addition, specific requirements must be met, including possessing an adequate supply of batteries, pre-notification given to the airline, proper storage during take-off and landing, and the possession of a written doctor's statement detailing the passenger's oxygen requirements. Individual airlines should be consulted about specific requirements. See also Chapter 16 for additional details on travel with respiratory conditions.

THE AIR CARRIER ACCESS ACT OF 1986: DENIAL OF BOARDING/PASSENGER ACCEPTANCE

While the airline may make certain regulations to assure the safety of the traveling public, it may in no way limit the ability of those with disabilities to board the aircraft, with rare exception. The Air Carrier Access Act of 1986 was established to ensure that persons with disabilities, as per the Americans with Disabilities Act definition, are treated without discrimination in any way, consistent with safe carriage of all passengers. This act, known as the "FAA final rule," required the Department of Transportation to publish air carrier access guidelines adopted in March 1990 (14 CFR Part 382). This regulation, which applies only to US-based carriers, states that a carrier may not refuse carriage of a passenger solely based on disability. Nor can it limit the number of disabled individuals on a flight. Further, a carrier may not limit transportation of an individual simply because his or her appearance or behavior is disturbing. Some take this to mean that any "sick" passenger must be accepted.

Exceptions to the "FAA final rule" do exist, however. A carrier may refuse to transport an individual if the carrier deems transportation of the passenger to be a risk to health or safety of the public or to be a clear violation of FAA rules. One such example of when an air carrier might justifiably refuse boarding to a disabled individual would include the inability to perform exit row functions when there is no other seat availability. Also, a carrier may refuse boarding to a passenger known to harbor communicable disease or a passenger who requires respiratory equipment not compatible with the aircraft.

The large responsibility to accept all disabled or ill passengers who do not pose a risk to the traveling public has made necessary the creation of the Complaint Resolution Official (CRO). This position is specifically mandated by Air Carrier Access Rules to resolve complaints or disagreements regarding the transportation of individuals with disabilities. This official or department is usually located in a central location and may involve discussion with an in-house consultant or physician. The physician may request information regarding the clinical scenario prior to making a decision on acceptance or denial of passenger boarding. The CRO may also be called on to make a decision regarding diversion of a flight during which the safety of a passenger or crew member might be jeopardized if it were to continue. Clearly, the issue of traveling with a disability or medical need can best be accomplished through early communication with the air carrier and its special assistance coordinator. Further advice and information for physicians who must advise passengers on travel or medical certifications is available though the Aerospace Medical Association (www.asma.org). (See also Chapter 16, "Traveling with Chronic Medical Conditions.")

DEEP VENOUS THROMBOSIS AND AIR TRAVEL

Sitting inactive for long periods of time predisposes even young, healthy individuals to developing deep vein thrombosis (DVT) in the lower extremities, but, as noted below, some travelers with certain health conditions face an even higher risk during long-distance travel. When a blood clot breaks away from the vein and travels to arteries serving the lungs, it is called a pulmonary embolism (PE), a life-threatening event with a mortality rate of more than 50% in some surveys. DVT and PE are often called venous thromboembolism (VTE).

The development of DVT in travelers during or shortly after long-distance air travel was given the popular name "economy class syndrome" because many travelers wanted to blame the ever-diminishing space of economy class seats on aircraft as the cause of the ailment. However, causal links have not been demonstrated. Limited data show the risk of air travel-associated DVT is similar among passengers in first class and economy class sections, and the etiology of air travel-associated DVT is probably multifactorial. A published study reported a lower incidence of symptomless DVT in a group of long-distance air travelers who used elastic compression stockings compared with those who did not and supports the concept that long periods of sitting and inactivity are plausible risk factors contributing to DVT. Cases of DVT have been reported following long train and automobile trips. In addition, other studies suggest that activation of coagulation induced by hypobaric hypoxia during air travel is another separate and important trigger of thrombosis. Dehydration developing during long flights could also contribute to increased blood coagulability. Personal health issues contributing to increased risk for air travel-associated DVT are shown in **Table 4.2**.

DVT of the lower extremities can be symptomless or symptoms may appear during or shortly after the flight. Although prolonged sitting commonly may cause some swelling of both lower legs, asymmetrical swelling and/or a cramp or tenderness in one lower leg, or swelling and bruising behind the knee of one leg, are symptoms of a blood clot. Chest symptoms usually appear 2-4 days or more after the initial clot in the calf, and signal PE. There may be shortness of breath, rapid breathing or panting, painful breathing, fever, coughing up blood, and/or fainting (often the first sign, especially in older people). Immediate medical evaluation is mandatory if chest or other systemic symptoms develop, because prompt diagnosis of and treatment for pulmonary embolism could be life saving.

All long-distance air travelers, but especially those whose trips are 8 hours or more, should consider the following DVT prevention guidelines in **Table 4.3**.

TURBULENCE-RELATED INJURIES

There are few published studies on the incidence of passenger injuries due to trauma during air travel. Episodes of turbulence can contribute to in-flight trauma by causing overhead luggage bins to open up, spilling contents onto passengers seated below, and by causing

TABLE 4.2 Risk Factors for Air Travel-Associated DVT
Sitting motionless for long periods (8 hours or more)
Adulthood, especially advanced age
Prior injuries to blood vessels (e.g., leg trauma, surgery, radiation therapy)
Estrogen use (oral contraceptives or hormone replacement therapy)
Pregnancy
Severe obesity
Infections
Inflammatory diseases (e.g., rheumatoid arthritis, Crohn disease, systemic lupus erythematosus)
Inherited clotting disorders (e.g., factor V Leiden, prothrombin gene mutation). *Note*: Uncommon in Asian, African, and Native American populations
Cancer (some cancers release prothrombotic substances)
Smoking

TABLE 4.3 DVT Prevention Guidelines

Sit in an aisle seat if possible to allow ease of getting up and around.
Get up and walk up and down the airplane aisle periodically when it's safe to do so.
Do calf muscle exercises once an hour while seated to promote muscular pumping action of venous blood back into the central circulation.
Drink plenty of water (about 1 glass per hour) and stay well hydrated—an added benefit is that trips to the lavatory will compel one to get up and move around.
Avoid excess consumption of coffee and alcohol, which have a diuretic effect and may contribute to dehydration.
Avoid drugs that promote sleepiness and long periods of immobility.
Below-knee graduated compression stockings providing 15-30 mmHg of pressure at the ankle during travel are recommended for air travelers with one or more of the health conditions associated with increased risk of DVT (Table 4.2).
Aspirin or anticoagulants to prevent VTE are not routinely recommended for long-distance travelers, but pharmacologic thromboprophylaxis may be prescribed on an individual basis for some travelers considered to be at particularly high risk, according to evidence-based clinical practice guidelines from the American College of Chest Physicians.

DVT, Deep vein thrombosis; *VTE,* venous thromboembolism.

traumatic injuries in unrestrained and ambulatory persons. In one limited report, 462 injuries caused by objects falling from overhead bins were reported in a 3-year period; >90% were head injuries to passengers seated in aisle seats. In a 10-year retrospective study of turbulence-related injuries among airline cabin crew, about one-half involved serious injuries, with the most frequent type being lower extremity fractures, especially the ankle. The conundrum is that sitting in an aisle seat and ambulating in the airplane aisle are recommended for prevention of VTE in passengers, but the risk of turbulence-related injuries could be lowered by sitting in a window seat and being restrained by a seat belt as much as possible.

IN-FLIGHT MEDICAL EMERGENCIES

With the aging of the population and the increase in commercial air travel now involving several billion passengers a year, it only follows that an increase in the number of in-flight medical emergencies would also occur. However, the incidence of these events is hard to estimate. Although medical events during flight are reported, the information was not collected in a standardized format, and it is difficult to compare data across carriers and regions. Two recently published retrospective studies of in-flight medical emergencies show that most cases were related to syncope, respiratory symptoms, or gastrointestinal symptoms, but potential cardiac symptoms such as chest pain were most often associated with diversion of the flight.

In 2004 the FAA implemented FAR 121.803, which specifies that all US-based commercial airlines must carry a defibrillator and an enhanced emergency medical kit. Airplanes that weigh more than 7500 lb and that have at least one flight attendant are subject to this rule. The items in the enhanced medical kit are listed in **Table 4.4**. Many airlines carry additional items in their onboard medical kits; however, it should be noted that IATA does not regulate the contents of emergency medical kits of international airlines, some of which may be inadequate to provide an effective emergency response.

Medical personnel are frequently onboard and can assist fellow passengers during a medical emergency. Due to the perceived reluctance for physicians or other medical personnel to render aid for fear of legal repercussions, a "Good Samaritan" provision was included in the Aviation Medical Assistance Act of 1998, which limits air carrier and non-employee passenger liability unless the assistance is grossly negligent or willful misconduct is evident. It has been suggested that volunteer physicians or other medically qualified volunteers

TABLE 4.4 Contents of Enhanced Medical Kit

Sphygmomanometer
Stethoscope
Three sizes of oral airways
Syringes
Needles
50% dextrose injection
Epinephrine
Diphenhydramine
Nitroglycerin tabs
Basic instructions
Non-sterile gloves
Oral antihistamine[a]
Non-narcotic analgesic[a]
Aspirin[a]
Atropine[a]
Bronchodilator inhaler[a]
Lidocaine and saline[a]
Intravenous (IV) fluid administration kit[a]
Bag valve mask (BVM) with self-reinflating bag (brand name AMBU bag)[a]
Cardiopulmonary Resuscitation (CPR) masks[a]

[a]Required under FAR 121.803.

(e.g., emergency department nurse, advanced nurse practitioner, or advanced paramedic) responding to an in-flight medical incident stay within the scope of their training and practice, request access to the on-board emergency medical kit, and coordinate their efforts with the flight crew and remote response/call center physician (if available).

Automatic External Defibrillators

The role of the AED is expanding in public access areas. As per figures published by the American Heart Association, sudden cardiac death occurs in about 1000 people per day in the United States. The chance of survival in such an event is less than 1 in 10. As in the teaching for all basic and advanced rescue personnel, the adage "shock first and shock fast" is of paramount importance. With ventricular fibrillation being the most common and the most treatable rhythm disturbance found at time of cardiac death, the importance of AEDs cannot be understated.

The implementation by the FAA of FAR 121.803 has seen the installation of AEDs in all major commercial passenger aircraft maintained by US airlines. All flight crew members including pilots receive training in the location, function, and intended use of AEDs, and flight attendants receive initial and recurring training in cardiopulmonary resuscitation and the use of AEDs every 2 years. This far-reaching regulation has gone a long way in making air travel safer for the thousands of passengers who fly with medical conditions both known and undiagnosed.

BEHAVIORAL PROBLEMS DURING AIR TRAVEL

Passengers behaving badly contribute to the increasing discomfort of air travel, and their behavior most often can be ascribed to a lack of courtesy and common sense. The behavior of the flying public reflects on the informality, self-indulgence, and permissiveness of modern society. Passengers engaging in personal grooming and hygiene tasks, including changing baby diapers in the close quarters of the economy class seat row, demonstrate gross bad manners. Crying babies and unruly children may cause nearby passengers to feel irritated and miserable. Alcohol intoxication, side effects of recreational and even prescribed drugs, sleep deprivation, jet lag, and/or mental stress may create acute psychological problems in certain passengers during air travel that could possibly result in injury to others who try to intercede. While airlines continue to work on ways to prevent, manage, and control passengers behaving badly, individual travelers who are affected should exit their seats if possible and quietly ask for assistance from a flight attendant, rather than directly confronting the person or persons creating the disturbance. Chapter 16, "Travel with Chronic Medical Conditions," and Chapter 17, "Mental Health and Travel," also contain advice on neuropsychiatric conditions and travel.

ACKNOWLEDGMENTS

Sincere thanks and appreciation to Thomas N. Bettes, M.D., M.P.H., who wrote the original chapter on "Air Carrier Issues in Travel Medicine" for the third and fourth editions of this book. This chapter has been adapted from his excellent foundation chapter.

FURTHER READING

Bettes, T.N., McKenas, D.K., 1999. Medical advice for commercial air travelers. Am. Fam. Physician 60, 801–810.

A concise, clinically oriented review for primary care providers advising traveling patients.

Centers for Disease Control and Prevention (CDC), 2014. Infection Control Guidelines for Cabin Crew Members on Commercial Aircraft. Available at <www.cdc.gov/quarantine/air/index> (accessed April 25, 2015).

This is a useful link for access to general health and infection control guidelines pertaining to commercial aircraft, as well as guidelines for specific outbreak situations (e.g., seasonal influenza, avian influenza, MERS-CoV, Ebola).

Chandra, A., Conry, S., 2013. In-flight medical emergencies. West. J. Emerg. Med. 14, 499–504.

Retrospective review of studies and high-quality topic summaries related to in-flight medical emergencies published between 1980 and 2010. Excellent discussion of approach to patient and clinical practice guidelines in the unique cabin environment.

Cummins, R.O., Schubach, J.A., 1989. Frequency and types of medical emergencies among commercial air travelers. JAMA 264, 1295.

This early study of medical emergencies associated with air travel showed that cardiovascular incidents occurred on the ground prior to boarding and after disembarking as well as on board the aircraft, suggesting that a reduction of stress factors associated with travel might be prudent for patients with cardiovascular disease.

Kahn, S.R., Lim, W., Dunn, A.S., et al., 2012. Prevention of VTE in nonsurgical patients: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. Chest 141 (Suppl. 2), e217–18S.

Evidence-based clinical practice guidelines contain recommendations on prevention of VTE for long-distance travelers.

Kenyon, T.A., Vaway, S.E., Ihle, W.W., et al., 1996. Transmission of multidrug-resistant *Mycobacterium tuberculosis* during a long airplane flight. N. Engl. J. Med. 334, 933–938.

A detailed analysis of the transmission of multidrug-resistant tuberculosis during long-haul air travel that demonstrates variables of seating and passenger activity in relation to the source case among passengers who had PPD skin test conversion on post-travel follow-up.

Peterson, D.C., Martin-Gill, C., Guyette, F.X., et al., 2013. Outcomes of medical emergencies on commercial airline flights. N. Engl. J. Med. 368, 2075–2083.

Retrospective review of 11,920 in-flight emergency calls from five domestic and international airlines to a physician-directed medical communications center during 2008-2010. Diagnoses, treatment plans, and outcomes are discussed in detail.

Wick, R.L., Jr., Irvine, L.A., 1995. The microbiological composition of airliner cabin air. Aviat. Space Environ. Med. 66, 220–224.

This study is interesting because it compares bacterial counts and mold counts in samples of airplane cabin air with air samples from city buses, shopping malls, and city street corners.

World Health Organization (WHO), 1998. Tuberculosis and Air Travel: Guidelines for Prevention and Control, third ed. WHO, Geneva. Available at <www.who.int/tb> (accessed April 21, 2015).

An essential reference containing guidelines and an algorithm for evaluating infectiousness in a source case of airplane tuberculosis and the need to notify other passengers after the flight.

World Health Organization (WHO), 2014. WHO Travel and Transport Risk Assessment: Interim Guidance for Public Health Authorities and the Transport Sector. WHO, Geneva. Available at <www.who.int/evd> (accessed April 21, 2015).

Interim guidance to address transmission and control of Ebola virus disease, to be used as a reference for developing national responses.