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## 11.1 Introduction

Airline travel has features that are perfect for spreading infectious diseases: the proximity of passengers in a confined space for a long time and the presence of travelers from every region of the world, some of which have high incidences of specific infectious diseases. Based on a review of 34 months of data from 5 domestic and international airlines, Peterson and colleagues [1] determined that the 3 most common situations prompting calls to a medical communications center were syncope (37%), respiratory problems (12%), and gastrointestinal symptoms (10%). Any of those signs and symptoms could be associated with an infectious disease. The actual prevalence of infectious diseases among the 11,920 in-flight medical emergencies in Peterson's study group was 2.8%. Focusing on children, Moore and associates [2] found that infectious diseases, neurologic emergencies, and respiratory tract problems were the leading reasons for medical consultation among the passengers transported by one airline between 1995 and 2002.

Upper respiratory infections and influenza are spread by coughing and sneezing; therefore, droplet precautions are warranted. Most airlines recirculate 50% of cabin air, passing it through high-efficiency particulate air filters [3]. Zitter and colleagues [4] found no difference in self-reported infection rates among passengers who had traveled in aircraft with that type of filter and those on aircraft with a single-pass cabin ventilation system. The long-held assumption that passengers seated more than 2 rows in front of or behind the primary patient have

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a lower risk of being infected than those closer to the sick person is now being challenged [5].

The Centers for Disease Control (CDC) becomes involved in cases of infectious diseases during air travel when the organization is notified by a public health office at a county health department that a recent traveler has been diagnosed with a contagious disease. The CDC then determines if the person was contagious during the flight and, if so, then launches a search for the other passengers. The diseases most commonly investigated by the CDC are infectious tuberculosis, measles, rubella, pertussis, and meningococcal disease [6].

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## 11.2 Patient Evaluation and Passenger Protection

During a flight, when evaluating a passenger suspected of having an infectious disease, the person should be treated as potentially contagious, especially if he or she currently has a fever or recently had a fever lasting more than 48 h. If possible, the potentially-infectious passenger should be separated from other passengers by 6 ft [5]. General infection control measures should be followed, e.g., treating body fluids as infectious, using good handwashing technique, and wearing disposable gloves. If the patient has respiratory symptoms, facemasks should be worn by the care provider, crew members who are assisting, and nearby passengers. Interactions with the patient should be brief and a limited number of other passengers and crew should interact with the person. Materials that come into contact with the symptomatic individual should be properly disposed. As appropriate, hand washing by the patient should be encouraged.

After taking appropriate steps to limit one's own exposure as well as that of the crew and other passengers, the responding provider should evaluate the passenger for airway compromise. If the patient has airway swelling, stridor, drooling, voice changes, or other significant abnormalities, recommending for flight diversion might be necessary. Patients with conditions such as croup may benefit from nebulized epinephrine, if available. When assessing the patient's breathing, the responding provider should evaluate for increased work of breathing, tachypnea, and breath sounds, using the stethoscope in the medical kit. Passengers who are wheezing could benefit from metered-dose inhalers (MDIs) or nebulizer treatments. Supplemental oxygen can also be provided.

Patients who could be septic or hypovolemic from gastrointestinal illness or insensible losses might show signs of circulatory compromise. Those who can tolerate oral fluids can be given oral rehydration fluid; for those who cannot, intravenous fluids can be started.

Infectious disease in children is also not uncommon. They are prone to conditions such as upper respiratory infections and otitis media, which can be quite painful during flight because of atmospheric changes, especially in children with poor Eustachian tube function. A nasal decongestant might provide relief to some patients [7].

### 11.3 Emerging Infectious Diseases

With the ease of international commercial travel, airlines have become vehicles for emerging infectious diseases. For example, during the Ebola outbreak in Africa, airlines became concerned about the transport of Ebola-infected passengers. The Ebola virus has an incubation period of 2–21 days and its symptoms are nonspecific—fever, weakness, muscle pain, headache, sore throat, vomiting, diarrhea, and bleeding. Ebola is spread through person-to-person contact and by contact with body fluids or secretions from infected people. Providers responding to a passenger who might have Ebola or similar disease should wear a facemask and gloves. Cabin crew members should be instructed to follow International Air Transport Association guidelines, which include distancing the symptomatic person from other passengers as much as possible, using a facemask, using plastic bags to dispose of tissues, storing soiled items as biohazardous material, and limiting contact with the symptomatic person, including use of gloves and hand hygiene. Ground control should be notified of the potential for passengers' exposure to an infectious agent so that authorities at the destination airport can be notified to make preparations to isolate the traveler on arrival [6].

Severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) have also emerged as life-threatening respiratory infections. These conditions are diagnostically similar to other respiratory infections, with fever and symptoms such as cough, shortness of breath, and difficulty breathing. Radiographic images obviously cannot be obtained during flight. When a passenger from an area where these conditions are endemic experiences suspicious symptoms he or she should be isolated from the other passengers as best as possible. Ground control should also be notified to facilitate isolation upon landing and access to medical treatment.

The Zika virus is a mosquito-borne flavivirus with the symptoms of fever, rash, conjunctivitis, muscle and joint pain, malaise, and headache. People can be infected with the virus through the bite of a mosquito as well as through sexual contact. The incubation period is currently unknown, but it is likely days. Pregnant women face the biggest risk from this virus, in that it has been linked to microcephaly in newborns. The treatment for Zika virus infection is typically supportive care. Because patients can present with a spectrum of nonspecific symptoms, healthcare providers should obtain a travel history. Depending on the person's symptoms, it may be difficult to distinguish Zika from other contagious infectious diseases.

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### 11.4 CDC Reporting

The US Code of Federal Regulations requires that a report be submitted by the airline to the CDC after an encounter with a passenger exhibiting specific signs and symptoms of infectious disease [6]. The guidelines differ on domestic and international flights.

The CDC requires reporting for passengers meeting certain criteria:

1. Fever (measured at  $\geq 100.4$  F, feels warm to the touch, or gives a history of feeling feverish) accompanied by one or more of the following:
  - (a) Skin rash
  - (b) Difficulty breathing
  - (c) Persistent cough
  - (d) Decreased consciousness or confusion of recent onset
  - (e) New unexplained bruising or bleeding (without previous injury)
  - (f) Persistent diarrhea
  - (g) Persistent vomiting (other than air sickness)
  - (h) Headache with stiff neck, or
  - (i) Appears obviously unwell OR
2. Fever that has persisted for more than 48 h OR
3. Symptoms or other indications of a communicable disease, as announced by the CDC through the *Federal Register*

If any reportable findings are identified, they should be communicated to the captain and ground control to facilitate appropriate isolation and medical treatment at the destination airport. As with all medical interventions, healthcare providers should document the patient interaction. In-flight care of passengers with known or suspected infectious diseases is primarily supportive, with a focus on isolation and protection of the care provider, crew, and other passengers.

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## 11.5 International Flights

Many cases of infectious communicable diseases aboard international flights have led to contact investigations to determine the origin of the disease and to identify others who may also be at risk of infection. For example, a measles outbreak in Australia in 2010 was traced to a 12-h international flight to that country from South Africa [8]. Nine cases of measles were confirmed, 5 of them in individuals who had been on that flight. The initial (“index”) case sparked a contact investigation that complied with Australian guidelines, i.e., passengers 2 rows in front of and 2 rows behind where the index case as seated were traced, as were children 2 years or younger who were on the flight. The 2-row proximity rule failed to identify other individuals who were infected, because they sat more than 2 rows away. Interestingly, two individuals who became infected on that flight were healthcare workers, who returned to their usual patient care duties after returning to Australia. The authors concluded that the 2-row rule should be reevaluated and that other strategies for contact investigation should be designed, with consideration of cabin layout, flight duration, and flight’s origin and destination as well as associated costs in relation to risks and benefits.

Hertzberg and Weiss [5] calculated that passengers who sit within 2 rows of an infected individual have a 6% risk of becoming infected and those who sit beyond

2 rows have a risk of about 2%. Thus, priority should be given to individuals seated within 2 rows of the index patient, but passengers seated elsewhere should not be neglected. The authors also pointed out that exposure risk is influenced by movement about the cabin and sharing air for a long period of time. Other actions that can aid contact investigations and contain or prevent an outbreak include issuing public service announcements to educate communities about the symptoms of an infectious threat and reducing delays in the diagnosis of a communicable disease that has been brought into a community or country [8].

When an epidemic occurs, the international community often imposes restrictions on travel and escalates screening processes. In 2014, the Ebola epidemic of West Africa generated preemptive measures to ensure the safety of the public. All passengers aboard flights associated with confirmed Ebola cases in the United States were included in contact investigations and tracings [9]. In addition, states monitored individuals who had traveled from Ebola-affected countries for 21 days after their flight [10].

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### Conclusion

Among the multitudes of commercial airline passengers are people with infectious diseases. They pose potential risks to their fellow passengers and to the medical professionals who volunteer to help in times of emergency. Most passengers who experience acute manifestations of infectious diseases during flight require interventions at the level of supportive care until the flight lands. Medical care providers should maintain close contact with the captain so that ground resources can be mobilized if necessary, ready to receive the patient upon landing. Federal and international guidelines require the reporting of encounters with patients with specific signs and symptoms. Compliance with those guidelines can be beneficial when the need arises to launch a contact investigation involving large numbers of people. The 2-row focus of established guidelines warrants reconsideration because the characteristics of air travel (close quarters, shared air supply) extend the threat of exposure to all parts of the cabin.

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