



Report to Ranking Member,  
Subcommittee on Aviation, Committee  
on Transportation and Infrastructure,  
House of Representatives

---

December 2015

# AIR TRAVEL AND COMMUNICABLE DISEASES

## Comprehensive Federal Plan Needed for U.S. Aviation System's Preparedness

# GAO Highlights

Highlights of [GAO-16-127](#), a report to the Ranking Member, Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives

## Why GAO Did This Study

Past communicable diseases, such as the recent Ebola epidemic, have resulted in many deaths and highlight the potential economic cost of disruptions to air travel and the U.S. and global economies.

GAO was asked to review the preparedness of the U.S. aviation system to respond to communicable diseases. This report examines (1) the extent to which selected U.S. airports and airlines have plans for responding to communicable disease threats from abroad and to which a national aviation-preparedness plan guides preparedness, and (2) the challenges that U.S. airports and airlines have faced when responding to threats and any actions taken to address them.

GAO reviewed available documents and interviewed representatives from 14 U.S. international airports—selected to reflect a range of activities and facilities—and the 3 major U.S. airlines. GAO also reviewed applicable federal requirements and international obligations and guidance for U.S. airports and airlines, and interviewed officials and reviewed documents from federal agencies and aviation stakeholder groups.

## What GAO Recommends

GAO recommends that DOT work with relevant stakeholders, such as the Department of Health and Human Services, to develop a national aviation-preparedness plan for communicable diseases. DOT agrees a plan is needed, but suggests public health agencies lead the effort. GAO continues to believe the recommendation is correctly directed to DOT, as discussed in this report.

View [GAO-16-127](#). For more information, contact Gerald Dillingham, Ph.D., (202) 512-2834, [DillinghamG@gao.gov](mailto:DillinghamG@gao.gov).

December 2015

## AIR TRAVEL AND COMMUNICABLE DISEASES

### Comprehensive Federal Plan Needed for U.S. Aviation System's Preparedness

## What GAO Found

All of the 14 airports and 3 airlines GAO reviewed have plans for responding to communicable disease threats from abroad, although the United States lacks a comprehensive national aviation-preparedness plan aimed at preventing and containing the spread of diseases through air travel. U.S. airports and airlines are not required to have individual preparedness plans, and no federal agency tracks which airports and airlines have them. Consequently, it is not clear the extent to which all U.S. airports and airlines have such plans. The plans GAO reviewed generally addressed the high-level components that GAO identified as common among applicable federal and international guidance, such as establishment of an incident command center and activation triggers for a response. GAO identified these components to provide a basis for assessing the breadth of the plans. The plans GAO reviewed for each airport were developed by, or in collaboration with, relevant airport stakeholders, such as Centers for Disease Control and Prevention's (CDC) airport staff. As provided in Annex 9, the Chicago Convention, an international aviation treaty to which the United States is a signatory, obligates member states to develop a national aviation-preparedness plan for communicable disease outbreaks. The Department of Transportation (DOT) and CDC officials contend that some elements of such a plan already exist, including plans at individual airports. However, FAA has reported that individual airport plans are often intended to handle one or two flights with arriving passengers, rather than an epidemic, which may require involvement from multiple airports on a national level. Most importantly, a national aviation-preparedness plan would provide airports and airlines with an adaptable and scalable framework with which to align their individual plans—to help ensure that individual airport and airline plans work in accordance with one another. DOT and CDC officials agree that a national plan could add value. Such a plan would provide a mechanism for the public-health and aviation sectors to coordinate to more effectively prevent and control a communicable disease threat while minimizing unnecessary disruptions to the national aviation system.

Aviation stakeholders GAO spoke with identified multiple challenges in responding to communicable disease threats and actions they took or would take in response. For example, airline and airport representatives told GAO they sometimes experienced difficulties sharing timely and accurate information about threats, and some reported that they improved communication by developing tools, such as standardized forms, to collect and share relevant information. Employees at aviation services firms that GAO spoke with—including contract workers who clean aircraft—raised concerns about the availability of training and access to equipment to control exposure to communicable diseases. Some airports GAO reviewed developed additional mechanisms to ensure adequate training and preparation during the Ebola threat. A national aviation-preparedness plan could serve as the basis for testing communication mechanisms among responders to ensure those mechanisms are effective prior to a communicable disease outbreak as well as to provide the basis for ensuring that airport and airline staff receive appropriate training and equipment to reduce their risk of exposure to communicable diseases during an outbreak.

---

# Contents

---

---

Letter		1
	Background	4
	Airports and Airlines That We Reviewed Have Plans, but a Comprehensive National Aviation-Preparedness Plan Does Not Exist	17
	Airports, Airlines, and other Stakeholders Faced Challenges Responding to Communicable Disease Threats and Are Taking Some Actions as a Result	30
	Conclusions	42
	Recommendation	43
	Agency Comments and Our Evaluation	43
Appendix I	Objectives, Scope, and Methodology	45
Appendix II	Technologies for Responding to Communicable Diseases in Aviation	50
Appendix III	Comments from the Department of Transportation	55
Appendix IV	GAO Contacts and Staff Acknowledgments	56
Appendix V	Related GAO Products	57
Table		
	Table 1: Selected Airports for Review	46
Figures		
	Figure 1: Major Epidemic Threats since 2002	5
	Figure 2: Potential Response by Flight Stage for Addressing Communicable Disease Threats from Abroad	10
	Figure 3: Top Five U.S. International Arrival Airports for Five Global Regions, 2014	14

---

---

Figure 4: U.S. Airports with Centers for Disease Control and Prevention Quarantine Stations, 2015

---

**Abbreviations**

ACI	Airport Council International
AEP	airport-emergency plans
CAPSCA	Collaborative Arrangement for the Prevention and Management of Public Health Events in Civil Aviation
CARE	Check and Report Ebola kit
CBP	U.S. Customs and Border Protection
CDC	Centers for Disease Control and Prevention
CDRP	communicable-disease response plan
Chicago Convention	Convention on International Civil Aviation
DHS	Department of Homeland Security
DOT	Department of Transportation
FAA	Federal Aviation Administration
HEPA	high-efficiency particulate air
HHS	Department of Health and Human Services
HIV	human immunodeficiency virus
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IHR	International Health Regulations
MERS	Middle East Respiratory Syndrome
MOU	memorandum of understanding
OSHA	Occupational Safety and Health Administration
PPD-8	Presidential Policy Directive 8
RBBS	Risk-Based Border Strategy
SARPs	standards and recommended practices
SARS	severe acute respiratory syndrome
TB	tuberculosis
WHO	World Health Organization

This is a work of the U.S. government and is not subject to copyright protection in the United States. The published product may be reproduced and distributed in its entirety without further permission from GAO. However, because this work may contain copyrighted images or other material, permission from the copyright holder may be necessary if you wish to reproduce this material separately.



December 16, 2015

The Honorable Rick Larsen  
Ranking Member  
Subcommittee on Aviation  
Committee on Transportation and Infrastructure  
House of Representatives

Dear Mr. Larsen:

In 2014, almost 52-million international air travelers entered the United States, and the Federal Aviation Administration (FAA) expects that number to continue to increase as the global economy continues to develop. The Ebola epidemic in West Africa in 2014 and 2015 renewed concerns about the spread of communicable diseases through air travel. More than any other mode of transportation, air travel creates the potential for an infection to move quickly from one part of the world to another.<sup>1</sup> In response to Ebola there were proposals in the United States to restrict travel and trade to and from affected countries, although public health officials advised permitting travel to allow access to medical supplies and qualified personnel to contain the epidemic. While deaths and illnesses may be the most visible effect of an outbreak, communicable disease threats also create economic costs. In the case of the 2003 severe acute respiratory syndrome (SARS) epidemic, for example, the International Air Transport Association (IATA) estimated the overall cost at \$33 billion of global gross domestic product in 2003. North American airline revenue losses alone were estimated at \$1 billion, while Asia Pacific airlines lost an estimated \$6 billion.<sup>2</sup>

---

<sup>1</sup>For more information about the interaction of the aviation sector and communicable disease threats, see Airport Cooperative Research Program, Transportation Research Board, *Interagency-Aviation Industry Collaboration on Planning for Pandemic Outbreaks*, Conference Proceedings 41 (Washington, D.C.: 2008).

<sup>2</sup>IATA, *Economic Briefing: Avian Flu* (May 2006).

---

We have found—in lessons learned from the response to the 2009 H1N1 influenza pandemic<sup>3</sup>—that interagency planning and exercises build formal networks and informal relationships that are valuable during a response.<sup>4</sup> Further, in the aviation area, international guidance for aviation stakeholders—including guidance for civil aviation authorities such as FAA—points to the importance of preparedness plans for communicable disease threats, with recommendations designed to reduce exposure to the disease and improve the response to health-related emergencies by establishing mechanisms for rapid decision-making and action.<sup>5</sup>

In light of recurring communicable disease threats, the continued growth in international air travel, and the need to prepare for future threats, you asked us to review issues related to the preparedness of the U.S. aviation system to respond to pandemics and other health crises. This report examines (1) the extent to which selected airports and airlines have preparedness plans to respond to communicable disease threats from abroad and the extent to which a national aviation-preparedness plan guides preparedness, and (2) what challenges U.S. airports and airlines, including their contractors, have faced when responding to communicable disease threats and any actions they have taken to respond to those challenges.

To conduct this work, we identified and reviewed applicable federal requirements, international obligations, as well as federal and international guidance for U.S. airports and airlines with international air traffic. We interviewed officials and reviewed available documents from five federal departments that represent the key federal departments with responsibilities for preparing for and responding to communicable disease

---

<sup>3</sup>According to the Centers for Disease Control and Prevention (CDC), *epidemic* refers to an increase, often sudden in the number of cases of a disease above what is normally expected in that population in that area. *Outbreak* carries the same definition of epidemic, but is often used for a more limited geographic area. Finally, *pandemic* refers to an epidemic that has spread over several countries or continents, usually affecting a larger number of people.

<sup>4</sup>GAO, *Influenza Pandemic: Lessons from the H1N1 Pandemic Should Be Incorporated into Future Planning*, [GAO-11-632](#) (Washington, D.C.: June 27, 2011).

<sup>5</sup>Airport Council International (ACI) and International Civil Aviation Organization (ICAO), *Airport Preparedness Guidelines for Outbreaks of Communicable Disease*, Revised (April 2009); IATA, *Emergency Response Plan: A Template for Air Carriers* (May 2009).

---

threats from abroad—the Departments of Transportation (DOT), Health and Human Services (HHS), Homeland Security (DHS), State, and Labor and their relevant components, including DOT’s Federal Aviation Administration (FAA), HHS’s Centers for Disease Control and Prevention (CDC), DHS’s U.S. Customs and Border Protection (CBP), and Labor’s Occupational Safety and Health Administration (OSHA). We identified high-level components that were common among applicable federal and international guidance, as well as corroborating information collected from aviation stakeholders whom we spoke with. Then, we developed a list of high-level components for airport and airline communicable-disease preparedness plans to provide a basis for assessing the breadth of the plans. We compared these components against the available plans collected from 14 airports and three airlines that we selected for review during our study. We did not evaluate the plans for sufficiency or level of preparedness. We selected for review 14 airports that met one or more of our selection criteria, which included being a large hub airport<sup>6</sup> with CDC staff on-site; receiving the largest and second largest number of international passengers from at least one of five world regions; having enhanced passenger entry-screening procedures in place for Ebola; and having experience with a confirmed Ebola case. We selected for review the three U.S. airlines that handle the largest quantity of international travelers.<sup>7</sup> In addition to reviewing the plans, we administered a questionnaire to each of the 14 airport operators on preparedness at their airport, such as the plans and procedures they have in place for a variety of circumstances. We interviewed a range of stakeholders to discuss preparedness plans and potential opportunities to improve preparedness, as well as to identify challenges airports and airlines have faced in responding to communicable disease threats, including Ebola, and actions stakeholders have taken to address those challenges. These stakeholders include representatives from the 14 selected airports and their local airport stakeholders—such as first responders, local public health officials, CBP officials, and CDC officials, if applicable; the three selected U.S. airlines; airport, airline, and flight attendant industry associations;<sup>8</sup> the International Civil Aviation Organization (ICAO); the

---

<sup>6</sup>U.S. commercial service airports accounting for 1 percent or more of total annual U.S. passenger enplanements. 49 U.S.C. § 47102(10).

<sup>7</sup>American Airlines, Delta Air Lines, and United Airlines.

<sup>8</sup>Airport Council International (ACI) North America, Airlines For America, and Association of Flight Attendants.

---

labor union representing airport- and airline-service workers; and contracted aviation-services employers and their employees.<sup>9</sup> We also identified challenges and actions through our attendance at an ICAO global symposium. Additional detail on the scope and methodology of our review is contained in appendix I.

We conducted this performance audit from November 2014 to December 2015 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

---

## Background

A number of communicable disease threats have raised concern regarding international transmission and travel since the 2003 SARS epidemic, which was the first major new disease of the 21st century, according to the World Health Organization (WHO) of the United Nations. WHO described that 2003 epidemic as a watershed event, because it revealed how much the world had changed in terms of the impact that communicable diseases can have in a highly mobile and closely interconnected world.<sup>10</sup> Figure 1 provides information about major communicable disease epidemics since 2002.

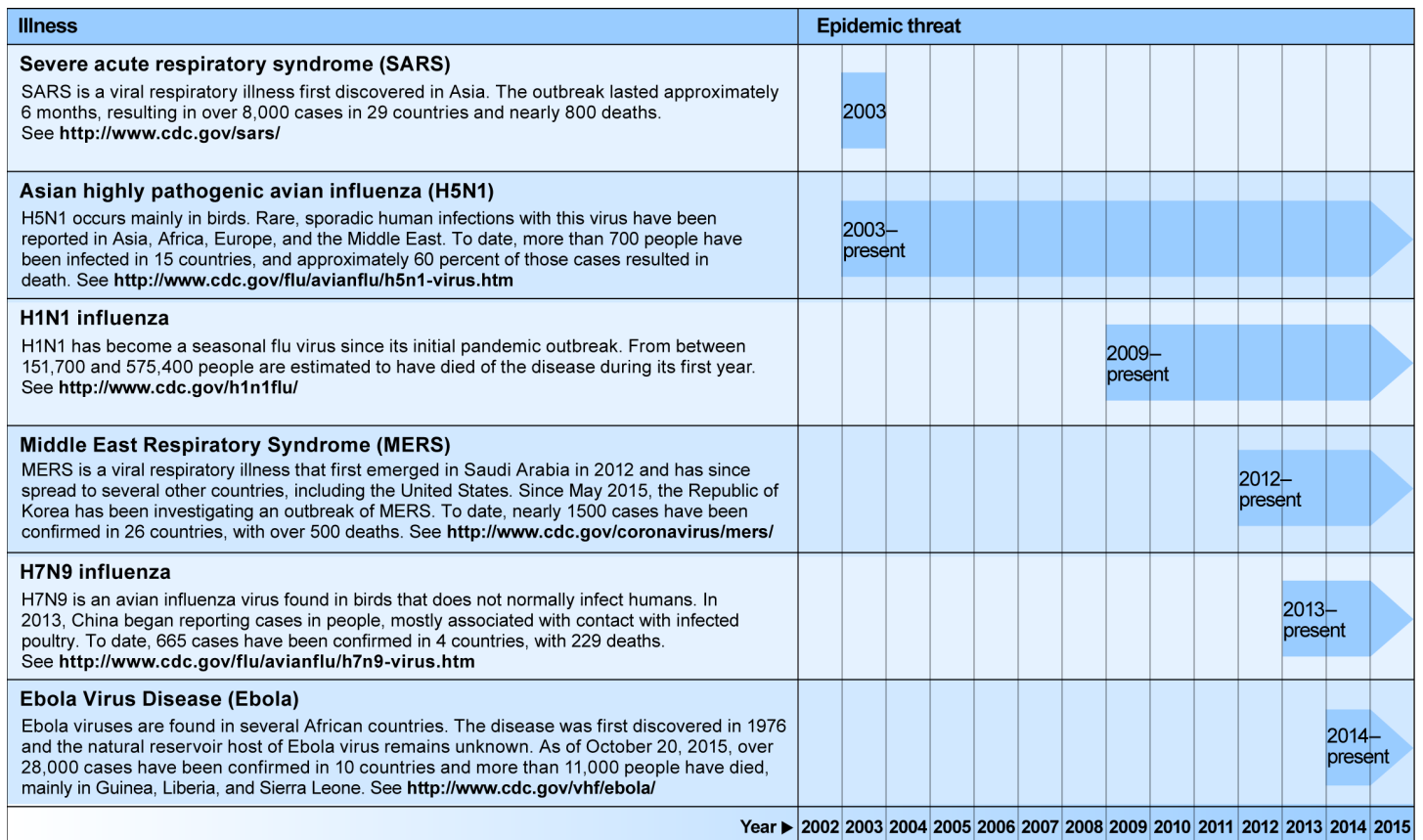
---

<sup>9</sup>We consulted with representatives from the union that represents these workers to identify aviation service employees to speak with, and we conducted interviews with two of the four firms that the nine employees identified worked for, as well as three of the four airports where they worked.

<sup>10</sup>WHO, *Outbreak Communication: Best Practices for Communicating with the Public during an Outbreak*, Report of the WHO Expert Consultation on Outbreak Communications held in Singapore, September 21–23, 2004.



**Figure 1: Major Epidemic Threats since 2002**



Sources: GAO analysis of Centers for Disease Control and Prevention and World Health Organization information. | GAO-16-127

The International Health Regulations (IHR) are an international agreement of the World Health Assembly, the governing body of WHO, and were originally adopted by the Assembly in 1969 to address certain disease threats. The IHR have evolved since then in response to the growth in international travel and trade and the emergence of international disease threats. Most recently, the IHR were revised in 2005 following the SARS epidemic.<sup>11</sup> WHO implements and oversees the IHR and—together with its partners, such as the International Civil Aviation Organization (ICAO)—helps member states build response capacities.

<sup>11</sup>The revised IHR (2005) were adopted by the World Health Assembly on May 23, 2005, and became effective in the summer of 2007.

---

ICAO takes a key role in coordinating the international aviation response to public health risks.<sup>12</sup> Through the IHR, WHO member states have agreed to build core capacities at designated ports of entry,<sup>13</sup> such as airports, to limit the spread of public health risks—such as communicable disease threats—while at the same time minimizing any unnecessary interference with travel and trade.

ICAO develops international standards and recommended practices (SARPs) for civil aviation systems, in cooperation with its member states and global aviation organizations.<sup>14</sup> Member states, including the United States, are obligated to establish regulations or take other appropriate steps to implement the ICAO standards within their own civil aviation systems.<sup>15</sup> In the United States, different agencies are responsible for different aspects of the civil aviation system, as discussed below. The SARPs include some health-related standards and recommended practices based on the most recent IHR obligations. To encourage member states to comply with these health-related SARPs, ICAO has developed a template for the development of national aviation public-health emergency-preparedness plans, which are obligations under the IHR.<sup>16</sup> The Collaborative Arrangement for the Prevention and Management of Public Health Events in Civil Aviation (CAPSCA) also works to bring together international, regional, national, and local

---

<sup>12</sup>ICAO is a United Nations specialized agency created in 1944 by the Convention on International Civil Aviation (Chicago Convention), under which ICAO Member States agreed, among other things, “to take effective measures to prevent the spread by means of air navigation of cholera, typhus (epidemic), smallpox, yellow fever, plague and such other communicable diseases as the [ICAO Member] States shall from time to time decide to designate.” Art. 14, Chicago Convention.

<sup>13</sup>Article 19 of the IHR.

<sup>14</sup>The ICAO Standard contained in paragraph 8.12 of Annex 9 (Facilitation) to the Chicago Convention states that “[ICAO Member] States shall comply with the pertinent provisions of the IHR. Member states are not obligated to follow the recommended practices, although these may also be used to develop regulations or guidance by the relevant agency of the member state’s government.

<sup>15</sup>Member states are obligated to notify ICAO of a “difference” from the international standard, if they find it impractical to fully comply with an international standard or otherwise differ from the standard in their regulations or practices. Art. 38, Chicago Convention.

<sup>16</sup>ICAO, *Template for a National Aviation Public Health Emergency Preparedness Plan*, accessed December 31, 2014, <http://www.capsca.org/Documentation/TemplateAviationPHEPNov2010.pdf>.

---

organizations to develop a coordinated approach to preparedness and response. Other international organizations, notably Airports Council International (ACI) and IATA, also provide assistance to airports and airlines, respectively, in preparing for communicable disease threats.

In the United States, a number of federal agencies, aviation stakeholders, and others have roles and responsibilities in preparing for, assessing, and responding to communicable disease threats in the aviation system. Each of the federal agencies involved in preparing for or responding to communicable disease threats from abroad have a different mission, including those described below, that affects their responsibilities for protecting against communicable disease threats. DHS and HHS are the lead agencies in a response to a communicable disease threat, and other federal agencies provide support as necessary.

- Within DHS, CBP aims to safeguard America's borders thereby protecting the public from dangerous people and materials while enhancing the nation's global economic competitiveness by enabling legitimate trade and travel. CBP officials at ports of entry, including airports, conduct the primary inspection of arriving international travelers and have authority to permit or deny admission to the United States.<sup>17</sup>
- Within HHS, CDC has defined its mission as protecting America from health, safety, and security threats, both foreign and domestic. With its partners, such as CBP, CDC responds to sick travelers who arrive in the United States at major airports, seaports, or land border crossings, when warranted. CDC alerts travelers about disease outbreaks and steps they can take to protect themselves. CDC also has the authority to quarantine passengers traveling from foreign

---

<sup>17</sup>CBP possesses broad authority under customs and immigration laws to examine merchandise, cargo, conveyances, and persons upon their entry to and exit from the United States. 19 U.S.C. §§ 482, 1461, 1496, 1499, 1581, 1582, 1589a, and 1595; 8 U.S.C. §§ 1222, 1225, and 1357.

---

countries, if necessary, to protect the general population and respond to disease threats to the United States.<sup>18</sup>

- Within DOT, FAA is responsible for safety of flight in the United States and the safe and efficient movement of air traffic in the national airspace system, as well as for the safety of U.S. airlines, other U.S. operators, and FAA-certificated air crews worldwide. As part of this responsibility, the agency regulates and certifies airports, airlines, and airmen and provides guidance through advisory circulars and other means.
- Within the Department of Labor, OSHA aims to assure safe and healthful working conditions for working men and women by setting and enforcing standards and by providing training, outreach, education, compliance, and assistance.<sup>19</sup>
- The Department of State (State) has the authority to grant visas, which allow foreign citizens to travel to a U.S. port of entry (generally an airport) and request permission to enter the United States.<sup>20</sup>

---

<sup>18</sup>Under section 361 of the Public Health Service Act (codified at 42 U.S.C. § 264), HHS is authorized to make and enforce regulations to prevent the entry and spread of communicable diseases from foreign countries into the United States and among states. The authority for carrying out these functions on a daily basis has been delegated to CDC, an agency in HHS. Under 42 C.F.R. parts 70 and 71, CDC may provide for the detention, medical examination, and release of persons arriving into the United States and traveling among states who are suspected of carrying these communicable diseases. Quarantinable diseases include cholera, diphtheria, infectious tuberculosis, plague, smallpox, yellow fever, viral hemorrhagic fevers (including Ebola), severe acute respiratory syndromes, and flu that can cause a pandemic (Executive Order No. 13674, § 1, 79 Fed. Reg. 45671 (July 31, 2014)).

<sup>19</sup>Several OSHA standards and directives are directly applicable to protecting workers against transmission of infectious agents. These include OSHA's Bloodborne Pathogens standard (29 C.F.R. § 1910.1030), which provides protection of workers from exposures to blood and body fluids that may contain blood-borne infectious agents; OSHA's Personal Protective standard (29 C.F. R. § 1910.132) and Respiratory Protection standard (29 C.F. R. § 1910.134) which provide some protection for workers when exposed to infectious agents transmitted through routes other than the bloodborne route; and OSHA's TB compliance directive which protects workers to a certain degree against exposure to TB through enforcement of existing applicable OSHA standards and the General Duty Clause of the OSH Act (29 U.S.C. § 654).

<sup>20</sup>A visa does not guarantee entry into the United States.

---

Depending on location and threat, these agencies along with aviation stakeholders and their partners—including local public health authorities,<sup>21</sup> first responders, contracted aviation-services firms, and others—may each have a role in preparing for or responding to a communicable disease incident. That is, the specific response actions taken by individual entities, such as airports and airlines—as well as federal, state, and local authorities—will depend on the operating characteristics of the airline or airport, disease characteristics, and the type and level of threat that exists. Finally, some roles and responsibilities for a response to a threat in the aviation system are established in law or by agreement and others may be defined in preparedness plans. Airports are required by FAA regulations to develop airport-emergency plans (AEP), which must address a variety of hazards, including aircraft incidents and accidents, acts of terrorism, fires, natural disasters, hazardous materials, power failures, or water rescues.<sup>22</sup> These plans are not required to address communicable disease threats.




The risk of disease transmission in an airport and aboard airlines may be heightened during a communicable disease epidemic, although airports, airlines, and public health authorities may have to address travelers with more common communicable diseases such as tuberculosis or measles at any time. The recent Ebola epidemic in West Africa provides an example of a regional epidemic that triggered governments and aviation stakeholders to take additional precautions during each stage of air travel to minimize the spread of the disease. Figure 2 shows routine and potential enhanced safety measures that may be taken before, during, and after flights by a variety of stakeholders.

---

<sup>21</sup>For purposes of this report, we refer to state, local, and tribal public health authorities as local public health authorities.

<sup>22</sup>14 C.F.R. § 139.325. See also FAA, *Advisory Circular: Airport Emergency Plan*, 150/5200-31C (Washington, D.C.: July 19, 2009).

**Figure 2: Potential Response by Flight Stage for Addressing Communicable Disease Threats from Abroad**

	Before flight 	During flight 	After flight 
<b>Routine communicable disease incident response</b>	<ul style="list-style-type: none"> <li>Airlines observe ill passengers for health threats to other passengers</li> </ul>	<ul style="list-style-type: none"> <li>Airline crew isolate and assess ill passengers, to the extent possible</li> </ul>	<ul style="list-style-type: none"> <li>Screening for signs and symptoms during routine interactions</li> </ul>
<b>Enhanced response to communicable disease outbreak</b>	<ul style="list-style-type: none"> <li>Exit screening</li> <li>Funnel passenger or flights to designated airports</li> </ul>	<ul style="list-style-type: none"> <li>Airline crew collect travel history</li> </ul>	<ul style="list-style-type: none"> <li>Entry screening</li> <li>Establish ongoing monitoring</li> </ul>
<b>If passenger poses sufficient risk of communicable disease</b>	<ul style="list-style-type: none"> <li>Delay travel</li> </ul>	<ul style="list-style-type: none"> <li>Airline crew report passenger illness</li> </ul>	<ul style="list-style-type: none"> <li>On-site assessment and transport</li> <li>Screening, evaluation, treatment, or transport</li> <li>Restrict further travel</li> <li>Federal, state, or local isolation or quarantine</li> </ul>

Source: GAO. | GAO-16-127

Before boarding an aircraft, passengers may be prevented from travel if they have a communicable disease that could pose a public health threat during the flight. For example, in the United States, DHS and HHS can identify travelers who are not allowed travel, based on public health threats.<sup>23</sup> Airlines may only refuse to board a passenger—or otherwise restrict or delay travel—with a communicable disease under DOT regulations if that passenger poses a direct threat to the health and safety of others.<sup>24</sup> Additionally, the Department of State can restrict visas for foreign travelers with a communicable disease, preventing them from entering the United States. Governments in areas experiencing such an outbreak may screen passengers exiting the area and restrict or

<sup>23</sup>When HHS requests DHS assistance, HHS notifies TSA of individuals it has identified as public health threats who should be designated “Do Not Board.” The public health “Do Not Board” list—created in response to concerns about prior drug-resistant tuberculosis-traveler incidents—is designed to ensure that airlines are notified that they should not allow the designated individuals on any commercial flights to or from the United States. See GAO, *Public Health And Border Security: HHS and DHS Should Further Strengthen Their Ability to Respond to TB Incidents*, [GAO-09-58](#) (Washington, D.C.: Oct. 14, 2008).

<sup>24</sup>An airline can refuse to transport a person with a communicable disease to the extent permitted by the airline’s contract of carriage and DOT’s disability regulation, 14 C.F.R. Part 382. Under DOT nondiscrimination regulations, passengers who have a communicable disease or infection may only be prevented from traveling; required to delay travel; subjected to any condition, restriction, or requirement not imposed on other passengers; or required to provide a medical certificate if the ill passengers pose a direct threat. A direct threat is “a significant risk to the health or safety of others that cannot be eliminated by a modification of policies, practices, or procedures, or by the provision of auxiliary aids or services.” 14 C.F.R. §§ 382.3 and 382.19(c).

---

discourage the transport of ill or possibly contagious passengers. Under the IHR, these decisions may be made based on recommendations from WHO, although states can make their own entry- and exit-screening decisions. During the SARS epidemic, WHO recommended screening travelers before their departure from affected areas on international flights for symptoms associated with SARS and advising travelers with symptoms to postpone travel. To date, WHO has not recommended screening passengers departing from a U.S. airport, and the United States has never instituted such a precaution, according to CDC officials. Aviation stakeholders have questioned the legal authority by which the United States could implement exit screening. According to CDC officials, such screening could be done under HHS's quarantine and isolation authorities.<sup>25</sup>

CDC regulations require pilots to immediately report to CDC any deaths or the occurrence of any travelers with signs or symptoms that may indicate a communicable disease infection during international flights coming to the United States.<sup>26</sup> In the case of an ill traveler, CDC guidance recommends that the aircraft's crew take practical measures to protect themselves and others. These measures may include avoiding direct contact with bodily fluids, and if indicated, isolating ill passengers who exhibit specific signs or symptoms consistent with a communicable disease, as well as providing ill passengers with tissues or a mask. In conducting its assessment, CDC may also request that aircraft crewmembers hand out information about health risks or collect and report information on a suspected ill passenger's travel history, as done during the recent Ebola epidemic in West Africa. According to CDC officials, reporting suspected ill travelers before the flight's arrival gives ground-based responders preparation time to provide for medical assessment and treatment of the traveler upon arrival, if warranted.

---

<sup>25</sup>42 U.S.C. § 264.

<sup>26</sup>CDC regulations require that "the commander of an aircraft destined for a U.S. airport shall report immediately to the quarantine station at or nearest the airport at which the aircraft will arrive, the occurrence, on board, of any death or ill person among passengers or crew." 42 C.F.R. § 71.21(b). CDC regulations define "ill person" (42 C.F.R. § 71.1). 42 C.F.R. Part 70.4 requires reports of suspected cases of communicable disease on interstate flights to be made to the local public health authority with jurisdiction for the arrival airport. ICAO standards require that notification be made to air traffic control authorities. FAA and CDC have an agreement on how notifications are relayed. See *Memorandum of Agreement between the Federal Aviation Administration and the Centers for Disease Control and Prevention*, October 26, 2010.

---

Once an aircraft with a suspected ill passenger approaches an airport, decisions about where to park the aircraft, how to respond to the suspected ill passenger, and how to deplane other passengers may be coordinated among stakeholders, according to ICAO guidance. Federal or local public health officials, first responders (e.g., fire or emergency medical technicians), airport authorities, air traffic control personnel, or a combination of these stakeholders may make these decisions and lead certain components of the response based on the situation and available response protocols or preparedness plans. If a communicable disease is confirmed, CDC is to follow established protocols and work with state and local public health authorities to assess and provide interventions to other travelers onboard the aircraft, if necessary.

Passengers infected with respiratory, gastrointestinal, or blood-borne communicable diseases may contaminate aircraft or airports with bodily fluids. Whether any measures beyond routine airline- and airport-cleaning practices are necessary will depend upon the characteristics of the disease in question, according to CDC guidance. For international flights, CDC may require additional cleaning or disinfection to prevent the transmission of a communicable disease.<sup>27</sup> Airline representatives told us that they may also opt for a more thorough decontamination as a precaution. Decontamination may be carried out by airport or airline staff or by contracted aviation-services firms.<sup>28</sup> During flights, cabin crew may clean potentially infectious material to protect other passengers, and CDC provides guidance on how to carry out this targeted cleaning. The occupational health and safety of airline, airport, or contracted aviation-service employees on the ground is overseen by OSHA, which sets and enforces workers' health and safety standards related to communicable diseases and provides guidance on personal protective equipment, decontamination, and handling waste contaminated by potentially infectious material, with certain exceptions.<sup>29</sup> On board an aircraft in

---

<sup>27</sup>42 C.F.R. § 71.32.

<sup>28</sup>According to FAA officials, any cleaning methods used to address a communicable disease threat must not negatively affect the airworthiness of the aircraft.

<sup>29</sup>OSHA considers occupational health and safety hazards faced by workers when prioritizing its inspections, including dangerous situations, fatalities, catastrophes, complaints, or referrals, among other criteria. This prioritization does not consider the potential for workers to spread occupational health hazards such as communicable diseases to the broader public. In the aviation system, the agency conducts new investigations based on reported safety incidents or worker allegations, according to agency officials.



---

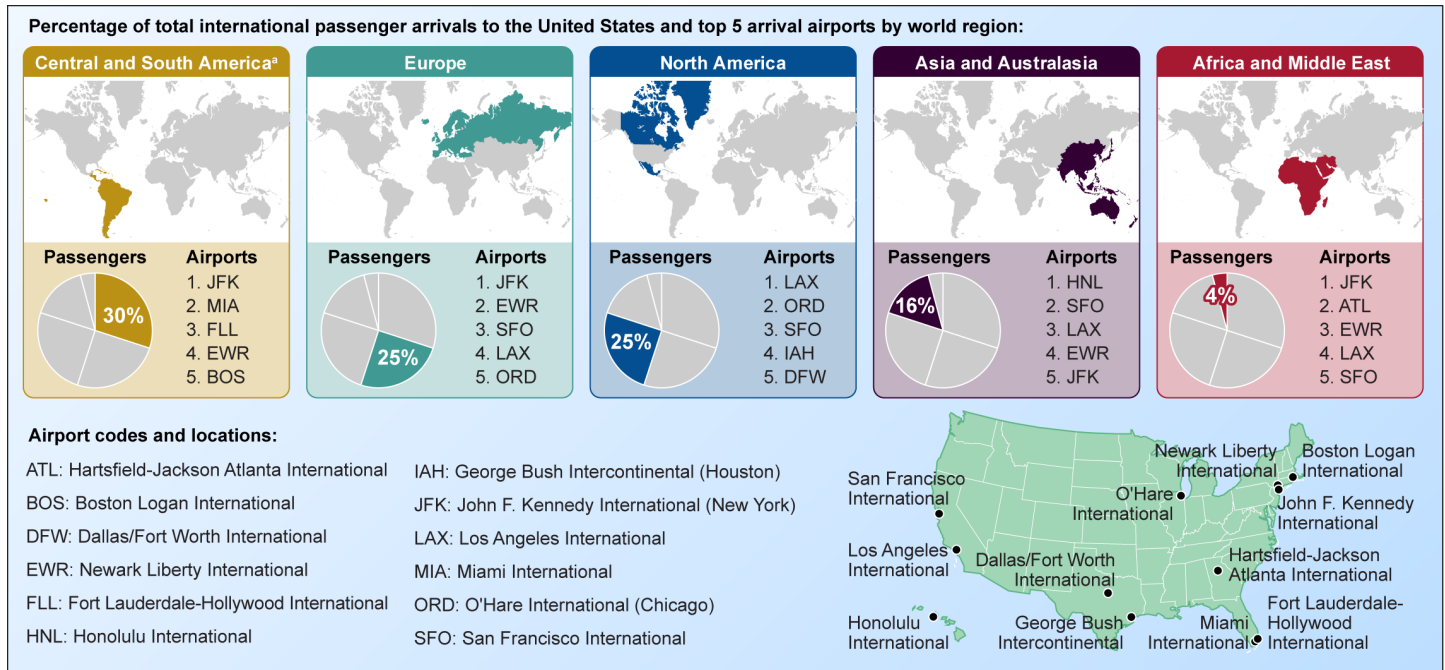
operation, responsibility for the health and safety of employees is divided between the FAA and OSHA. FAA is responsible for all working conditions of flight crew (i.e., pilots, flight engineers, and flight navigators) and for most, but not all, working conditions of cabin crew (e.g., flight attendants).<sup>30</sup>

According to DOT's origin-and-destination ticketing data, almost 52-million air passengers entered the United States from other countries in 2014, including returning U.S. citizens. While the United States does not receive non-stop commercial flights from all countries, including the West African countries that suffered the recent Ebola outbreak, passengers come from every corner of the globe and fly into airports both large and small. Figure 3 shows passenger arrivals from five regions of the world and the top five airports receiving passengers whose travel originated from each of these regions in 2014 (for a total of 12 airports), based on the original departure airport in the ticket itinerary. Together, these 12 airports received about 50 percent of the total number of passengers coming into the United States from abroad in 2014—accounting for more than 25 million passenger arrivals.

---

<sup>30</sup>OSHA standards are not applicable to working conditions onboard an aircraft while it is in operation, with the exception of OSHA's standards on hazard communication, blood-borne pathogens exposure, and occupational noise exposure under a memorandum of understanding (MOU) between the agencies. An aircraft is in operation from the time it is first boarded by a crewmember, preparatory to a flight, to the time the last crewmember leaves the aircraft after completion of that flight. See *Memorandum Of Understanding Between The Federal Aviation Administration U.S. Department Of Transportation And The Occupational Safety And Health Administration U.S. Department Of Labor*, August 26, 2014.

**Figure 3: Top Five U.S. International Arrival Airports for Five Global Regions, 2014**



Sources: GAO analysis of Department of Transportation data and Map Resources. | GAO-16-127

<sup>a</sup>Central and South America region includes the Caribbean.

Even if an ill passenger on an international flight is not detected while onboard an aircraft, he or she may be identified after arrival during the customs and immigration inspection process. After an international flight arrives in the United States, passengers are to undergo routine inspection or possibly enhanced screening for communicable diseases under authorities held by HHS<sup>31</sup> and DHS (by agreement).<sup>32</sup> During primary inspection, CBP staff are expected to visually observe arriving international travelers for certain signs and symptoms of communicable diseases during their routine interactions with travelers and then notify

<sup>31</sup>HHS has statutory responsibility for preventing the introduction, transmission, and spread of communicable diseases into the United States and between the states. 42 U.S.C. §§ 264, 265.

<sup>32</sup>In 2005, DHS and HHS signed an MOU outlining cooperative efforts to enhance the nation's preparedness against the introduction, transmission, and spread of quarantinable and serious communicable diseases from foreign countries into the United States and its possessions.

---

CDC, as appropriate.<sup>33</sup> CBP and CDC may investigate further by asking specific questions during primary inspection—such as inquiring about travel to affected areas—or by conducting additional assessments such as taking body temperatures during secondary or tertiary screening.

For passengers who are asymptomatic (not displaying symptoms) but at heightened risk for a communicable disease, CDC officials may also establish a means of ongoing monitoring.<sup>34</sup> For example, asymptomatic passengers from Ebola-affected countries—Guinea, Liberia, and Sierra Leone<sup>35</sup>—receive a Check and Report Ebola (CARE) kit upon arriving in the United States if they are found to be at heightened risk of exposure. The kit contains guidance and tools to measure and report symptoms to local public health officials for the 21-day disease incubation period. Local public health authorities are responsible for protecting public health within their jurisdictions.<sup>36</sup> While CDC and state and local public health agencies coordinate closely on many issues, state and local public health authorities may, at their discretion and based on their legal authority, impose restrictions or requirements in their jurisdictions that are more stringent than those issued by CDC.<sup>37</sup>

In certain extraordinary circumstances, passengers or flights from areas experiencing a communicable disease outbreak could be redirected to designated U.S. airports with the capacity to receive them. This process is commonly referred to as “funneling,” and it may involve re-routing passengers by changing their itineraries or directing flights to certain

---

<sup>33</sup>CBP has jurisdiction over immigration and customs and—together with its DHS partner organizations—assists HHS by enforcing quarantine rules and regulations. 42 U.S.C. § 268(b); see also 42 U.S.C. § 97 (including quarantines imposed under state laws). CBP officers are trained to identify signs and symptoms of communicable disease of public health concern in travelers.

<sup>34</sup>According to CDC officials, implementation of such measures is extremely rare and would require cooperation with state and local public health departments.

<sup>35</sup>Given the spread of the Ebola epidemic, additional screening questions were also directed at travelers from Mali and Nigeria for a period of time.

<sup>36</sup>In general, state and local public health authorities are responsible for protecting public health within their jurisdictions, which may, at times, overlap with federal authority.

<sup>37</sup>During the Ebola outbreak, for example, some jurisdictions put limits on the movement of asymptomatic travelers returning from affected countries in West Africa. Likewise, monitoring ranged from in-person checkups by medical personnel in some jurisdictions to travelers from the affected countries entering data themselves through an online portal.

---

airports. Beginning in October 2014, for example, CBP directed all flights to the United States with passengers whose recent travel included Ebola-affected countries to be routed to one of the following five designated airports where CBP and CDC staff conducted enhanced entry screening procedures:<sup>38</sup>

- John F. Kennedy International Airport,
- Newark Liberty International Airport,
- Washington Dulles International Airport,
- Hartsfield-Jackson Atlanta International Airport, and
- Chicago O'Hare International Airport

Prior to passenger re-routing by airlines, these five airports accounted for 94 percent of existing arrivals from the affected countries in West Africa (Guinea, Liberia, and Sierra Leone), according to CBP officials, all of which arrived on connecting flights through other countries.<sup>39</sup> Travelers who might have arrived at a different airport are now re-routed by airlines—or “funneled”—to arrive at one of these five designated airports. Any non-military U.S. health personnel returning from the Ebola-affected countries also have to return via these airports and go through enhanced screening.

Airports that are not designated to receive passengers from areas affected by a communicable disease outbreak may still encounter individuals who have recently traveled from affected areas even when funneling has been put in place. There have been Ebola-related responses at airports that were not identified for funneling, for example. One way this could happen is by a passenger traveling on a “broken ticket”—a separate itinerary for travel between the affected country and the United States via an intermediate destination, such as a country in Europe. In this instance, a passenger from an affected country may have bought two tickets—one to Europe and a separate ticket to the United

---

<sup>38</sup>CBP has authority under 19 U.S.C. § 1433(c) and 19 C.F.R. § 122.32 to limit the locations where aircraft entering the United States from abroad may land. CBP announced that all flights to the U.S. carrying persons who have recently traveled to, from, or through Ebola-stricken countries were to arrive at one of these five U.S. airports. 79 Fed. Reg. 63313 (Oct. 23, 2014).

<sup>39</sup>As of September 21, 2015, enhanced entry screening was discontinued for travelers coming to the United States from Liberia, following two incubation periods (42 days) since the last survivor tested negative for Ebola in that country. As of October 20, 2015, funneling was still in place for travelers from Guinea and Sierra Leone.

---

States, following a layover. Another scenario is that a passenger could have transferred to a domestic flight after passing through a designated airport and developed symptoms of infection on the later flight. In cases such as these, CDC officials or local public health authorities, or both, may conduct public health assessments and follow-up activities.

---

---

## Airports and Airlines That We Reviewed Have Plans, but a Comprehensive National Aviation-Preparedness Plan Does Not Exist

---

### Airports and Airlines That We Reviewed Generally Have Communicable-Disease Preparedness Plans

#### Airports and Airlines We Reviewed Have Preparedness Plans

All of the 14 airports and three airlines we reviewed have plans—often contained in multiple documents—in place for responding to communicable disease threats from abroad. The plans in place for each airport and airline generally address the high-level components that we identified as common among applicable federal and international guidance.<sup>40</sup> We identified these components to provide a basis for

---

<sup>40</sup>For airports, we identified six high-level components through review of DOT's and HHS's *National Aviation Resource Manual for Quarantinable Diseases* and ACI's and ICAO's airport preparedness guidelines for outbreaks of communicable disease. After identifying these components, we used corroborating information about high-level components for communicable-disease preparedness that we obtained from DOT and FAA officials, a representative of CAPSCA, and some airport representatives. For airlines, we identified four components through review of IATA's emergency-response plan template for air carriers.

---

assessing the breadth of the plans, not to evaluate the sufficiency of the plan's contents or the level of preparedness that the plans provide.

We found the plans in place at each of the 14 airports addressed the following six high-level components:

1. Establishment of an incident command center.
2. Coordination among various stakeholders.
3. Selection and use of personal protective equipment for various stakeholders.
4. Training for various stakeholders.
5. Some protocols for responding to a threat, such as meeting the aircraft, maintaining a quarantine area, or transporting a suspected ill passenger.
6. Protocols for decontamination.

The plans in place at each airport were developed by, or in collaboration with relevant airport stakeholders, including airport operators, first responders, state and local public health representatives, and officials from CDC and CBP, as applicable. Not all airports had a separate communicable-disease preparedness plan that alone addressed all six high-level components. For example, when asked about communicable-disease preparedness planning, representatives from 11 of the 14 airports reported that the procedures for responding to these threats at their airport were contained in multiple documents,<sup>41</sup> ranging from a general emergency preparedness plan, such as the airport-emergency plan (AEP)—required by FAA regulations, but not required to specifically address communicable diseases<sup>42</sup>—to a disease-specific preparedness plan, such as a pandemic influenza response plan. Other types of

---

<sup>41</sup>Representatives from the remaining three airports reported that procedures for responding to communicable disease threats at their airport were contained in one document.

<sup>42</sup>14 C.F.R. § 139.325. FAA provides airport operators guidance, in the form of an *Advisory Circular*, for development and implementation of an AEP. FAA AC 150/5200-31C. The *Advisory Circular* recommends that airports structure their plans using a functional approach, which strives to avoid duplication of a planning effort for every hazard and task. Thus, it provides some guidance to airports for developing basic emergency response procedures, such as assigning responsibilities for emergency operations, which are relevant to the response to any type of emergency—including communicable disease threats.

---

documents included a checklist for first responders; standard-operating procedures for a specific disease, such as Ebola; and CDC's communicable-disease response plans (which are discussed more below). During the Ebola outbreak, representatives from eight airports that we reviewed reported developing an additional Ebola-specific response plan or adapting an existing plan.

All three of the airlines we reviewed have a preparedness plan for responding to communicable disease threats. The plans themselves were not available to us because of their proprietary nature; however, based on our conversations with airline representatives and a review of summary information regarding their plans, we can report that the three airlines' plans addressed the following four high-level components:

1. Establishment of emergency response team and designation of emergency response center.
2. Description of the triggers that inform the level and nature of a response.
3. Activation triggers for the response team and response center.
4. Identification of roles and responsibilities for relevant stakeholders.

Furthermore, all three airlines stated that they carry universal precaution kits that include equipment to respond to suspected communicable diseases onboard aircraft flying internationally.<sup>43</sup>

As noted above, some airports have in place a CDC communicable-disease response plan (CDRP)—specifically 18 total airports that currently have (or had) a CDC quarantine station on site, 11 of which were included in our review. CDRPs fulfill part of WHO's IHR obligations for establishing core capacity at designated points of entry.<sup>44</sup> The CDRPs, according to CDC officials, were developed in coordination with relevant

---

<sup>43</sup>ICAO provides guidance in Annex 6 to the Chicago Convention on the type, number, location, and contents of medical supplies to be carried on aircraft, including the typical contents for a universal precaution kit—which may be used to clean up potentially infectious materials and to protect cabin crew members who are assisting potentially infectious passengers.

<sup>44</sup>Core capacities at airports for responding to events that may constitute a public health emergency of international concern include providing appropriate public health emergency response by establishing and maintaining a public health-emergency contingency plan. WHO, IHR (2005) – 2<sup>nd</sup> ed., Annex B.

---

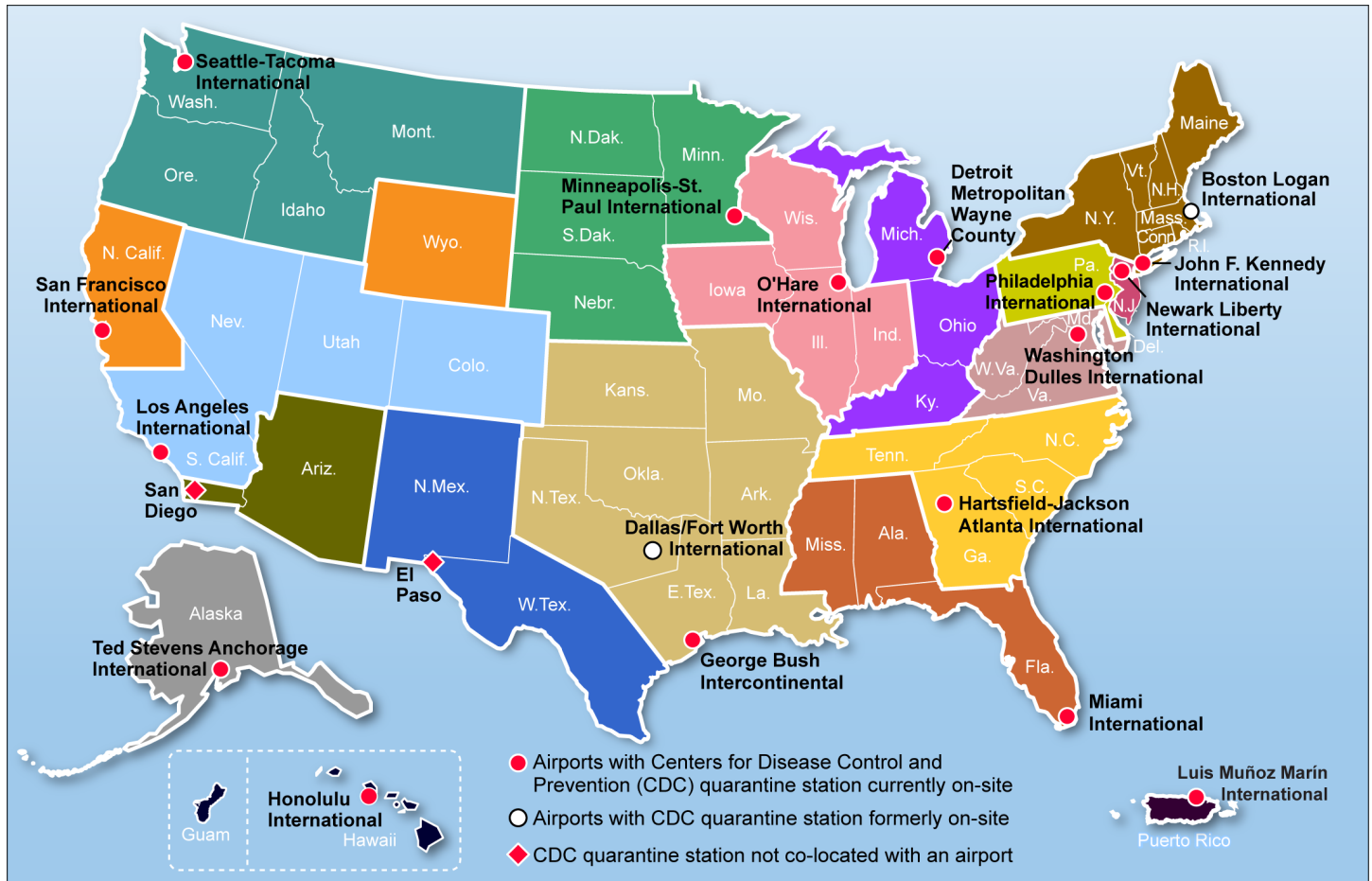
stakeholders and partners at each airport and based on a framework provided by CDC to airport quarantine stations. The existence of a CDRP at an airport does not preclude an airport operator or other airport stakeholders from developing and maintaining one or more additional preparedness plans or documents. In fact, representatives from all but one of the airports that we reviewed that have a CDRP reported having additional preparedness documents (10 of 11 airports). Representatives from 3 of those 10 airports that reported having plans contained in multiple documents do not view the CDRP as the airport's main preparedness plan for communicable diseases. One CDC official from the Quarantine and Border Health Services Branch noted that CDRPs at some airports are more developed than others and recognized that CDC quarantine staff in collaboration with relevant airport stakeholders are continually updating and improving the CDRPs. Figure 4 shows the 16 U.S. airports that currently have a CDC quarantine station and the 2 airports that formerly had one.<sup>45</sup> Each of these quarantine stations is also responsible for enforcing quarantine regulations at all airports within its assigned jurisdiction.

---

<sup>45</sup>According to CDC officials, the closure of the CDC quarantine stations at Dallas/Fort Worth International and Boston Logan International airports is temporary and was a result of budget constraints.



**Figure 4: U.S. Airports with Centers for Disease Control and Prevention Quarantine Stations, 2015**



Sources: CDC and Map Resources. | GAO-16-127

DOT officials told us that in 2010, DOT and the aviation industry requested that CDC expand its outreach to further the development of CDRPs beyond airports with quarantine stations on site to airports without them.<sup>46</sup> CDC officials told us that since that request, the agency has been working to expand the coverage of CDRPs to select U.S. airports. These

<sup>46</sup>The request resulted from a series of meetings convened by DOT at the request of the aviation industry and attended by representatives from HHS, DHS, DOT, and the aviation industry to discuss standardized entry and exit screening at airports. According to DOT officials, the request did not specify which airports to extend CDC's outreach, in part because, at that time, CDC was resistant to any expansion.

---

officials told us that they are in the process of identifying priority airports using criteria that include the number and origins of arriving international passengers. These officials reported that at least three airports (one of which was included in our review) without quarantine stations on site have already collaborated with CDC to develop an airport preparedness plan for communicable disease threats.<sup>47</sup> According to these officials, however, CDC response efforts to disease outbreaks, such as the cholera outbreak following the Haiti earthquake in 2010, have slowed these outreach efforts. CDC officials said they hope to complete this effort in the next several years, but do not have a specific established completion date.

FAA officials told us that they encourage airports and airlines to develop preparedness plans for communicable disease threats. For example, in July 2009, FAA Office of Airport Safety and Standards issued a CertAlert<sup>48</sup> to FAA airport inspectors to encourage airport operators to either update their pandemic flu plans—plans that airports may have developed in response to the avian influenza threat of H5N1 that began in 2003—or, for those that did not have a plan, to develop such a plan for their airport. In late 2014, FAA officials told us that they began planning an update of the July 2009 CertAlert, but it was delayed due to the Ebola response. As of August 2015, no updated CertAlert has been issued.

FAA officials told us that they do not track or review airport or airline plans—in part because they lack adequate public health expertise, which they believe CDC would have, to assess whether an airport's or airline's plan would be effective at preventing or reducing the spread of communicable diseases. FAA officials further noted that communicable diseases rarely threaten the safety of flight, which is FAA's primary regulatory jurisdiction. CDC officials in the Division of Global Migration and Quarantine office told us that they review CDRPs every 2 years at the 16 airports with quarantine stations currently on-site, and the CDC quarantine station staff at the airport review them during the in-between years. However, CDC officials noted that they do not formally track the

---

<sup>47</sup>For the purposes of our review, we do not consider these plans to be CDRPs since they are at airports that do not currently have—or did not formerly have—a CDC quarantine station on site.

<sup>48</sup>CertAlert 0912. According to FAA, CertAlerts give FAA's Airports Safety and Operations Division a quick way of providing additional guidance on Airport Certification and related issues to FAA inspectors and staff.

---

development of any preparedness plans for communicable disease threats at airports that do not currently have a quarantine station on site.

Airports and airlines are not required to develop and maintain preparedness plans for communicable disease threats. And neither FAA nor CDC systematically tracks which airports and airlines have such plans. Thus, FAA and CDC officials could not tell us the full extent to which airports that receive international passengers and airlines that operate international flights have preparedness plans in place. The 18 airports with CDRPs accounted for about 58 percent of the international arriving passengers to the United States in 2014. These 18 airports— together with the 3 airports we reviewed without CDRPs, but with their own preparedness plans—accounted for about 65 percent of the international arriving passengers in 2014 (or about 34 million of the almost 52-million total).

#### A Variety of Entities Provide Resources to Help Develop Plans

A variety of entities, including FAA, CDC, state and local public health entities, and international sources, provide resources to help airports and airlines develop communicable-disease preparedness plans. In 2006, DOT, in coordination with CDC, published the *National Aviation Resource Manual for Quarantinable Diseases*,<sup>49</sup> which provides guidance for airports and airlines on how to develop a communicable-disease preparedness plan that can be adapted and implemented for a variety of sizes and types of communicable disease threats. When we asked representatives from three airports specifically about DOT guidance for preparedness plans during interviews, representatives from two airports were familiar with the Manual, but noted that it was outdated. An official from DOT's Office of Intelligence, Security, and Emergency Response told us that DOT has no plans to update it, in part, because in DOT's view, everything contained in the document can be found on other websites and doing so might create a document that could not be rapidly updated, as might be necessary in facing an emerging public health threat.

The guidance for specific disease threats that is published by CDC also provides some information for those attempting to develop plans or procedures for responding to a specific disease threat. For example, CDC

---

<sup>49</sup>Oak Ridge Institute for Science and Education, *National Aviation Resource Manual for Quarantinable Diseases*, a report prepared for the Department of Transportation (December 2006).

---

published several guidance documents for airport and airline employees regarding Ebola, including guidance for personal protective equipment for airport and airline cleaning crews and interim guidance about Ebola infection for airline crews, cleaning personnel, and cargo personnel.<sup>50</sup> Local public health entities also provide resources, such as public health advisories, that airports reported using to help develop such plans.

Finally, some international guidance and technical assistance is available to airports and airlines in developing communicable disease plans.<sup>51</sup> For example, in 2009, ACI, in collaboration with ICAO, published the *Airport Preparedness Guidelines for Outbreaks of Communicable Disease* to help airports.<sup>52</sup> Through CAPSCA, ICAO works to bring international, regional, national, and local organizations together to combine efforts and develop a coordinated approach to respond to public health risks. CAPSCA's efforts include providing voluntary visits to airports to help them prepare for communicable disease threats.

---

## The United States Lacks a Comprehensive National Aviation-Preparedness Plan

### ICAO Standard Obligates Member States to Establish a National Aviation-Preparedness Plan

In 2007, ICAO adopted a standard that obligates each ICAO member state to establish a national aviation-preparedness plan for communicable disease outbreaks that pose a public health risk or public health emergency of international concern.<sup>53</sup> In 2010, ICAO, by resolution,<sup>54</sup> further urged member states to ensure that the public health sector and

---

<sup>50</sup><http://www.cdc.gov/quarantine/air/managing-sick-travelers/ebola-guidance-airlines.htm>.

<sup>51</sup>The National Academies' Aviation Cooperative Research Program also issues guidance, such as the Transportation Research Board's *Airport Cooperative Research Program, Report 91* that recommends mitigation measures at airports and on aircraft, but is not guidance for developing a communicable disease preparedness plan.

<sup>52</sup>ACI and ICAO, *Airport Preparedness Guidelines for Outbreaks of Communicable Disease*, Revised (April 2009).

<sup>53</sup>Section F of Annex 9, subparagraph 8.16.

<sup>54</sup>ICAO, International Civil Aviation Organization Assembly, Res. A37-13 (November 2010).

---

the aviation sector collaborate to develop a national preparedness plan for aviation to help prevent the spread of communicable diseases through air travel, and that member states establish requirements for the involvement of stakeholders, such as airport operators and airlines, in the development of the plan. In guidance to member states for developing a national aviation-preparedness plan, ICAO recommends that such a plan include guidance that is generic to all communicable diseases. This guidance can then be adapted for specific diseases. Officials from the DOT office responsible for coordinating U.S. policy for presentation to ICAO told us that it is the responsibility of each member state to either implement regulations or other appropriate measures to comply with ICAO standards or to file a “difference” with ICAO.<sup>55</sup>

While the United States has not developed a national aviation-preparedness plan for communicable disease outbreaks, DOT and CDC officials contend that some elements of such a plan already exist. Specifically, officials from DOT’s Office of Intelligence, Security, and Emergency Response and FAA’s Office of National Security Programs and Incident Response, as well as CDC’s Division of Global Migration and Quarantine, told us that some elements of a national aviation-preparedness plan are encompassed in various documents that include airports’ individual plans, including CDRPs at airports with quarantine stations on site. However, FAA reported to ICAO in 2010—by way of answering an ICAO questionnaire on member states’ fulfillment of this standard<sup>56</sup>—that individual airport plans are intended to handle one or two flights with inbound passengers and not respond to a full epidemic, which may require a response involving multiple airports on a national level. Officials from CDC’s Division of Global Migration and Quarantine also told us that while the United States does not have a national aviation-preparedness plan, past planning efforts, such as the 2005 *National Strategy for Pandemic Influenza* and its associated 2006 implementation

---

<sup>55</sup>A difference filing does not necessarily signify that a member state is in noncompliance; for example, a difference filing could signify that a member state’s current regulations are different in character, but achieve the same objective by other means.

<sup>56</sup>International Civil Aviation Organization, *State Letter EC 6/22-10/51* (June 22, 2010).

---

plan developed in response to the avian influenza threat of H5N1,<sup>57</sup> as well as CDC's Risk-Based Border Strategy (RBBS),<sup>58</sup> helped inform their decision making in the national-level response to Ebola as this response pertained to the screening and risk assessment of passengers arriving from the affected countries. The pandemic influenza national strategy and implementation plan, however, are neither aviation-specific nor designed to address communicable disease outbreaks of various types (e.g., different diseases), as we have found in past work.<sup>59</sup> Furthermore, CDC officials told us that the RBBS has been superseded by CDRPs, which represent the most up-to-date preparedness efforts at U.S. airports.

DOT and CDC officials also told us that while a national aviation-preparedness plan could have value, they do not believe that their respective agencies should be the lead in the development of such a plan. DOT officials said that a national aviation-preparedness plan for communicable disease outbreaks would be valuable to support a unified approach where multiple entities, including DOT, have input into the plan's development and can then test and exercise the plan. These officials also noted that while DOT's Office of the Secretary serves as the liaison to ICAO for Annex 9 to the Chicago Convention, in which the relevant ICAO standard is contained, complying with an ICAO standard

---

<sup>57</sup>In 2005, the Homeland Security Council issued the *National Strategy for Pandemic Influenza*, which identified three pillars of the National Strategy including preparedness and communication, surveillance and detection, and response and containment. In turn, the 2006 *National Strategy for Pandemic Influenza Implementation Plan* identified actions and expectations for federal agencies under each pillar to make effective international and domestic transportation decisions in order to maintain infrastructure services, mitigate adverse economic impacts, and sustain societal needs in the case of a pandemic influenza threat. The implementation plan focuses not only on transportation, but also on protecting human and animal health, law enforcement, and institutions, among other areas. Developed in response to the avian influenza threat of H5N1 that began in 2003, the strategy has not been updated to address other types of communicable diseases.

<sup>58</sup>In response to a requirement in the 2006 pandemic influenza implementation plan that required federal agencies to develop a strategy for border intervention that could be used during pandemics, CDC designed a strategy referred to as the Risk-Based Border Strategy (RBBS), which officials described as a flexible and scalable strategy for designing appropriate entry-screening at airports.

<sup>59</sup>In 2011, following the H1N1 pandemic, we found that the federal government did not activate some aspects of the pandemic influenza national strategy and implementation plan in response to H1N1 (such as critical infrastructure protection and border and trade measures) because they were not relevant given the specific characteristics of the disease outbreak. See [GAO-11-632](#).

---

could be led by any number of other federal agencies. DOT officials believe that while DOT should be a key contributor to the development of a national aviation-preparedness plan, HHS should be the lead federal agency in developing such a plan, in part because DOT does not have sufficient public health expertise, which they believe HHS does. CDC officials noted that since communicable disease is just one of many threats to the commercial aviation sector, a broader, all-hazards national aviation plan that includes communicable disease as a component may be more prudent or warranted.<sup>60</sup> These officials also noted that a stand-alone plan may not be necessary, as they believe that the elements currently in place are sufficient, as reflected in the successful national Ebola response effort. Yet these officials also stated that they could see value in aspects of a national aviation-preparedness plan where stakeholders come together to discuss preparedness, resulting in a document that is collaborative and likely agreed upon by relevant parties. CDC officials told us that if a national aviation-preparedness plan were to be developed, DOT would be in the best position to lead the effort because FAA and DOT have stronger and deeper ties to the relevant stakeholders that would be involved in such a broad effort. While the DOT and CDC may not agree on which agency should lead the development of a national aviation-preparedness plan, DOT's Office of the Secretary is the liaison to ICAO for Annex 9 to the Chicago Convention, in which the relevant ICAO standard is contained, and is responsible for overseeing the aviation sector.

#### A National Plan Aims to Provide an Adaptable and Scalable Framework

ICAO's guidance to member states in developing a national aviation-preparedness plan also recommends that such a plan contain guidance that is generic to all communicable diseases and can be adapted to

---

<sup>60</sup>In 2011, the White House released Presidential Policy Directive 8 (PPD-8) that aims to facilitate an integrated, all-of-nation, capabilities-based approach to preparedness. PPD-8 defined five mission areas—Prevention, Protection, Mitigation, Response, and Recovery—and directed the development of a series of policy and planning documents to enhance national preparedness. The White House, *Presidential Policy Directive 8 on National Preparedness* (Washington, D.C.: Mar. 30, 2011). Among the planning documents, DHS has included several functional and incident-specific annexes, which describe the principles, roles and responsibilities, and coordinating structures for delivering the core capabilities to support PPD-8. The current annexes are neither targeted to the needs of the aviation sector, nor do they provide detailed information on preparing for and responding to human communicable disease incidents, specifically. For example, the Biological Incident Annex notes that specific operational guidelines, developed by respective organizations to address their unique planning considerations, will supplement this annex.

---

specific diseases. It also recommends that specific measures adopted at individual airports correspond to defined communicable disease threat alert levels, such as WHO's pandemic alert phases or a national public-health authority's alert levels, to help ensure that procedures are scaled up and down as circumstances of the public health threat change. Adopting measures that correspond to different risk levels or types of diseases would provide individual airports with an adaptable and scalable framework with which to align their plans—without which airports could find it challenging to prepare for a national response effort. For example, representatives from four airports that were not designated to conduct enhanced-screening for Ebola reported developing their own Ebola-specific response plans during the Ebola outbreak—sometimes with and sometimes without input from federal stakeholders. The airports did this in part because they did not know what their responsibilities would be in the long run or to what extent they would need to have procedures in place in the event that a suspected ill passenger was traveling on a broken ticket.<sup>61</sup> An adaptable and scalable framework would subsequently improve harmonization of individual plans across airports and airlines—helping ensure that the individual plans work in accordance with one another for a national level response effort—and serve as the basis for training airport and airline staff and crew.<sup>62</sup> For example, representatives from one airport told us that, in their view, many airports had good efforts under way to respond to Ebola, but that the efforts were fragmented across airports leaving passengers and airlines to deal with differences in how travel is handled at each airport.

Public-Health and Aviation  
Sector Coordination Has Been  
Insufficient

ICAO guidance to member states for developing a national aviation-preparedness plan for communicable disease outbreaks states that implementation of any measures within a preparedness plan should be a well-coordinated multi-agency effort to avoid confusion, inconsistencies, and duplication of resources, as well as minimize inconvenience to

---

<sup>61</sup>A broken ticket involves a person traveling on a separate itinerary for travel between the affected country and the United States via an intermediate destination, such as from a country in Africa to a county in Europe on the way to the United States.

<sup>62</sup>WHO also states, in guidance to national public-health authorities in preparedness planning at designated points of entry, that individual plans need to be aligned with each other in order for tasks and actions to flow seamlessly from the national to the local level, particularly during response to public health threats at a national level. WHO, *International Health Regulations (2005): A Guide for Public Health Emergency Contingency Planning at Designated Points of Entry* (2012).



---

travelers. DOT officials reported not being involved in or consulted on the decision to funnel passengers from Ebola-affected countries to five airports and implement enhanced entry-screening procedures. And while the officials believe that funneling passengers was a good decision in the case of the Ebola threat, they expressed concern about what might happen during future national-level communicable disease response efforts if decisions affecting aviation are made without their input. For example, in response to the avian influenza threat of H5N1 that began in 2003, national efforts included discussions on funneling all international passengers through 30 U.S. airports and screening all arriving passengers—an option provided under RBBS.

Representatives from three of the four airports that we spoke with about this issue, as well as ACI representatives, expressed concern that funneling all arriving international passengers to 30 airports and screening them was unrealistic due to the resource requirements it would impose on airports and delays that could ripple across the national airspace system. DOT officials further noted that from an air traffic control perspective, many major U.S. airports are already at or near full capacity and shifting a significant amount of air traffic to these airports could result in gridlock. CDC officials acknowledged that funneling passengers to 30 airports and screening them all was a worst-case scenario and pointed out that RBBS was designed to be flexible and scalable and to serve as an adaptable framework for entry-screening at airports, as the RBBS framework did for the Ebola outbreak. DOT officials highlighted that because the number of passengers coming from the Ebola-affected countries is quite small relative to the total number of international passengers entering the United States (less than 25,000 out of almost 52-million total passenger arrivals in 2014), the impact from re-routing passengers to five airports and the time and resources needed to conduct the enhanced screening did not result in an unreasonable impact on the national aviation system. This may not be the case if the communicable disease threat were to come from China, for example, or another region with large numbers of passengers or flights to the United States.<sup>63</sup>

DOT officials also reported that they did not always have the opportunity or were provided insufficient time to review or comment on CDC Ebola guidance or fact-sheets addressed to aviation stakeholders. For example,

---

<sup>63</sup>China accounted for almost 1.5-million passenger arrivals in 2014.

---

a DOT official told us that because similar information was often posted in multiple places and because documents that the officials had reviewed in the past got renamed, revised, and re-published, the DOT official had to continue to watch out for published CDC guidance that included recommendations for the aviation industry. The DOT official highlighted that CDC guidance did not always have the DOT issues portrayed correctly and that failure to adequately coordinate with DOT could have safety consequences in some circumstances. For example, if a disinfectant that is used to clean suspected Ebola contamination is not compatible with the aircraft materials (e.g., aluminum) or is used in the wrong manner, such as using too concentrated a solution, the aircraft could be damaged, which could negatively affect its airworthiness. Officials from CDC's Division of Global Migration and Quarantine acknowledged that some CDC webpages about Ebola developed prior to the beginning of the Ebola outbreak in 2014 contained misinformation related to aircraft disinfectants, but noted that the information was promptly removed once officials became aware of the problem. These officials also told us they sought DOT's input in guidance relevant to aviation, but acknowledged that at times during the Ebola outbreak, things moved very quickly and webpages were reorganized to make information easier to find.

---

## Airports, Airlines, and other Stakeholders Faced Challenges Responding to Communicable Disease Threats and Are Taking Some Actions as a Result

While aviation stakeholders we spoke with reported having plans that address communicable diseases, they also reported facing multiple challenges in responding to threats and taking actions to address these challenges. Aviation stakeholders that we spoke with reported challenges in responding to communicable disease threats including obtaining guidance, communicating, coordinating among responders, and assuring employees have appropriate training, equipment, and sanitary workplaces. To address these challenges, aviation stakeholders reported taking actions such as developing communication tools and strategies; reviewing, exercising, and improving response plans; and providing training, equipment, and cleaning supplies. A national aviation-preparedness plan could serve as the basis for testing communication mechanisms among responders to ensure those mechanisms are effective prior to addressing a communicable disease outbreak. It could also serve as the basis to ensure that airport and airline staff have received appropriate training and access to properly maintained equipment to reduce the risk of exposure to communicable diseases during an outbreak.

---

## Guidance and Communication Challenges

Stakeholders at 12 of the 14 airports we spoke with reported challenges in obtaining guidance on how to respond to communicable disease threats or in communicating during specific incidents. Various stakeholders including federal agencies, airports, airlines, and contracted aviation-services employers reported taking actions to improve access to timely guidance and communication. As we have found in prior work, planning efforts and exercises can help develop relationships between federal officials and stakeholders that are useful in responding to communicable diseases.<sup>64</sup> Moreover, ICAO recommends that national aviation-preparedness plans include a communication system and emphasizes the importance of periodically testing this communication system.

## Guidance from Federal Agencies

Representatives at 7 of the 14 airports we spoke with reported difficulties obtaining prompt and clear guidance from federal agencies including CDC, CBP, and FAA on how to respond to specific communicable disease threats including Ebola. According to CDC, CDC Quarantine Station officials referred airport questions about the Ebola response to CDC headquarters to ensure airports received consistent guidance that reflected the most up-to-date information. However, representatives at 3 of the 10 airports with Quarantine Stations with whom we spoke said that CDC headquarters did not provide requested guidance within short time frames. Representatives from two airports said the initial federal response to Ebola was not clear because it did not correspond to a national plan or unified approach with which the representatives were familiar. In addition, a representative at another airport reported experiencing confusion determining the magnitude of the threat that Ebola posed and what guidance to follow given that FAA did not address these issues.

CDC officials we spoke with described inherent challenges to providing prompt guidance on the recent Ebola threat, as well as actions the agency took to address airports' and airlines' information needs during the response. Communicable disease outbreaks are unpredictable by their very nature. CDC officials told us that information evolved during the Ebola response and that answers to particular questions were not always readily available. In these instances, CDC formulated responses with the assistance of leadership and subject-matter experts. According to officials, CDC dedicated additional resources to provide in-depth and

---

<sup>64</sup>[GAO-11-632](#).

---

timely Ebola guidance, and met with aviation industry partners both collectively and individually.

## Communications during Flight

Airport-emergency responders at 6 of the 14 airports we interviewed told us that airlines sometimes do not provide them with information that is as complete, accurate, and immediate as they would like when a traveler becomes ill during a flight. CDC officials also told us that information provided by airlines or air traffic control to CDC was often incomplete or inaccurate. While CDC requires pilots on international flights to U.S. airports to immediately notify CDC of ill travelers suspected of having a communicable disease<sup>65</sup>—as determined by signs and symptoms—flight crews must focus on safely operating the aircraft during critical phases of a flight such as takeoffs and landings.<sup>66</sup> This situation may preclude immediate notification, according to CDC officials. Furthermore, CDC officials and some responders we spoke with said that ill travelers or their caregivers may be reluctant or unable to share information, cabin crew may lack expertise in assessing relevant medical conditions, and information may develop inaccuracies as it passes from passenger to flight attendant to pilot to various ground-based responders. CDC officials also stated that a lack of proper equipment (thermometer, for example) on the aircraft may limit flight crews from providing a rapid and detailed notification of illness. CDC makes available guidance and tools to report traveler death or disease that outline reporting requirements and requested information.<sup>67</sup> However, airport responders and CDC officials said that airlines do not use a common template to record or communicate this requested information. Inaccurate or untimely information can slow down an appropriate response (such as conducting assessments before travelers have exited the aircraft) or trigger precautions unnecessarily. For example, representatives at one airport described launching an Ebola response after being alerted by an airline of a suspected case, only to discover that the passenger was traveling from

---

<sup>65</sup>42 C.F.R. § 71.21(b).

<sup>66</sup>Under FAA regulations, “No certificate holder shall require, nor may any flight crewmember perform, any duties during a critical phase of flight except those duties required for the safe operation of the aircraft.” 14 C.F.R. § 121.542.

<sup>67</sup>42 C.F.R. § 71.21(b). Requested information includes aircraft identification, departure airport, destination airport, estimated time of arrival, number of persons on board, number of suspected cases on board, and the nature of the public health risk, if known. HHS, Centers for Disease Control and Prevention, *For U.S. Arrivals: CDC Death and Disease Reporting Tool for Pilots* (Washington, D.C.: August 2014).

---

East Africa—rather than an Ebola-affected area in West Africa—and suffering from a fear of flying rather than a physical illness.

Airport, airline, and other stakeholders have taken actions to improve communication about ill travelers during flights including real-time consultations with emergency medicine consultants, evaluating telemedicine technologies, and dedicating a radio frequency for emergencies to enable communication during flight with ground-based medical responders. See appendix II for additional information about technologies used to respond to communicable disease threats. In addition, CDC officials said that they conduct follow-up investigations when they receive reports of suspected communicable disease incidents on flights that airlines did not report and that CDC addresses with airlines any deficiencies found.

Aviation stakeholders have developed various tools to improve their communication about and response to medical problems. For example, one U.S. airline uses a checklist form to guide flight attendants in collecting and sharing traveler information with emergency medicine professionals who are remotely located. Another example comes from the AIRSAN Project, a stakeholder network that addresses response at the European Union level to public health threats in air transport. The AIRSAN Project developed operational tools including a flow chart and questionnaires to help cabin crew with decision making and information gathering to assess public health risks, communicate with ground-based responders (including public health officials who use the same tools), apply public health measures during the flight, and minimize interference with international traffic.

#### Communication after Arrival

Representatives at two of the three airlines we spoke with said that CDC does not routinely notify airlines of the results of an ill passenger's screening or diagnostic tests unless a positive diagnosis confirms a communicable disease. Representatives from one airline stressed that it experienced challenges obtaining information about the status of ill passengers or passengers who were not ill during flight but screened positive for risk of Ebola after leaving the aircraft. Representatives from this airline said these challenges impact their operations as well as their relationships with employees and customers. CDC officials confirmed that CDC does not routinely notify airlines when CDC determines a passenger's condition is not of public health concern or before diagnosing passengers suspected of communicable diseases. However, CDC protocols call for notifying airlines when a positive diagnosis confirms a communicable disease of public health concern. CDC officials also said

---

that if there were suspicions but no diagnosis of a communicable disease, CDC might provide airlines with general information when media coverage or other concerns arise but would not provide personally identifiable information.<sup>68</sup>

All of the employees we spoke with from two contracted aviation-services firms that conduct aircraft cabin cleaning said that after incidents when a traveler became ill during a flight, the cabin crew does not always notify them of potentially infectious bodily fluids that had contaminated the aircraft. In its general infection-control guidance to airlines, CDC recommends that cabin crews notify cleaning crews of where and how ill passengers may have contaminated the aircraft and remind cleaning crews that additional personal protective equipment may be required. Given that it is typically unclear whether or not an illness that develops during a flight is contagious, CDC recommends treating any bodily fluid as potentially infectious regardless of whether or not an identified communicable disease outbreak threatens to spread to the United States. Aircraft cleaners we spoke with said that cleaning crews often have limited time to clean an aircraft before the boarding process begins for the next flight, and so may need to request additional time to conduct additional cleaning necessary to decontaminate the aircraft.

Some of the airlines and the contracted aircraft-cleaning employers we spoke with reported taking steps to improve communication about travelers' health status after leaving the aircraft and any contamination that cleaners may need to address. For example, a foreign airline has developed a paper-based form for cabin crews and public health officials to record and share information about potentially contaminated items on the aircraft and the disinfection agents the cleaning contractor should use. The contracted aircraft-cleaning employer we spoke with reported directing employees who clean international flights at one of the five enhanced screening airports for Ebola to notify their crew lead of any bodily fluids they encounter and to treat these fluids as potentially infectious.

---

<sup>68</sup>CDC officials also noted that illness reporting often occurs after air travel when a passenger is diagnosed during a visit to the local health department or doctor's office. The state and local public health departments then report these cases to CDC quarantine stations.

---

## Challenges in Providing Information to the Public

Keeping the traveling public informed about communicable disease risks and implications can help manage public anxiety to avoid unnecessary social disruption and economic losses, according to the WHO. WHO notes that intense public scrutiny may accompany a communicable disease incident, and DOT recommends in its *National Aviation Resource Manual for Quarantinable Diseases* that airports plan “how they will handle the onslaught of media inquiries and reports from the very outset of the communicable disease incident.”

We interviewed airport representatives and their partners, such as emergency-management and public-health officials, and found that the need to provide public information in the wake of the Ebola outbreak and related airport incidents could create a variety of challenges. The 14 airports we spoke with and their partners provided the following examples:

- Responding quickly enough to rapidly developing public concern: Some airport representatives said that suspected communicable disease incidents could quickly generate public concern. Representatives at three airports we spoke with emphasized the need to provide information quickly, and representatives at two of these airports stated a preference for a proactive rather than reactive approach to the media.
- Providing partners useful information: Emergency management officials at one airport conducting enhanced screening for Ebola and state public health officials working with this airport said they did not receive information needed to respond to media requests or inform senior public officials. However, representatives at another airport that conducts enhanced screening for Ebola noted that sharing information about a suspected communicable disease incident too broadly could cause unnecessary alarm.
- Addressing the volume of concerns: Representative from two airports said that addressing public information requests could require significant resources or create a challenging work environment.

Some airport representatives and union representatives also identified instances when information was requested that they believe should not be made available or could be better secured. For example, union representatives for cabin crews expressed concern that co-workers can identify crewmembers on a flight with an ill passenger and subsequently avoid working with them or even make their identities public via social

---

media. Union representatives suggested that airlines could do more to protect crewmembers' identities after a potential communicable disease incident, but an airline we spoke with said that crewmembers' identities could be discovered by a variety of means outside of the control of the airline, including direct observation.<sup>69</sup>

Airport and airline representatives we spoke with identified actions they took to provide information about the Ebola threat to better inform the public. For example, three airports we spoke with highlighted using social media to provide information or respond to concerns in real time. Representatives from one of these airports and one of the three airlines we spoke with noted that it was useful to disseminate public information developed by CDC because of its credibility.

---

## Challenges in Coordinating Incident Response

Representatives at 8 of the 14 airports that we interviewed identified challenges coordinating various entities' roles and actions when conducting communicable disease responses or exercises. Representatives from the 14 airports we spoke with and their partners reported challenges with:

- Lines of authority and plan alignment: Representatives from four airports we interviewed reported challenges determining lines of authority, such as whether CDC or fire department officials lead emergency medical services, or aligning stakeholders' response plans, such as airlines' plans, with the airports' response plans.
- Unnecessary interference: Representatives from three airports we spoke with reported that the actions of one type of responder had negative implications for another responder or for airport operations and that these complications were avoidable. For example, during the response to a passenger suspected of Ebola, responders blocked off a road to provide themselves with space to put on personal protective equipment. However, in so doing they blocked all baggage-handling trucks' access to the baggage claim area, and in turn, the baggage-handling trucks blocked other responders' access to the aircraft.

---

<sup>69</sup>DOT officials told us that DOT's Office of Aviation Enforcement and Proceedings does not enforce any law or regulation that would protect crewmember identifying information from being accessed by other airline employees in the event of possible exposure to a communicable disease and that unless the issue affects safety, FAA regulations would not apply.



- 
- Coordinating with contracted aviation-services firms: Representatives at two airports said that after completing the questionnaire we provided them, they realized that they likely should do more to coordinate with contracted aviation-services firms that operate at the airport.

Airport representatives reported taking various approaches to improve their coordination during a response. Airport officials reported using strategies such as conducting meetings or training with aviation stakeholders to provide information and clarify lines of authority in responding to communicable diseases, using centralized notification and communication hubs, and coordinating response activities through emergency operations centers or unified command structures. In addition, airport representatives at 2 of the 14 airports we interviewed highlighted their practice of reviewing the response plans of each airline operating at the airport to understand airlines' approach and assist with any gaps that the airport might identify. Representatives from each of the 14 airports we spoke with used some level of exercises and debriefs to improve the efficiency and effectiveness of their response, including four airports that conducted full-scale exercises that address simulated communicable-diseases incidents. In addition, airports debriefed staff involved with actual incidents that involve communicable disease response to assess and improve their operational capability. However, neither DOT nor HHS requires airports to conduct communicable disease exercises and debriefs, and the communicable disease exercises conducted by airports, varied in comprehensiveness from table-top to full-scale exercises, according to airport officials with whom we spoke.

According to an aviation medicine expert at ICAO, collaboration between aviation and public health officials presents the biggest challenge in managing communicable diseases in the aviation sector. For example, under airport all-hazards plans, officials typically isolate aircraft away from the terminal in order to minimize suspected threats (e.g., bomb threats), but in a public health emergency it may be more appropriate to park an aircraft near the terminal to provide emergency responders access, according to this expert. Representatives from 3 of the 14 airports we interviewed mentioned adapting their practices during the Ebola outbreak or recent exercises to park incoming aircraft with ill travelers suspected of communicable diseases at or near the gate rather than at a remote location.

---

## Challenges in Training and Equipping Contracted Aviation-Service Employees

Contracted aviation-service employees—including airport cleaning, aircraft cleaning, and passenger-service employees (e.g., wheelchair attendants), and associated union representatives we interviewed—expressed concern that these service employees did not receive adequate communicable disease training and reported challenges accessing appropriate personal protective equipment, cleaning equipment, and cleaning supplies. Inadequate training, equipment, and supplies could lead to employee exposures to pathogens that could in turn result in infections. This risk could extend to passengers since they share the same aircraft environment. OSHA violations provide some evidence for concerns and challenges related to appropriate pathogen-exposure-control planning, training, vaccinations, and personal protective equipment.

OSHA's blood-borne pathogens standard requires employers to provide employees who encounter blood, certain bodily fluids, and other potentially infectious materials while carrying out job duties with:

- Training: initial and annual training—including the opportunity to ask questions of a knowledgeable trainer—on methods to control exposures to pathogens and additional training when changes occur that affect employees' occupational exposure to potentially infectious materials.<sup>70</sup>
- Personal protective equipment: appropriate personal protective equipment such as gloves, gowns, eye protection, and masks.<sup>71</sup>
- Sanitary work surfaces: work surfaces that have been noticeably contaminated by potentially infectious materials must be decontaminated with an appropriate disinfectant immediately or as soon as feasible.<sup>72</sup>

---

<sup>70</sup>29 C.F.R. § 1910.1030(g)(2).

<sup>71</sup>29 C.F.R. § 1910.1030(d)(3)(i).

<sup>72</sup>29 C.F.R. § 1910.1030(d)(4).

- 
- Vaccination and post-exposure evaluation and follow-up: employees must be offered the hepatitis B vaccination and be evaluated and provided follow-up after an exposure incident.<sup>73</sup>

We spoke with nine workers employed by aviation-services firms that contract with airports or airlines. Collectively, these nine employees worked for four different firms at four separate airports. Employees and union representatives we spoke with reported gaps in training, equipment, supplies, and time to decontaminate aircraft.

- No routine or outbreak-specific training: Employees from three of the four contracted aviation-services firms that we spoke with said that employers do not provide formal, hands-on training to understand risks and minimize workers' exposure to potentially infectious materials, and that employers did not provide hand-on training to respond to specific disease outbreaks such as Ebola.<sup>74</sup> For example, aircraft cabin cleaners from one firm reported not knowing where to dispose of hazardous material and so sometimes simply disposed of it with non-hazardous garbage.
- Inadequate personal protective equipment: Aircraft cabin cleaners we spoke with from the two firms that conduct cabin cleaning reported that the gloves employers provided were too thin and that they could not replace gloves immediately if they ripped because of the need to clean aircraft quickly.<sup>75</sup>
- Unsanitary conditions and unavailable resources to clean: Wheelchair attendants at both airports where we interviewed passenger-service employees reported that wheelchairs were not always decontaminated after coming in to contact with potentially infectious

---

<sup>73</sup>29 C.F.R. § 1910.1030(f)(1).

<sup>74</sup>At least one employee of three of the four of the aviation services firms we spoke with said employers did post written notices about the Ebola outbreak in their workplace or provided copies of these notices to employees directly.

<sup>75</sup>Aircraft-cleaning employees with one contracted firm reported that their employer began providing better quality gloves in May 2015 after employees filed a complaint with a state occupational safety and health agency.

---

materials such as feces.<sup>76</sup> Employees with each of the three firms that conduct airport or aircraft cabin cleaning reported lacking sufficient and clean towels. For example, one employee said that cabin cleaners sometimes use the same towels to clean potentially infectious materials and later to clean food service equipment such as coffeemakers. Employees at two of the three firms that conduct cleaning reported difficulties accessing cleaning solutions, and employees we interviewed from one of the two firms that conduct aircraft cabin cleaning said that cleaning solutions sometimes are not properly labeled, causing them to use the wrong concentration.

- Insufficient time to clean: A union representative and employees we interviewed from one of the two firms that conduct aircraft cabin cleaning noted that some cleaning solution instructions indicate that the solution should sit for a period of time on potentially contaminated surfaces before cleaning, but that this was not always possible when cleaners have to quickly prepare the aircraft for another flight.

Violations of state and federal occupational health standards by contracted aviation-services employers provide some support to employees' concerns that aviation services' employers do not always ensure that their employees received blood-borne pathogen training and personal protective equipment. Union representatives provided us with examples of citations between December 2012 and July 2015 resulting from complaints aviation-service employees filed with the union's assistance. We used publicly available information from OSHA to confirm that at least 11 of these citations resulted in violations of OSHA's blood-borne pathogens standard or analogous state standards that are at least as effective.<sup>77</sup> Among these violations were instances when aviation-services employers did not provide employees with appropriate pathogen

---

<sup>76</sup>A representative from the firm that employs the wheelchair attendants whom we spoke with said that while employees typically use anti-microbial wipes to sanitize passenger transport equipment such as wheelchairs before they use the equipment, this step does not necessarily meet OSHA's requirements for decontamination. This representative said that airport authorities or airlines typically own passenger transport equipment, and a separate firm responsible for airport terminal cleaning is typically responsible for cleaning passenger transport equipment.

<sup>77</sup>None of these violations were committed by aviation services employers whose employees we spoke with. Two of the four firms with employees we spoke with have open investigations into potential violations of OSHA's blood-borne pathogens standard or analogous state standards.

---

exposure control planning, training, vaccinations, and personal protective equipment. Eight of the 11 violations were designated serious violations, which indicates a substantial probability that death or serious physical harm could result, unless the employer did not, and could not with the exercise of reasonable diligence, know of the presence of the violation. In total, OSHA found that these 11 violations led to 680 instances when conditions did not meet OSHA's blood-borne pathogens standard, and almost all of these instances (676 out of 680) affected over 100 employees. OSHA records indicate that employers took corrective actions to address these violations.

We interviewed representatives from two aviation-services employers that contract with airports and airlines, and both said that they comply with training, personal protective equipment, and decontamination standards required by regulation. Representatives from the firm that conducts aircraft cabin cleaning said that airlines provide employees with labeled cleaning products that trained managers dilute to ensure that the products used are appropriate as indicated by the original-equipment manufacturer. In addition to providing employees with required training, personal protective equipment, and supplies, representatives from both aviation-services firms that we spoke with reported taking additional precautions during the Ebola outbreak such as providing employees with additional hands-on training, personal bottles of hand sanitizer, and information about Ebola on tablet devices that some employees use to carry out job duties.

In addition, airports, airlines, and union representatives we spoke with reported taking steps to mitigate aviation-service employees' exposure to communicable diseases, especially since the Ebola threat emerged. For example, representatives from two airports we spoke with have established airport minimum standards—including hazardous material training—to qualify or license aviation-services firms that operate at the airport. Representatives from all three airlines we spoke with said that they provided contracted firms with additional information to help them prepare for the Ebola threat and reported taking steps to ensure that contracted employers provide employees appropriate training and personal protective equipment. Union representatives also reported providing training on infection control for aviation-service employees at some international airports during the Ebola outbreak.

---

## Conclusions

Air travel—more than any other mode of transportation—creates the potential for infected persons to move quickly from one part of the world to another while sharing confined quarters with other travelers. With the anticipated growth in international air travel, the recurring threat of communicable diseases from abroad, and the potential economic cost of disrupting air travel, it is imperative that the U.S. aviation system is sufficiently prepared to help respond to any communicable disease threat. The 14 airports that we reviewed (11 of which have CDC-developed CDRPs) had a plan or plans in place that in combination with one another met the six high-level components that we identified as common components in federal and international guidance. CDC is working to expand development of CDRPs to select U.S. airports that the agency is currently identifying, using criteria involving the origins and the total volume of international arriving passengers, but it is uncertain when CDC will be able to complete this effort. Furthermore, Annex 9 to the Chicago Convention obligates member states to establish a national aviation-preparedness plan—a plan intended to provide a mechanism for the public health sector to coordinate with the aviation sector in the event of a communicable disease threat. Yet DOT and CDC officials acknowledge that only certain “elements” of a national aviation-preparedness plan are in place. Such a plan could help maximize an effective response to a public health threat, while minimizing potential inefficiencies in the national response effort and unnecessary disruptions to the national aviation system. A national aviation-preparedness plan that is generic to all communicable diseases and can be adapted for specific diseases would provide individual airports and airlines with an adaptable and scalable framework with which to integrate their individual plans and promote harmonization of individual plans across airports and airlines. As such, the plan could also serve as the basis for testing communication mechanisms among responders to help ensure those mechanisms are effective. In addition, it could help ensure that airport and airline staff have received appropriate training and access to properly maintained equipment during an outbreak to reduce the risk of exposure to communicable diseases. Finally, DOT officials expressed concern about their lack of involvement in decisions made during the Ebola outbreak that involved the aviation sector. Developing and maintaining a national aviation-preparedness plan could foster a shared understanding and agreement among all relevant stakeholders, and help balance the needs of the aviation and public health sectors.

---

## Recommendation

To help improve the U.S. aviation sector's preparedness for future communicable disease threats from abroad, we recommend that the Secretary of Transportation work with relevant stakeholders, such as the Department of Health and Human Services, to develop a national aviation-preparedness plan for communicable disease outbreaks. Such a plan could establish a mechanism for coordination between the aviation and public health sectors and provides clear and transparent planning assumptions for a variety of types and levels of communicable disease threats.

---

## Agency Comments and Our Evaluation

We provided a draft of this product to DOT, HHS, DHS, Labor, and State for comment. In its written comments reproduced in appendix III, DOT partially concurred with our recommendation. State did not provide comments to include in this report. HHS, DHS, and Labor only provided technical comments that we incorporated, as appropriate.

With regard to our recommendation, DOT agreed that there is a need for a national aviation-preparedness plan for communicable diseases to help improve the U.S. aviation sector's preparedness for future communicable disease threats. DOT further proposed that those agencies that have both legal authority and expertise for public health take the lead role in developing such a plan within the existing interagency framework for national-level all-hazards emergency preparedness planning, for which DOT stands ready to participate. We agree that public health expertise is needed in developing a national aviation-preparedness plan. However, as stated in our report, DOT has primary responsibility in overseeing the aviation sector and DOT's Office of the Secretary is the liaison to ICAO for the Annex to the Chicago Convention that obligates member states to establish a national aviation-preparedness plan. As such, we believe that DOT is in the best position to work with its relevant stakeholders, including those that have the needed public health expertise, to develop a national aviation-preparedness plan. DOT also provided technical comments that we incorporated, as appropriate.

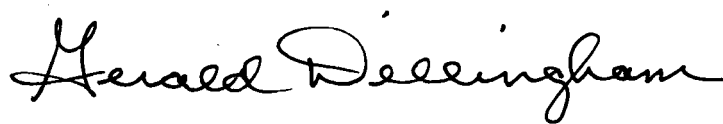
---

We are sending copies of this report to the Secretary of the Department of Transportation, the Secretary of the Department of Health and Human Services, the Secretary of the Department of Homeland Security, the Secretary of the Department of Labor, the Secretary of the Department of State, and other interested parties. In addition, the report is available at no charge on the GAO website at <http://www.gao.gov>.

---

If you or your staff have any questions about this report, please contact me at (202) 512-2834 or [DillinghamG@gao.gov](mailto:DillinghamG@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix V.

Sincerely yours,

A handwritten signature in black ink that reads "Gerald Dillingham". The signature is written in a cursive style with a large initial "G" and a long, sweeping underline.

Gerald L. Dillingham, Ph.D.  
Director  
Physical Infrastructure Issues



---

# Appendix I: Objectives, Scope, and Methodology

---

## Objectives

GAO was asked to review the preparedness of the U.S. aviation system in responding to communicable disease threats from abroad. This report examines:

1. The extent to which selected U.S. airports and airlines have preparedness plans to respond to communicable disease threats from abroad and the extent to which a national aviation-preparedness plan guides preparedness.
2. Challenges that U.S. airports and airlines including contractors have faced when responding to threats and the actions have they taken to help address those challenges.

---

## Scope

*Characteristics of communicable disease threats from abroad:* We considered the following characteristics as applicable to the scope of our review:

- communicable disease of public significance (e.g., non-routine diseases, including Ebola, SARS, and MERS),
- international arriving traveler,
- suspected ill traveler is identified onboard an arriving aircraft, or
- suspected ill traveler is identified in an airport after deplaning aircraft.

We considered the following characteristics as not applicable to the scope of our review:

- traveler who is ill with seasonal flu or other routine disease that is not of public significance,
- solely domestic travelers,
- threat of communicable disease spread by cargo or animals,
- bioterrorism (i.e., traveler using communicable disease as a weapon),
- continuity of Operations, and
- known medical transport (ill person is identified prior to departing host country).

*Selected airports and airlines:* We selected for review 14 airports—which accounted for about 53 percent of total international arriving passengers in 2014—that met one or more of the following criteria (see table 1):

- have enhanced passenger entry-screening procedures in place for international passengers arriving from the three current or past Ebola-affected countries in West Africa;
- received the first and second largest number of international passengers from each of five world regions in 2014;

- large hub airports<sup>1</sup> with a Centers for Disease Control and Prevention (CDC) quarantine station on site at the time of our review;
- large hub airports without a CDC quarantine on site, but still receiving a larger number of international passengers relative to other large hubs without a CDC quarantine station on site;
- experienced a confirmed Ebola case;
- have a station manager from one of the three U.S. airlines in our review; and
- are located within proximity to a GAO office.

**Table 1: Selected Airports for Review**

Airport	Centers for Disease Control and Prevention (CDC) quarantine station on site	Ebola enhanced entry screening	First and second highest number of international passenger arrivals from one or more world regions in 2014
Dallas/Fort Worth International	a		
Fort Lauderdale-Hollywood International	b		
Hartsfield- Jackson Atlanta International	X	X	X
Honolulu International	X		X
John F. Kennedy International	X	X	X
Los Angeles International	X		X
McCarran International (Las Vegas)	b		
Miami International	X		X
Newark Liberty International	X	X	X
O'Hare International (Chicago)	X	X	X
Orlando International	b		
Seattle-Tacoma International	X		
San Francisco International	X		X
Washington Dulles International	X	X	

Source: CDC and GAO analysis of DOT's O&D data.

<sup>a</sup>Dallas Fort-Worth formerly had a CDC quarantine station on site.

<sup>b</sup>Large hub airports without a CDC quarantine on site, but still receiving a larger number of international passengers relative to other large hub airports without a CDC quarantine station on-site.

<sup>1</sup>U.S. commercial service airports accounting for 1 percent or more of total annual U.S. passenger enplanements. 49 USC 47102(10)).

We selected for review the three U.S. airlines that handle the largest quantity of international passengers—American Airlines, Delta Air Lines, and United Airlines.

*Departments and components:* Our review involved five federal departments—the Departments of Transportation (DOT), Health and Human Services (HHS), Homeland Security (DHS), State, and Labor. We selected these departments because they represent the key federal departments with responsibilities for preparing for and responding to communicable disease threats from abroad. Within these five departments we collected and reviewed available documentation and interviewed officials from various components that play a key role at their respective departments for these matters, principally DOT’s Federal Aviation Administration (FAA), HHS’s CDC, DHS’s U.S. Customs and Border Protection (CBP), and Labor’s Occupational Safety and Health Administration (OSHA).

---

## Methodology

To examine the extent to which airports and airlines have plans in place to respond to communicable disease threats from abroad, we developed and administered a questionnaire to airport operators of the 14 selected airports on general preparedness at their airport.<sup>2</sup> The questionnaire included questions about communication with local stakeholders about communicable diseases, guidance used to develop any plans for communicable disease response, and plans or procedures that the airport had in place for a variety of situations or stakeholders, such as establishing the parking location for an aircraft and training for airport employees. We then conducted follow-on interviews with the 14 airport operators and relevant local stakeholders, who generally included first responders, local public health officials, CBP officials, and CDC officials, if applicable, about their preparedness. We also collected from the 14 selected airports and 3 selected airlines relevant and available preparedness plans for communicable disease threats. We identified and reviewed applicable federal requirements and international obligations, including the International Civil Aviation Organization’s (ICAO) Standards and Recommended Practices, and guidance for U.S. airports and airlines

---

<sup>2</sup>At one airport where the terminals are owned and operated independent of the airport authority, the airport operator suggested that we also administer the questionnaire to an operator of an international terminal, whose responses, as indicated by the airport authority, would be similar to the other international terminals.

with international air traffic. We identified high-level components that were common across applicable federal and international guidance, obligations, and requirements, as well as corroborating information collected from aviation stakeholders with whom we spoke.<sup>3</sup> We then developed a list of high-level components for airports' and airlines' communicable-disease preparedness plans to provide a basis for assessing the breadth of the plans. We compared these high-level components against the available plans collected from the 14 airports and three airlines as a method to assess the breadth of the plans. We then reviewed the structure and contents of these plans, but did not evaluate the plans for sufficiency or level of preparedness. We reviewed available documents from the five selected federal departments and their relevant components and interviewed officials from these departments. We also interviewed representatives from federal and international airport, airline, and flight-attendant industry associations,<sup>4</sup> and ICAO about preparedness plans generally and potential opportunities to improve preparedness.

To examine challenges that U.S. airports and airlines, including contractors, have faced when responding to communicable disease threats, including Ebola, and the actions they have taken to help address those challenges, we first identified challenges through interviews with selected airports and airlines as discussed above, as well as interviews with representatives from the labor union representing airport- and airline-service employees, and airport- and airline-contract employers of service employees. We consulted with representatives from the union that

---

<sup>3</sup>For airports, we identified six high-level components through review of DOT and HHS's *National Aviation Resource Manual for Quarantinable Diseases* and ACI and ICAO's airport preparedness guidelines for outbreaks of communicable disease. The six components are establishment of an incident command center, coordination among various stakeholders, selection and use of personal protective equipment for various stakeholders, training for various stakeholders, some protocols for responding to a threat, and protocols for decontamination. After identifying these components, we used corroborating information about high-level components to communicable preparedness collected from DOT and FAA officials, a representative of CAPSCA, and some airport representatives. For airlines, we identified four components through review of IATA's emergency-response plan template for air carriers. The four identified components are establishment of an emergency response team and designation of an emergency response center, description of the triggers that inform the level and nature of a response, activation triggers for the response team and response center, and identification of roles and responsibilities for relevant stakeholders.

<sup>4</sup>Airport Council International (ACI), Airlines For America (A4A), and Association of Flight Attendants (AFA).

represents these employees to identify nine aviation-service employees with whom we spoke, and we conducted interviews with two of the four firms that these nine employees worked for, as well as three of the four airports they worked at. We also identified challenges to responding to communicable disease threats and actions taken by stakeholders during our attendance at a Global Symposium—convened by ICAO in collaboration with the World Health Organization (WHO)—of the Collaborative Arrangement for the Prevention and Management of Public Health Events in Civil Aviation (CAPSCA) program, which is a global, collaborative arrangement that works to bring together international, regional, national, and local organizations to develop a coordinated approach to preparedness and response. We also collected and reviewed available after-action reports that airports used to assess their responses to simulated communicable disease incidents. In addition, to corroborate comments we heard from airline-service employees (e.g., aircraft cabin cleaners or wheelchair attendants) and their union representatives, we reviewed summaries of inspections and violations related to OSHA’s blood-borne pathogens standard that were initiated by employees with the support of their union. The challenges faced by U.S. airports, airlines, and contracted aviation-services firms and the actions taken to address these challenges that we describe in this report represent information provided to us during interviews and site visits, but may not capture all of the challenges and actions taken by the airports, airlines, and aviation-services firms we spoke with.

We conducted this performance audit from November 2014 to December 2015 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

---

# Appendix II: Technologies for Responding to Communicable Diseases in Aviation

---

A few technologies have been implemented, or are being developed, to identify or mitigate potential outbreaks of communicable diseases through air travel. These include screening passengers to detect travelers who may have an infectious disease (ill travelers), utilizing temperature screening to diagnose ill travelers, and using data analysis to identify disease outbreaks and potential traveler movement patterns.<sup>1</sup>

---

## Temperature-Screening Technologies

U.S. Customs and Border Protection (CBP) personnel routinely observe travelers during their primary inspection and refer those that show symptoms of a communicable disease—or those recently traveling from an area of concern—for further assessment by Centers for Disease Control and Prevention (CDC) staff or other health authorities. Additional screening, such as was carried out during the Ebola threat, may include more targeted assessments during enhanced screening. According to the CBP, there are three main screening methods used for identifying passengers entering the United States who may have communicable diseases during the Ebola outbreak: (1) collecting advance passenger information, (2) visual inspection or taking of temperatures, and (3) questioning travelers. All of these methods are used for screening airplane passengers arriving in the United States, but only temperature measurement is associated with on-site health technology. Temperature checks may be conducted with contact or noncontact thermometers, but outside of the current Ebola response, this check is typically not common and only done in the setting of assessment of a suspected ill traveler reported to CDC, according to CDC officials.

Entry screening for Ebola at enhanced screening airports in the U.S. includes using non-contact infrared thermometers, under the enhanced screening protocols put in place to address the disease threat. Non-contact thermometer-based temperature measurement is a simple enough premise, but an agency official suggested it has both low sensitivity and specificity for detecting passengers with infectious disease.<sup>2</sup> In other words, such temperature measurement alone has a low chance of correctly identifying ill travelers and a low chance of correctly

---

<sup>1</sup>The evaluations and claims of the technologies were not independently assessed by the GAO.

<sup>2</sup>Targeted populations are typically passengers who were recently in an area of an active outbreak.

excluding healthy travelers. In the case of enhanced screening for Ebola, CDC officials or CBP contractors use thermometers that are commercially available following primary inspection by CBP personnel. To date, no mass screening of airplane passengers—where every passenger’s temperature is taken—has been conducted at a U.S. airport. During the recent Ebola outbreak, for example, only passengers with recent travel to, from, or through outbreak countries, such as Sierra Leone, were identified for temperature screening.

Internationally, both non-contact infrared thermometers as well as thermal scanners have been used for entry and exit passenger screening for communicable diseases, including Ebola and severe acute respiratory syndrome (SARS). For example, in 2009, during the H1N1 influenza pandemic, many international airports—but not U.S. airports—implemented temperature-screening procedures. However, the literature reports questionable effectiveness from temperature screening, stemming in part from the aforementioned low sensitivity.<sup>3</sup> Some of the performance issues result from variabilities in temperature measurements exceeding the threshold for fever indication—variabilities of up to 3 degrees Celsius under some circumstances, such as after smoking, whereas fever can be indicated by an elevation of 1 degree Celsius for Ebola, for example. Temperature variability results from several factors including metabolism, medication, environment, and conditions, such as certain cancers, which are not quarantinable diseases of concern for airport screening purposes. Further, passengers who are in the incubation period of illness may not exhibit fevers, given that such periods of several infectious diseases typically last longer than most flights. According to scientific literature, camera-based thermograms have been used internationally. For example, camera-based temperature measurement, followed by ear-based temperature measurement, has been tentatively shown to be effective for monitoring Dengue Fever in Taiwan. Dengue fever is not a U.S. quarantinable disease, and another study indicated uncertainty that temperature screening is effective for mitigating community transmission

---

<sup>3</sup>A study in the 2013 *World Health Organization (WHO) Bulletin* suggests that exit screening in regions of active outbreak is more efficient than entry screening at all possible destination airports. See Khan, K., et al, “Entry and exit screening of airline travelers during the A(H1N1) 2009 pandemic: a retrospective evaluation,” *Bull World Health Organ*, vol. 90 (2013): 368-376. Our report focuses on entry screening because the United States has not carried out exit screening during disease outbreaks within the past decade. However, during the Ebola outbreak, exit screening was implemented in Ebola outbreak countries with CDC and CBP assistance.

of this disease. Generally, however, thermal cameras are more expensive than thermometers and their precision is not better. A possible reason for deploying thermal cameras is the eventual capacity to screen large numbers of travelers rapidly, but the benefits of this approach have not been established.

---

## BioMosaic

The CDC has developed a “Big Data” approach for identifying and tracking communicable disease outbreaks through data collection and analysis.<sup>4</sup> Information provided by BioMosaic can be used to help determine the risk of international spread of disease and to target potential CDC intervention by identifying potential threats, although it cannot be used to identify specific ill individuals. Launched in 2011 by the CDC’s Division of Global Migration and Quarantine, BioMosaic is a data analytics tool that works with collections of data, including news sources, historical travel information, and public databases to map the health and demographics of foreign-born populations within the United States (e.g., diaspora), as well as disease outbreaks internationally.<sup>5</sup>

For example, in 2014, the CDC reported the first confirmed cases of Middle East Respiratory Syndrome (MERS) infections in the United States and, by using BioMosaic, was able to identify the major points of entry into the country, as well as the volume of travelers entering from Saudi Arabia and the United Arab Emirates. CDC was able to identify five cities within the United States that accounted for 75 percent of arrivals from those two countries.

---

## Flight-Related Medical Technologies

Several technologies are being evaluated for potential use in tracking or mitigating disease, including communicable diseases. These technologies could potentially be used for air travel. These include (1) telemedicine, (2) air circulation control, (3) genetic sequencing of airplane lavatory waste,

---

<sup>4</sup>“Big Data” and data analytics can refer to analysis of large data sets—typically too large for conventional computational methods—to extract meaningful patterns and results.

<sup>5</sup>BioMosaic (sometimes Bio-Mosaic) entails collaboration among the CDC, several academic institutions, and data projects including BioDiaspora (now called BlueDot) and HealthMap that track disease trends. The focus on foreign-born persons is to help mitigate existing health disparities between them and U.S.-born persons. A comprehensive list of data sources is beyond the scope of this report, but includes a variety of sources including Google News and the International Air Transport Association (IATA) databases.



and (4) point-of-care diagnostic technology. These technologies are at various stages of development and their effectiveness and cost considerations are not established.

Airlines use a variety of approaches in responding to ill passengers during flight. United Airlines is currently exploring the use of telemedicine, whereby some technology can be used on board an aircraft to provide a remotely located doctor with information—such as vital signs—needed for diagnosis and determining whether a flight diversion is needed.

Development of altered air circulation devices may also mitigate the spread of communicable diseases. Currently, air in an aircraft is filtered by high-efficiency particulate air (HEPA) filters, but effectiveness relies on the air's passing through the filters. If a pathogen circulates widely within an aircraft cabin prior to being filtered, there may be an increased chance of person-to-person transmission of the disease. Air-circulation-altering devices may provide more isolated air environments for each passenger, but these devices have not yet been developed to the point where they have been tested or validated.

Recent research used meta-genomic examination of the content of airplane lavatories by sequencing and detecting the relative abundance of select pathogens (not quarantinable infectious diseases, however). By isolating and determining the sequence from genetic material found in passenger bio-waste, the researchers were able to determine the types of antibiotic resistance carried by passengers' microbes. Researchers were also able to identify specific pathogens, as well as their relative abundance based on the geographic origin of the samples. This method is potentially useful for global surveillance of communicable diseases, antibiotic resistances, and transmission routes. However, there are potential challenges to implementing this approach. For example, the researchers identified that implementing this method from all flights on a weekly basis would be challenging, given the current state of technology.

Additionally, developments in point-of-care technology—methods that can be used in doctor's offices, hospitals, or on the field (e.g., at an airport), instead of a laboratory—are increasing the speed of diagnosis as well as the variety of diseases that can be targeted. For example, companies have developed FDA-approved tests for human immunodeficiency virus (HIV) that do not require laboratory equipment and can provide results in as little as 20 minutes. Some tests for communicable diseases, such as influenza, have been developed and FDA-approved, but studies have indicated the sensitivities can be variable. Future improvements may lead

---

to feasible screening based on, for example, microfluidics devices that can identify multiple concomitant infections.

# Appendix III: Comments from the Department of Transportation



U.S. Department  
of Transportation  
Office of the Secretary  
of Transportation

Assistant Secretary  
for Administration

1200 New Jersey Avenue, SE  
Washington, DC 20590

DEC 03 2015

Gerald Dillingham, Ph.D.  
Director, Physical Infrastructure  
U.S. Government Accountability Office  
441 G Street NW  
Washington, DC 20548

The Department of Transportation (DOT) is committed to ensuring a fast, safe, efficient, accessible and convenient transportation system for the American people. We agree that there is a need for a national aviation-preparedness plan for communicable diseases to help improve the U.S. aviation sector's preparedness for future communicable disease threats.

However, responding to these threats within the transportation context, as well as in other respects, is primarily a matter of public health emergency preparedness. We are prepared to support those agencies that, unlike the Department of Transportation, have both the legal authority and expertise to develop a national aviation preparedness plan for communicable diseases and we stand ready to participate in their planning efforts. To be effective, these efforts should be conducted within the existing interagency framework for national-level all-hazards emergency preparedness planning. As a result, we concur in part with the recommendation.

We will provide a detailed response to the recommendation within 60 days of the report's issuance. We appreciate the opportunity to offer our comments on the GAO draft report. Please contact Madeline Chulumovich, Director of Program Management and Improvement, at (202) 366-6512 with any questions or if the GAO would like to obtain additional detail about these comments.

Sincerely,

Jeff Marootian  
Assistant Secretary for Administration

---

# Appendix IV: GAO Contacts and Staff Acknowledgments

---

## GAO Contact

Gerald L. Dillingham, Ph.D., 202-512-2834, or [dillinghamg@gao.gov](mailto:dillinghamg@gao.gov)

---

## Staff Acknowledgments

In addition to the contact named above, the following individuals made important contributions to this report: Paul Aussendorf, Assistant Director; David Hooper; Hayden Huang; Molly Laster; David Lysy; Jacob McAuliffe; Josh Ormond; Sarah Resavy; Gretchen Snoey; Russell Voth; and Amelia Weathers.

---

# Appendix V: Related GAO Products

---

*Emerging Infectious Diseases: Asian SARS Outbreak Challenged International and National Responses.* [GAO-04-564](#). Washington, D.C.: April 28, 2004.

*Influenza Pandemic: Further Efforts Are Needed to Ensure Clearer Federal Leadership Roles and an Effective National Strategy.* [GAO-07-781](#). Washington D.C.: August 14, 2007.

*Influenza Pandemic: Opportunities Exist to Address Critical Infrastructure Protection Challenges That Require Federal and Private Sector Coordination.* [GAO-08-36](#). Washington D.C.: October 31, 2007.

*National Response Framework: FEMA Needs Policies and Procedures to Better Integrate Non-Federal Stakeholders in the Revision Process.* [GAO-08-768](#). Washington, D.C.: June 11, 2008.

*Public Health And Border Security: HHS and DHS Should Further Strengthen Their Ability to Respond to TB Incidents.* [GAO-09-58](#). Washington, D.C.: October 14, 2008.

*Influenza Pandemic: Sustaining Focus on the Nation's Planning and Preparedness Efforts.* [GAO-09-334](#). Washington D.C.: February 26, 2009.

*Influenza Pandemic: Increased Agency Accountability Could Help Protect Federal Employees Serving the Public in the Event of a Pandemic.* [GAO-09-404](#). Washington D.C.: June 12, 2009.

*Influenza Pandemic: Monitoring and Assessing the Status of the National Pandemic Implementation Plan Needs Improvement.* [GAO-10-73](#). Washington D.C.: November 24, 2009.

*Disaster Response: Criteria for Developing and Validating Effective Response Plans.* [GAO-10-969T](#). Washington, D.C.: September 22, 2010.

*National Preparedness: DHS and HHS Can Further Strengthen Coordination for Chemical, Biological, Radiological, and Nuclear Risk Assessments.* [GAO-11-606](#). Washington, D.C.: June 21, 2011.

*Influenza Pandemic: Lessons from the H1N1 Pandemic Should Be Incorporated into Future Planning.* [GAO-11-632](#). Washington D.C.: June 27, 2011.

---

*FEMA Has Made Limited Progress in Efforts to Develop and Implement a System to Assess National Preparedness Capabilities.* [GAO-11-51R](#).  
Washington, D.C.: October 29, 2010.

*Influenza Pandemic: Agencies Report Progress in Plans to Protect Federal Workers but Oversight Could Be Improved.* [GAO-12-748](#).  
Washington, D.C.: July 25, 2012.

*Emergency Preparedness: Opportunities Exist to Strengthen Interagency Assessments and Accountability for Closing Capability Gaps.* [GAO-15-20](#).  
Washington, D.C.: December 4, 2014.

---

---

## GAO's Mission

The Government Accountability Office, the audit, evaluation, and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

---

## Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents at no cost is through GAO's website (<http://www.gao.gov>). Each weekday afternoon, GAO posts on its website newly released reports, testimony, and correspondence. To have GAO e-mail you a list of newly posted products, go to <http://www.gao.gov> and select "E-mail Updates."

---

## Order by Phone

The price of each GAO publication reflects GAO's actual cost of production and distribution and depends on the number of pages in the publication and whether the publication is printed in color or black and white. Pricing and ordering information is posted on GAO's website, <http://www.gao.gov/ordering.htm>.

Place orders by calling (202) 512-6000, toll free (866) 801-7077, or TDD (202) 512-2537.

Orders may be paid for using American Express, Discover Card, MasterCard, Visa, check, or money order. Call for additional information.

---

## Connect with GAO

Connect with GAO on [Facebook](#), [Flickr](#), [Twitter](#), and [YouTube](#).  
Subscribe to our [RSS Feeds](#) or [E-mail Updates](#).  
Listen to our [Podcasts](#) and read [The Watchblog](#).  
Visit GAO on the web at [www.gao.gov](http://www.gao.gov).

---

## To Report Fraud, Waste, and Abuse in Federal Programs

Contact:

Website: <http://www.gao.gov/fraudnet/fraudnet.htm>

E-mail: [fraudnet@gao.gov](mailto:fraudnet@gao.gov)

Automated answering system: (800) 424-5454 or (202) 512-7470

---

## Congressional Relations

Katherine Siggerud, Managing Director, [siggerudk@gao.gov](mailto:siggerudk@gao.gov), (202) 512-4400, U.S. Government Accountability Office, 441 G Street NW, Room 7125, Washington, DC 20548

---

## Public Affairs

Chuck Young, Managing Director, [youngc1@gao.gov](mailto:youngc1@gao.gov), (202) 512-4800  
U.S. Government Accountability Office, 441 G Street NW, Room 7149  
Washington, DC 20548



Please Print on Recycled Paper.