



July 2022

CONTACT TRACING FOR AIR TRAVEL CDC's Data System Needs Substantial Improvement

Accessible Version

GAO Highlight

Highlights of [GAO-22-105018](#), a report to congressional addressees

Why GAO Did This Study

The COVID-19 pandemic has underscored the importance of public health measures aimed at controlling the transmission of communicable diseases. Air travel can play a role in quickly spreading communicable diseases across the world and throughout communities. Given this potential, contact tracing for air passengers is an important measure for protecting public health.

GAO was asked to examine CDC's process for collecting and managing air passengers' contact information to facilitate contact tracing. This report addresses: (1) the factors that affect CDC's ability to collect this information, (2) recent actions CDC has taken to improve the quality of the information it collects, and (3) how effectively it collects and manages this information.

GAO reviewed relevant federal documentation, including regulations, orders, technical guidance, and public comments, as well as available CDC data. GAO also interviewed officials from CDC, U.S. Customs and Border Protection, and the Federal Aviation Administration, and selected representatives from the aviation, travel, and public health industries.

What GAO Recommends

GAO is making three recommendations, including that CDC redesign its data management system for air passenger information or deploy a new one. CDC concurred with the recommendations.

View [GAO-22-105018](#). For more information, contact Heather Krause at (202) 512-2834 or krauseh@gao.gov.

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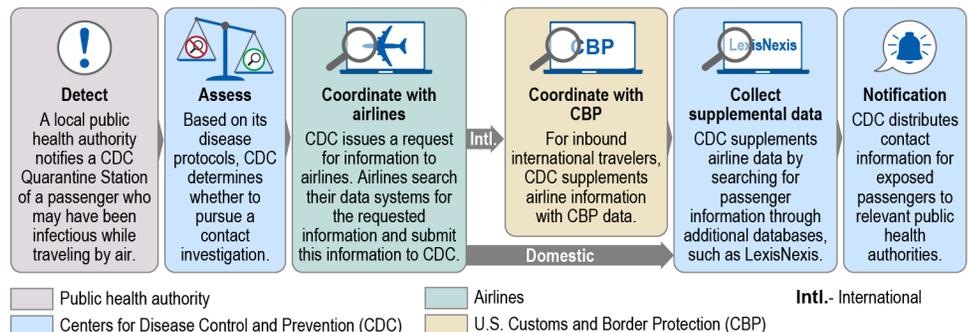
CONTACT TRACING FOR AIR TRAVEL

CDC's Data System Needs Substantial Improvement

What GAO Found

The Centers for Disease Control and Prevention (CDC) plays a key role in contact tracing for air travel—the process of identifying and notifying passengers who may have come into contact with a person infected with a communicable disease during a flight. However, several factors affect CDC's ability to collect timely, accurate, and complete air passenger information to support contact tracing by local public health authorities. For example, airlines may not have accurate and complete information about passengers to share with CDC because the contact information provided to book a ticket may be for a third party, like a travel agent, not for passengers. Further, because no single, complete, and reliable source of passenger information exists, CDC often conducts research to fill in gaps, extending the time it takes to share information with local public health authorities.

Overview of Process for Collecting Air Passengers' Contact Information



Source: GAO analysis of CDC information. | GAO-22-105018

Since the start of the COVID-19 pandemic, CDC has taken some actions to improve the quality of information it collects. For example, since November 2021, CDC has required airlines to collect certain information—including name, phone number, email, and physical address—no more than 72 hours before departure from passengers traveling on flights into the United States and to transmit the information to CDC in a defined format.

However, limitations in how CDC collects and manages air passengers' contact information—including CDC's use of an outdated data management system—hinder the agency's ability to monitor public health risks and facilitate contact tracing. The data management system—developed in the mid-2000s—was not designed for rapid assessment or aggregation of public health data across individual cases. For example, CDC is unable to quickly and accurately identify the number of passengers exposed to a specific infected passenger on a flight. Nor does the system contain the necessary data fields to assess the quality of air passenger information CDC receives, such as a field to determine the timeliness of airlines' responses to CDC's request. Consequently, CDC is not positioned to efficiently analyze and disseminate data to inform public health policies and respond to disease threats. Nor is it positioned to evaluate its performance in collecting and sharing quality passenger information.

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Abbreviations

APIS	Advance Passenger Information System
ATS	Automated Targeting System
CBP	U.S. Customs and Border Protection
CDC	Centers for Disease Control and Prevention
DHS	Department of Homeland Security
DOT	Department of Transportation
FAA	Federal Aviation Administration
HHS	Department of Health and Human Services
ICAO	International Civil Aviation Organization
MERS	Middle East Respiratory Syndrome
MOU	memorandum of understanding
NNDSS	National Notifiable Diseases Surveillance System
OMB	Office of Management and Budget
QARS	Quarantine Activity Reporting System
SARS	severe acute respiratory syndrome
USCIS	U.S. Citizenship and Immigration Services
WHO	World Health Organization

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July 11, 2022

Congressional Addressees

The introduction and spread of COVID-19 throughout the United States has underscored the importance of public health measures aimed at controlling the transmission of communicable diseases. Responsibility for protecting the health of the public from communicable diseases rests heavily with state and local public health authorities. With regard to air travel into the United States and between states, however, federal agencies and the Centers for Disease Control and Prevention (CDC), in particular, play a unique role in helping prevent or mitigate disease transmission. Contact tracing for air passengers is the process of identifying and notifying persons who may have come into contact with a person infected with a communicable disease during a flight. It is one public health measure that is particularly important because of air travel's known potential to quickly spread communicable diseases across the world and throughout communities. For example, several studies have reported that the introduction and initial spread of COVID-19 throughout the United States was tied to air travel.¹

However, CDC has faced long-standing challenges to collecting and sharing timely, accurate, and complete contact information for air passengers with local public health authorities to facilitate contact

¹See for example: Jeffrey Prince and Daniel H. Simon, *The Effect of International Travel on the Spread of COVID-19 in the U.S.* (Dec. 21, 2020), Kelley School of Business Research Paper No. 2021-02, available at SSRN: <https://ssrn.com/abstract=3753069> or <http://dx.doi.org/10.2139/ssrn.3753069>; Christopher A. Mouton et al., *COVID-19 Air Traffic Visualization: By January 31, 2020, at Least 1.5 Daily Infected Passengers Were Originating in China*. Santa Monica, CA: RAND Corporation, 2020, https://www.rand.org/pubs/research_reports/RRA248-2.html; and Michel Bielecki et al., "Air travel and COVID-19 prevention in the pandemic and peri-pandemic period: A narrative review," *Travel medicine and infectious disease*, vol. 39 (2021): 101915. doi:10.1016/j.tmaid.2020.101915.

tracing.² The ability of public health authorities to quickly contact potentially exposed passengers to advise them on post-exposure actions, such as testing or quarantining, is critical to stopping the chain of disease transmission. Inaccurate or incomplete contact information may delay or even preclude notifying an exposed passenger, potentially leading to broader community spread of a disease.

These challenges have been exacerbated by the ongoing COVID-19 global pandemic. For example, CDC officials estimated that the number of flights warranting a contact investigation in 2020 increased more than 10,000 percent from 2019—taxing the aviation and public health sectors' systems and resources.

The CARES Act includes a provision for us to report on our ongoing monitoring and oversight efforts related to the COVID-19 pandemic.³ This report is a part of that body of work.⁴ We also were asked to examine CDC's process for collecting and managing air passenger contact information to facilitate contact tracing. This report addresses:

- the factors that affect CDC's ability to collect timely, accurate, and complete air passenger contact information from airlines and other sources;

²For example, in 2004, we reported on CDC's challenges in collecting timely and complete passenger information during the 2003 severe acute respiratory syndrome (SARS) outbreak. Following that report, CDC proposed—though never finalized—a rule to expand requirements that airlines collect designated pieces of information for passengers traveling on both international inbound and domestic interstate flights and transmit that information to CDC within 12 hours of request. See GAO, *Emerging Infectious Diseases: Asian SARS Outbreak Challenged International and National Responses*, [GAO-04-564](#) (Washington, D.C.: Apr. 28, 2004). Also, as discussed later in this report, CDC issued, in February 2020, an Interim Final Rule requiring airlines to, in response to a CDC order, collect and provide CDC with five designated pieces of information for passengers traveling on inbound international flights. Control of Communicable Diseases; Foreign Quarantine, 85 Fed. Reg. 7874 (Feb. 12, 2020) (codified at 42 C.F.R. § 71.4(d)–(e)).

³Pub. L. No. 116-136, § 19010, 134 Stat. 281, 579-81 (2020).

⁴We regularly issued government-wide reports on the federal response to COVID-19. For the latest report, see GAO, *COVID-19: Current and Future Federal Preparedness Requires Fixes to Improve Health Data and Address Improper Payments*, [GAO-22-105397](#) (Washington, D.C.: Apr. 27, 2022). Other government-wide reports on this topic are available on GAO's website at <https://www.gao.gov/coronavirus>.

- the actions CDC has taken since the onset of the COVID-19 pandemic to improve the quality of air passenger contact information it collects; and
- how effectively CDC collects and manages air passenger contact information to facilitate contact tracing.

To conduct this work, we reviewed relevant statutes and regulations pertaining to contact tracing for air travel. We also assessed the activities of the three key federal departments with roles in facilitating contact tracing for potentially exposed air passengers—the Department of Health and Human Services (HHS); Department of Homeland Security (DHS); and Department of Transportation (DOT)—as well as their relevant components, including HHS’s CDC, DHS’s U.S. Customs and Border Protection (CBP), and DOT’s Federal Aviation Administration (FAA). And, we interviewed officials from four of the 20 CDC regional quarantine stations: Atlanta (Hartsfield-Jackson Atlanta International Airport); Chicago (O’Hare International Airport); Los Angeles (Los Angeles International Airport); and San Francisco (San Francisco International Airport).⁵ We selected these quarantine stations based on the volume of international and domestic passengers at the airport co-located with the quarantine station, among other factors.

To identify and obtain perspectives on factors affecting CDC’s ability to collect timely, accurate, and complete passenger contact information, in addition to speaking with officials from identified agencies, we interviewed or received written responses from six selected U.S. commercial passenger airlines: American Airlines, Delta Air Lines, JetBlue Airways, Southwest Airlines, Spirit Airlines, and United Airlines. We selected these airlines based on passenger volumes and seating practices, among other characteristics. We also interviewed representatives from four industry groups representing the aviation sector, two associations representing local public health authorities, and three travel industry organizations to obtain broader stakeholder perspectives on contact tracing for aviation.

To describe CDC’s actions since the onset of the COVID-19 pandemic to improve the quality of air passenger contact information it collects and manages, we reviewed regulatory documents including CDC’s 2020 Interim Final Rule for the Control of Communicable Diseases, as well as associated implementing orders, technical instructions, and submitted

⁵CDC quarantine stations are located at 20 ports of entry and land-border crossings where most international travelers arrive. Eighteen of the 20 stations are located at international airports.

public comments. In addition, we reviewed applicable CBP documents describing the expansion of coordination efforts between CDC and CBP in collecting information for passengers traveling on flights to the United States.

We assessed CDC's ability to effectively collect and manage air passenger contact information against 1) CDC guidance for maintaining and using public health data to inform agency activities and respond to disease events; 2) the Office of Management and Budget's (OMB) Federal Data Strategy; 3) federal internal control standards related to data entry, information processing and information system design, and program monitoring; and 4) leading practices GAO has previously identified for program evaluation and performance measurement and evaluation. As part of our assessment, we reviewed a sample of data from and available documentation on CDC's Quarantine Activity Reporting System (QARS) and interviewed CDC officials. Additional detail on the scope and methodology of our review is contained in appendix I.

We conducted this performance audit from February 2021 to July 2022 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

The COVID-19 global pandemic has renewed concerns about the spread of communicable diseases through air travel, as well as about the U.S.

aviation system's preparedness to respond to such threats.⁶ As of June 2022, more than 86 million cases of COVID-19 had been reported in the United States, resulting in more than 1 million deaths.⁷ More than any other mode of transportation, air travel creates the potential for infectious diseases to move quickly from one part of the world to another. Beginning with the 2003 severe acute respiratory syndrome (SARS) epidemic, a number of communicable disease threats—such as the 2009 H1N1 influenza pandemic, the 2012 Middle East Respiratory Syndrome (MERS) outbreak, and the 2014 Ebola Virus Disease outbreak—have raised concerns regarding international transmission of diseases from travel. The SARS epidemic 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 impact communicable diseases can have in a highly mobile and interconnected world.⁸

⁶In 2015, we reported on the preparedness of the U.S. aviation system to respond to pandemics and other health crises. We recommended that the Secretary of Transportation work with relevant stakeholders, including HHS, to develop a national aviation-preparedness plan for communicable diseases. In June 2020, we urged Congress to take legislative action to require DOT to develop a national aviation-preparedness plan. As of March 2022, according to agency officials, DOT plans to take the lead, working closely with HHS and DHS, in developing such a plan building upon the Runway to Recovery and guidance materials from the International Civil Aviation Organization. According to officials, DOT intends to complete and implement the preparedness plan in 2023. See GAO, *Air Travel and Communicable Diseases: Comprehensive Federal Plan Needed for U.S. Aviation System's Preparedness*, [GAO-16-127](#) (Washington, D.C.: Dec. 16, 2015) and GAO, *COVID-19: Opportunities to Improve Federal Response and Recovery Efforts*, [GAO-20-625](#) (Washington, D.C.: June 25, 2020).

⁷Data on COVID-19 cases in the U.S. are based on aggregate case reporting to CDC and include probable and confirmed cases as reported by states and jurisdictions. CDC COVID-19 counts are subject to change due to delays or updates in reported data from states and jurisdictions. According to CDC, the actual number of COVID-19 cases is unknown for a variety of reasons, including that people who have been infected may have not been tested or may have not sought medical care. See CDC, "COVID Data Tracker: Trends in Number of COVID-19 Cases and Deaths in the US reported to CDC, by State/Territory," accessed June 22, 2022, <https://covid.cdc.gov/covid-data-tracker/#datatracker-home>.

⁸World Health Organization, *Outbreak Communication: Best practices for communicating with the public during an outbreak*. (Singapore: Sept. 21–23, 2004). Report of the WHO Expert Consultation on Outbreak Communications.

Contact Tracing Roles and Responsibilities

Contact tracing is a key public health measure to help control the transmission and spread of communicable diseases. When implemented effectively, contact tracing separates the people who have, or may have, a communicable disease from those who do not by identifying infected individuals, notifying their “contacts”—all the people they may have transmitted the disease to—and communicating information on measures, such as getting tested or quarantining, that potentially exposed contacts should take.

In the United States, contact tracing investigations and notifications are primarily carried out by state and local public health authorities. Yet in the case of contact tracing for passengers potentially exposed while flying into the country or between states, several federal agencies, the airline industry, and international organizations also play a role in supporting state and local public health authorities. Specifically:

- HHS has statutory authority to make and enforce regulations to prevent the introduction, transmission, and spread of communicable diseases into the United States and between states.⁹ Within HHS, CDC is responsible for public health surveillance, which is the ongoing, systematic collection, analysis, interpretation, and dissemination of data regarding health-related events to inform public health policies and respond to disease threats. As part of this surveillance, staff and contractors within CDC’s Division of Global Migration and Quarantine in its headquarters and 20 regional quarantine stations spearhead the collection of air passenger contact information from airlines and other sources. Subsequently, CDC provides this information to state and local public health authorities to carry out their contact tracing investigations.
- CBP—through a memorandum of understanding between HHS and DHS¹⁰—supports CDC by sharing information on passengers traveling into the United States that the agency already collects from

⁹42 U.S.C. § 264(a).

¹⁰In 2005, HHS and DHS signed a memorandum of understanding (MOU) that documented CBP’s support of CDC in providing information for travelers arriving by air into the United States. Under this MOU, CBP provides CDC with selected passenger information that it collects for the purpose of CBP’s mission at the border and that is also deemed useful to CDC, under the MOU, in preventing the introduction, transmission, and spread of communicable diseases into and within the United States.

airlines and other federal agencies for the purpose of CBP's mission at ports of entry.¹¹ Of the information that CBP collects, it provides CDC with those elements that are relevant to responding to a public health threat.

- FAA, while not directly involved with collecting or sharing passenger contact information, regulates aviation safety, including safety of airlines, which provide CDC with passenger information. In addition, given FAA's knowledge of the aviation sector, it has played a key role in coordinating with relevant stakeholders, including CDC, CBP, and airlines, in responding to public health threats in areas that relate to air travel.
- International organizations, such as WHO and the International Civil Aviation Organization (ICAO), issue international public health regulations and guidance.¹² WHO implements and oversees these regulations and—together with its partners, such as ICAO—helps member states, like the United States, build response capacities. ICAO plays a key role in coordinating the international aviation response to public health risks. This coordination includes providing to member states recommended protocols for contact tracing for various diseases and standards for information relevant to public health threats collected by border protection agencies. For example, in the case of an infected passenger identified during a flight, ICAO's recommended practice is to collect specific elements of passenger contact information using a standard paper form, known as the Public Health Passenger Locator Form.¹³ Countries may also rely on this form when collecting contact information from passengers on a flight arriving from locations with an identified communicable disease outbreak.

¹¹In the United States, a port of entry is an officially designated location (airport, seaport, or land-border location) where DHS officers or employees are assigned to clear merchandise, collect duties, and enforce customs laws; and where DHS officers inspect persons seeking to enter or depart, or applying for admission into, the United States pursuant to U.S. immigration and travel controls. CBP collects passenger information in order to fulfill its mission of securing the U.S. border while facilitating lawful travel and trade. See 19 C.F.R. § 122.49a(b).

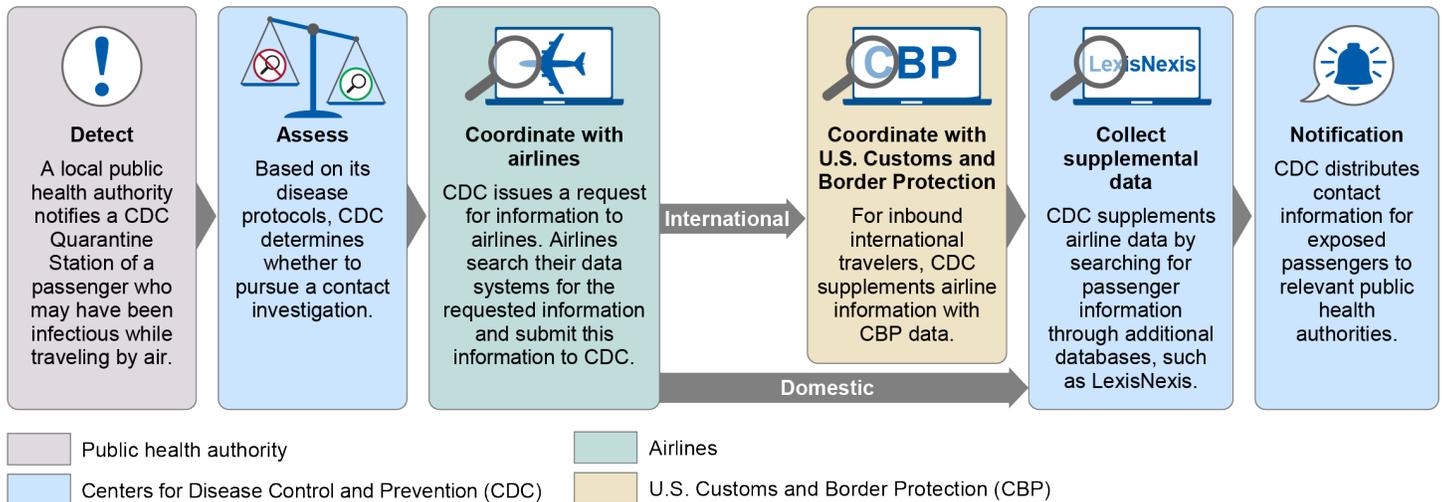
¹²The International Health Regulations were originally adopted by the World Health Assembly, the governing body of WHO, in 1969 to address certain disease threats.

¹³This form solicits specific elements of contact information and is to be distributed to passengers who may have been exposed to an individual infected with a communicable disease during flight in case they need to be contacted at a future date.
<http://www.icao.int/safety/aviation-medicine/Pages/guidelines.aspx>.

CDC’s General Process for Collecting Air Passenger Information

After an individual infected with a communicable disease is identified as having recently traveled by air into the country or between states, CDC is notified—most often by a local public health authority—to help identify other passengers on the flight who were potentially exposed (“contacts”).¹⁴ To facilitate the contact tracing investigation, CDC seeks to collect contact and other relevant information about the exposed passengers from multiple sources—particularly airlines and in some instances CBP. Finally, CDC shares this information with the state or local public health authority with jurisdiction for the locality in which the exposed passenger is residing, whether permanently or temporarily (see fig. 1).

Figure 1: Overview of Process for Collecting Air Passengers’ Contact Information to Support Contact Tracing



Source: GAO analysis of CDC information. | GAO-22-105018

To conduct effective contact tracing investigations for passengers potentially exposed on a flight, CDC has identified five essential elements of data for passenger contact information: name, U.S. address, email, and primary and secondary phone number. CDC also seeks to collect other information—such as seat number, initial and connecting flight

¹⁴According to representatives from an organization representing state and local public health authorities, CDC is generally not involved in providing contact information for contact tracing investigations for passengers exposed to an infectious disease traveling within one state (i.e., intrastate flight).

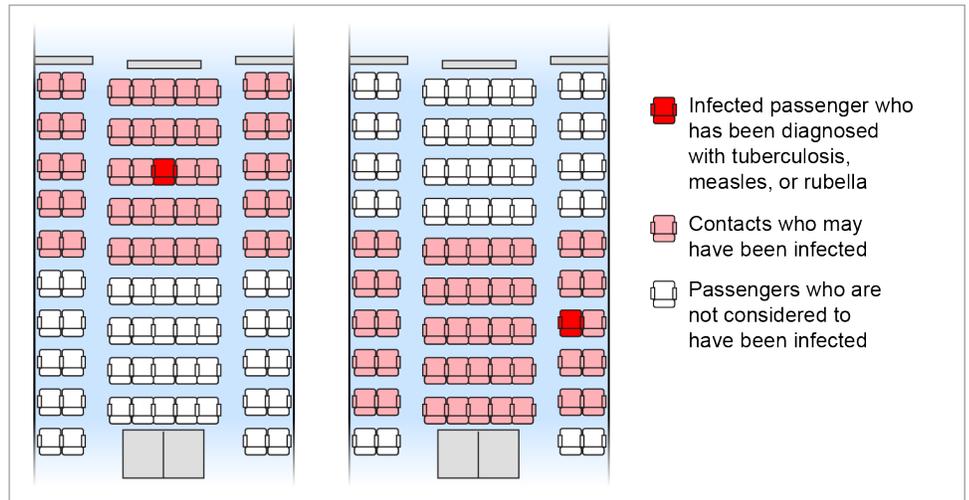
numbers, and final travel destination—that helps both identify passengers who may have been exposed and facilitate the sharing of information with appropriate state and local public health authorities.

CDC seeks to collect this information when it deems a contact investigation for the infected passenger is warranted based on CDC-established protocols, which are informed by international guidance.¹⁵ CDC develops these protocols based on several factors, including the proximity of that individual to the infected passenger on the aircraft. For example, protocols for COVID-19, as well as for measles and tuberculosis—the diseases most often identified in air travel prior to COVID-19—specify that passengers in the same row and two rows in front and behind (with some exceptions, such as for bulkheads) are in the “contact-zone” and warrant a contact investigation. For twin-aisle aircraft, this process may require contacting close to 50 passengers, as shown in figure 2. Factors other than proximity include the disease characteristics (e.g., method of transmission or incubation time) and other characteristics of the specific case, such as the flight time (i.e., exposure duration) and time between flight arrival and notification of CDC.¹⁶

¹⁵See, for example, World Health Organization, *Tuberculosis and air travel: guidelines for prevention and control*, 3rd ed. (World Health Organization: 2008).

¹⁶Thresholds for exposure duration and time to notification are disease dependent. For example, according to CDC protocols for tuberculosis, a contact investigation is warranted if the flight is 8 hours or longer gate-to-gate, the travel occurred within 3 months of diagnosis, and CDC was notified within 3 months of travel, among other factors.

Figure 2: Examples of Air Passengers Seated in Proximity to an Infected Passenger, Potentially Warranting a Contact Investigation, according to CDC Protocols



Source: Centers for Disease Control and Prevention (CDC) and GAO. | GAO-22-105018

To obtain contact information for these passengers, CDC requires that airlines provide passenger information that is available and already maintained by the airline, such as information in its reservation system or frequent flyer datasets. In doing so, CDC traditionally issues a flight manifest request (i.e., manifest order) to airlines.¹⁷ An airline manifest would include additional information necessary to identify potentially exposed passengers, such as seat assignments.

For passengers traveling on inbound international flights, CDC seeks to supplement the information provided by airlines with passenger information that CBP has already collected to enforce customs, immigration, and agriculture laws at the border and ports of entry. Specifically, CDC submits a request to CBP seeking additional information for exposed passengers. In response to CDC’s request, CBP uses its Automated Targeting System (ATS)—which is a decision support tool that aggregates data from various data systems—to search and extract contact information that is relevant to responding to public health

¹⁷A flight manifest is a document maintained by airlines that includes a list of passengers of an aircraft compiled before departure based on flight check-in information.

threats—such as a passenger’s address or passport number.¹⁸ CBP has traditionally provided these data to CDC in a standard Excel file format through a secure federal data network. Some of the data that CBP maintains is collected from airlines through the agency’s existing data transmission feeds prior to departure, while some data are from other CBP and non-CBP datasets and systems.¹⁹

Throughout this process, CDC officials record the five essential elements of contact information for the infected passenger and potentially exposed passengers, as well as other information about each case (e.g., flight number, date, arrival location, passport number), as they are received into its Quarantine Activity Reporting System (QARS). According to CDC, QARS is a web-based and secure electronic data system first developed as a legacy case-management system in the mid-2000s that supports collection of data for ill persons on inbound international or interstate flights. CDC has described QARS as a system that enables the quantification and analysis of the information collected to support disease surveillance. For contact tracing, CDC officials use QARS to integrate the passenger contact information and case records, and then to transmit relevant information to public health authorities through a web-based platform.²⁰

¹⁸Specifically, ATS aggregates data from various systems and datasets—including the Advance Passenger Information System and Passenger Name Record data provided by airlines—to compare traveler, cargo, and conveyance information against law enforcement, intelligence, and other enforcement data using risk-based scenarios and assessments.

¹⁹CBP uses an electronic data interchange system known as the Advance Passenger Information System to collect passenger and crew manifest data for individuals traveling to or from the United States by commercial or private aircraft, among other modes, as part of the agency’s vetting process at ports of entry, which include some airports. In addition, commercial airlines are required to provide CBP electronic access to certain passenger reservation and/or departure information (if the airline maintains this information) regarding passengers traveling on international flights to or from the United States. These are called Passenger Name Record data. CBP also uses additional datasets as part of its pre-travel information screening, such as the Global Enrollment System.

²⁰CDC transmits this information through its Epidemic Information Exchange system, which according to CDC, is a secure, web-based platform that allows for instant transfer of public health data, including information regarding contact investigations, from CDC to jurisdictions across the United States.

Multiple Factors Impede CDC's Collection of Timely, Accurate, and Complete Passenger Information

Several factors affect CDC's efforts to collect the timely, accurate, and complete air passenger information it needs to facilitate contact tracing.²¹ Key factors include limitations in airlines' ability to collect accurate and complete information from passengers and the time it takes airlines to respond to CDC's requests for information. In addition, because there is no single, complete, and reliable source of air passenger information available, CDC must, in many cases, spend time conducting its own research to fill in gaps.

Limitations in airline information. According to CDC, the agency relies on airlines to identify specific passengers inside the contact zone of the aircraft and provide any available contact information they have for those passengers. However, CDC officials, airline representatives, and airline association representatives we spoke with told us that airlines are frequently unable to provide accurate and complete passenger information.²² For example, CDC reported that in a 2015 sample of international manifest reports, 100 percent were missing at least one of the five essential data elements—name, U.S. address, email, and primary

²¹CDC officials and representatives from local public health associations discussed other challenges related to contact tracing for air travel that are outside of the scope of this report. These challenges included the capacity of state and local health authorities to notify CDC of infectious passengers based on their case investigations and to act on notifications from CDC of air passenger contacts.

²²In response to a requirement in 42 C.F.R. § 71.4(c) to evaluate the burden of its 2017 Final Rule, CDC reported in 2019 that airlines only provided complete information for about 16 percent of CDC's requests for passengers traveling on inbound international flights (an increase from almost zero percent). These results were based on examination of 48 randomly selected airline manifests provided in response to CDC requests between June 17, 2017, and January 12, 2018. See CDC, *CDC Report as Required by the 2017 Control of Communicable Diseases Final Rule* (Atlanta, Ga.: Feb. 6, 2019).

and secondary phone number.²³ According to these stakeholders, there could be several reasons for this limitation.

First, according to one airline representative, airlines may not have complete information because passengers are not required to provide airlines all five of the essential data elements of contact information that CDC seeks, such as an email address, to book a ticket or check in to a flight. And in the case of airlines operating under a marketing code-share agreement, passenger contact information may be collected by the marketing airline and not available to the operating airline to provide to CDC, according to representatives from an airline association.²⁴

Second, passengers may choose not to provide the airline with accurate or complete contact information, according to representatives from three airline associations and from two of the six airlines we interviewed. These airline representatives highlighted that airlines lack a means to confirm the accuracy of passenger-reported information.

Finally, passenger contact information may be incomplete as a result of how the airline ticket was purchased. Representatives from all six of the selected airlines we interviewed told us that for tickets purchased through third parties, such as an online travel agency, the phone number and email address provided to the airline for booking purposes may be for the travel agency, not the passenger. Depending on the airline, more than half of an airline's tickets may be booked through third parties. Representatives from a travel industry association and from an organization that provides the technologies to distribute booking information to and from airlines explained that travel agencies often

²³This explanation was stated in CDC's *Federal Register* publication of its 2017 rule requiring airlines to respond to a CDC manifest order within 24 hours by making available to CDC elements of passenger information for passengers potentially exposed on international inbound flights to the extent that they were readily available and already maintained by the airline. *Control of Communicable Diseases*, 82 Fed. Reg. 6890, 6931 (Jan. 19, 2017).

²⁴Marketing airlines are those airlines that market flights to consumers, whether the airline operates those flights or those flights are operated by a codeshare partner airline.

provide their own contact information as a way to support customers (i.e., passengers) in managing reservation changes and cancellations.²⁵

Time for airlines to provide information. CDC has reported that prior to COVID-19, it often took airlines longer than the requested timeframe of 24 hours to provide passenger information and that in some cases, airlines took up to 3 days to respond.²⁶ Representatives from all six airlines we interviewed told us they consistently provide CDC with passenger information within the requested timeframe of 24 hours.²⁷ However, representatives from two of the six airlines we spoke with said that delays may occur when they do not receive complete or accurate information about the infected traveler from CDC, such as an incorrect flight number, travel date, or misspelled name—information airlines need to retrieve the appropriate manifest and identify passengers seated in the contact zone. For example, a representative from one airline said that CDC may only provide a name and date of travel, with no flight number, and that it can take the airline several days to retrieve the manifest with such limited information. On the other hand, this representative said the airline could provide the requested information in 2 to 3 hours when CDC provides the flight number in addition to the passenger’s name and date of travel.

CDC officials told us that information on infected passengers comes directly from local public health authorities, and that CDC is limited by what those authorities are able to provide. Public health authorities collect any available information from the infectious passenger seeking treatment in their jurisdiction, but the passenger might not provide complete or accurate information or be able to recall the travel details.

Need to seek supplemental information. Due to gaps or obvious errors in data provided by airlines, CDC often must seek supplemental information from additional sources, such as from CBP or research databases, adding further time to the contact tracing process. CDC officials estimate that after the agency has been notified of an infected passenger, it can take up to 2 weeks to collect information on potentially

²⁵These technologies—known as global distribution systems—are computer systems that display airline flight schedule and fare information so that travel agents can query it to “book” (i.e., reserve and purchase) flights for consumers.

²⁶CDC, *CDC Report as Required by the 2017 Control of Communicable Diseases Final Rule* (Atlanta, Ga.: Feb. 6, 2019).

²⁷We interviewed representatives of six U.S. commercial passenger airlines. CDC officials told us that foreign airlines may take longer to respond to CDC’s requests for passenger information.

exposed passengers and share this information with local public health authorities. This delay can contribute to broader community spread of a disease, as potentially exposed passengers may become difficult to locate and notify, or they may become symptomatic or infectious during this time.

For passengers traveling on inbound international flights, CDC is able to supplement airline-provided information with data provided by CBP. CDC officials told us that CBP may have more accurate passenger information—such as an up-to-date physical address where the passenger resides or is staying in the United States—because CBP checks the information against a passenger’s passport, and the passengers risk penalties if they provide false information.²⁸ However, CBP only collects data for passengers on flights arriving into the United States.²⁹ These passengers constituted about 25 percent of the travelers (or about 120 million travelers) flying into and within the United States on scheduled flights in 2019, and about 13 percent since the onset of the COVID-19 pandemic.

For cases in which the information collected from airlines and CBP is outdated or incomplete, and for all cases in which the passengers were traveling on domestic interstate flights, CDC conducts manual searches for contact information in other databases, such as LexisNexis—further extending the length of this process.

Even after conducting supplemental research, CDC may not have complete or accurate passenger contact information. Representatives from two organizations representing public health authorities told us that it is not uncommon for CDC to provide them with incomplete contact information, such as a partial name. In such cases, public health staff must invest significant resources to identify and locate the correct individual, according to these representatives.

²⁸For example, individuals may be fined or imprisoned for willfully and knowingly using, or attempting to use, a passport that was secured by false statements. 18 U.S.C. § 1542.

²⁹CBP also collects data on passengers departing the United States. See, e.g., 19 C.F.R. § 122.75a.

CDC Has Made Some Improvements to the Quality of Air Passenger Information It Collects for Inbound International Travel

Since the COVID-19 global pandemic began in March 2020, CDC has taken some actions to improve the timeliness, accuracy, and completeness of the information it collects from various sources for passengers arriving on flights into the United States. These actions included expanding coordination with CBP and establishing new requirements for inbound international flights.

CDC and CBP Have Expanded Coordination for International Travel

In response to the COVID-19 pandemic and following a series of Presidential proclamations, CBP, in coordination with CDC, has taken steps to provide more timely and complete information to CDC for passengers on inbound international flights believed to have been exposed to a communicable disease.³⁰ Specifically, since the pandemic began, CBP has (1) automated the process by which it searches for and provides passenger information to CDC in certain scenarios and (2) expanded the federal agency datasets through which CBP searches for information.³¹

First, CBP built automated rules within its Automated Targeting System such that, without waiting for CDC requests for individual passengers, CBP officials can identify travelers who are subject to travel restrictions due to an outbreak in their departure country, but who are permitted to travel to the United States under an approved exemption. For example, following the identification of the Omicron variant in South Africa, a Presidential proclamation on November 26, 2021, invoked section 212(f) of the Immigration and Nationality Act to restrict travel of noncitizens with

³⁰On January 31, 2020, the White House issued the “Proclamation on Suspension of Entry as Immigrants and Nonimmigrants of Persons who Pose a Risk of Transmitting 2019 Novel Coronavirus,” the first of several proclamations issued regarding COVID-19 related travel restrictions. Proclamation No. 9984, 85 Fed. Reg. 6709 (Jan. 31, 2020).

³¹CBP also reported that during the pandemic, Department of State agreed to begin sharing visa application data with CBP and subsequently CDC.

recent presence in any of the eight listed African countries.³² CBP could then extract relevant passenger data from ATS, aggregate them into person-centric records for each traveler, and transmit the record to CDC within 8 hours of the flight's arrival through a secure data file transfer.

Selected Foreign Countries' Actions

Some of CDC's actions have similarities with strategies for air travel that other countries have recently undertaken in response to COVID-19. Public health and border protection officials we spoke with from Australia, Canada, and the United Kingdom told us that their countries also increased automation in collecting and managing passenger information. Some countries are also working to improve coordination with their respective border protection agencies to leverage more information. To help inform the public, one country publishes on a website flights that had passengers infected with COVID-19 onboard.

Source: GAO summary of interviews with public health and border protection officials from selected foreign countries. | GAO-22-105018

In February 2021, CBP expanded the agreement with CDC to allow CBP to share information for passengers traveling on inbound international flights beyond those who recently traveled from 212(f)-restricted countries.³³ In some cases, however, CDC continues to rely on the labor-intensive, semi-automated process of submitting a request to CBP for specific passengers identified through airline manifests. CDC officials also told us that as of December 2021, no decision had been made as to whether CBP's automated process of search and transmission would continue beyond the pandemic.

Second, CBP expanded the number of federal datasets it searches for relevant information to share with CDC. For example, U.S. Citizenship and Immigration Services (USCIS), a component of DHS, collects and maintains information from noncitizens applying for immigration benefits, including their contact information. To support CDC's public health follow-up efforts, CBP has shared with CDC biographic information on approved and pending lawful permanent residents collected by USCIS since September 2020.

CDC Has Established New Requirements for Inbound International Flights

Since the onset of the COVID-19 pandemic, CDC has taken several regulatory actions that increased the requirements for airlines to collect, maintain, and transmit to CDC specific elements of passenger

³²Section 212(f) of the Immigration and Nationality Act (INA) gives the President of the United States the authority to issue Presidential proclamations to suspend entry of any noncitizen for a period of time deemed necessary by the President whenever the President finds that entry of such individuals would be detrimental to the interests of the United States. 8 U.S.C. § 1182(f). The restrictions on these eight countries have been rescinded, effective December 31, 2021.

³³CBP has published Privacy Impact Assessments on this data exchange. See Department of Homeland Security, *DHS/CBP/PIA-066 CBP Support of CDC for Public Health Contact Tracing* (Washington, D.C.), accessed March 14, 2022, <https://www.dhs.gov/publication/dhscbppia-066-cbp-support-cdc-public-health-contact-tracing>.

information. Prior to the pandemic, CDC regulations for contact tracing generally did not require airlines to collect any specific data elements from passengers to support contact tracing or to provide them in any particular format.³⁴ While airline representatives we interviewed expressed reservations about the new requirements, they told us that they are ultimately willing and able to comply with them.

In early 2020, following the first reported cases of COVID-19 in China, CDC held discussions with the airline industry and other federal agencies, including CBP and FAA, to identify actions to improve the quality of information CDC could collect from airlines. In February 2020, CDC issued an Interim Final Rule requiring airlines to, in response to a CDC order, collect and provide CDC with five designated pieces of information for passengers traveling on inbound international flights.³⁵ Under this interim rule, CDC issues implementing orders to airlines to trigger the requirements.³⁶

In October 2021, CDC issued its most recent order—a global contact tracing order, which requires airlines to collect, maintain, and, after receiving a CDC request, transmit to CDC specific elements of passenger information within a specific timeframe.³⁷ CDC reports that these requirements are intended to provide timelier, accurate, and complete passenger information to CDC for passengers traveling on flights arriving into the United States. Airlines are to:

³⁴Specifically, CDC's regulations required airlines only to respond to a CDC manifest order within 24 hours by making available to CDC passenger data to the extent that they were already available and maintained by the airline. Control of Communicable Diseases, 82 Fed. Reg. 6890, 6975 (Jan. 19, 2017) (codified at 42 C.F.R. § 71.4).

³⁵These five designated elements of passenger contact information comprise the international traveler's full name, address while in the United States (or permanent residence if a U.S. citizen or lawful permanent resident), primary phone number, secondary phone number, and email address. Control of Communicable Diseases; Foreign Quarantine, 85 Fed. Reg. 7874, 7880 (Feb. 12, 2020) (codified at 42 C.F.R. § 71.4(d)–(e)).

³⁶For example, CDC issued an order in February 2020 requiring airlines to collect and provide data for passengers who were in the People's Republic of China within 14 days of entry into the United States. Collection of Certain Data Regarding Passengers and Crew, 85 Fed. Reg. 10439 (Feb. 24, 2020).

³⁷This order went into effect November 8, 2021. See Requirement for Airlines to Collect and Transmit Designated Information for Passengers, 86 Fed. Reg. 61246, 61246 (Nov. 5, 2021).

- *Collect the five designated elements of contact information—to the extent that they exist—from all passengers traveling on inbound international flights no more than 72 hours before departure.* CDC explains in the order that the best way to ensure passengers' contact information is available in real time is to collect the information before they board a flight.
- *Transmit the contact information to CDC in a defined format, using one of the specified data transfer mechanisms.*³⁸ By requiring airlines to provide CDC data in a specified format, the information can be entered into its QARS data management system more quickly, ultimately improving the overall timeliness of the data.

Selected Foreign Countries' Processes for Collecting Information

During the pandemic, in contrast to the United States, some foreign governments expanded and automated a process by which they collect information directly from passengers arriving on international flights rather than through the airlines. For example, Australia, Canada, and the United Kingdom each developed an online form, web portal, or mobile application to collect information from passengers before departure. Officials from these countries told us that the information they collected also supported enforcement of national quarantine and vaccination policies. These officials said their efforts improved data quality, but that collecting accurate information directly from passengers did pose challenges. Officials from one of the countries noted that no country has a "golden ticket" solution for contact tracing following air travel.

Source: GAO summary of interviews with public health and border protection officials from selected foreign countries. | GAO-22-105018

Stakeholders had mixed views on CDC's recent rule and orders. Representatives from a major airline association told us that while they believe the rule and orders have placed an outsized burden on the industry, airlines are ultimately willing and able to comply with the requirements.³⁹ Several aviation stakeholders, including representatives from four airline associations and three airlines, highlighted that FAA's leadership and knowledge were particularly helpful in "translating" the nuances of airlines' processes and systems for CDC officials.

On the other hand, representatives from a major airline association and one airline told us that despite repeated requests, CDC has not communicated with them where the gaps exist in the passenger information it collects, or the extent to which these requirements would improve the accuracy or completeness of information. As discussed above, one such example of a gap is that passenger contact information may still be inaccurate for passengers who have purchased tickets through third parties, such as an online travel agency.

Nevertheless, according to CDC officials, their recent regulatory actions have resulted in the agency being able to more quickly collect more complete and up-to-date information for passengers traveling on inbound international flights. CDC officials said that, as of March 2022, they were

³⁸Depending on the transmission mechanism used, airlines may in some cases also be required to maintain the passenger data for up to 30 days and provide the data within 24 hours of a CDC request (i.e., CDC manifest order).

³⁹To comply with the global contact tracing order, representatives from three airline associations and four airlines told us airlines will need to make—and some airlines already have made—significant modifications to their IT systems potentially costing millions of dollars in order to collect and maintain the required data elements for transmission to CDC in the required format.

undertaking an assessment of these improvements, but that the results of the assessment were not yet complete.

However, as currently issued, the new requirements are temporary. CDC officials and airline representatives told us in March 2022 that they assumed these requirements would be permanent, yet it is uncertain when, or if, a permanent rule will be issued.⁴⁰ The Interim Final Rule states that CDC promulgated the rule in response to the COVID-19 public health emergency and that the rule will cease to be in effect either when the pandemic is over or when the Secretary of HHS determines there is no longer a need.⁴¹

Unaddressed Limitations in How CDC Collects and Manages Air Passengers' Information Hinder Contact Tracing

While CDC has taken some steps to improve the quality of information it collects for passengers on inbound international flights, other limitations in how CDC collects and manages air passenger information have not been addressed and hinder the agency's efforts to facilitate contact tracing. Specifically, CDC lacks sufficient controls to reduce the risk of errors and inconsistencies resulting from manual entry of passenger information. In addition, CDC has not fully assessed potential opportunities to improve data quality. Moreover, the outdated design of the QARS data

⁴⁰The Department of Homeland Security published in the Fall 2021 Unified Agenda that it is working on a proposed rule that would require air carriers to transmit additional data elements through the Advance Passenger Information System (APIS) for all commercial airline passengers arriving in the United States in order to support border operations and national security. According to the Unified Agenda publication, this collection of additional data elements will also support the efforts of CDC's contact tracing for air travel. 87 Fed. Reg. 5002, 5086 (Jan. 31, 2022). Airline representatives told us they expect this new rule will include a requirement for all international airlines to provide the five designated elements of contact information that CDC is currently requiring under the global contact tracing order.

⁴¹The Interim Final Rule states: "Unless extended after consideration of submitted comments, this interim final rule will cease to be in effect on the earlier of (1) the date that is two incubation periods after the last known case of 2019-nCoV, or (2) when the Secretary determines there is no longer a need for this interim final rule." 85 Fed. Reg. 7874, 7874 (Feb. 12, 2020).

management system does not meet CDC's needs for disease surveillance in air travel.⁴²

CDC Lacks Sufficient Controls to Reduce the Risk of Errors and Inconsistencies Resulting from Manual Data Entry

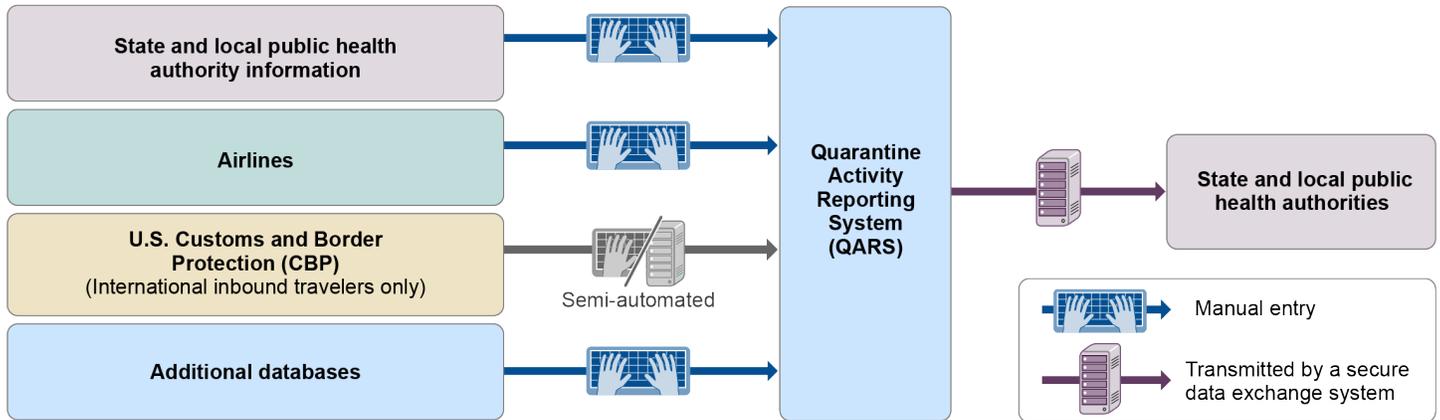
CDC's process for entering air passenger information into its QARS data management system has the potential for errors and inconsistencies, due to the need to manually enter information collected in varying formats from multiple sources. Data entry by numerous staff and contractors across the country, including for the same case investigation record, further heightens this risk. However, CDC lacks sufficient controls on data entry, such as adequate training and procedures for system users and consistent validation checks, to help ensure data quality and reliability.

As shown in figure 3, CDC collects and receives information from multiple sources. This information is received in a variety of formats. For example, representatives from all six airlines we interviewed told us they generally transmit data to CDC in encrypted email attachments in a range of formats, such as Microsoft Word, Excel, or Adobe Acrobat. Some airlines provide information on Telex printouts that often have illegible portions, according to one CDC official we interviewed.⁴³ CDC staff and contractors must translate and enter these data—often manually—into spreadsheets, which are then uploaded into CDC's QARS data management system.

⁴²In the past, we have also reported on issues related to CDC's data security. For example, in June 2018, we identified control and program deficiencies in the core security functions related to safeguarding the confidentiality, integrity, and availability of CDC's information systems and information. That report was designated as "limited official use only" (LOUO) and not publicly released because of the sensitive information it contained. We published a subsequent report in December 2018 that discussed the findings in our June 2018 report, but with references to the sensitive information removed. CDC has taken actions to address all 195 recommendations contained in those reports. See GAO, *Information Security: CDC Needs to Improve Its Program and Resolve Control Deficiencies*, GAO-18-437SU (Washington, D.C.: June 20, 2018) and GAO, *Information Security: Significant Progress Made, but CDC Needs to Take Further Action to Resolve Control Deficiencies and Improve Its Program*, GAO-19-70 (Washington, D.C.: Dec. 20, 2018).

⁴³Telex is an international system of sending written messages. Messages are converted into signals, which are transmitted over a network and then printed out by a machine in another place.

Figure 3: Illustration of CDC’s Reliance on Manual Entry to Process Air Passenger Contact Information into Its Quarantine Activity Reporting System



Source: GAO analysis. | GAO-22-105018

In addition, while CBP has recently automated portions of the process for contact investigations pertaining to passengers traveling on international inbound flights, CDC’s process for entering the passenger information from CBP may include numerous non-automated steps between requesting and receiving the data. For example, according to CDC officials, if airlines are unable to provide a partial airplane manifest of the contact zone to CDC, then officials located at CBP’s National Targeting Center must query CBP data systems for all passenger records and seat numbers to determine which travelers were within the contact zone.⁴⁴ This process entails a CDC or CBP official manually populating the configuration of an entire flight into a spreadsheet in order to determine where an infectious passenger sat in relation to other passengers. Finally, regardless of the source, CDC may need to fill gaps in passenger contact information by conducting its own research using additional databases, such as LexisNexis, and manually entering these data into QARS.

Numerous CDC staff and contractors across the agency’s locations and divisions—including headquarters and the 20 regional quarantine stations—enter information from these sources into QARS, sometimes even for one passenger’s case record. For example, when local public

⁴⁴CBP’s National Targeting Center leads all of CBP’s pre-departure targeting and vetting efforts. The National Targeting Center is a 24/7 operations entity responsible for providing advance information and research about high-risk travelers and cargo and facilitating coordination between law enforcement and intelligence agencies in support of CBP’s anti-terrorism mission and efforts to keep high-risk individuals and cargo from boarding U.S.-bound flights.

health authorities notify a quarantine station in their jurisdiction of a person who may have traveled while infectious, staff at that location open a case investigation by manually entering into QARS the information provided. Then, as part of the process of collecting supplemental passenger information, additional staff may access and edit the case records, including staff in headquarters and in regional Quarantine Stations.

The process of numerous individuals translating data from various formats and manually entering them into the QARS data management system presents risk of errors. For example, CDC officials reported instances in which staff mislabeled passenger information, such as by erroneously entering the flight's arrival date as predating its departure or creating duplicate entries when entering the results of a passenger's laboratory test. Moreover, providing access for multiple staff to enter information into one case record may be helpful, but it can lead to inconsistencies in the way information is documented. For example, information used to identify whether a case investigation is warranted is inconsistent among case records because staff may enter this information using personal judgement, according to CDC officials.

CDC's reliance on additional contracted staff to enter information into QARS for the increased number of contact investigations during the pandemic could introduce further risk of inconsistencies. CDC estimates that for each year from 2015 through 2019, about 80 to 130 distinct flights warranted at least one contact investigation, compared to more than an estimated 25,000 distinct flights in 2020.⁴⁵ Officials at one regional quarantine station told us that since the outset of the pandemic, the number of staff has increased from four full-time employees to more than 30 additional contractors.

Federal standards for internal controls highlight the importance of adopting and implementing controls for data entry and information processing to maximize data quality.⁴⁶ A control activity may include providing adequate training to users, developing standard operating

⁴⁵Because one infected passenger may travel on multiple flights, the number of distinct flights warranting at least one contact investigation may be greater than the number of notifications received by CDC warranting contact investigations.

⁴⁶GAO, *Standards for Internal Control in the Federal Government*, [GAO-14-704G](#) (Washington, D.C.: Sept. 10, 2014).

procedures for data entry, or conducting consistent validation checks of data entered.

CDC has taken some steps to improve data quality since the pandemic began. CDC officials who work with QARS told us they have provided some training to staff to reduce errors and increase consistency in data entry. For example, recognizing the need for additional training to account for the expanded number of contractors using QARS, a data analyst from CDC headquarters visited one of CDC's 20 regional quarantine stations to personally oversee staff training and provide training materials, such as "practice homework." However, because the training is not institutionalized across CDC offices, its effectiveness is limited and continuation uncertain. In addition, CDC was unable to provide us documentation of a detailed user manual or other documented standard operating procedures for QARS users.

CDC officials who work with QARS told us they recently began to conduct informal, manual retrospective reviews of QARS data to track frequent data entry errors and find ways to improve data reliability. In response to these reviews and other work, the officials have implemented some automated system logic checks, such as to restrict a QARS user from incorrectly entering a flight arrival date that precedes the flight's departure. However, CDC prioritizes logic checks for the "highest impact" variables due to limited resources, and additional checks are needed, according to the officials.

Without sufficient data entry controls, such as adequate training that is institutionalized across the agency, standard operating procedures, and comprehensive logic checks, to help increase data reliability, CDC is limited in its ability to facilitate contact tracing and effectively monitor the public health risk associated with air travel more broadly. For example, due to irregularities in data quality, CDC officials were unable to provide us with sufficiently reliable information—such as the number of manifest requests CDC has submitted to airlines, or the total number of passengers who were exposed and warranted a contact investigation—for each year from 2015 through 2020. Rather, CDC provided estimations of this information with explanations of the limitations of its reliability.

Using unreliable data, CDC may be overestimating or underestimating the number of cases it conducts annually in total or at one of its quarantine stations, hindering the agency's ability to make informed decisions about workload or staff resource allocations among its 20 regional quarantine stations. CDC officials said that in some instances, data analysts have

discovered data entry errors much later—sometimes years later—when they were attempting to analyze the data for secondary purposes. This raises questions about additional undiscovered errors in the air passenger information CDC shares with its public health partners.

CDC Has Not Fully Assessed Potential Opportunities to Improve Data Quality

Data entry controls can help to reduce errors and inconsistencies when manual data entry is required. However, CDC has not fully assessed other potential opportunities to improve data quality. CDC officials told us that in their efforts to respond to the COVID-19 pandemic, they have identified some steps that may improve how CDC collects and manages passenger information—such as standardizing how local public health authorities share this information with CDC—but they have not assessed feasibility or fully explored whether other potential opportunities exist.⁴⁷

Specifically, CDC officials told us that CDC and state and local health authorities use established data exchange standards when sharing information for other activities, including disease surveillance, but those standards are not currently compatible for air passenger information.⁴⁸ For example, those data exchange standards do not apply to personal identifiable information, which passenger contact information contains. CDC officials said that if public health authorities and CDC were able to adopt data exchange standards for air passenger information, such standards could increase automated data sharing between CDC and local public health authorities and reduce the need for some manual entry.

⁴⁷We recently issued a report that discussed CDC efforts related to other public health data systems. CDC has made progress in modernizing the U.S. public health collection and surveillance infrastructure through its Data Modernization Initiative. However, CDC's Data Modernization Initiative's strategic implementation plan does not articulate the specific actions, time frames, and allocation of roles and responsibilities needed to achieve its objectives. We recommended that CDC define specific action steps and time frames for the agency's data modernization efforts, and HHS agreed with this recommendation. See [GAO-22-105397](#).

⁴⁸Data standards can be defined generally as technical specifications that describe how data should be stored or exchanged for the consistent collection and interoperability of that data across different systems, sources, and users. CDC reports that CDC and local public health authorities use National Notifiable Diseases Surveillance System (NNDSS) architectural standards as a basis for integrated surveillance information systems in public health departments. These architectural standards help public health agencies accept electronic data exchanges from healthcare systems and enables health departments to create and send standards-based case notifications to CDC for NNDSS.

In addition, CDC officials told us they frequently do not receive information on the outcomes of case investigations performed by local public health authorities. Representatives from organizations representing public health officials told us that some state health departments have reported that it is unclear whether CDC has a standardized process for soliciting feedback on contact tracing investigation outcomes from state and local public health authorities. CDC officials said data exchange standards that increase bi-directional exchange of data with local public health authorities may increase the information CDC receives on outcomes, allowing the agency to better assess the overall quality of information it provides as part of the contact tracing process.

In addition, CDC has previously recognized that standardizing the format in which it receives manifest information from airlines could improve data quality but has not fully explored the feasibility of doing so for information on passengers traveling on interstate flights. CDC officials told us that its recent global contact tracing order requiring airlines to provide information for passengers traveling on inbound international flights in a standardized format has improved the timeliness and accuracy of the information. Yet airlines still provide information for domestic interstate flights to CDC in different formats, and it is unclear if the Interim Final Rule and global contact tracing order will become permanent.⁴⁹ CDC officials told us they focused on passengers traveling on inbound international flights—despite being a small proportion of the total passengers flying into and between states—because CDC’s Division of Global Migration and Quarantine, which spearheads the collection of air passenger information, focuses on activities that reduce the chance of diseases crossing international borders.

While CDC officials told us the agency has recently begun to take steps to evaluate its process for collecting and managing air passenger information, these officials said that constrained resources and competing priorities have limited CDC’s ability to advance these efforts. Evaluation plays a key role in program planning, management, and oversight by

⁴⁹In 2005, CDC proposed requirements for airlines to collect and transmit passenger information for international and interstate flights to CDC within a specified timeframe, but ultimately the rule was not finalized. Control of Communicable Diseases, 70 Fed. Reg. 71892 (proposed Nov. 30, 2005).

providing feedback on both program design and execution.⁵⁰ Agencies can use performance information to make various types of management decisions to improve programs and results. In addition, federal standards for internal control state that agencies should develop monitoring activities, including periodic evaluations, to ensure programs are meeting agency objectives.⁵¹

CDC officials told us they are still discussing developing a plan to identify gaps in its process and opportunities to address them, as well as to assess the overall quality of the information it shares with local public health partners. One of the areas that officials said they hope to explore is the feasibility of adapting data exchange standards to decrease manual entry of data into QARS. While such efforts appear promising, as of March 2022, CDC was still discussing details of the plan and did not have a timeline for completion.

CDC's Data Management System Is Outdated and Does Not Meet CDC's Needs

Initially developed in the mid-2000s, CDC's data management system for air passenger information (QARS) limits CDC's ability to effectively facilitate contact tracing and conduct disease surveillance for air travel. The QARS system has independent rather than linked case records, lacks the functionality to efficiently analyze data, and has limited data fields. This situation makes it difficult for CDC to assess and aggregate data across individual cases, develop its own contact tracing protocols, and evaluate its performance in collecting and sharing timely, accurate, and complete passenger information.

More specifically, officials told us that CDC developed QARS from a legacy record-keeping system that collected and managed information for each passenger case independent of others. Because QARS was not designed for rapid assessment or aggregation of public health data across individual cases, it hinders CDC's ability to report key information

⁵⁰GAO, *Program Evaluation: Strategies to Facilitate Agencies' Use of Evaluation in Program Management and Policy Making*, [GAO-13-570](#) (Washington, D.C.: June 26, 2013); *Performance Measurement and Evaluation: Definitions and Relationships*, [GAO-11-646SP](#) (Washington, D.C.: May 2011); and *Managing For Results: Enhancing Agency Use of Performance Information for Management Decision Making*, [GAO-05-927](#) (Washington, D.C.: Sept. 9, 2005).

⁵¹[GAO-14-704G](#).

as part of the contact tracing process. For example, CDC is unable to quickly and accurately identify the number of passengers exposed to a specific infected passenger, or their relationship to the infected passenger (e.g., family member or travel companion). As a result, it is difficult to share with public health authorities any connected cases within their jurisdictions or trends regarding outbreaks in their area. According to representatives from an organization representing local public health authorities, when CDC shares information on potentially exposed passengers who may have been exposed, CDC does not always indicate that the case is connected to a traveler the local public health authority previously notified CDC about. These representatives said this type of information could help local public health authorities prioritize and conduct their contact investigations.

The system's outdated design, which does not allow CDC to efficiently analyze data, also affects CDC's ability to develop its own protocols for supporting contact tracing. For example, to develop a reporting threshold protocol for COVID-19—such as, the number of days passed since exposure after which public health authorities no longer need to report an infectious passenger to CDC—the agency had to engage in a process it described as resource intensive to extract data from QARS and conduct additional analyses outside of the system. CDC developed this threshold to prioritize cases with the highest likelihood of spreading COVID-19, as CDC would not initiate a contact investigation in QARS for cases reported outside of this time period. During the time it took CDC to develop the threshold, state and local public health authorities may have been using their constrained resources to initiate contact investigations for cases that CDC would no longer characterize as high priority.

The design of QARS system also impedes CDC's ability to assess the quality of air passenger information it receives from other sources. Officials told us QARS does not contain the data fields necessary to allow them to assess timeliness, accuracy, or completeness of information collected from its sources. For example, according to officials, QARS does not contain the information necessary to quickly and accurately determine how long it takes an airline to fulfill a manifest request.

CDC officials also told us they are unable to use QARS to identify and thus distinguish among the various sources of data elements, hindering their ability to assess the quality of data received from airlines versus other sources. Rather, CDC must often use time-consuming supplemental processes—such as by using Excel spreadsheets,

visualization dashboards, or proxy variables to obtain information—to assess the information it collects.

CDC has conducted a formal evaluation of the timeliness and completeness of passenger contact information provided by airlines for international flights one time, in 2019.⁵² According to CDC officials, because CDC could not identify information collected from airlines versus other sources, staff had to extract data from QARS and create spreadsheets outside of the system to evaluate data. This process took several months to complete, as CDC had to review each individual case file.⁵³ CDC has only minimally assessed the quality of information it receives for passengers traveling on domestic interstate flights, in part because QARS system limitations make such analyses time-consuming and resource-intensive. However, officials estimate contact investigations for domestic interstate flights constituted more than 90 percent of total contact investigations in 2020.

The limitations in the design of the QARS system prevent CDC from meeting the standards of its own strategic documents or federal standards for internal control. Specifically, CDC's strategic documents call for the ability to swiftly disseminate contact data to local public health authorities, identify gaps in current prevention and control efforts, and update aging technology systems in order to store, access, and transport timely, quality data.⁵⁴ Federal standards for internal control state that agencies should design information systems that help achieve their objectives and respond to risks.⁵⁵ CDC officials told us they have identified many areas to improve QARS but have not fully defined the system requirements that would better enable the agency to meet its needs.

⁵²This evaluation was conducted as required by its 2017 rule. See 42 C.F.R. § 71.4(c).

⁵³The 2019 evaluation report stated that there was some evidence that timeliness improved since the 2017 regulation went into effect; however, completeness of contact data provided by airlines generally did not change.

⁵⁴See U.S. Centers for Disease Control and Prevention, *A CDC Framework for Preventing Infectious Diseases: Sustaining the Essentials and Innovating for the Future*. (Atlanta, Ga.: October 2011); *National Center for Emerging and Zoonotic Infectious Diseases Strategic Plan: 2018-2023* (Atlanta, Ga.: August 2018); and *Information Technology Strategic Plan (ITSP) FY 2021-FY 2023* (Atlanta, Ga), accessed Apr. 22, 2022, <https://www.cdc.gov/od/ocio/it-strategic-plan/2021-23/overview/goal1/index.html>.

⁵⁵GAO-14-704G.

CDC officials said the limitations of the QARS system were somewhat manageable before the COVID-19 pandemic, when CDC received about 100 notifications per year of an infected passenger warranting contact tracing, compared with more than an estimated 17,000 in 2020. Even so, prior to the pandemic, CDC had been assessing the limitations in the design of QARS and was in the early stages of developing a modernization plan, according to officials. However, officials said CDC put those efforts on hold during the height of the pandemic to focus resources on their response efforts. In April 2022, officials told us they had recommenced efforts to identify and define system requirements but had not finalized a work plan or timelines for when or if QARS would be updated or replaced.

CDC officials fully acknowledged the system's limitations, but said competing priorities and resource constraints within the agency have thus far curtailed any attempts to make improvements. OMB's Federal Data Strategy states, however, that an agency should provide resources explicitly to leverage data assets, which includes ensuring that sufficient human and financial resources are available to support the management, maintenance, and use of strategic data assets, as well as data driven agency decision-making.⁵⁶

The explanatory statement accompanying the Consolidated Appropriations Act, 2022, designated an increase of \$8 million for quarantine programs, which as provided by the President's proposed budget for fiscal year 2022, would support modernizing public health programs that protect U.S. communities from infectious diseases. According to officials, modernizing QARS and other data systems that connect CDC to state and local public health authorities would be among the modernization efforts. CDC officials told us the agency is formulating plans for specific funds.

Conclusions

The COVID-19 pandemic has revealed major shortcomings in CDC's process for facilitating contact tracing by state and local public health authorities for passengers potentially exposed to communicable diseases during flights. In a connected world, COVID-19 is not the first, and will

⁵⁶Office of Management and Budget, *Executive Office of the President, Memorandum for the Heads of Executive Departments and Agencies, Federal Data Strategy – A Framework for Consistency* (Washington, D.C.: June 4, 2019).

likely not be the last, communicable disease to spread quickly beyond borders and threaten U.S. public health and the economy. Contact tracing—when performed effectively in conjunction with other public health measures like testing and quarantining—can help slow or stop the chain of disease transmission. Given the role that air travel plays in the initial and subsequent spread of communicable disease, CDC and local public health authorities have an acute need to access high-quality passenger contact information.

However, CDC faces significant challenges in collecting timely, accurate, and complete passenger information. Recent efforts to improve the quality of information it collects from airlines and CBP to facilitate contact tracing have helped but mostly apply to passengers traveling on inbound international flights—a small fraction of the total number of air travelers. In addition, these efforts may only be temporary. Moreover, CDC has yet to fully address limitations in its data entry process and in the system it uses to manage air passenger contact investigations, resulting in unreliable data that are of limited use.

In the short term, implementing sufficient data entry controls could enable CDC to quickly improve the quality of its data. Further, undertaking longer-term and more complex efforts—including assessing other ways to improve the quality of air passenger information it collects and manages, and updating or replacing its data system—can strengthen CDC’s ability to monitor public health risks related to air travel, support contact tracing by state and local health authorities, and evaluate and improve its own processes.

Recommendations for Executive Action

We are making the following three recommendations to CDC:

The Director of CDC should implement controls for the entry of data into its Quarantine Activity Reporting System (QARS), including by providing adequate training and standard operating procedures that are documented and institutionalized for system users and by conducting consistent validation checks. (Recommendation 1)

The Director of CDC should assess additional opportunities to improve the quality of air passenger information it collects and manages—including opportunities to increase automation by adopting or establishing

data exchange standards—and take action, as appropriate, based on this assessment. (Recommendation 2)

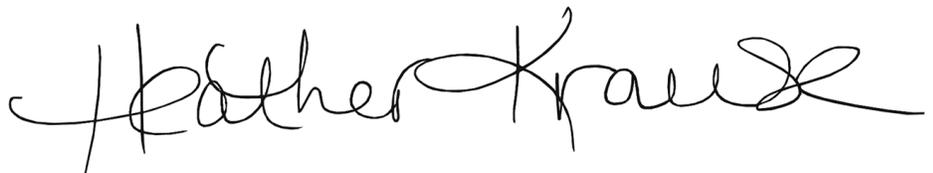
The Director of CDC should re-design QARS or deploy a new data system that would allow CDC to more effectively facilitate contact tracing for air passengers and conduct disease surveillance for air travel. (Recommendation 3)

Agency Comments

We provided a copy of this report to HHS, DHS, and DOT for review and comment. In written comments reproduced in appendix II, HHS concurred with our recommendations. DOT, DHS, and HHS also provided technical comments, which we incorporated as appropriate.

We are sending copies of this report to the appropriate congressional committees, 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, 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 Heather Krause at (202) 512-2834 or krauseh@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 III.



Heather Krause
Director, Physical Infrastructure

List of Addressees

The Honorable Patrick Leahy
Chairman
The Honorable Richard Shelby
Vice Chairman
Committee on Appropriations
United States Senate

The Honorable Ron Wyden
Chairman
The Honorable Mike Crapo
Ranking Member
Committee on Finance
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The Honorable Kevin Brady
Republican Leader
Committee on Ways and Means
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The Honorable Rick Larsen
Chair
Subcommittee on Aviation
Committee on Transportation and Infrastructure
House of Representatives

Appendix I: Objectives, Scope, and Methodology

This report examines: (1) the factors that affect CDC’s ability to collect timely, accurate, and complete air passenger contact information from airlines and other sources; (2) the actions CDC has taken since the onset of the COVID-19 pandemic to improve the quality of air passenger contact information it collects; and (3) how effectively CDC collects and manages air passenger contact information to facilitate contact tracing.

Scope

Contact tracing scenarios and process steps. This report focuses on how CDC collects and manages contact information for passengers traveling on inbound international and domestic interstate scheduled flights. We focused on scenarios when the infected passenger is identified after a flight.¹ Because the contact tracing process for airline crew (e.g., flight attendants and pilots) is separate from that of passengers, we excluded the process for collecting contact information from airline crews from our review. We also excluded from our review any efforts for identifying contacts outside the aircraft, such as when infectious travelers may have come into contact before or after a flight with transportation security officials or airport workers. We did not review the methods used by public health authorities to conduct contact tracing after obtaining air passenger contact information from CDC.

Federal departments and components. We assessed the activities of three federal departments—the Departments of Health and Human Services (HHS); Homeland Security (DHS); and Transportation (DOT). We selected these departments because they represent the key federal departments with roles for facilitating contact tracing for potentially

¹In some cases, airlines may report that a passenger onboard the aircraft has symptoms of an infectious disease to CDC, who then alert the public health authority within relevant jurisdictions. CDC regulations require airlines to report travelers with certain signs and symptoms of disease, and all deaths that occur during international flights coming into the United States. 42 C.F.R. § 71.21. When this occurs, CDC may collect air passenger contact information directly through a passenger locator form from travelers on impacted flights, and CDC may use the passenger data to perform the contact investigation themselves.

exposed air passengers. Within these three departments we collected and reviewed available documentation and interviewed officials from various components that play a key role at their respective departments, principally HHS's CDC, DHS's U.S. Customs and Border Protection (CBP), and DOT's Federal Aviation Administration (FAA).

Selected CDC quarantine stations. We interviewed officials from four CDC quarantine stations co-located with international airports: Atlanta (Hartsfield-Jackson Atlanta International Airport); Chicago (O'Hare International Airport); Los Angeles (Los Angeles International Airport); and San Francisco (San Francisco International Airport). We selected these four quarantine stations from the 20 total stations based on several factors, including high volume of international and domestic passengers at airports co-located with the quarantine station, number of states within the geographic jurisdiction of the quarantine station, recommendations from federal and aviation industry stakeholders, and additional factors, such as if the quarantine station is co-located at an airport in which an airline we interviewed is headquartered.² We selected these factors in order to obtain a breadth of perspective on CDC's collection and management of air passenger information as these quarantine stations would likely have routinely conducted contact investigations both before and during the COVID-19 pandemic, as well as had regular contact with airlines that provided both domestic and international flights. The views of the officials we spoke with from these quarantine stations are not generalizable to the views of all officials working in CDC's quarantine stations.

Selected airlines. We interviewed or received written responses from six selected U.S. commercial passenger airlines: American Airlines, Delta Air Lines, JetBlue Airways, Southwest Airlines, Spirit Airlines, and United Airlines. To select these airlines, we first identified U.S. scheduled large passenger airlines that had operating revenues of \$1 billion or more

²To determine passenger volumes at airports, we used airline data for flights and passengers by airports for passengers on U.S. mainline passenger airlines traveling from international and domestic destinations in the U.S. for calendar year 2019. We obtained these data from Diiio, a private contractor that provides online access to U.S. airline financial, operational, and passenger data with a query-based interface. We used calendar year 2019 data because it is more representative of typical market activity prior to the COVID-19 pandemic

during calendar year 2019.³ We then selected these airlines based on international flights' passenger volume, the operation of both international and domestic flights, recommendations from stakeholders, and other unique factors, such as booking and seating practices, among other characteristics.⁴ The views of these airlines are not generalizable to all U.S. commercial airlines operating scheduled flights. We also did not consider regional passenger airlines or air taxis in our selection because regional airlines typically operate domestic flights on behalf of mainline carriers. As a result, few regional airlines collect or transmit passenger data to CDC for contact tracing. We also did not include cargo airlines or charter flights in our selection because of their more limited role with respect to contact tracing for air travelers.

Methodology

To address our objectives, we reviewed relevant statutes and regulations. For example, we reviewed a number of regulatory documents including CDC's 2005 proposed rule, 2017 final rule, and 2020 Interim Final Rule for the Control of Communicable Diseases, as well as associated implementing orders and submitted public comments.⁵ We also reviewed publications and studies from CDC, industry, and academia on topics related to contact tracing for air travel. These documents were identified and selected based on a search of relevant literature published between January 2016 and March 2021.⁶

³Bureau of Transportation Statistics classifies as "Group III" airlines. We used calendar year 2019 Bureau of Transportation Statistics groupings to match the most recent year of passenger volume data available, which in calendar year 2019 included 10 mainline passenger airlines in group III.

⁴We identified airlines with the highest volume of passengers traveling on international flights through Diio airline market data for onboardings on U.S. mainline passenger airlines traveling from international destinations to the U.S. for calendar year 2019. We did not consider domestic flight volume as the recent efforts undertaken by CDC to improve its process to collect air passenger information only involved inbound international flights.

⁵We reviewed 42 C.F.R. part 71, including proposed and final rules issued in 2005, 2017, and 2020 (see, e.g., 85 Fed. Reg. 7874 (Feb. 12, 2020)). These regulations describe CDC's authority to collect air passenger information for inbound international flights. We also reviewed 42 C.F.R. part 70, which describes CDC's authority to collect air passenger information for interstate flights.

⁶The search was conducted in the following databases: EBSCO, ProQuest, ProQuest Dialog, and Scopus.

To better understand factors affecting CDC's process to collect and manage air passenger contact information we reviewed policies, guidance, and other documentation relevant to CDC's process. In particular, we reviewed CDC's guidance to airlines and the public regarding this process,⁷ a 2004 CDC-commissioned study on the agency's contact tracing process,⁸ and a Memorandum of Understanding between HHS and DHS establishing specific cooperation mechanisms to enhance preparedness against the introduction, transmission, and spread of communicable diseases from foreign countries into the U.S.⁹ We also interviewed officials or received written responses from the three selected federal departments and respective components, the four CDC quarantine stations, and representatives from the six selected airlines identified above. We also interviewed representatives from five industry groups representing the aviation sector,¹⁰ two associations representing local public health authorities,¹¹ two global distribution systems companies,¹² and Travel Technology Association, a travel industry association, to obtain broader stakeholder perspectives on contact tracing for aviation.

To describe the actions CDC's has taken since the onset of the COVID-19 pandemic to improve the quality of air passenger contact information it collects, we reviewed CDC regulatory documents related to its Interim Final Rule and associated implementing orders, including technical instructions to airlines, documents submitted to the Office of Management

⁷See, for example, U.S. Centers for Disease Control and Prevention, *Protecting Travelers' Health from Airport to Community: Investigating Contagious Diseases on Flights* (Atlanta, GA.), accessed Feb. 16, 2021, <https://www.cdc.gov/quarantine/contact-investigation.html>.

⁸Volpe National Transportation Center, *Real-Time Data for CDC Location of At-Risk Passengers: Final Report* (Cambridge, MA: June 29, 2004).

⁹*Memorandum of understanding between the Department of Health and Human Services and the Department of Homeland Security* (October 2005).

¹⁰We interviewed the following aviation industry groups: Airlines for America, International Air Transport Association, National Air Carrier Association, and Regional Airline Association.

¹¹We interviewed the following associations representing local public health authorities: Association of State and Territorial Health Officials and National Association of County and City Health Officials.

¹²Global distribution systems are computer systems that display airline flight schedule and fare information so that travel agents can query it to "book" (i.e., reserve and purchase) flights for consumers. We interviewed the following companies: Amadeus and TravelPort.

and Budget to fulfill requirements related to the Paperwork Reduction Act, and the Privacy Impact Assessment for QARS. We also reviewed applicable CBP documents including information on the expansion of coordination efforts between CDC and CBP in collecting information for passengers traveling on inbound international flights.¹³

For contextual information on how CDC's actions compare to other countries, we reviewed documents and interviewed officials from public health, border protection, and transportation agencies of the three selected countries: Canada, Australia, and the United Kingdom. To select these countries, we first identified countries with foreign contact tracing programs or initiatives as of April 2021.¹⁴ We then identified from that list, countries that had one million or more passengers arrive or depart on direct flights to and from the United States in calendar year 2019 based on DOT data.¹⁵ We then selected these three countries to provide a variety of regions and locations.¹⁶ We also considered other unique factors, such as characteristics of the country's data collection program (e.g., collection mechanism); similarities to the United States (e.g., privacy laws); and recommendations from other stakeholders.

To assess CDC's ability to effectively collect and manage air passenger contact information, we reviewed available federal agency documentation on data strategies and our past work on public health threat response and data management systems to identify leading practices for maintaining and using health data to inform agency activities and respond to disease

¹³Department of Homeland Security, Privacy Impact Assessment for the CBP Support of CDC for Public Health Contact Tracing, DHS/CBP/PIA-066a (Washington, D.C.: Feb. 12, 2021).

¹⁴We identified 97 countries that have programs to electronically collect passenger information for public health purposes, most of which have been initiated due to the COVID-19 pandemic.

¹⁵We identified 16 countries under this criteria based on Diio airline data. In addition, we considered data only from 2019 because it represents more typical flight patterns than 2020 data due to the COVID-19 pandemic. We also only considered flights operated by U.S. airlines.

¹⁶For variety, we did not select more than one country in the following regions: North America, Central America, Caribbean, South America, Europe, Central and Southeast Asia, and Pacific. We also selected at least one country in Europe and one country in North America due to the higher volume of flights between the United States and European Union and North America, and due to European privacy laws that airlines have identified as of particular concern for contact tracing programs.

events.¹⁷ We also reviewed leading practices GAO has previously identified for program evaluation and performance measurement and evaluation.¹⁸ We compared CDC's current process to collect and manage air passenger contact information with relevant portions of these criteria.

We also determined that the control activities component of internal control was significant to this objective, along with the three underlying principles that management should design the entity's information system and related control activities to achieve objectives, respond to risks and implement control activities through policies, and develop monitoring activities, including periodic evaluations.¹⁹ Specifically, we assessed the agency's process to collect and manage contact investigation data to determine whether it was capable of meeting current program objectives as described in agency documentation.²⁰

¹⁷Office of Management and Budget, Executive Office of the President, *Memorandum for the Heads of Executive Departments and Agencies, Federal Data Strategy – A Framework for Consistency* (Washington, D.C.: June 4, 2019). For our previous work on public health threats and disease response, see, for example, GAO, *Emerging Infectious Diseases: Asian SARS Outbreak Challenged International and National Responses*, [GAO-04-564](#) (Washington, D.C.: Apr. 28, 2004); *Air Travel and Communicable Diseases: Comprehensive Federal Plan Needed for U.S. Aviation System's Preparedness*, [GAO-16-127](#) (Washington, D.C.: Dec. 16, 2015); and *COVID-19: Federal Efforts Could be Strengthened by Timely and Concerted Actions*, [GAO-20-701](#) (Sept 21, 2020). For our previous work on data management systems, see, for example, GAO, *Oil and Gas Wells: Bureau of Land Management Needs to Improve Its Data and Oversight of Its Potential Liabilities*, [GAO-18-250](#) (Washington, D.C.: May 16, 2018); *Oil and Gas: Interior Should Strengthen Management of Key Data Systems Used to Oversee Development on Federal Lands*, [GAO-21-209](#) (Washington, D.C.: May 27, 2021); and *COVID-19: Data Quality and Considerations for Modeling and Analysis*, [GAO-20-635SP](#) (Washington, D.C.: July 30, 2020).

¹⁸GAO, *Program Evaluation: Strategies to Facilitate Agencies' Use of Evaluation in Program Management and Policy Making*, [GAO-13-570](#) (Washington, D.C.: June 26, 2013); *Performance Measurement and Evaluation: Definitions and Relationships*, [GAO-11-646SP](#) (Washington, D.C.: May 2011); and *Managing For Results: Enhancing Agency Use of Performance Information for Management Decision Making*, [GAO-05-927](#) (Washington, D.C.: Sept. 9, 2005).

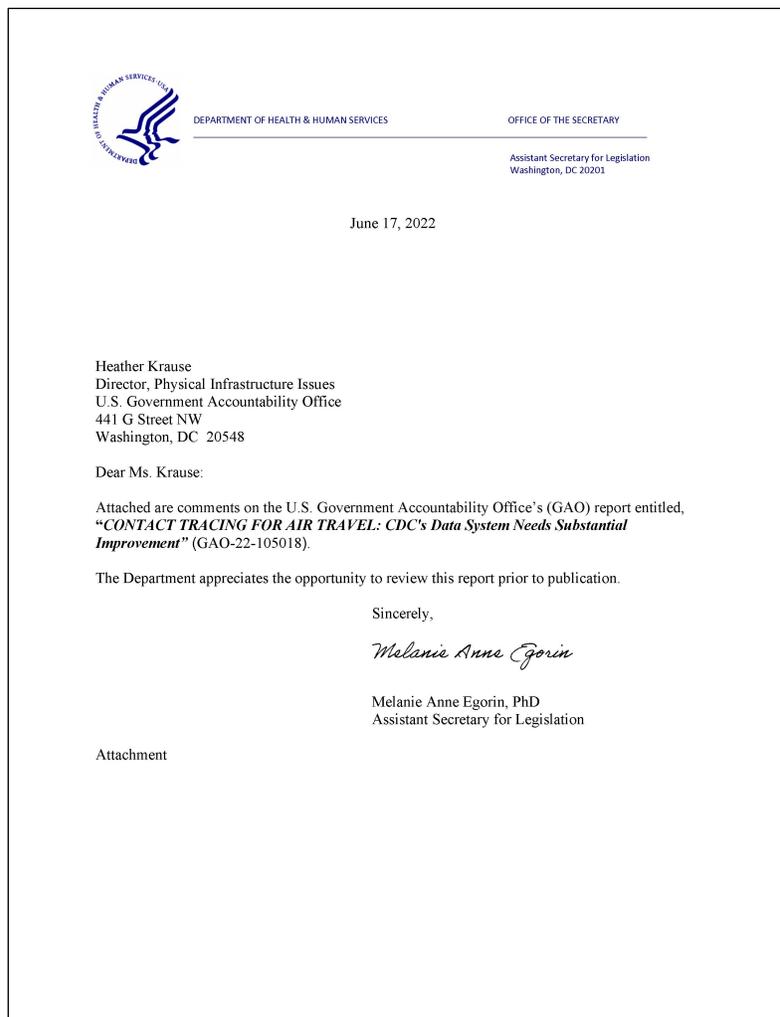
¹⁹GAO, *Standards for Internal Control in the Federal Government*, [GAO-14-704G](#) (Washington, D.C.: Sept. 10, 2014).

²⁰See U.S. Centers for Disease Control and Prevention, *A CDC Framework for Preventing Infectious Diseases: Sustaining the Essentials and Innovating for the Future* (Atlanta, Ga.: October 2011); *National Center for Emerging and Zoonotic Infectious Diseases Strategic Plan: 2018-2023* (Atlanta, Ga.: August 2018); and *Information Technology Strategic Plan (ITSP) FY 2021-FY 2023* (Atlanta, Ga), accessed Apr. 22, 2022, <https://www.cdc.gov/od/ocio/it-strategic-plan/2021-23/overview/goal1/index.html>.

We also reviewed the reliability of CDC's data collected and managed in its Quarantine Activity Reporting System (QARS). To assess the reliability of contact investigation data, we interviewed CDC officials about how the data were collected, managed, and used, and the steps CDC takes to ensure the data are accurate, complete, and reliable. We also requested that CDC provide us with contact investigation information from 2015 through 2020, such as the number of manifest requests CDC submitted to airlines or the total number of passengers who were exposed and warranted a contact investigation, among other things. CDC officials told us that they were unable to provide this information with sufficient reliability and ease due to irregularities in data quality and system limitations within QARS. Instead, they provided a sample of extracted data from a 3-month period in 2021. They also provided us the results of data system queries we requested for each year between 2015 and 2020 with explanations of the limitations of its reliability, query results which we used in our report to provide contextual information. We then reviewed any available documentation related to procedures for data entry, validation, and management to determine the extent to which these elements assisted with agency objectives and aligned with selected control activities.

We conducted this performance audit from February 2021 to July 2022 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: Comments from the Department of Health & Human Services



**GENERAL COMMENTS FROM THE DEPARTMENT OF
HEALTH & HUMAN SERVICES ON THE GOVERNMENT
ACCOUNTABILITY OFFICE'S DRAFT REPORT ENTITLED —
CONTACT TRACING FOR AIR TRAVEL: CDC's Data System
Needs Substantial Improvement (GAO-22-105018)**

The U.S. Department of Health & Human Services (HHS) appreciates the opportunity from the Government Accountability Office (GAO) to review and comment on this draft report.

Recommendation 1:

The Director of CDC should implement controls for the entry of data into its Quarantine Activity Reporting System (QARS), including by providing adequate training and standard operating procedures that are documented and institutionalized for system users and by conducting consistent validation checks.

HHS Response

HHS *concur*s with GAO's recommendation.

CDC currently provides training to QARS users through multiple modalities: in person by other station staff; live, remote training by subject matter experts; remote recording through CDC's eLearning platform; a detailed instruction guide on the QARS website; a training version of QARS for practice of data entry; and job action sheets with screen shots. Additionally, CDC will establish a continuous quality improvement process or plan to build a culture based on data quality. CDC also plans to minimize errors and improve data quality by improving the user interface and creating a better user experience (e.g., using more readable font).

Consistent validation checks would require either additional staff to monitor increased entries into QARS or the development of a system which can perform self-validation and data exchange with other government systems. While CDC does plan to make upgrades to QARS, given other priorities for the upgrade, funding is not currently available for this specific recommendation.

Recommendation 2:

The Director of CDC should assess additional opportunities to improve the quality of air passenger information it collects and manages—including opportunities to increase automation by adopting or establishing data exchange standards—and take action, as appropriate based on this assessment.

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HHS *concur*s with GAO's recommendation.

CDC has instituted a project to improve data interoperability with public health departments to share traveler information. Additionally, there is an agency-wide effort to institute standardized messaging parameters for travelers. This will create the standardized variables to be used by public health partner systems when CDC

**Appendix II: Comments from the Department
of Health & Human Services**

exchanges data with them.

Recommendation 3:

The Director of CDC should re-design QARS or deploy a new data system that would allow CDC to more effectively facilitate contact tracing for air passengers and conduct disease surveillance for air travel.

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HHS *concur*s with GAO's recommendation.

CDC is in the initial phases of a complete re-design of QARS that will include recoding, revalidation, and migration to a cloud environment. The re-design will better synthesize data from other federal agency partners that CDC works with for reporting and analysis purposes.

Text of Appendix II: Comments from the Department of Health & Human Services

DEPARTMENT OF HEALTH & HUMAN SERVICES
SECRETARY

OFFICE OF THE
SECRETARY

Assistant Secretary for Legislation Washington, DC 20201

June 17, 2022

Heather Krause
Director, Physical Infrastructure Issues
U.S. Government Accountability Office
441 G Street NW Washington, DC 20548

Dear Ms. Krause:

Attached are comments on the U.S. Government Accountability Office's (GAO) report entitled, "CONTACT TRACING FOR AIR TRAVEL: CDC's Data System Needs Substantial Improvement" (GAO-22-105018).

The Department appreciates the opportunity to review this report prior to publication.

Sincerely,
Melanie Anne Egorin, PhD
Assistant Secretary for Legislation

Attachment

GENERAL COMMENTS FROM THE DEPARTMENT OF HEALTH & HUMAN
SERVICES ON THE GOVERNMENT ACCOUNTABILITY OFFICE'S DRAFT
REPORT ENTITLED — CONTACT TRACING FOR AIR TRAVEL: CDC's Data
System

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Appendix III: GAO Contact and Staff Acknowledgments

GAO Contact

Heather Krause, 202-512-2834 or krauseh@gao.gov

Staff Acknowledgments

In addition to the individual named above, Paul Aussendorf, Eric Bachhuber, Sue Bernstein, Scott Borre, Jonathan Carver, Erin Guinn-Villareal, Hayden Huang, Neelaxi Lakhmani, Diona Martyn, Josh Ormond, Katherine Raymond, Kelly Rubin, Gretchen Snoey, Michael Soressi, and Laurel Voloder made key contributions to this report.

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