


A magnifying glass is positioned over a map of the United States and Mexico. The lens of the magnifying glass is centered over the Gulf of Mexico, with the word 'MEXICO' clearly visible. Other cities like 'SAN FRANCISCO', 'LOS ANGELES', 'DENVER', 'DALLAS', 'HOUSTON', 'MONTERREY', 'MEXICO CITY', and 'ACAPULCO' are also visible on the map. The background is a light blue color.

To Screen or Not to Screen: The Role of Airport Screenings in Controlling the Spread of Infectious Diseases

By Dana Martin

Each year, the number of people traveling between countries increases. In 2012 alone, nearly three billion people flew internationally.¹ The sheer number of people taking international flights, coupled with the more rapid emergence of infectious diseases, makes it easier than ever for localized outbreaks to become global health emergencies. How do these infectious agents hitch a ride with passengers, and what role does screening play in containing the public health risk posed by international air travel?



In 2005, the World Health Organization (WHO) ratified changes to the 1969 International Health Regulations (IHR). The changes were designed to prevent, protect against, control and provide a public health response to the international spread of disease “in ways that are commensurate with and restricted to public health risks, and which avoid unnecessary interference with international traffic and trade.”² During the early phase of a pandemic, entry and exit screening can be made mandatory under the IHR. Such screenings are required as core capacities for designated airports so they can respond to events that may constitute a public health emergency of international concern.³

Aside from the IHR, there is no overarching body regulating screenings related to international travel. Many countries require screenings for specific situations, such as mandatory overseas medical examinations for immigrants and refugees before admission to the United States.⁴ In its Travelers’ Health website, the Centers for Disease Control and Prevention (CDC) outlines screening considerations for parasitic and nonparasitic infections in asymptomatic return travelers, noting that it has not put official guidelines or recommendations in place for those returning from international travel who have no symptoms of illness.⁵

Two Current Health Threats

The most notable current health threat is the much publicized Ebola outbreak in West Africa. In late September, CDC estimated that, with corrections made for underreporting, there could be 1.4 million cases of Ebola in Liberia and Sierra Leone by January.⁶ One reason for this unprecedented growth is the fact that the virus has spread to major cities in five West African countries. In contrast, past outbreaks have been contained relatively quickly and have been restricted to remote areas. This spread into cities and across country borders makes the virus much more difficult to contain. While authorities are focusing on treatments and vaccines to control this outbreak, concern among the public over international travel, especially into and out of affected countries, is high. In response to the outbreak, WHO is recommending that affected countries carry out exit screening at international airports, seaports and major land crossings.⁷

Another current health threat is wild poliovirus. As of this writing, four countries are currently exporting the virus: Pakistan, Cameroon, Equatorial Guinea and the Syrian Arab Republic. In addition, six countries are infected with, but not currently exporting, the virus: Afghanistan, Ethiopia, Iraq, Israel, Nigeria and Somalia.⁸ In May, the IHR Emergency Committee declared the virus a public health emergency and issued temporary recommendations for affected countries. For exporting countries, the recommendations include ensuring all residents and long-term visitors receive a dose of polio vaccine. For infected countries, the recommendations include encouraging residents and long-term visitors to receive a dose of polio vaccine prior to international travel. In an August follow-up meeting, the IHR Emergency Committee stated that the possible consequences of international spread had worsened since its May declaration, noting the increase in susceptible populations living in virus-free but conflict-torn areas where routine immunization services have deteriorated. The IHR extended its temporary recommendations and requested another reassessment in November.⁸

Not All Diseases Are Created Equal

Both Ebola and poliovirus raise numerous questions about the role of screening in international travel. For Ebola, the IHR is recommending exit screening in affected countries. For poliovirus, as of this writing, the IHR is recommending vaccination when traveling to and from affected countries. While screening has not been made mandatory in the latter case, the U.S. did implement mandatory screening for Ebola in October. Passengers who travel from nations struck by Ebola to Washington Dulles (Washington, D.C.), John F. Kennedy (New York), Newark Liberty (New Jersey), O’Hare (Chicago) and Hartsfield-Jackson (Atlanta) airports are now required to have their temperatures checked and fill out a health questionnaire.

Required and Recommended Travel Vaccinations

The International Health Regulations requires only two vaccinations as of this writing. Yellow fever vaccination is required for travel to certain parts of sub-Saharan Africa and South America, and the meningococcal vaccination is required by the Saudi Arabian government for travel during the period of the Hajj.²⁵ In addition, individual countries recommend numerous vaccines for travel to various parts of the world. For those traveling from the United States to other countries, the Centers for Disease Control and Prevention provides information about travel requirements and recommendations at its Travelers' Health webpage at wwwnc.cdc.gov/travel/destinations/list. This page also includes information for clinicians.

According to White House press secretary Josh Earnest, increased screening for Ebola at these airports will capture 94 percent of passengers arriving from African nations that are battling the virus.⁹ Shortly after, Britain began screening travelers coming from Ebola-hit parts of West Africa at Heathrow and Gatwick airports and on Eurostar trains from Belgium and France.¹⁰

In late October, the Centers for Disease Control and Prevention (CDC) announced it will actively monitor individuals traveling from Liberia, Sierra Leone and Guinea for Ebola symptoms for 21 days after they enter the U.S. CDC Director Dr. Thomas Frieden said that travelers from the region will be required to take their temperatures twice a day and will be responsible for reporting their daily temperatures and any Ebola-related symptoms. State health departments will be responsible for enforcing the monitoring program, Frieden said.¹¹

When an infectious disease emerges or experiences a resurgence, instinct tells us that every international traveler should be screened; otherwise, global travel will be unsafe. Taking this thinking to the extreme is what leads those like Donald Trump to make statements about the intrinsic lack of safety with regard to bringing a patient with Ebola into the United States for treatment as part of an appropriate medical evacuation. But even moderately concerned laypersons may believe a pandemic is just one flight away and that indiscriminate screening is the answer to the suppression of infectious diseases posing a worldwide threat.

According to WHO, infectious diseases seem to be emerging

more quickly than ever. Nearly 40 new diseases have been discovered that were unknown a generation ago.¹² In addition, many diseases that were once under control are re-emerging.² To gain a better understanding of the applicability of airport screening in international travel for these diseases, it's important to understand that not all pathogens have the same microbiological characteristics. According to a retrospective evaluation of the A(H1N1) pandemic conducted by WHO, several factors need to be assessed to determine whether international passengers should be screened. These include the following:

- Will screening likely result in source control?
 - If source control is not possible, is international export of the pathogen in question likely?
 - What is the prevalence of infection and symptomatic disease in travelers?
 - What is the clinical spectrum of illness, and can relevant illness be detected through direct observation, traveler health declarations, complementary tests or some combination of these approaches?
 - What are the operating characteristics and limitations of available screening methods?
 - What is the global epidemiologic pattern of the epidemic disease at the time when traveler screening is first contemplated?
 - What are the opportunity costs of detecting other infectious diseases of lesser significance as a result of screening?
 - What is the perceived contagiousness and severity of the epidemic disease, and what are its estimated health and economic effects?
 - What is the availability and cost of effective methods for preventing or treating the epidemic disease?
 - What are the projected public health benefits of health screening at airports relative to those that could be achieved by intervening at other international frontiers, domestic frontiers or both?
- Other factors to consider regarding the effectiveness of screening, especially with air travel, are the disease's incubation period and whether transmission is possible in the absence of symptoms.³
- In the case of poliovirus, the expanded surveillance and screening recommended within exporting countries is not the same as entry or exit screening of international travelers at airports or other major crossing points. The former pertains to surveillance within a country rather than between country borders. Only two countries — the Kingdom of Saudi Arabia and India — currently have polio vaccination requirements for entry. Other countries have no entry requirements at this time but may put a requirement in place in the future.¹³
- The European Centre for Disease Prevention and Control indicated last May that screening the polio vaccination status of travelers to Europe was not deemed necessary, stating: "There is evidence that the high vaccination coverage at the national level has prevented re-introduction [sic] of [wild poliovirus] — despite periodic detection in the EU."¹⁴ This

helps explain why the IHR's temporary recommendations regarding vaccination target those who live in and travel to and from affected countries. Where vaccination coverage is high, what some call "herd immunity" takes hold, making it unlikely that the virus will spread even if it is reintroduced through international travel.

In the case of Ebola, after the meeting of the Ebola Emergency Committee under the IHR in early August, WHO provided recommendations to countries to help contain the current Ebola outbreak. One recommendation is that countries be prepared to detect, investigate and manage Ebola cases, including having the ability to identify and care for travelers coming from known Ebola-infected areas who arrive at international airports or major land crossing points with unexplained fever and other symptoms.¹⁵ As noted above, WHO also recommended that anyone traveling from affected countries by air, sea or major land crossings be screened on exit.⁷

WHO issued a travel and transport update that outlines the risk of Ebola virus disease for various groups and details recommendations for public health authorities and the transport sector. The update states that the risk of Ebola transmission during commercial flights is low. That is because the disease cannot be spread while infected individuals are asymptomatic. In addition, the incubation period for the disease is relatively long (up to 21 days), which means the likelihood of developing symptoms during a flight is quite low. WHO does warn that infected individuals could travel long distances during the disease's incubation period without showing symptoms until they reach their destinations.¹⁶ This is exactly what happened in Texas in late September, when the first case of Ebola in the United States was confirmed in a man who had recently flown to Dallas from Liberia. He became symptomatic only after his arrival. Because he was not symptomatic — and, therefore, not contagious — at the time of his flight, neither exit nor entry screening would have flagged him as infected. (In fact, he was screened on exit from Liberia but had no fever.)¹⁷

The WHO update adds that a passenger with Ebola symptoms could board a commercial flight without disclosing his or her health status. It reads: "It is highly likely that such patients would seek immediate medical attention upon arrival, especially if well-informed, and then should be isolated to prevent further transmission. Although the risk to fellow travellers [sic] in such a situation is very low, contact tracing is recommended in such circumstances."¹⁶

Lessons Learned from SARS and A(H1N1)

Not all infectious diseases will have the same profile as poliovirus, with its high level of vaccination coverage in unaffected countries, or as Ebola, with its low risk of transmission during international travel. We've already seen diseases that have a higher rate of transmission, including severe acute

Air Travel Risks May Extend Beyond the Plane

Many travelers are concerned about their risk of contracting an infectious disease while on board an international flight. But, what about the areas in which air travelers spend time before and after their flights? Standing in airport lines, congregating at crowded gates, passing through jet bridges, waiting at baggage claim areas, passing through customs and taking public transit to and from the airport might put travelers at greater risk than their actual flights.

The authors of "Screening for Infectious Diseases at International Airports: The Frankfurt Model," published in *Aviation, Space, and Environmental Medicine*, posit that the transmission of diseases such as SARS and influenza, which have higher rates of transmission, are more likely to occur in areas proximal to the plane than on the plane itself. Their reasoning is that ventilation systems within the plane are often superior to those in the airport and its surrounding areas.

The authors propose several ways to curb the spread of infection in areas where people spend time before and after flights. First, ventilation systems in these areas should be optimized to help prevent the spread of droplet infections. Second, procedures that discourage the formation of lines such as at the boarding gate should be implemented. Third, jet bridges should have ventilation systems that flow toward the outside. And, fourth, aggressive air-sanitation measures should be installed.³

respiratory syndrome, also known as SARS. The international community learned just how quickly SARS could travel during the 2002–2003 outbreak. This outbreak led to 8,448 reported cases and 774 reported deaths. In a matter of weeks, the disease infected individuals in 37 countries, with a spread across four continents within three days by way of global air traffic. Before the outbreak subsided, affected countries included Canada, China, Singapore, the United States and Vietnam, in addition to the originating country, Hong Kong.^{3,18,19}

In 2009, A(H1N1) went from posing a pandemic threat to being a full-blown pandemic in less than two months.²⁰ This

Passenger Misinformation: One Downside of Screening

On Sept. 30, Thomas Eric Duncan became the first person diagnosed with Ebola in the United States after traveling from Liberia to Dallas.^{20,26,27} He underwent exit screening before leaving Liberia, which entailed filling out a questionnaire and undergoing three airport screenings that included temperature scans. He did not have a fever, and his questionnaire answers reportedly stated that he had not touched the body of someone who had died in an area affected by the disease. After he developed Ebola, news reports state that Duncan did in fact have contact with people afflicted with Ebola in Liberia, according to witness reports, including caring for an infected individual at a residence outside Monrovia.²⁷

Duncan's case raises an important question with regard to airport screenings. When screening relies in part on passenger-supplied information, even the most comprehensive screening efforts can fail if a passenger provides erroneous information about his or her exposure risk. Though travelers have the potential to respond to screening questionnaires inaccurately, keeping borders open is paramount to allowing other countries access to them, which in turn facilitates efforts to help control the outbreak.²⁷ In an Oct. 2 Twitter chat on Ebola led by CDC experts, CDC Travelers' Health stated that people completing screenings don't always know when they've been exposed. It adds: "[Screening] doesn't need to be perfect to work."²⁸ Still, Duncan's story needs to be a larger discussion about taking measures to develop screening methods that are not undermined by unverifiable subjective information.

pandemic originated in Mexico but resulted in approximately 60.8 million cases, 274,304 hospitalizations, and 12,469 deaths in the United States alone, according to CDC.²¹

Both SARS and A(H1N1) are examples of infectious diseases with characteristics that differ from that of Ebola or poliovirus. Like Ebola, only those who are symptomatic can transfer SARS. But unlike Ebola, SARS can be passed through coughing and sneezing.²² The incubation period for SARS is

typically two to seven days,²² compared with up to 21 days for Ebola. In the case of A(H1N1), like other flu viruses, those who are infected are contagious for up to one day before they become symptomatic.³ A(H1N1) is thought to be spread by people with the virus when they cough, sneeze or talk.²³ The incubation period is about two days.² And, unlike wild-type poliovirus, people didn't have widespread protection in the form of a vaccine against SARS and A(H1N1) when they emerged. They were new viruses that populations had no protection against.

These differences in characteristics matter because, as noted above, responses to outbreaks, including international travel responses, must be based on the specifics of each infectious disease. For instance, the authors of a retrospective evaluation of the A(H1N1) pandemic concluded that exit screening at just six airports in Mexico would have caused the least disruption to international air traffic and would have allowed for the assessment of about 90 percent of all at-risk travelers. The authors are careful to note, however, that the relative benefits and costs of exit and entry screening are not fixed.²

Exit Screening vs. Entry Screening

Exit screening entails screening passengers at the point of departure from an affected area. Entry screening entails screening all passengers at the point of entry into a country. In many cases and as noted above, exit screening appears to confer more benefits than entry screening. During the A(H1N1) outbreak, indiscriminate entry screening, as opposed to exit screening, would have required assessing 67.3 million low-risk travelers at 1,111 international airports to ensure every at-risk traveler from Mexico was screened. Even targeted entry screening would have been cumbersome, requiring screening at 82 international airports in 26 countries.²

In terms of targeted screening, the authors of the retrospective evaluation postulate that, at the initial stages of a pandemic caused by a pathogen with a similar or longer incubation period than A(H1N1), the potential benefits of targeted entry screening over exit screening appear to be marginal because most flights have shorter durations than the incubation period.² In other words, those who are asymptomatic on exit screening will most likely still be asymptomatic if screened upon arrival at their destinations. Again, microbiological characteristics come into play. One example is that of travelers harboring infectious agents with very short incubation periods who are flying on long, nonstop intercontinental flights from areas with substantial epidemic activity. In these cases, targeted entry screening could be a reasonable addition to exit screening.²

In the case of Ebola, WHO is specifically recommending exit screening from affected countries as opposed to entry screening. The drawbacks of entry screening include its overall cost, its reliance on health and human resources that could otherwise

be focused on areas of greater need, and the difficulty of orchestrating consistent screening at all airports around the world.^{2,16} At the same time, exit screening has its drawbacks: It places the screening burden on the affected country or countries while providing the benefits to other countries, and it becomes more difficult the closer an outbreak is to a major international hub.² Whether one or both are utilized, both exit and entry screening measures must abide by the IHR's mandate that unnecessary interference with international traffic and trade be avoided.

Managing Current and Future Threats

The role of entry and exit screening is complicated and comprises only one aspect of disease containment and control. There is no single approach to suppressing the spread of diseases that constitute international public health emergencies. Just as Ebola, wild poliovirus, SARS and (A)H1N1 are all distinct pathogens, distinct courses of action are required to contain them. The IHR works in real time to follow the evolution of diseases and the factors affecting their emergence and transmission.²⁴ In addition, retrospective analyses such as those carried out for (A)H1N1 and SARS allow more insight into the efficacy of responses to outbreaks, and provide information that can be used to help guide the management of future outbreaks. Ebola and poliovirus are not the first diseases to pose a global health threat, and they won't be the last. While responding to both diseases, the international community is learning even more about how to handle the next emergency that threatens public health. Ultimately, the question "to screen or not to screen" is not specific enough for any given threat. The international community needs to know who to screen, where to screen, when to screen, how to screen and if to screen — in addition to having the means to implement screenings and other protective measures on a global scale. ❖

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