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THE AVIATION INDUSTRY AND THE TRANSMISSION OF COMMUNICABLE DISEASE: THE CASE OF H1N1 SWINE INFLUENZA

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Airplanes are now a necessary feature of modern life, allowing for the quick and convenient transportation of both goods and passengers from one side of the world to another in a matter of hours. Today air transport has replaced ships as the primary carrier of passengers traveling internationally; in fact, ninety-five percent of international travel is now by air.1 Although air travel has become a central feature of modern life, it is not without its problems. Among the problems is a range of “threats to human health” that emerge from the nature of airplane cabins, which lack fresh air and require the close proximity of a large number of people in a small enclosed space.2

In the past year, with the emergence of the H1N1 influenza, more commonly referred to as the swine flu, air travel and the spread of infectious disease have garnered much attention from both the government and the public.3 The outbreak also

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sparked concerns over the transmission of disease and the quality of air in airplane cabins.\(^4\)

Airplanes assist in the spread of communicable diseases in two distinct ways: (1) they facilitate the spread of new diseases from one city or country to another;\(^5\) and (2) they allow for the transmission of disease between passengers during flight.\(^6\) Both of these problems have been acknowledged and addressed by a myriad of different organizations, both national and international, which have promulgated regulations and recommendations to help resolve concerns relating to the health of those traveling on board airplanes.\(^7\)

This comment will examine various actions taken by both international and national organizations leading up to, and in response to, the 2009 H1N1 outbreak, and it will analyze the effectiveness of both the national and international responses to the pandemic. It will explore the debate regarding air quality in airplane cabins. Additionally, it will analyze how the aviation industry has been impacted by health regulations, looking particularly at the International Health Regulations and the response by various U.S. governmental departments. Part I will provide historical information regarding epidemics, the International Health Regulations, and the Federal Aviation Administration and Center for Disease Control and Prevention. This history will include background information related to the formation of the organizations, focusing on those aspects that are relevant to the aviation industry. Part II will discuss the ongoing debate between various experts regarding air quality in airplane cabins, and Part III will examine and analyze the response to the swine flu pandemic and consider what should be done in the future to help prevent the spread of disease through air travel.

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ment will propose suggestions to improve pandemic-response plans by recommending a more health-centered approach, as opposed to an approach focused almost entirely on economic considerations.

I. HEALTH CRISSES AND AVIATION REGULATIONS

A. WORLDWIDE HEALTH CRISSES DURING THE 20TH AND 21ST CENTURIES

Before delving into the current situation, it is worthwhile to examine a brief history of worldwide health crises to understand why both national and international governmental bodies have grown concerned about the possibility of a devastating worldwide pandemic. While the widespread increase in international air travel definitely contributes to the spread of disease in today's world, worldwide pandemics occurred long before the advent of commercial aviation. Most notably, in 1918, the Spanish influenza pandemic spread to half the world's population, killing approximately 50 million people worldwide and 600,000 in the United States alone.

Nearly a century later, in 2003, the world was confronted with another worldwide health scare. Concerns over the possibility of another pandemic were revived when a strain of avian flu began spreading across Asia, eventually making its way to fifteen countries, and resulting in 282 deaths.

8 See Balasubramaniam, supra note 1, at 675–76.
1. The 2003 SARS Outbreak

Also, in early 2003, the world had its first encounter with severe acute respiratory syndrome (SARS). On March 12, 2003, the World Health Organization (WHO) announced the emergence of SARS to the world. Within only a couple of days, it became clear that the illness had spread and was continuing to spread by air travel along major airline routes. By August 7, 2003, the WHO had reported 8,422 SARS cases, resulting in 916 deaths worldwide.

The SARS epidemic also illustrates the role that international air travel plays in the spread and transmission of communicable disease. SARS is transmitted when an individual comes in close contact with someone who is infected, resulting in “exposure to infected respiratory droplets expelled during coughing or sneezing.” SARS, which started in China, was spread around the world by a physician who had treated an infected patient. The infected physician traveled to Hong Kong, where he stayed in a hotel and infected “at least sixteen other hotel guests and visitors all linked to the same floor.” When the guests returned home in the following days, they spread the disease to Vietnam, Singapore, and Canada. In the case of SARS transmission, passengers on airplanes within three rows of an infected individual were most at risk. On one flight, it was thought that one infected passenger likely transmitted SARS to 22 out of 119 passengers on board.

Unfortunately for the aviation industry, the SARS outbreak had an immensely negative impact on consumer perceptions of the airline industry. Presumably due to people’s fear that they would be infected with SARS while traveling, the SARS outbreak resulted in a larger decrease in international travel than the war

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15 Id. at 73–74.
16 Id. at 73.
17 Id. at 75.
18 Id. at 74.
19 Id.
20 Id. at 74–75.
21 Id. at 75.
23 Id.
24 See Balasubramaniam, supra note 1, at 675–76.
in Iraq.\textsuperscript{25} Worldwide, scheduled flights in June 2003 were down 3\% from the year before with China and the Asia Pacific region being hit the hardest.\textsuperscript{26} In fact, there was a forty-five percent decrease in flights to China during the SARs outbreak.\textsuperscript{27} By the end of the year, the International Air Transport Association (IATA) indicated a 2.4\% decrease in international travel in 2003 as compared to 2002.\textsuperscript{28}

2. \textit{The Emergence of H1N1 Influenza (Swine Flu)}

Then, in 2009, the world came face to face with “its first pandemic in over forty years”—the H1N1 swine flu pandemic.\textsuperscript{29} The outbreak started in Mexico on March 18, 2009,\textsuperscript{30} and then quickly spread to the United States and Canada.\textsuperscript{31} Only two months after the first reported case, 13,398 cases had been reported in forty-eight countries.\textsuperscript{32} On April 26, the U.S. Department of Health and Human Services declared a public-health emergency.\textsuperscript{33} Then on June 11, 2009, Margaret Chan, Director-General of the WHO, raised the pandemic alert level from phase 5 to phase 6, “thereby declaring the pandemic (H1N1) 2009.”\textsuperscript{34} Subsequently, on October 24, 2009, President Obama

\begin{footnotesize}
\textsuperscript{25} See \textit{SARS Hit Airlines 'More than War,'} BBC News (June 13, 2003), http://news.bbc.co.uk/2/hi/business/2986612.stm.
\textsuperscript{26} Id.
\textsuperscript{27} Id.
\textsuperscript{30} WHO, Timeline of Influenza A (H1N1) Cases (May 27, 2009), http://www.who.int/csr/disease/swineflu/history_map/InfluenzaAH1N1_maps.html.
\textsuperscript{32} Influenza-Like Illness in the United States and Mexico, \textit{supra} note 31.
\textsuperscript{34} WHO, Pandemic Influenza (Oct. 21, 2009), http://www.euro.who.int/influenza/20080618_2 ("WHO uses a six-phased scale of pandemic alert to inform the world of the global spread of a new virus and as a global framework for countries in pandemic preparedness and response planning . . . . Pandemic alert phase 6 is defined as a new virus causing sustained community-level outbreaks in more than one WHO region.").
\end{footnotesize}
declared the 2009 H1N1 pandemic a national emergency. As of January 15, 2010, cases of H1N1 have been reported in more than 208 countries, resulting in at least 13,554 deaths worldwide. The number of reported cases continues to increase daily. Just six years after the SARS outbreak, the world was once again in the midst of a global health crisis, and concerns regarding communicable disease and air travel were revived.

B. The International Health Regulations

1. The Beginnings of International Cooperation and the International Sanitary Regulations

The health crises discussed above reflect the need for international cooperation in preventing the spread of disease. Starting even before the outbreak of the 1918 Spanish influenza, the need for international cooperation in the area of health was recognized. As a result, the aviation industry in the United States must be concerned not only with its national laws and regulations, but also with those promulgated by international bodies. The need for an international response to communicable disease epidemics is evident from the transnational nature of the problem and the impossibility of containing communicable diseases unless nations work together. This “globalization of public health” has compelled international bodies to devise approaches for solidified and effective action during worldwide health emergencies.

37 Id.
39 See, e.g., Balasubramaniam, supra note 1, at 685–87 (detailing provisions of the WHO constitution that apply to the aviation industry).
40 See David P. Fidler, The Globalization of Public Health: Emerging Infectious Diseases and International Relations, 5 IND. J. GLOBAL LEGAL STUD. 11, 12, 15 (1997) (“The blurring of distinction between national and international health suggests that the forces of globalization are undermining the sovereign state’s ability to prevent and control infectious diseases.”).
41 Id. at 11 (“[T]he current EID [Emerging Infectious Disease] crisis has made the globalization of public health a permanent feature of international relations.”).
42 Aginam, supra note 38, at 946.
The history of international concern over the spread of communicable diseases begins with the International Sanitary Conferences, the first of which was held in France in 1851 in response to the European cholera epidemics of 1830 and 1847. This European effort was followed soon after by the Americas, whose first international health discussion was the Inter-American Sanitary Convention held in 1905. The convention required all nations involved to notify others of any cases of cholera, plague, or yellow fever. This convention was followed by the development of the Pan-American Sanitary Code, which expanded the duty of notification from three diseases to ten.

Subsequently, in 1948 the WHO was established as a specialized agency of the United Nations to deal specifically with international health issues, including issues related to aviation health. In 1951, the WHO adopted the International Sanitary Regulations (ISR) to provide "international standards for disease notification and for handling infected [travelers] and goods." Its "goal was to structure State responses to infectious disease outbreaks . . . so that States could protect themselves from disease importation and spread in ways that were scientifically effective and the least restrictive of trade and travel possible." The ISRs originally only applied to six infectious diseases that were the most concerning at the time—smallpox, typhus, relapsing fever, yellow fever, cholera, and plague.

Even this initial version of the ISRs contained numerous provisions relating to aviation and its role in the spread of communicable diseases. For example, it contained provisions regarding vaccination requirements for international travel, a

43 Id. at 946–47.
44 Id. at 947.
45 Id.
46 Id.
51 See, e.g., id. at 18–24.
State's duty to report any cases of disease caused by international traffic, sanitation at airports and of aircraft, measures concerning the international transport of goods and baggage, and a multitude of other regulations regarding aviation-related health concerns.\(^{52}\)

2. 1969 International Health Regulations

In 1969, the ISRs were renamed International Health Regulations (IHR)\(^ {53}\) and were subsequently revised again to regulate only cholera, plague, and yellow fever, instead of the original six.\(^ {54}\)

Despite the WHO's best efforts, the 1969 version of the IHRs ultimately proved to be ineffective at providing a desirable international approach to communicable disease.\(^ {55}\) This was due to "the lack of an enforcement mechanism," as well as the economic situations in the developing world that made the "notification certification, and hygienic transport [requirements] . . . unfeasible."\(^ {56}\) Also, the early version of the IHRs "ultimately doomed the system because it provided no guidance for dealing with new and unknown infectious diseases" other than the three diseases listed in the 1969 revision.\(^ {57}\) As a result of the above drawbacks and following the outbreaks of avian flu and SARS in 2003, the World Health Assembly adopted the revised IHRs in 2005.\(^ {58}\) The revised IHRs became binding on member states on June 15, 2007,\(^ {59}\) shortly before the 2009 swine flu pandemic began.

3. The 2005 Revised International Health Regulations

The revised IHRs are broader in scope and "emphasize[ ] collective action to prevent, detect, and contain any type of public

\(^{52}\) Id. at 9–11, 15–21.
\(^{53}\) International Health Regulations, supra note 48.
\(^{54}\) Timeline of Influenza A (H1N1) Cases, supra note 30.
\(^{56}\) Id.
\(^{57}\) Id. at 32.
health event that might constitute a global threat." The revisions greatly expanded the scope of the IHRs, which now "apply to diseases (including those with new and unknown causes), irrespective of origin or source, that present significant harm to humans." The revised IHRs also contain a framework specifically designed for responding to an influenza pandemic.

Under the new IHRs, the "disease-specific framework" has been replaced with a new approach that encompasses a broader range of diseases and circumstances. As a result, the new IHRs allow for regulation of pandemics just like the H1N1 pandemic that the world is currently experiencing. In fact, the H1N1 outbreak prompted the Director-General of the WHO to declare a "public health emergency of international concern." This was "the first time that declaration had been used under the newly revised [IHR]." According to the revised IHRs, a "public health emergency of international concern" is an event that poses a public health risk to other States through the international spread of disease and to potentially require a coordinated international response.

While significant changes were made in the revision process, the main goal of the IHRs remains the same—"protecting international health security with the least interference to international travel and trade." Article 3.4 of the revised IHRs provides that "States have . . . the sovereign right to legislate and to implement legislation in pursuance of their health policies . . . . In doing so they should uphold the purpose of these Regu-

62 Id.
63 Fidler, supra note 40, at 361–62.
64 GEORGE WASHINGTON SCHOOL, supra note 60, at 3 ("The broader approach now in effect emphasizes collective action to prevent, detect, and contain any type of public health event that might constitute a global threat.").
66 GEORGE WASHINGTON SCHOOL, supra note 60, at 2.
67 International Health Regulations, supra note 7, at 9.
lations."\(^6\) Article 23 of the revised IHRs allows, for public health purposes, the performance of a "non-invasive medical examination [upon arrival or departure of travelers] which is the least intrusive examination that would achieve the public health objective."\(^7\) The question that will be addressed later is whether the United States' response to the swine flu was in line with these objectives.

C. THE FAA AND THE CDC

Both the Centers for Disease Control and Prevention (CDC) and the Federal Aviation Administration (FAA) have been involved in providing regulations and guidance to airlines and airports relating to the spread of communicable diseases.\(^7\) The CDC originated as part of the U.S. Department of Health and Human Services in 1946 to combat malaria.\(^7\) The mission of the organization is "to collaborate to create the expertise, information, and tools that people and communities need to protect their health—through health promotion, prevention of disease, injury and disability, and preparedness for new health threats."\(^7\)

The CDC and its actions are relevant to the aviation industry, as the CDC is concerned with "prevent[ing] disease outbreaks" and "guard[ing] against international disease transmission."\(^7\)

In guarding against international transmission of swine flu, the CDC was the main source of information for both passengers and airlines, providing guidance to both groups relating to the H1N1 pandemic.\(^7\)

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\(^6\) International Health Regulations, supra note 7, at 10.

\(^7\) Id. at 20.

\(^7\) See, e.g., Interim Guidance for Management of Influenza-Like Illness Aboard Commercial Aircraft During the 2009–10 Influenza Season, supra note 7; Memorandum from FAA, S. Region Airports Div., Airport Certification Safety Inspection Team to All 14 CFR part 139 Airport Operators (May 21, 2009), available at http://www.faa.gov/airports/southern/airport_safety/part139_cert/certalerts/media/so_certalert_0905.pdf [hereinafter Memorandum from FAA, S. Region].

\(^7\) CDC, Our History – Our Story, http://www.cdc.gov/about/history/our story.htm (last visited July 7, 2010).

\(^7\) CDC, CDC Organization, http://www.cdc.gov/about/organization/cio.htm (last visited July 7, 2010).

\(^7\) Our History – Our Story, supra note 72.

The other agency that has a tremendous impact on issues surrounding the aviation industry and communicable disease is the FAA. While the FAA regulates a multitude of civil aviation activities, this comment will address only those regulations that relate to the spread of disease on aircraft—namely those relating to air quality in airplane cabins and passenger health. This comment will also suggest other actions that the FAA could possibly take to help promote passenger health and prevent the international spread of disease.

II. CABIN AIR QUALITY

A. THE DEBATE OVER AIR QUALITY IN AIRPLANE CABINS

1. History of the Debate Regarding Cabin Air Quality

Over the last few decades, airplane passengers and crew have voiced concerns about cabin air quality. Questions regarding the quality of air in airplane cabins have been raised not only with respect to the spread of communicable diseases but also in debates concerning smoking in airplane cabins. Most recently, people, both inside and outside of the aviation industry, have also expressed concern about toxic fume events.

In the 1980s, two major concerns of both passengers and crew were smoking in airplane cabins and the effects of secondhand

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76 See, e.g., Memorandum from FAA, S. Region, supra note 71.
79 Fume events occur when oil mixes with the compressed air resulting in fumes or smoke entering the airplane cabin. See Aerotoxic Association, About Aerotoxic Syndrome, http://www.aerotoxic.org/index.php/about-aerotoxic-syndrome (last visited Jan. 20, 2010); see also Ruwantissa Abeyratne, Forensic Aspects of the Aerotoxic Syndrome, 21 MED. & L. 179, 180–83 (2002) (providing a discussion on the causes of fume events and symptoms of aerotoxic syndrome; complications include “gastro-intestinal, respiratory and nervous system effects,” along with blurred vision, “memory impairment, shaking and tremors, nausea/vomiting, vertigo and loss of consciousness”).
smoke on non-smoking passengers. In response to these concerns, in 1986 Congress requested a report about air quality in airplane cabins from the National Research Council (NRC). The final report, *The Airliner Cabin Environment: Air Quality and Safety*, recommended "the elimination of smoking on domestic airline flights," as well as various other steps that the government could take to improve air quality and promote the health of those on board aircraft. The FAA subsequently took action by banning smoking on all domestic flights. In addition, under 14 C.F.R. § 252.5, foreign carriers must prohibit smoking on scheduled passenger flights between points in the United States and also "between the U.S. and any foreign point."

Most of the concerns regarding the spread of disease in airplanes involve the ventilation systems currently in place, but experts' opinions on the exact source of the problem differ widely. Until the 1990s, aircraft cabins were provided with 100% fresh air; however, in the '90s, manufacturers began building aircraft ventilation systems in such a way as to allow for the recycling of air. The reasoning for this change was that recycling air conserved fuel, thus lowering the airlines' operating costs.

In 1996, the Code of Federal Regulations was amended in order to reflect this change in ventilation system design. As amended, the relevant regulation allowed for the use of ventilation systems that combine fresh air with uncontaminated, recirculated air. Currently, under 14 C.F.R. § 25.831, "the

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80 See Revreby v. United Airlines, Inc., 293 N.W.2d 260, 261 (Iowa 1980) (passenger filed suit against airline after experiencing discomfort as a result of the smoking by other passengers).

81 See Cabin Air Quality, supra note 78 (statement of William W. Nazaroff).

82 Id.

83 14 C.F.R. § 252.3 (2010) ("Air carriers shall prohibit smoking on all scheduled passenger flights.").


85 Abeyratne, supra note 2, at 55–56 (blaming the re-circulation of air and lack of fresh air for air quality problems); Hocking & Foster, supra note 6, at 10 (attributing air quality problems to depressed humidity and inadequate supply of outside air).


87 Id. at 188.


89 Id. at 28,685 ("permits a ventilation system that uses a mixture of the minimum amount of fresh air and any desired quantity of recirculated air that is shown to be uncontaminated by odors, particulates, or gases").
ventilation system must be designed to provide a sufficient amount of uncontaminated air to enable the crewmembers to perform their duties without undue discomfort or fatigue and to provide reasonable passenger comfort." The regulation also requires "the ventilation system . . . be designed to provide each occupant with an airflow containing at least 0.55 pounds of fresh air per minute."

In 2000, Congress directed the FAA to ask the NRC to undertake another study into cabin air quality. Two years later the NRC produced a report entitled, The Airliner Cabin Environment and the Health of Passengers and Crew. The report concluded that although disease transmission in airplane cabins has been documented, the transmission is due to the "high occupant density and the proximity of passengers" and not to aircraft ventilation systems. But the report is not the end of the story, as there is a wide debate among researchers concerning whether disease transmission on airplanes is really due solely to the proximity of individuals, or if the ventilation system does play a role in facilitating transmission.

Vice President Joe Biden revived concerns regarding transmission of disease and quality of air in airplane cabins in his response to the swine flu outbreak. To the dismay of the aviation industry, in one highly publicized remark, Biden "told a television audience that he [advised] family members to avoid confined spaces such as airplanes" as a result of the HINI outbreak. Whether his concern was warranted is up for debate, as studies regarding cabin air quality and the risks associated with contracting an illness while traveling on an airplane have produced mixed results.

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91 Id.
92 See Cabin Air Quality, supra note 78 (statement of William W. Nazaroff).
93 Id.
94 Id.
95 See, e.g., Abeyratne, supra note 2, at 53–56; Hocking & Foster, supra note 6, at 7–11.
96 Martin, supra note 4, at B1.
97 Id.
98 Compare Hocking & Foster, supra note 6, at 8 ("the public perception that flying promotes colds is correct"), with Cabin Air Quality, supra note 78 (statement of William W. Nazaroff) (NRC concluded that disease "[t]ransmission does not appear to be facilitated by aircraft ventilation systems.").
2. Different Perspectives on the Air Quality Issue—What Exactly is the Problem?

Those who believe that air quality in airplane cabins is poor and contributes to the spread of disease have characterized airplane cabins as "veritable incubator[s] of potential disease" that are dirtier than "floors in locker room showers." Researchers have attributed poor air quality in airplane cabins to a variety of sources including filters, restricted air flow, recirculated air, lack of outside air, and low humidity. Due to differing opinions regarding the nature of the problem, there is also a wide variety of opinions regarding what should be done to solve the problem. The following discussion will summarize the different suggestions as to the cause of the problem as well as solutions that have been proposed.

While air filters have been touted as an adequate solution to problems of air quality, they have also been criticized. According to John Moorehead, a researcher with the Battelle Memorial Institute, filters are "virtually clogged with fungus, yeast, bacteria, and dust," and are providing an environment for dangerous microbes to grow instead of killing them. The International Air Transport Association's (IATA) publication, "General Guidelines for Maintenance Crew," supports this notion. The IATA warns maintenance crew that the high efficiency particulate air (HEPA) filters "may contain microorganisms trapped in their meshes" and advises those handling the filters to "apply

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100 Id. (discussing problems associated with air filters).
101 Abeyratne, supra note 2, at 55–56 (source of problem is the recirculation of "stale air").
102 Hocking & Foster, supra note 6, at 10 (attributing problems with air quality to low humidity and inadequate supply of outside air).
103 See, e.g., id. at 7–8 (proposing that cabins be humidified with de-ionized water); Special Report: Cabin Safety: Contaminated Cabins Can Spread Disease, supra note 99 (recommending that air filters be treated); Abeyratne, supra note 2, at 55 (suggesting to airlines that air filters should be changed more frequently).
105 Id. ("The grow-through to the far side was evidenced in filters with between 5–13 months of in-service time—well short of an 18-month replacement cycle.").
reasonable precautions.”

Despite this problem, “buying cheaper filters and replacing them more often” is not the solution, according to one researcher, because less expensive filters are “not as effective.” Instead, one recommendation advanced at the 17th Annual International Cabin Safety Symposium is to treat the filters with a mix of peroxide, ozone, and oxygen ions. This will allow for the killing of dangerous microbes without the fungal buildup. Anti-microbial coatings could also be applied to the aircraft’s ducting in order to provide a healthier cabin environment.

Others believe that poor air quality is not a result of filters but rather is due to recirculated (rather than fresh) air in the cabin. The proponents of this theory believe that the source of the air quality problem is the recirculation of “stale air,” which results in an “increase[ed] . . . chance of survival of bacteria in the aircraft cabin.” Also, though recirculated air has the supposed advantage of being more humid, “the source of humidification is your neighbors’ breath.” Ruwantissa Abeyratne, a senior official with the International Civil Aviation Organization (ICAO), suggests that changing the air filters that provide ventilation more frequently would assist in solving the problems associated with recirculated air. However, the practice of “buying cheaper filters and replacing them more often” has been explicitly rejected by others, who doubt the effectiveness of cheaper filters. In addition, the more frequent replacement of the high quality filters would likely lead to a significant increase in costs to the airlines. Therefore, the best
solution may be to treat the filters with a killing agent as suggested above.117

Martin Hocking, a chemist at the University of Victoria in Canada, believes the restricted use of outside air and low humidity in airplane cabins enables the spread of influenza.118 In a study published in the Journal of Environmental Health Research, Hocking determined that airplane passenger transmission rates for colds were found to be 113 times the normal ground-level transmission rates, confirming the public’s perception that flying increases one’s chances of acquiring an illness.119 The study concluded that the increased transmission rates were likely a result of a combination of dry cabin air, “small cabin air space per person, and low outside air replacement rates.”120 The lack of humidity in the airplane cabin allegedly prevents the proper functioning of the natural human defense system in fighting viruses and bacteria.121 Also, other studies suggest that the restricted air flow and lack of outside air increase the residence time of infectious diseases, thereby increasing the possibility of exposure to a disease.122 Abeyratne has proposed a return to the pre-1990s method of using 100% fresh air that is humidified as a solution to the low humidity.123 But this would lead to increased fuel consumption, driving up costs for airlines.124 Another solution proposed by Hocking is to increase the humidity of aircraft air with de-ionized water.125 However, another expert, while admitting that low humidity is a factor in the spread of influenza in aircraft, believes that “[a]dding humidity to the cabin environment could worsen the situation” by aiding microbial growth.126 In the end, increasing humidity in order to reduce transmission of disease appears to create more problems

117 See supra notes 110–112 and accompanying text.
118 Hocking & Foster, supra note 6, at 10.
119 Id. at 7–8.
120 Id. at 7. The study also found that recirculation of aircraft air was not a significant factor in the increased transmission rates. Id.
121 Id. at 10.
122 See, e.g., Association of Flight Attendants, supra note 77. “Residence time” refers to “the length of time that an infectious agent stays airborne.” Id.
123 Abeyratne, supra note 2, at 55–56.
124 Id. (“[R]ecycling is a universal practice, which is calculated to conserve fuel . . . .”)
125 Hocking & Foster, supra note 6, at 7–8.
than it solves. As a result, increasing humidity may not be the right solution.

3. Other Proposed Actions to Help Improve Air Quality

According to presenters at the 17th Annual International Cabin Safety Symposium, there are a number of measures that can, and arguably should, be adopted to help solve the problem of transmitting diseases in the airplane cabin. These suggestions include simple steps such as screening passengers and disinfecting cabin surfaces, as well as more long-term solutions like incorporating recirculation-free zones in the cabin designed to isolate infected passengers from healthy ones. Another proposed solution is to “reverse the direction of cabin airflow, from top down to bottom up.” This way “any contaminated air would tend to be drawn up and away from people, reducing the opportunity for transmission of pathogens.”

Another promising solution to air quality problems lies in new technology that has recently been developed by BAE Systems and has been successfully tested on aircraft. Last year, BAE introduced a new cabin air management system named AirManager. The inventor of the technology claims that the new system is able to destroy a variety of contaminants very quickly—killing “99.999% of bio-hazards and remov[ing] particles down to below 0.1 micron” in a single pass. While the airline industry currently touts HEPA filters as the solution to air quality concerns, the new technology “provides far greater reduction of airborne contaminants” than is achieved by HEPA filters. Other positives include the fact that the AirManager has potential for fuel savings and is easy to install. The company claims that due to the ability of the system to work more

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127 Id.
128 Id.
129 Id.
130 Id.
131 Id.
132 Id.
133 Id.
134 Id. One micron is equal to one-millionth of a metre—the size of a single particle of cigarette smoke. Id.
135 Id.
136 Id.
137 Id.
effectively, fuel savings could cover the purchase cost of AirManager in the first year. Additionally, installation of the system “can be achieved during overnight line maintenance.”

While this new technology might seem like the perfect solution to cabin air quality problems, equipping airplanes with this new technology could be difficult. Generally speaking, airlines respond unfavorably to requirements to install new and expensive equipment, especially when they do not see an economic benefit from doing so.

Therefore, a cost-benefit analysis of the AirManager system is necessary. Costs of the system would be those associated with purchasing, installing, and maintaining the new equipment. The benefits would potentially be increased air quality, increased crew and passenger health, and potential fuel savings. However, it is questionable whether installation would increase the demand for air travel even during a communicable-disease outbreak. If the new system was effective in achieving a sense of security among the public, the installation might be worth the costs. Also, depending on the amount of fuel savings the new system could provide, that alone might be enough to convince airlines that equipping their airplanes with the new system would be worth it.

Another option would be for the FAA to simply recommend the use of AirManager instead of requiring it, but voluntary compliance with this recommendation would probably be unlikely, unless the airline companies saw some advantage to following the recommendation. Airlines might be persuaded to install the new system voluntarily if, as the inventor claims, it would result in a significant amount of fuel savings or if it would increase the public’s desirability of the airline.

AirManager could also enter the industry by way of consumer demand. Should AirManager be installed in some aircraft and be found superior to the HEPA filters, other airlines may be

138 Id.
139 Id.
141 Gale, supra note 132 (claiming that AirManager operates more effectively than current systems, and that installation allows for potential fuel savings that would cover the cost of the new system within one year).
forced to follow suit to remain competitive in the industry. Another possibility would be for the FAA to implement some form of equipage incentive program, as has been done in the past with regard to Automatic Dependence Surveillance Broadcast. This type of program would encourage equipage by the airlines despite the high costs that can be associated with installing new equipment.

As illustrated above, there are plenty of people with negative thoughts about the airplane cabin’s potential for spreading communicable disease and plenty of suggested solutions. But others, including the Air Transport Association, downplay the threat by maintaining that “air onboard a commercial aircraft is cleaner than that in most public buildings” and by declaring the belief that a person on a plane is more susceptible to influenza to be a myth. The FAA also disagrees with attacks on the adequacy of airplane ventilation systems, stating in its response to the NRC’s report examining cabin air quality that problems of disease transmission are a result of the passengers’ close proximity; therefore, changes in ventilation will not minimize disease transmission.

These varying opinions form the basis of the primary complaint by the Association of Flight Attendants (AFA) and the NRC, which is an inadequate supply of published, objective data relating to cabin air quality and the transmission of communicable diseases.
ble diseases in the airplane environment.\textsuperscript{147} Reportedly, industry executives also believe that "the absence of airline cabin standards is a result of disagreement on what constitutes safe air."\textsuperscript{148}

4. What Should Be Done to Improve Air Quality, if Anything?

The appropriateness of measures designed to improve cabin air quality depends entirely on whether there is a problem and, if so, what the exact source of the problem is. Therefore, in developing solutions and a plan for future action, it must first be determined whether air quality significantly increases the likelihood of disease transmission or if the increase in transmission is purely incident to the close proximity of a large group of people in an enclosed space. As seen from the above discussion, proposed suggestions for improving air quality range from the quick and easy to the more long-term and demanding. Both the AFA and the NRC have expressed the need for a more complete and objective review of air quality. Such research is necessary, as it would allow for the development of more accurate views on cabin air quality and hopefully lead to an adequate solution, if one is needed. For now, the FAA has refused to require airlines to take any steps to improve air quality,\textsuperscript{149} and it continues to stick to its position that the cabin environment is no less healthy than other enclosed spaces.\textsuperscript{150}

\textsuperscript{147} Association of Flight Attendants, \textit{supra} note 77 (claims the shortage of objective data on the issue is due to "the near-refusal of airlines and manufacturers to allow researchers financially independent of the airline industry access to aircraft, and the FAA's apparent refusal to institute and manage a centralized air quality incident reporting system"); see also \textit{Cabin Air Quality, supra} note 78 (statement by William W. Nazaroff).


\textsuperscript{150} Jon L. Jordan, \textit{The Cabin Air Quality Issue}, in \textit{THE FEDERAL AIR SURGEON'S COLUMN} (June 22, 2005), http://www.faa.gov/library/reports/medical/fasmb/editorials_jj/airquality/ ("When compared to known air quality in many homes, office buildings, or other enclosed spaces where people congregate, the air quality in air carrier operations appears to be equivalent or superior.").
III. AVIATION'S RESPONSE TO SWINE FLU

A. RESPONSE TO SWINE FLU IN THE UNITED STATES

Despite the FAA's consistent refusal to implement more stringent air quality regulations,\(^{151}\) it did provide guidance to airlines following the swine flu outbreak.\(^{152}\) On April 29, 2009, just days after the U.S. Department of Health and Human Services had declared a public health emergency,\(^{153}\) the FAA recommended that air carriers follow CDC recommendations regarding swine flu.\(^{154}\) It also heavily emphasized the need for airports that had not already done so to develop pandemic flu plans, taking into account guidance from the CDC and the ICAO.\(^{155}\) In May 2009, the FAA continued to maintain that a department-wide-pandemic-influenza plan was in place and that it was "safe to fly."\(^{156}\) Furthermore, despite the growing concern over the possibility of an H1N1 pandemic, the United States, based on guidance from the CDC and the WHO, "opted to not conduct either entry or exit health screening of international passengers."\(^{157}\)

The United States' approach to air travel during the swine flu outbreak was to shift responsibility for containment of the swine flu onto the passengers themselves.\(^{158}\) The CDC recommended that efforts to minimize the international spread of swine flu focus on encouraging those with flu-like symptoms not to travel.\(^{159}\)

\(^{151}\) McCartney, supra note 149 (concerning the FAA's failure to take action on air quality).


\(^{153}\) Johnson, supra note 33 (declaring a public health emergency on April 26, 2009).

\(^{154}\) Safety Alert for Operators 09009, supra note 152.

\(^{155}\) Memorandum from FAA, S. Region, supra note 71; see also Memorandum from Michael W. Brown, Manager, Airport Safety & Operations Div. AAS-300, to FAA Airport Certification Safety Inspectors (July 16, 2009), available at http://www.faa.gov/airports/airport_safety/certalerts/media/cert0912.pdf.

\(^{156}\) Aviation Consumer Issues, supra note 3, at 5.


\(^{158}\) Interim Guidance for Management of Influenza-Like Illness Aboard Commercial Aircraft During the 2009-10 Influenza Season, supra note 7.

\(^{159}\) Id. ("The Centers for Disease Control and Prevention (CDC) recommends that efforts to reduce the spread of influenza on commercial aircraft focus on encouraging air carrier employees and passengers who have an influenza-like illness (ILI) not to travel.").
The CDC also focused its time on providing information about flu prevention, such as washing your hands and covering your cough.\footnote{See, e.g., Outbreak Notice: 2009 H1N1 Flu: Global Situation, supra note 75.} The CDC made posters, such as the one in Figure A to encourage such practices by the public.\footnote{CDC, Cover Your Cough (Dec. 8, 2009), http://www.cdc.gov/Flu/protect/covercough.htm (providing the public with instructions on how to properly cover your cough and clean your hands).}

**Figure A:**

![Poster: Cover Your Cough, Clean Your Hands](image)

In response to these recommendations, a number of airports and airlines took actions such as placing alcohol-based hand sanitizer in airports, removing pillows and blankets from flights, and adding hand sanitizer to planes.\footnote{Martin, supra note 4.} The CDC even launched a Travel Health Campaign in an attempt to encourage healthy travel.\footnote{CDC, Travel Health Campaign: Are Any of these Posters Hanging Around Your Town? (Nov. 19, 2009), http://wwwnc.cdc.gov/travel/content/h1n1-campaign-posters.aspx.} It produced posters such as those found in Figure B, to provide health tips to air travelers.\footnote{Id. (The posters contain tips for healthy travel: "Travel only when you feel well. Get your flu vaccine. Wash your hands often. Cover your coughs and sneezes.")}
The CDC also promulgated "Interim Guidance for Management of Influenza-Like Illness aboard Commercial Aircraft during the 2009-10 Influenza Season."165 These guidelines included recommendations for flight crew in the instance that a passenger might experience flu-like symptoms during a flight.166 The CDC suggested that in dealing with such a passenger crew members should: (1) "Minimize the number of persons directly exposed to the ill person and if possible separate the ill person from others by 6 feet . . . ;" (2) "Keep interactions with the ill person as brief as possible;" (3) "Ask the ill traveler to wear a face mask if it can be tolerated and one is available [and i]f a face mask cannot be tolerated, provide tissues and ask the ill person to cover his or her mouth and nose when coughing or sneezing;" and (4) "Practice good hand hygiene and encourage others, including the ill person, to do the same."167

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165 Interim Guidance for Management of Influenza-Like Illness aboard Commercial Aircraft during the 2009-10 Influenza Season, supra note 7.
166 Id.
167 Id.
B. Was the U.S. Response to Swine Flu Adequate?

1. Recommendations v. Regulations

Despite the guidelines discussed above, an article in the Los Angeles Times reported that sick passengers were not being separated from other passengers or being asked to wear a mask.\textsuperscript{168} On multiple flights operated by various airlines, flight attendants did nothing to intervene in situations involving an obviously ill passenger.\textsuperscript{169} For example, on one United Airlines flight, flight attendants failed to provide a mask to a passenger with a "phlegmy cough."\textsuperscript{170} Flight attendants on flights operated by numerous airlines, including both American Airlines and Southwest Airlines, told passengers who were interested in receiving a mask that no masks were available.\textsuperscript{171} In response to the airlines' failure to provide masks to sick passengers, six airlines all had the same defense: "although they typically have masks available on flights, no policy requires flight attendants to offer them to ill passengers."\textsuperscript{172} Another more practical concern raised by an editor at smarttravel.com, Tim Winship, is that the recommendation that the ill passenger be placed six feet away from other passengers would be extremely difficult (if not impossible) to comply with, given the crowded nature of aircraft.\textsuperscript{173} Therefore, it is questionable how helpful the CDC guidelines have been in preventing the transmission of swine flu on airplanes.

One group upset by the FAA's approach to the swine flu outbreak was the Association of Flight Attendants (AFA). Following the outbreak, the AFA voiced its concerns with the FAA's response in testimony to the House Subcommittee on Aviation.\textsuperscript{174} Immediately following the H1N1 outbreak, the AFA sent a letter to the FAA requesting the FAA to take specific steps to prevent the spread of infectious disease.\textsuperscript{175} For instance, the AFA requested that the FAA require that "airlines provide flight attendants with non-latex gloves and masks . . . , allow flight attendants

\textsuperscript{169} Id.
\textsuperscript{170} Id.
\textsuperscript{171} Id.
\textsuperscript{172} Id.
\textsuperscript{173} Id.
\textsuperscript{174} Aviation Consumer Issues, supra note 3, at 22–23 (statement of Patricia A. Friend).
\textsuperscript{175} Id. at 22.
with flu-like symptoms themselves to call in sick without risk of discipline, . . . develop, implement, and enforce passenger screening standards," and ensure that airplanes have proper hand-washing equipment.\textsuperscript{176} Instead of implementing the above regulations, the FAA "turned a deaf ear" to the AFA's demands.\textsuperscript{177} The AFA was not satisfied with this response, and in testimony to the House Subcommittee on Aviation, it emphasized its concern that airline management is more concerned with the appearance of flight attendants than with the health of the public and the flight crew.\textsuperscript{178}

The FAA's reasons for resorting to guidelines and recommendations instead of regulations during the swine flu outbreak are likely very similar to its reasons (discussed above) for hesitating to require that airlines install expensive equipment.\textsuperscript{179} Such regulations would increase costs for airlines at a time when their profits are low, due not only to the swine flu but also to high fuel costs and the current economic recession.\textsuperscript{180} With that said, the costs associated with providing masks and gloves to flight attendants seem likely to be extraordinarily minimal\textsuperscript{181} and may be worth the increased employee health and passenger security that such measures would produce. On the other hand, it is also foreseeable that having flight attendants wear masks could create fear among consumers, who might take that as evidence that it is not safe to fly. At the very least, masks should always be

\textsuperscript{176} Id. at 22–23.
\textsuperscript{177} No Cabin Safety Changes Despite Spread of H1N1 Virus, 23 AIR SAFETY Wk., June 29, 2009, available at 2009 WLNR 12490944.
\textsuperscript{178} Aviation Consumer Issues, supra note 3, at 23 (statement of Patricia A. Friend).
\textsuperscript{179} See supra note 140 and accompanying text (regarding the FAA's hesitation in implementing regulations to install new equipment).
\textsuperscript{181} Daniel J. DeNoon, Swine Flu (H1N1) and Face Masks (July 23, 2009), http://www.webmd.com/cold-and-flu/features/swine-flu-h1n1-and-face-masks (one box of fifty face masks costs ten to fifteen dollars); Synthetic Gloves, http://www.dontheglove.com/syntheticgloves (last visited Mar. 25, 2010) (one box of 1,000 gloves costs $3.95).
available on board for those passengers who would like to wear them and for flight attendants that must deal with sick passengers.

2. **Contrasting the U.S. Response to Swine Flu with Hong Kong’s Response to SARS**

While the United States took a non-interference approach in the wake of the swine flu, other countries, such as Japan and China, took a very different approach, screening all incoming passengers for symptoms of the flu, requiring temperature checks, and implementing other various health screening measures.\(^{182}\)

In evaluating the effectiveness of the U.S. approach to the swine flu pandemic, it is interesting to compare the U.S. approach to swine flu with the approach taken by the Hong Kong government in response to the 2003 SARS outbreak. When the SARS outbreak began in Asia, Hong Kong adopted several measures to contain the virus and to prevent the international transmission of SARS.\(^{183}\) In response to the outbreak, Hong Kong quickly implemented legislation that contained provisions allowing for: “prevent[ion of] the departure of any person having a history of contact with SARS-infected persons or persons suspected of having SARS;” medical examinations and body temperature screening “of passengers both arriving in and departing from Hong Kong;” and detention of any person suspected of having SARS.\(^{184}\) “[A]ll passengers arriving [in Hong Kong] were asked to complete mandatory health declaration forms,” and all “were required to undergo temperature checks . . . using infra-red screening devices designed to detect the presence of a fever.”\(^{185}\) These temperature checks were mandatory not only for passengers but also for all airline crew.\(^{186}\) The declaration form required passengers to disclose “the presence of a fever” or “any history of contact with SARS-infected persons.”\(^{187}\)

In addition, similar to the U.S. Travel Health Campaign, “the Hong Kong Government commenced a public education cam-


\(^{183}\) Chan & Schloenhardt, supra note 5, at 485–86.

\(^{184}\) Id. at 491–92.

\(^{185}\) Id. at 496.

\(^{186}\) Id. at 497.

\(^{187}\) Id. at 498.
campaign" to inform travelers about SARS and the different measures which had been adopted.\footnote{Compare id. at 499 with Travel Health Campaign, supra note 163.} In its effort to stop the spread of the disease, Hong Kong went above and beyond the recommendation of the WHO by screening not only all departing travelers but also all passengers arriving in Hong Kong from other parts of the world.\footnote{Chan & Schloendhardt, supra note 5, at 500; see also WHO, Update 11—WHO Recommends New Measures to Prevent Travel Related Spread of SARS (Mar. 27, 2003), http://www.who.int/csr/sars/archive/2003_03_27/en/ [hereinafter Update 11].}

Prior to Hong Kong’s implementation of the above procedures, approximately 6% of the SARS cases in Hong Kong were believed to be imported by travelers entering the country; following the introduction of the above measures, no new imported cases occurred.\footnote{WHO, Update 74 – Global Decline in Cases and Deaths Continues (June 5, 2003), http://www.who.int/csr/don/2003_06_05/en/.} Furthermore, there were no reports of in-flight SARS transmission following the introduction of the screening procedures.\footnote{WHO, Severe Acute Respiratory Syndrome (SARS): Report by the Secretariat, at 3, WHO Doc. EB113/33 Rev. 1 (Jan. 23, 2003), available at http://apps.who.int/gb/ebwha/pdf_files/EB113/eb11333r1/pdf.}

However, the screening measures only detected two SARS cases.\footnote{Chan & Schloendhardt, supra note 5, at 503.} This prompted criticism from some who felt that the “measures were overly expensive, unnecessarily intrusive and time-consuming to the traveller, while producing very little effect.”\footnote{Id. at 504.} Critics claim that while the border control and screening measures “helped freeze SARS in its tracks . . . they also drained away billions of dollars in lost trade and tourism.”\footnote{Charles Piller, In SARS Aftermath, the WHO’s in Charge, L.A. TIMES, Jul. 13, 2003, at A1.} Critics also argue that such screening measures create a level of panic that surpasses the real problem.\footnote{Id.} However, as Chan and Schloendhardt point out, this criticism seems to ignore the fact that the SARS outbreak began with one infected passenger who caused the disease to spread to thirty countries within a matter of weeks.\footnote{WHO, Update 83 – One Hundred Days into the Outbreak (June 18, 2003), http://www.who.int/csr/don/2003_06_18/en/.} Also, it is not known to what extent the measures
served to discourage those with symptoms of SARS from traveling, thus contributing to the containment of the disease.\textsuperscript{197}

Keeping the actions taken by Hong Kong in mind, a question arises as to whether the WHO should have recommended that Mexico and the United States take a similar approach in regards to the H1N1 outbreak. The measures taken in Hong Kong, while costly, did contribute to the eradication of the disease in a relatively short period of time and with a limited number of deaths.\textsuperscript{198} Also, some of the procedures, such as temperature screening and health declaration forms, do not interfere with international travel to a great degree. While they might take minimal amounts of time away from the traveler, the procedures are not overly invasive or time-consuming. Although it would be difficult to say now whether such measures would have halted, or at least delayed, the spread of H1N1, it is worth taking the different approaches and their respective outcomes into consideration.

C. Questions to Think About and Ideas for the Future

What should be done to promote healthy air travel? First, the FAA could force the airlines to take steps to make air travel healthier by promulgating regulations relating to air quality. For instance, the FAA could require that all airlines equip planes with the new AirManager technology in order to improve cabin air quality and to reduce in-flight transmission of communicable disease.\textsuperscript{199} Other possibilities would be requiring that filters and ducting be treated, requiring that new planes be built with no-recirculation zones, or requiring that new planes be designed so that the air flows from the bottom up.\textsuperscript{200} Despite the perceived benefits of requiring airlines to comply with all or some of the above measures, the imposition of such regulations would likely face stiff resistance from the airline industry, which tends to disfavor these types of costly actions and refuses to ac-

\textsuperscript{197} See Chan & Schloenhardt, supra note 5, at 502.
\textsuperscript{198} World Health Report 2003, supra note 11, at 75 (attributing 916 deaths to the SARS outbreak); WHO, China's Latest SARS Outbreak Has Been Contained, But Biosafety Concerns Remain – Update 7 (May 18, 2004), http://www.who.int/csr/don/2004_05_18a/en/index.html (explaining that the human chain of SARS transmission has been broken).
\textsuperscript{199} See supra notes 132–39 and accompanying text.
\textsuperscript{200} See supra notes 128–31 and accompanying text.
knowledge any air quality problems to begin with.\textsuperscript{201} Therefore, less intrusive and costly options such as requiring availability of masks and hand sanitizers may be better received.

As mentioned above, the goal of the IHRs is to contain the spread of disease with the least interference with international trade and travel.\textsuperscript{202} In the case of the U.S. government's handling of the swine flu and the WHO's recommendations regarding the same, the interference with international travel was almost non-existent.\textsuperscript{203} People continued to engage freely in international travel despite the WHO's characterization of H1N1 as a "public health emergency of international concern."\textsuperscript{204} Not surprisingly, it did not take long for the H1N1 influenza to transcend the North American continent and to spread around the world.\textsuperscript{205} Is this the proper balance intended by the IHRs? Why were the WHO recommendations so much more stringent in the case of SARS just six years earlier?\textsuperscript{206} One possible explanation would be the serious nature of SARS as compared to the mild symptoms associated with the swine flu.\textsuperscript{207} But what about those individuals at risk for complications from H1N1? Where do you draw the line in balancing health risks and potential interference with the world economy? Is this even a proper question to ask? Although the goal sounds like a good one, it is difficult to imagine how allowing any travel would be justified in the case of a very serious and deadly disease outbreak.

While there are serious economic consequences to restricting trade and travel (especially to the aviation industry), were there to be a serious pandemic, the cost of having such a high number of ill or dying people would be equally, if not more, devastating to the world economy. The SARS pandemic, discussed above, resulted in an estimated $30–$140 million in economic costs.

\textsuperscript{201} See Industry Questions NPRM on ADS-B Out, supra note 140 (discussing aviation industry hesitation regarding FAA requiring ADS-B Out, due to the fact that the equipment is too expensive and the FAA provides little incentive for voluntary equipage); see also FAA's Proposed SDR Revisions Receive Scathing Reviews, supra note 140 (discussing airline complaints that requirement is excessively burdensome "with little value to the safety"); Letter from James C. May, supra note 144.

\textsuperscript{202} See supra note 70 and accompanying text.

\textsuperscript{203} See supra note 157 and accompanying text.

\textsuperscript{204} See supra notes 157 & 164 and accompanying text.

\textsuperscript{205} See supra notes 90–35 and accompanying text.

\textsuperscript{206} See supra note 157 and accompanying text; see also Update 11, supra note 189.

\textsuperscript{207} Yanzhong Huang, The H1N1 Virus: Varied Local Responses to a Global Spread, YALE GLOBAL, Sept. 1, 2009, http://yaleglobal.yale.edu/content/h1n1-virus-varied-local-responses-global-spread.
due to cancelled travel and decreased investment in Asia with "service industries and airlines suffer[ing] the greatest losses."\textsuperscript{208} While this is a lot of money, the potential losses that could have resulted had SARS not been rapidly contained can only be imagined.

The proper balance between health and interference with trade and travel likely falls somewhere between Hong Kong's approach to SARS in 2003 and the U.S. approach to swine flu in 2009. It seems that minimally invasive procedures that could greatly reduce the transmission of disease on flights should not only be recommended in the case of a pandemic but required. The risks associated with allowing a pandemic to spread purely because it is not in the economic interest of airlines to comply with guidelines are not only irresponsible but potentially unethical. Requirements such as providing masks, treating air filters, and providing hand sanitizer on flights are all simple steps that could potentially go far in reducing in-flight transmission of disease. Furthermore, if subsequent studies suggest that there are problems with air quality, the FAA needs to be proactive by requiring that changes be made for the health of both passengers and crew, either by installing new technology or changing cabin-ventilation-system design.

Similarly, temperature checks and declaration forms provide protection against the spread of disease with only minimal interference to international trade and traffic. The FAA should require that the aviation industry take such steps in an epidemic-type situation, when there is a possibility that those arriving or departing from the United States are infected with a communicable disease.

Another question to be asked in preparing for future epidemics is who should be responsible for preventing the transmission and spread of disease on airplanes? In the case of the swine flu, the United States placed virtually all responsibility with the passengers.\textsuperscript{209} This is concerning in light of the fact that one passenger's irresponsible behavior could ultimately result in the international spread of disease and thousands or even millions of deaths worldwide. With these sorts of serious consequences in mind, a more sensible approach would be to place at

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\textsuperscript{208} \textit{Severe Acute Respiratory Syndrome (SARS): Report by the Secretariat}, supra note 191, at 2.

\textsuperscript{209} See supra notes 158–61 and accompanying text.
least some responsibility for the prevention of the spread and transmission of disease on the government and the airlines.

In conclusion, there are numerous questions to be considered with regard to the international and national response to the H1N1 pandemic. Balancing health against interference with the world economy and international travel is not an easy thing to do, and it is difficult to know where to draw the line. In the case of the 2009 pandemic, the line was drawn more on the side of the economy than on the side of health, which may or may not have been the correct response. It is hard to say if any action short of closing down the borders of North America would have halted the spread of H1N1. As far as the IHRs are concerned, the United States definitely interfered with trade and travel to the least extent possible but was not as successful in achieving the first part of the goal—namely preventing the international spread of disease. After this pandemic is over, both international and national bodies will most definitely need to meet to determine what they can do to prevent and contain future pandemics. Luckily, most of those infected with H1N1 only faced mild symptoms, but the next disease could be much more lethal. In that scenario, the line may need to be drawn more in favor of health than the economy.

210 See Huang, supra note 207.