

# Influenza in Travelers: Epidemiology, Risk, Prevention, and Control Issues

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**Abstract** Influenza is the most frequent travel related infection preventable by universally available vaccines, but preventive measures were neglected until recently. Since the spread of pandemic (H1N1) 2009, various public health measures have been promoted first to contain, then to mitigate, the pandemic. Some of these measures contradicted recommendations issued by the World Health Organization and were of questionable efficacy. However, travelers may benefit from targeted recommendations on influenza risk reduction (eg, by social distancing or immunization). These recommendations are particularly indicated for those with an increased personal risk profile and for those likely to be exposed to influenza patients.

**Keywords** Travel · Influenza · Epidemiology · Vaccine · Antivirals

## Introduction

When it became apparent in April 2009 that influenza A (H1N1) 2009 was a “Public Health Emergency of International Concern” and subsequently pandemic Phase 6 was declared by the World Health Organization (WHO), the world was on the move. The latest World Tourism Organization statistics had reported 922 million International Tourist Arrivals for the year 2008, although a clear negative growth was experienced in the second half of 2008

[1]. Although many countries initially attempted aggressive containment as the initial strategy to limit the spread of infection, it soon became obvious that the virus had already spread worldwide. Mitigation to win time (ie, until vaccines would be widely available) soon became the logical strategy. The WHO explicitly did not recommend restricting international travel; moreover, it never did. Nevertheless, various national authorities imposed restrictive or diagnostic measures, although many of these measures previously were demonstrated to be ineffective (Table 1).

## Influenza in Travelers: Epidemiologic Facts

The incidence rate of seasonal influenza in travelers to tropical and subtropical countries is estimated to be 1% per month [2•]. The risk of influenza transmission related to travel (eg, at airports, in the aircraft cabin) is undetermined; only three reports of in-flight transmission have been published [3]. The aircraft as a vector for global spread of influenza is of greater concern. In the current pandemic, it has been demonstrated that countries receiving more than 1,400 passengers from Mexico were at a significantly elevated risk for importation of pandemic (H1N1) 2009; international air traffic alone was more than 92% sensitive and specific in predicting importation [4•]. However, a variety of other respiratory viruses have also been diagnosed during that phase, including rhinovirus, coronavirus, influenza B, and parainfluenza virus, illustrating that many different viral transmissions can simultaneously occur even during a pandemic [5]. Travel-associated spread of influenza (H1N1) 2009 at a rock music festival in Belgium was reported [6]. However, although this pandemic had a significant impact during the winter in Australia, “swine flu” hardly affected consumers’ outbound travel plans [7].

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**Table 1** The initial noncoordinated response to the H1N1 (2009) pandemic: examples of measures related to international travel

Travel advisories	Countries/institutions (examples)
Postpone nonessential travel—all	India, Malta, New Zealand
- To Mexico	Canada, Indonesia, Israel, USA
- To Mexico, USA, Canada	Malaysia
- To countries with confirmed case	Australia, Belize, Bosnia, Kuwait
- To Portugal	Chinese Taipei (Taiwan)
- To Britain, Spain, USA	Uganda
- To China	Mexico
Traffic restrictions	
- Ban nonstop flights to Mexico	Argentina, China, Cuba, Peru
- Closure of borders	Neighbors of Ukraine (November)
In-flight and entry/exit measures at airports	
- Doctor on board	Lufthansa from Mexico to Germany
- Crew must notify air traffic control about suspected communicable illness	ICAO, Aircraft General Declaration (Annex 9, Appendix 1)
- Visual screen by health professionals on arrival	Various countries
- Temperature check devices	Various countries
- Information leaflets	Various countries
- Contact cards, questionnaire	Various countries
- Quarantine (hotel), self-quarantine (home)	Hong Kong, Philippines
- Predeparture exit screening	Mexico

ICAO International Civil Aviation Organization

Even before the appearance of the influenza (H1N1) 2009 pandemic, influenza or unspecified upper respiratory tract infections associated with mass events, such as the winter Olympic games [8] or the hajj [9], had been documented. Influenza outbreaks had also occurred in association with cruise ship travel [10].

### Evaluation of Travel-Related Public Health Measures

Within the limited time since the detection of this current pandemic, little substantial evidence on the efficacy of specific travel-related public health measures had been presented. Thus, we shall examine the plausible effect of these measures or draw analogies with previous pandemic threats.

Considering the measures listed in Table 1, it is logical that postponing nonessential travel to countries or, more specifically, to areas with high prevalence of pandemic influenza (H1N1) 2009 may reduce the spread. In contrast, it is difficult to understand why some countries issued travel restrictions for certain destinations that were of comparatively low risk. Traffic restrictions such as closing borders is not mentioned in the revised International Health Regulations (IHR 2005) and the Third Meeting of the IHR Emergency Committee explicitly recommended not to close borders [11]. At best, some small island nations could

successfully rely on intensive travel-volume restrictions alone to avoid the arrival of pandemic influenza or of subsequent pandemic waves [12].

Entry screening of travelers through thermal scanning at international borders had hardly any documented effect on detecting severe acute respiratory syndrome (SARS) cases; exit screening appeared slightly more effective [13]. The WHO explicitly states that it “does not believe entry and exit screenings would work to reduce the spread of this disease. However, country-level measures to respond to a public health risk are the decision of national authorities under the International Health Regulations 2005” [14]. Consequently, a report specified that “border screening had too strong a political imperative in Australia not to be implemented in the early stages of the pandemic” (ie, entry screening, although known to be ineffective, was implemented under political and media pressure) [7].

Health declarations also did not show detectable benefit. SARS was contained largely through traditional public health interventions, such as finding and isolating case-patients, quarantining close contacts, and enhanced infection control. A pilot study has demonstrated that screening at disembarkation requires large numbers of staff [15]. Because viral shedding in influenza patients starts 1 to 2 days before the onset of symptoms [16], entry screening is not a method that would allow detection of asymptomatic passengers during the incubation period. Persistent viral

shedding may potentially allow for transmission after patients recover clinically [17]. Symptomatic passengers may use antipyretic agents to pass thermal screening undetected. The value of border screening in deterring travel by ill persons and in building public confidence is unsubstantiated. Also, the value of health alerts or other information leaflets and posters remains to be evaluated.

Given that the 2009 hajj would take place at the end of November—during the pandemic wave in the Northern hemisphere—health authorities of the Kingdom of Saudi Arabia held consultations with the WHO to mitigate the effects of influenza [18, 19]. It was concluded that:

- High-risk groups should voluntarily refrain from hajj, particularly
  - Pregnant women and individuals with chronic disease
  - Those younger than 12 years or older than 65 years of age (25% usually are pilgrims older than 65)
- Thermal screening should be done on arrival to isolate patients with influenza-like illness
- Various nonpharmaceutical preventive measures should be recommended, such as
  - Washing (with soap) required before the five prayers
  - Hand sanitizers with alcohol permitted
  - Cough etiquette (but no face masks)
- To obtain the hajj visa, proof of vaccination with monovalent pandemic (H1N1) 2009 vaccine was required for those originating in countries with supplies of vaccine
- Antivirals
  - Routine chemoprophylaxis was not recommended
  - As soon as possible, treat all hospitalized persons and outpatients in high-risk groups

According to preliminary results, among the 1.6 million hajj pilgrims in 2009, 40% were immunized against seasonal influenza, and 10% had received the pandemic (H1N1) vaccine. There were 73 confirmed cases of pandemic (H1N1) 2009 and five deaths associated with the infection [20•], which is less than many would have expected.

Singapore has published a first account regarding its containment phase from the end of April to the end of June 2009. In this period, 116 of the 152 patients at Tan Tock Seng Hospital with confirmed pandemic influenza (H1N1) met the definition for having an imported, travel-associated infection. Several observations are relevant. The first cases of pandemic influenza (H1N1) arriving from several countries in Southeast Asia were recorded earlier than the official recognition of community transmission in those countries. One quarter of those patients had boarded their

flights despite the onset of symptomatic illness. Only 54% of all patients had temperatures exceeding 38°C as per the case definitions suggested by the WHO and the US Centers for Disease Control and Prevention (CDC). Only 13% of the patients, therefore, were detected by screening at the airport, whereas 87% were self-reported to Tan Tock Seng Hospital or were referred there by doctors in the city [21•].

### Options for Individual Prevention and Self-Therapy

In all likelihood, travelers will continue to need specific advice regarding pandemic influenza in the coming months because further pandemic waves may occur. The WHO does not recommend travel restrictions related to pandemic influenza (H1N1) 2009, except for persons who are ill [14]. In slight contrast, the CDC recommends that travelers at increased risk of complications from influenza may want to consider postponing travel [22]. Based on mathematical modeling, there is no reason to delay international travel to reduce the spread of infection [14]. Both the WHO and the CDC recommend social distancing from patients and basic hygienic measures to help prevent the spread of infection.

Surprisingly, neither agency mentions vaccination being indicated for travel, whereas we would consider it clearly indicated or to be considered for at least some groups of travelers (Table 2) [23•]. The seasonal vaccine for use in the 2010 Southern hemisphere influenza season will contain an A/California/7/2009 (H1N1)-like virus; an A/Perth/16/2009 (H3N2)-like virus; and a B/Brisbane/60/2008-like virus [24].

Thus, it will no longer be necessary to inject a separate pandemic vaccine. Clearly, it would be beneficial for travel health physicians to have the vaccine designated for the opposite hemisphere available in addition to having the vaccine for their own hemisphere [25]. For instance, there

**Table 2** Travel-related recommendation of pandemic (H1N1) 2009 vaccine or seasonal influenza vaccine containing the pandemic strain (21)

Primarily based on national recommendations in travelers, particularly recommend/consider

- High-risk groups and their travel companions:
  - Age: very low, senior travelers older than 50 y (USA), 60–65 y
  - Comorbidity: particularly cardiopulmonary, immunologic
  - Medical tourists
- High-risk settings:
  - Captive setting: cruise ship, camp, mass gathering, tour group, crews
  - Occupational: medical, multiple contacts, including hotel staff
  - Expedition participants (eg, high-altitude trekking)
- All who request maximum protection

(Data from Centers for Disease Control and Prevention [21])

may be an increased need for those attending the FIFA World Cup in South Africa in June–July 2010 [26].

The CDC recommends that travelers at increased risk for complications should consult with their doctors and consider carrying antiviral medications with them on their trip as a treatment option, particularly in situations where appropriate medical care may be delayed or unavailable [21••]. Possibly antivirals for the travel kit should also be discussed with travelers in high-risk settings, such as those with occupational exposure, with multiple contacts, or some travelers who will be in confined settings (eg, cruise ships; Table 2) [23•].

## Conclusions

Global surveillance for the first time made it possible to follow the evolution of the influenza pandemic on a daily basis. Several weeks after the report of the initial influenza (H1N1) 2009 outbreaks, it was recognized that containment strategies could no longer be sustained, and the goal shifted to mitigating the effects of the pandemic until vaccination became feasible. While preparing for a possible second wave of the pandemic, vaccination gained emphasis in the prevention of influenza (H1N1) 2009; the 2010 seasonal Southern hemisphere vaccine will contain the pandemic strain. In addition to vaccination, other measures (eg, hygiene practices and social distancing) are important to maintain good health during travel. Travelers will continue to benefit from specific advice targeting influenza prevention.

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- Of major importance

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