A STUDY ON A ROLE OF AIRTRAVEL IN THE TRANSMISSION OF INFLUENZA

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ABSTRACT

The Severe acute respiratory syndrome outbreak of 2002 showed how air travel can have an important role in the rapid spread of newly emerging infections and could potentially even start pandemic. In addition to the flight crew, Public health professionals have an important role in the management of infectious diseases transmitted on airlines and should be familiar with guidelines provided by local and international authorities.

Keyword: Influenza, Air travel and In-flight transmission

1. Introduction:

Over 1 billion passengers travel by air annually;50 million of these travel to the developing world.(1,2) Although infrequently reported and very difficult to assess accurately, there is a risk of disease transmission during commercial air travel and this risk has become the focus of heightened attention. The growing mobility of people and popularity of airline transportation has amplified the potential for disease to be transmitted to passengers not only during but also before and after flights. Here, we review knowledge about transmission of infectious diseases associated with commercial air travel, with particular emphasis on transmission within the aircraft passenger cabin.

2. The aircraft cabin environment:

During flight, the aircraft cabin is a ventilated, enclosed environment that exposes passengers to hypobarichypoxia, dry humidity, and close proximity to fellow passengers. This space is regulated by an environmental system that controls pressurisation, temperature, ventilation, and air filtration on the aircraft. Although this system is wholly automated, the number of airconditioning packs in operation, zone temperatures, and the mixture of fresh and re-circulated air delivered to the cabin can be manipulated by the flight deck. When parked at the terminal, fresh air is supplied to the aircraft by auxiliary power units. During flight, fresh air is supplied into the cabin from the engines where the air is heated, compressed, cooled, and passed into the cabin to be circulated by the ventilation system.(3) The outside air is assumed to be sterile at typical cruising altitudes. Air circulation patterns aboard standard commercial aircraft are side-to-side (laminar) with air entering the cabin from overhead, circulating across the aircraft, and exiting the cabin near the floor . Little front-toback (longitudinal) airflow takes place.(3–9) This air circulation pattern divides the air flow into sections within the cabin, thereby limiting the spread of airborne particles throughout the passenger cabin. Most commercial aircraft in service recirculate 50% of the air delivered to the passenger cabin for improved control of cabin circulation, humidity, and fuel efficiency.(5–9) This recirculated air usually passes through high efficiency particulate air filters (HEPA) before delivery into the cabin. Normal airline cabin air exchange rates range from 15 to 20 air changes per hour compared with 12 air changes per hour for a typical office building.(3–9) Ventilation capacity varies substantially, dependent on the aircraft type but typically averages 10 (4·7 L/s) cubic feet per minute(.3,6–10) Ventilation rates can also vary within the different cabin sections, such as first and economy class.(7,9) In general, HEPA filters used on commercial airlines have a particle-removing efficiency of 99·97% at 0·3 microns(.4,6,7,9,11). These filters remove dust, vapours, bacteria, and fungi. HEPA filters also effectively capture viral particles because viruses usually spread by droplet nuclei.(7,11) No ventilation operational standards for commercial aircraft are available. Although a survey showed that most air carriers equip their large aircraft with HEPA filters, neither the Civil Aviation Authority nor the Federal Aviation Administration require their use (9,12,13). Cabin air quality has been the focus of many media investigations and criticism from special interest groups.(14–16) Most of this concern is associated with the perception that airborne particles are distributed throughout the entire cabin by the ventilation system. However, no peer-reviewed

scientific work links cabinair quality and aircraft ventilation rates to heightened health risks compared with other modes of transport or with office buildings so this work is limited, the group concluded that temperature, humidity, air speed, and concentrations of carbon monoxide, carbon dioxide, and microbiological flora aboard 14 commercial flights.

3. Screening Phase:

Our country intensified its initial response by instituting both inbound and outbound passenger screening to identify persons with symptoms or signs compatible with SARS. All passengers were now required to obtain, read, and respond to questions on **Entry screening for human cases of influenza** form in the airport. Secondary screening procedures were established for all passengers who answered yes to any of the questions. It was mandatory for any such passenger to be referred to a screening nurse who administered a standard in-depth questionnaire and protocol. The secondary screening protocol included reasons for assessment, symptoms present at time of assessment, oral temperature, and defined criteria for disposition. On the basis of the responses elicited in the protocol, a passenger was released or referred to a predetermined hospital for an in-depth medical evaluation. Any passenger with an elevated temperature reading was referred to the screening nurse for confirmation, completion of the screening protocol, and referral to hospital, if necessary.

In 2009, The government of India has decided to screen all people entering india via the main airport hubs of Mumbai, New Delhi, Goa, Jaipur, Kochi, Kolkatta, Chennai, Bangalore and Hyderabad. It said the primary focus will be on passengers entering from the United States of America, United Kingdom, Canada, Mexico, France and New Zealand. A team of 32 Medical Professionals have been Posted at these airports.

4. Modes of disease transmission:

Four routes for the spread of microorganisms exist: contact, airborne, common vehicle, and vector-borne. Contact transmission involves direct contact in which body-to-body contact takes place, or indirect in which the susceptible person comes into contact with a contaminated intermediate host (fomite). Large droplet transmission is judged a form of contact transmission in which large droplets (_5 microns) contaminated with microorganisms are generated when an

infected person sneezes, coughs, or talks. These droplets are propelled short distances (_1 m) and deposited on a susceptible host's conjunctiva or mucosa. Airborne transmission happens by aerolisation of an infectious agent through droplet nuclei (residua of large droplets containing microorganisms that have evaporated to _5 microns). These residual droplets become aerosolised and disperse widely, dependent on environmental conditions, and remain suspended in air for indefinite periods. Common vehicle transmission involves one inanimate vehicle, which transmits infection to many hosts, and typically applies to microorganisms spread by food and water. Vector-borne transmission results from the spread of disease by insects and vermin. All types of disease transmission are relevant to commercial air travel.Large droplet and airborne mechanisms probably represent the greatest risk for passengers within the aircraft because of the high density and close proximity of passengers. In addition to proximity, successful spread of contagion to other hosts is dependent on many factors, including infectiousness of the source; pathogenicity of the microorganism; duration of exposure; environmental conditions (ventilation, humidity, temperature); and host-specific factors such as general health and immune status.(4,7,9). How these factors affect risk of disease transmission within the aircraft cabin is unclear.

5. Risk of transmission:

The risk of disease transmission within the confined space of the aircraft cabin is difficult to determine. Insufficient data prohibits meta-analysis, which would for each respective contagion. Many of the available epidemiological studies are compromised by reporting bias caused by incomplete passenger manifests, thereby complicating risk assessment. Despite these limitations, data suggest that risk of disease transmission to other symptom-free passengers within the aircraft cabin is associated with sitting within two rows of a contagious passenger for a flight time of more than 8 h. (3,4,7,9,12,) This association is mainly derived from investigations of inflight transmission of tuberculosis, but is believed to be relevant to other airborne infectious diseases. (3,4) Some variation in this association has been reported, with one outbreak of severe acute respiratory syndrome (SARS) in which passengers seated as far as seven rows from the source passenger were affected. Risk of disease transmission within the aircraft cabin also seems to be affected by cabin ventilation.

In general, proper ventilation within any confined space reduces the concentration of airborne organisms in a logarithmic fashion, and one air exchange removes 63% of airborne organisms suspended in that particular space. The main laminar flow pattern within the aircraft cabin with the practice of frequent cabin air exchanges and use of HEPA filtration for recirculated air clearly limits transmission of contagion.(4,7,9,12). Transmission becomes widespread within all sections of the passenger cabin when the ventilation system is nonoperational, as shown by an influenza outbreak when passengers were kept aboard a grounded aircraft with an inoperative ventilation system. Risk assessment incorporating epidemiological data into mathematical models may show how proximity and ventilation affects disease transmission aboard commercial airlines. Deterministic modelling with data from an in-flight tuberculosis investigation revealed that doubling ventilation rate within the cabin reduced infection risk by half. Risk also reduced exponentially to almost zero in passengers seated 15 seats from the infectious source. Clearly ventilation provides a crucial determinant of risk, and efforts to increase ventilation will reduce risk.

6. SARS:

SARS is a non-typical pneumonia caused by a coronavirus. The global spread by air travellers and in-flight spread of SARS has been documented. The disease is believed to usually be spread by large aerosolised droplets or by direct and indirect contact, but airborne or small droplet transmission better explains the distribution of SARS cases that has occurred on commercial airlines. The first severe contagious disease of the 21st century, SARS exemplifies the ever present threat of new infectious diseases and the real potential for rapid spread made possible by the volume and speed of air travel. Finally, the distribution pattern of SARS transmission aboard the flight emphasises the need to study airborne transmission patterns aboard commercial aircraft.

6.1 Common cold

Common cold outbreaks as a result of air travel have not been reported, which could be attributable to the difficulties of investigating such outbreaks in view of the ubiquitous nature of the common cold. One study compared the risk of developing an upper respiratory tract infection during air travel in passengers flying on aircraft that recirculated 50% cabin air versus aircraft

using 100% fresh air in the passenger cabin.36 Recirculation of aircraft cabin air was not a risk factor for contracting upper respiratory tract infection symptoms.

6.2 Influenza

The aircraft as a vector for global spread of influenza strains is a greater concern than is in-flight transmission. The fact that influenza outbreaks worldwide have been affected by influenza strains imported by air travel is well established; however, only three studies of in-flight transmission of influenza have been reported. The first was in an outbreak of influenza A/Texas strain aboard a commercial carrier in 1979 that resulted in 72% of all passengers aboard the airline contracting influenza within 72 h. The secondary attack rate in their families was estimated to be 20% within 2 weeks. The high transmission rate in this particular case was believed attributable to passengers being kept aboard the aircraft for 3 h with an inoperative ventilation system while repair work was being done. The second study described an outbreak of influenza A/Taiwan/1/86 at a naval air station in 1989 in military personnel who were returning from temporary duty. The third outbreak happened in 1999 in mine workers travelling on a 75-seat aircraft 15passengers travelling with the index case developed symptoms within 4 days. Nine of the 15 were seated within two rows, and all were seated within five rows, of the index case. No further influenza outbreaks aboard commercial aircraft have been reported since 1999.

7. Conclusion:

Of the border control measures available, reducing traveler numbers has the biggest effect on the delay and even then it is necessary to get the number of travelers down to a very low number. An equivalent control measure is to quarantine all arriving passengers with near perfect compliance. Our results indicate that short of virtually eliminating international travel, border control measures add little to avoiding, or delaying, a local epidemic if an influenza pandemic takes off . All forms of border control are eventually Overwhelmed by the cumulative number of infected travelers that attempt to enter the country.

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