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Aviation Advisors

AIR TRANSPORT AND PANDEMIC INFLUENZA

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Ruwantissa Abeyratne's article in the June, 2006 issue of *Air & Space Law*,[2] examines some of the implications for air travel of an avian influenza pandemic. He states that a 'rapidly spreading pandemic will be as disastrous to the industry as the aftermath of the events of 11 September 2001'.[3] And while Abeyratne concludes that, in the event of such a pandemic, it would not be realistic economically to shut down an industry – air transport – that is critical to the economy, he also cites with approval a recognition on the part of ICAO 'that air travel will most likely be looked at as one of the main means by which the disease would spread globally'.[4] He further states that air transport would be 'a conduit between nations for the global transmission of the disease [an avian flu pandemic] across boundaries'.[5]

In this regard a number of significant studies (published just before and after Abeyratne's article) in *Nature*, *PLoS Medicine* and the *Proceedings of the National Academy of Sciences*, and a report in *Science*, address the question as to whether air travel restrictions would, in fact, materially slow down the spread of a flu pandemic.[6] This is, of course, a

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2 Ruwantissa Abeyratne, 'Implications of an Avian Flu Pandemic for Air Transport', (2006) 31 *Air & Space Law*, No. 3, pp. 159-171.

3 *Supra*, p. 160.

4 *Supra*, p. 170. The main focus of the article is 'the sustenance of the aviation industry following an avian flu pandemic' (p. 171). Indeed, for Abeyratne, States and international organisations have '*a moral obligation* to watch the interests of the air transport industry in the face of a global pandemic of avian flu' (emphasis added) (p. 161). The author at some length also asserts the primacy of ICAO, and its virtues, in the event of any such pandemic: 'ICAO has rightfully, and with foresight, recognized that the risk of a pandemic of avian flu would place the Organization, as the specialized agency of the United Nations dealing with international civil aviation, in a leadership role to take action to harmonize the response of the aviation industry … ICAO will stand ready to assist Contracting States …' (pp. 170-171).

5 *Supra*, p. 162. He also states that, as against the spread of a communicable disease through an aircraft cabin, 'the international community should be more concerned with the transmission of the disease across boundaries, which is the real danger …': *Supra*, pp. 165-166.

6 Ben S. Cooper et al., 'Delaying the International Spread of Pandemic Influenza', (2006) 3 *PLoS Medicine*, No. 6, pp. 0845-0855; Timothy C. Germann et al., 'Mitigation strategies for pandemic influenza in the United States', (2006) 103 *Proceedings of the National Academy of Sciences of the United States of America*, No. 15, pp. 5935-5940; Neil M. Ferguson et al., 'Strategies for

key question for passengers, the air transport industry, industry generally, international organisations and States.

This research note outlines the key findings of these studies with regard to air transport.

1. Is 'the most important disease vector today … the Boeing 747'?[7]

While Abeyratne cites the WHO[8] Global Influenza Preparedness Plan,[9] and refers throughout to the role of WHO in any pandemic influenza and generally, no mention is made of WHO's conclusion that enforcement of travel restrictions to and from affected areas is 'considered impractical in most countries'.[10] Indeed, 'most governments that have studied the idea [travel restrictions or bans] have rejected it'.[11] The impracticality (and ineffectiveness) of such travel restrictions is noted by Cooper et al.,[12] the first of three *model* studies considered here which suggest that, with some qualifications, air travel restrictions are either likely to be of little value in delaying pandemics,[13] will likely only slow down or 'delay slightly' the spread of the influenza by a few days to weeks 'without reducing the eventual size of the outbreak' or 'impacting the eventual number ill'[14] or 'are unlikely to delay spread [of an influenza pandemic] by more than 2-3 weeks unless more than 99% effective'.[15]

A fourth study which analyses data from 1996 to 2005 and suggests, amongst other things, 'an influence of domestic air travel on the rate of inter-regional spread in the US',[16] is also considered.

1.1 Cooper et al.

Against a background of significant increases in international air travel which, for the authors, 'might be expected to lead to more rapid global dissemination [of pandemic

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mitigating an influenza pandemic', (2006) 442 *Nature*, 27 July, pp. 448-452; and John S. Brownstein et al., 'Empirical Evidence for the Effect of Airline Travel on Inter-Regional Influenza Spread in the United States', (2006) 3 *PLoS Medicine*, No. 10, pp. 0001-0010. These studies are considered in summary in Martin Enserink, 'Ground the Planes During a Flu Pandemic? Studies Disagree', (2006) 313 *Science*, 15 September, p. 1555.

7 Enserink, *supra*, states that 'it's almost a cliché among researchers to say that the most important disease vector today is the Boeing 747'.

8 The World Health Organization.

9 Such plan sets out 'the role of WHO and recommendations for national measures before and during pandemics': World Health Organization, *WHO Global Influenza Preparedness Plan* (World Health Organization, Switzerland, 2005). Abeyratne, *supra*, note 2, refers to the plan at pp. 162 (note 15) and 164 (note 26).

10 WHO, *supra*, p. 44.

11 Enserink, *supra*, note 6, citing Neil M. Ferguson, a co-author of one of the four studies considered here.

12 Cooper at al, *supra*, note 6.

13 *Supra*, p. 0845.

14 Germann et al., *supra*, note 6, pp. 5935 and 5938-5939.

15 Ferguson et al., *supra*, note 6, p. 448.

16 Brownstein et al., *supra*, note 6, pp. 0001.

influenza] than in previous pandemics',[17] the study by Cooper et al., using 'a stochastic[18] ... model of the international spread of influenza based on extensions of coupled deterministic epidemic transmission models',[19] shows that 'under most scenarios restrictions on air travel are likely to be of surprisingly little value in delaying epidemics, unless almost all travel ceases very soon after epidemics are detected'.[20] Further, '[t]he relative ineffectiveness of travel restrictions for controlling pandemic influenza is a consequence of the rapid initial rate of growth of the epidemic in each city and the large number of people infected'.[21]

More specifically,

> pandemic influenza is expected to have a much shorter serial interval than SARS, and delays in international spread that could be achieved by restricting almost all travel would be far more modest. Even if 99.9% of all travel could be stopped, epidemics in most cities would be delayed by no more than 4mo[nths]. Moreover, the conclusion that a policy of isolating only the largest cities would guarantee success implicitly assumes that closing major airports would cause infected individuals who would have travelled through them to abandon their journeys rather than seek alternative routes, and that disease spread by routes other than air travel can be ignored without substantially altering the conclusions. This seems rather implausible.[22]

And, even on the basis of optimistic assumptions, the study found that 'large and widely enforced travel restrictions would usually delay epidemic peaks by only a few days; to have a major impact, restrictions would have to be almost total and almost instantaneous'.[23] The study also found that *local* control measures able to reduce the transmission of influenza had 'greater potential for reducing the rate of global spread'[24] and that airport entry screening 'would have a negligible impact on the course of a pandemic once it was underway'.[25]

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17 Cooper et al., *supra*, note 6, p. 0845.

18 Or probabilistic.

19 Cooper et al., *supra*, note 6, p. 0846, '[t]o evaluate the potential of travel restriction and local control measures to impede global dissemination'. Such class of models 'has been shown to be capable of accurately forecasting local and global spread of epidemic and pandemic influenza and accounting for the global distribution of other pathogens, but has not previously been used to assess the impact of travel restrictions or other control options for pandemic influenza'.

20 *Supra*, p. 0845.

21 *Supra*, p. 0850.

22 *Supra*, p. 0851.

23 *Supra*, pp. 0851-0852. And '[o]nly

24 Supra, p. 0852. Results suggested 'that resources might be better directed at reducing transmission locally and at attempting to control outbreaks during the earliest stages of sustained human-to-human spread, when movement restrictions are likely to be a more valuable containment measure': *Supra*, p. 854.

25 *Supra*, p. 852.

1.2 Germann et al.

The study by Germann et al. is, as its title suggests, concerned with pandemic influenza mitigation strategies solely in the United States.[26] The authors state that the occurrence of another influenza pandemic is inevitable, and that recent events suggest such occurrence will take place sooner rather than later.[27] They also note that '[t]he course of an influenza outbreak is sensitive to many factors, particularly population mobility',[28] and while 'formally imposed quarantine or travel restriction policies are possible, voluntary changes in hygienic and social behaviour (including travel plans) will undoubtedly occur'.[29]

The authors conclude that, if a pandemic influenza virus does reach the United States,

> the US population could begin to experience a nation-wide pandemic within 1 month of the earliest introductions. Our simulations indicate that the rapid imposition of a 90% reduction in domestic travel would slow the virus spread by only a few days to weeks[30] … without reducing the eventual size of the outbreak, unless other behavioural or medical responses are introduced.[31]

Put another way, 'restricting travel after an outbreak is detected is likely to delay slightly the time course of the outbreak without impacting the eventual number ill'.[32]

Notwithstanding that their simulation model was designed for the United States, the authors believe that their qualitative conclusions 'will hold for other countries or regions with highly mobile populations'.[33]

1.3 Ferguson et al.

With reference to the United States and Great Britain, Ferguson et al. examine[34] options for mitigating an influenza pandemic in the event that 'initial containment of a novel influenza outbreak' fails. The authors find 'that border restrictions and/or internal travel restrictions are unlikely to delay spread by more than 2-3 weeks unless more than 99% effective'.[35]

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26 That by Cooper et al. examined the international spread of pandemic influenza.
27 Germann et al., *supra*, note 6, p. 5935.
28 *Supra*.
29 *Supra*, pp. 5936-5937.
30 Depending on the basic reproductive number.
31 Germann et al., *supra*, note 6, p. 5938-5939.
32 *Supra*, p. 5935.
33 *Supra*, p. 5940.
34 Using a large-scale epidemic simulation: Ferguson et al., *supra*, note 6, p 448.
35 *Supra*.

2. 'The footprints of 9/11':[36] Brownstein et al.

As Brownstein et al. note, '[u]nderstanding the role of airline travel in large-scale influenza spread is especially important given the mounting threat of an influenza pandemic'.[37] The authors measured from 1996 to 2005 in the United States the rate of inter-regional spread and timing of influenza and, as a result, provided 'the first empirical evidence for the role of airline travel in long-range dissemination of influenza'.[38]

The results of the study

> suggest that inter-regional spread occurs by a … mechanism … where air travel may be an important mode of long-range dissemination of influenza … Our results suggest that for a non-pandemic year, travel during the Thanksgiving holiday may be central to the yearly national spread of influenza in the U.S. Similarly, we found that international airline travel influences the absolute timing of seasonal influenza mortality.[39]

Further,

> [t]he flight ban in the US after the terrorist attack of September 11, 2001, and the subsequent depression of the air travel market provided a natural experiment for the evaluation of the effect of flight restrictions on disease spread. The importance of airline activity was highlighted by the delayed peak of influenza in 2001-2002 following the period of reduced flying activity. This finding is further validated by the absence of a similar delay in influenza activity in France, where flight restrictions were not imposed.[40]

For their authors, their study indicates that airline travel fluctuations 'impact on large-scale spread of influenza'.[41] Regionally, the results 'suggest an important influence of international air travel on influenza timing as well as an influence of domestic air travel on influenza spread in the US'.[42] Nonetheless, the authors believe that, 'for the global influenza pandemic widely believed to be inevitable, *the efficacy of travel advisories, flight restrictions, or even complete flight bans as a control measure is still uncertain*'.[43]

Authors of the first three studies outlined above have questioned the findings of the Brownstein et al. study. Ferguson says that there is no evidence of any causal relationship between travel and the timing of the flu season,[44] and one of Germann's co-authors

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36 The expression is used in Enserink, *supra*, note 6.
37 Brownstein et al., *supra*, note 6, p. 0002.
38 *Supra*, p. 0001.
39 *Supra*, p. 0007.
40 *Supra*.
41 *Supra*, p. 0008.
42 *Supra*.
43 *Supra*. Emphasis added.
44 Neil Ferguson cited in Enserink, *supra*, note 6.

believes that, while the Brownstein et al. study is 'very nice', conclusions cannot be drawn from the effect of 11 September 2001.[45]

Abeyratne makes a number of useful contributions to our understanding of the implications of what he terms 'an avian flu pandemic' for air transport. While his comment that air transport would be a conduit between nations for the global transmission of such a pandemic across boundaries[46] is in its terms correct, a number of recent studies have questioned whether air travel restrictions would be effective in delaying the spread of a pandemic influenza.[47] This research note outlines the main findings of these studies for air transport, and those of a fourth study which is to some extent at odds with them.[48] The question of air transport restrictions in the event of such a pandemic is a critical one not just for the air transport industry but for States generally.

45 Ira Longini (Germann et al., *supra*, note 6) cited in Enserink, *supra*.

46 Abeyratne, *supra*, note 2, p. 162.

47 Further, as previously mentioned, WHO has concluded that *enforcement* of travel restrictions to and from affected areas is 'considered impractical in most countries' (World Health Organization, *supra*, note 9) and 'most governments that have studied the idea [travel restrictions or bans] have rejected it' (Enserink, *supra*, note 11).

48 Although, again, one of the final conclusions of that study is that, 'for the global influenza pandemic widely believed to be inevitable, the efficacy of … flight restrictions, or even complete flight bans as a control measure is still uncertain' (Brownstein et al., *supra*, note 43).