Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Predicting the potential for within-flight transmission and global dissemination of MERS

We read with interest Abdullah Assiri and colleagues'[1] report about the recent emergence of a new pathogen, Middle East respiratory syndrome coronavirus (MERS-CoV). MERS-CoV has an epicentre in Saudi Arabia, but cases have been reported from Italy, France, Germany, Tunisia, and the UK.[1] The basic reproduction number (R_0) of MERS-CoV has been estimated to be less than one, indicating that the virus is unlikely to cause an epidemic.[2,3] However, we note that even when the R_0 of a pathogen is below one it can be transmitted during long-distance flights.[4] Within-flight transmission has been documented for influenza, measles, smallpox, tuberculosis, and severe acute respiratory syndrome.[4] We used a mathematical model to predict the potential for within-flight transmission of MERS-CoV.[5] Specifically, we predicted the number of new infections that could be caused by one person with MERS-CoV taking a long-distance flight. The model was parameterised to reflect conditions in a Boeing 747, and MERS-CoV infectivity was defined in terms of infectious quanta per hour.[6] We assumed, on the basis of existing data, that MERS is less infectious than influenza, which has an infectivity of about 100 quanta per hour (range 79–128).[2,5] We set the infectivity of MERS-CoV at about 50 quanta per hour (range 6–140).

Our modelling shows transmission will be confined to the cabin where the index case is located. The figure shows the outcome of 10 000 scenarios, with a different value for the infectivity of MERS-CoV used in each. On a 5 h flight (eg, from Saudi Arabia to Pakistan), roughly one infection could occur if the index case travels by first class, and roughly three infections could occur if he or she travels in economy. On a 13 h flight (eg, from Saudi Arabia to New York), the number of infections would double. Notably, a superspreader on a 13 h flight, releasing about 140 quanta per hour, could cause roughly four infections in first class or 15 infections in economy.

Although the risk to public health (ie, the number of infections) are greatest if the index case travels by economy rather than by first class, the per-passenger risk of becoming infected with MERS-CoV is greatest if the index case travels by first class rather than by economy (figure). Over 5 h, the risk would be about 3% in first class versus about 1% in economy for a fully occupied flight; correspondingly, the risk would be about 8% versus 2% on a 13 h flight. The risk is substantially greater if the index case is a superspreader; for example, if the index case releases 140 quanta per hour and takes a 13 h flight, the per-passenger risk would be about 16% for first-class travel and 5% for economy travel.

Our modelling suggests that, if within-flight transmission of MERS-CoV occurs, one infectious individual could cause multiple simultaneous outbreaks in several different countries. Therefore, even if MERS-CoV does not have the potential to cause an epidemic,[2,3] the probability of global dissemination of this new pathogen could be high.

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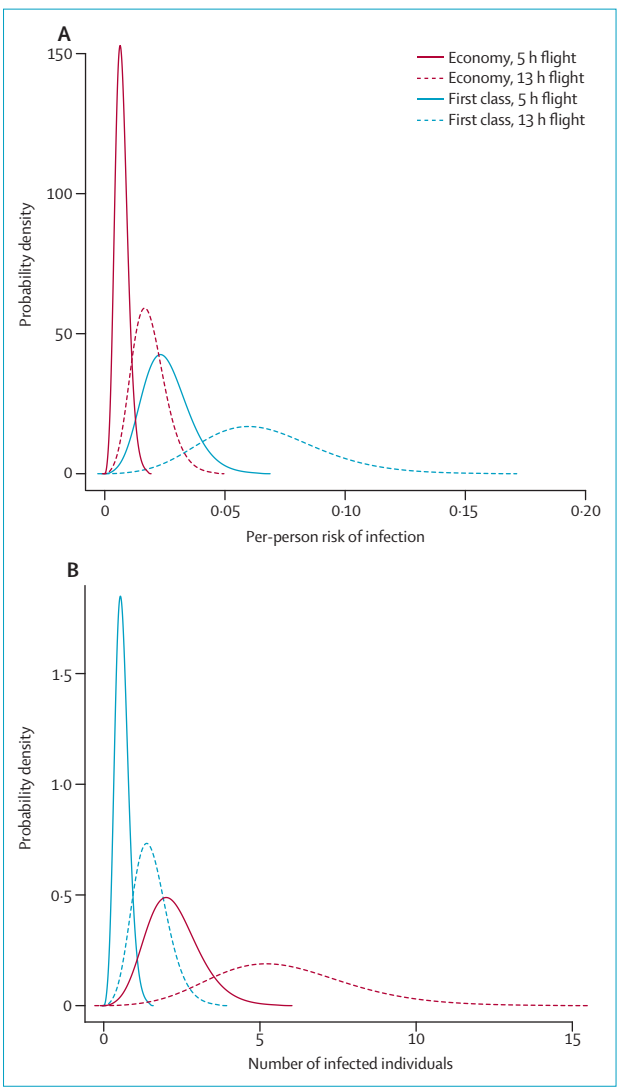

***Figure*: Within-flight transmission of MERS-CoV**
Each probablity distribution is based on 10 000 scenarios with different levels of index-case infectivity. Red lines represent predictions for which the index case travels by economy, and blue lines represent travel by first class. Solid lines represent predictions for a 5 h flight and dotted lines show predictions for a 13 h flight. (A) The predicted number of infections caused by one infectious case of MERS during a long-distance flight. (B) The predicted per-passenger risk of infection due to one infectious case of MERS during a long-distance flight.

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This online publication has been corrected. The corrected version first appeared at thelancet.com/specialty on July 20, 2015