

Researchers describe potential for MERS coronavirus to spread internationally

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The life-threatening MERS coronavirus that has emerged in the Middle East could spread faster and wider during two international mass gatherings involving millions of people in the next few months, according to researchers who describe the most likely pathways of international spread based upon worldwide patterns of air travel.

Researchers led by Dr. Kamran Khan of St. Michael's Hospital encouraged health care providers to learn from the experience of SARS by anticipating rather than reacting to the introduction of MERS in travelers returning from the Middle East. SARS, which was also caused by a previously unknown coronavirus, killed 800 people worldwide a decade ago, including 44 in Toronto, and cost the Canadian economy an estimated \$2 billion.

The MERS [coronavirus](#), which appears to have emerged in the Middle East in early 2012, has spread to several countries in Western Europe and North Africa where there have been localized clusters of cases. Worldwide about 80 cases have been confirmed, with a mortality rate of more than 50 per cent.

Dr. Khan said there is potential for the virus to spread faster and wider during two annual events that draw millions of domestic and foreign Muslims to Saudi Arabia. The first is umrah, a pilgrimage that can be performed at any time of year but is considered particularly auspicious during the month of Ramadan, which this year began on July 9 and ends on Aug. 7. The second is the hajj, a five-day pilgrimage required of all physically and financially able Muslims at least once in their life. It takes place Oct. 13-18 this year and is expected to draw more than 3 million people.

Dr. Khan's team analyzed 2012 worldwide airline traffic and historic hajj data to predict population movements in and out of Saudi Arabia and the broader Middle East during these two mass

gatherings to help countries assess their potential for MERS introduction via returning travelers and pilgrims. He also used World Bank economic and per capita [health care expenditure](#) data to help gauge individual countries' abilities to detect imported MERS in a timely manner and mount an effective public health response.

Results of the study were published in the online journal *PLOS Currents: Outbreaks*.

Dr. Khan, an infectious disease physician, is the founder of BioDiaspora, a web-based technology that uses global air traffic patterns to predict the international spread of infectious disease. The BioDiaspora platform has been used by numerous international agencies, including the U.S. Centers for Disease Control and Prevention, the European Centre for Disease Prevention and Control and the World Health Organization to evaluate emerging infectious disease threats, including those during global mass gatherings such as the Olympics and the hajj.

"With millions of foreign pilgrims set to congregate in Mecca and Medina between Ramadan and the hajj, pilgrims could acquire and subsequently return to their home countries with MERS, either through direct exposure to the as-of-yet unidentified source or through contact with domestic pilgrims who may be infected," he said.

Dr. Khan's team found that of the 16.8 million travelers who flew on commercial flights out of Saudi Arabia, Jordan, Qatar and the United Arab Emirates between June and November 2012 (the period starting one month before Ramadan and ending one month after the hajj) 51.6 per cent had destinations in just eight countries: India (16.3 per cent), Egypt (10.4 per cent), Pakistan (7.8 per cent), Britain (4.3 per cent), Kuwait (3.6 per cent), Bangladesh (3.1 per cent), Iran (3.1 per cent) and Bahrain (2.9 per cent).

Twelve cities—Cairo, Kuwait City, London, Bahrain, Beirut, Mumbai, Dhaka, Karachi, Manila, Kozhikode (India), Istanbul and Jakarta—each received more than 350,000 commercial air travelers between June and November 2012 from the four countries where MERS cases have been traced back to. considering the diagnosis led to delays in implementing appropriate infection control measures, which in turn enabled SARS to spread within health care institutions.

Provided by St. Michael's Hospital

In contrast to SARS, where the disease was introduced into predominantly high-income countries through air travel, more than half of all air travelers departing Saudi Arabia, Jordan, Qatar and UAE have final destinations in low or lower-middle income countries. Two-thirds of all hajj pilgrims originate from low or lower-middle income countries.

Of particular note is the degree of connectivity between the Middle East and South Asia. Collectively, India, Pakistan, Bangladesh, Afghanistan and Nepal represent the final destinations of nearly one-third of all international air travelers departing Saudi Arabia, Jordan, Qatar and the UAE, and the origins of roughly one in four foreign hajj pilgrims worldwide.

"Given that these countries have limited resources, they may have difficulty quickly identifying imported MERS cases, implementing rigorous infection control precautions and responding effectively to newly introduced cases," Dr. Khan said.

Dr. Khan's previous research suggests that if screening of air travelers for MERS is considered, it would be far more efficient and less disruptive to the world's air traffic to screen travelers as they leave source areas in the Middle East rather than screen the same travelers as they arrive at other airports around the world. However, all countries receiving pilgrims and other travelers from known MERS areas should mobilize their infectious disease surveillance and public health resources in ways that are commensurate with their potential for MERS introduction, he said.

Educating and preparing front-line health care providers to consider the possibility of MERS in patients is also critical, he said, since that is a necessary first step to implement effective infection control practices that could minimize the risk of spread to others. In the SARS epidemic, delays in

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