

Researchers map the potential spread of yellow fever virus to cities around the world

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Researchers led by Dr. Kamran Khan of St. Michael's have mapped the worldwide pathways through which yellow fever virus could spread by analyzing global patterns of airline travellers, the environmental conditions needed to enable transmission of the virus within a city, and countries' requirements for travellers to provide proof of yellow fever vaccination upon entry. Credit: St. Michael's Hospital

The deadly yellow fever virus has the potential to spread into cities around the world where it previously hasn't been seen, according to a new study led by St. Michael's Hospital.

Researchers led by Dr. Kamran Khan of St. Michael's have mapped the worldwide pathways through which [yellow fever virus](#) could spread by analyzing global patterns of airline travellers, the environmental conditions needed to enable transmission of the virus within a city, and countries' requirements for travellers to provide proof of yellow fever vaccination upon entry.

Published in the *Bulletin of the World Health Organization*, the research does not model a particular outbreak, but rather examines the potential spread for yellow fever virus to spread between the world's cities.

"Imagine a yellow fever outbreak as a fire," said Dr. Khan, who is a scientist at the Li Ka Shing Knowledge Institute of St. Michael's Hospital. "Embers can fly off in different directions, and if they land in the right place, they can create another fire. We studied the global conduits through which yellow fever virus can spread, and the potential for new yellow fever outbreaks to occur in the world's urban areas."

The team of researchers took a global panoramic view of yellow fever virus. They separated the world into three types of places: endemic areas, places where yellow fever virus is established; areas that appear suitable for yellow fever virus transmission but where it has not yet been seen; and non-endemic areas where there is no yellow fever virus and the environment appears unsuitable for it to spread. Yellow fever is spread through the bite of an *Aedes aegypti* mosquito, which can also transmit viruses such as dengue, chikungunya and Zika.

According to the U.S. Centers for Disease Control and Prevention (CDC), about 15 per cent of people who get yellow fever develop

serious illness that can be fatal.

"Yellow fever vaccine is the best protection against yellow fever disease," says Dr. Martin Cetron, head of CDC's Division of Global Migration and Quarantine. "CDC urges anyone traveling to a country where yellow fever is circulating to be vaccinated against yellow fever. Yellow fever vaccine is available at a limited number of clinics in the U.S., and people with some medical conditions shouldn't be vaccinated, so travellers should plan ahead."

Some countries have set up policies requiring international travellers to provide proof of yellow fever vaccination upon entry. Dr. Khan and his team took into account which countries require proof and which currently don't. They then analyzed the travel patterns of 1.4 billion people flying through commercial airports around the world.

"There are different levels of risk depending on where the person is travelling to and where they are coming from," Dr. Khan said. "In today's increasingly connected world, one of the key concerns is that yellow fever virus could be carried by a traveller into a densely populated city that has the environmental conditions necessary to support its transmission, but where the virus has never been seen before. In this setting, the urban population would have essentially have no preexisting immunity to the virus."

Through their analysis, Dr. Khan's team found that:

- 89 per cent of travellers departing from yellow fever-endemic areas to other yellow fever-endemic areas were required to provide proof of vaccination upon entry
- Less than 35 per cent of travellers departing yellow fever-endemic areas for cities that appear suitable for yellow fever virus transmission were required to provide proof of vaccination

upon entry

- Less than 25 per cent of travellers who departed from areas of the world where there is no yellow fever virus for areas that are endemic with yellow fever virus were required to provide proof of vaccination upon entry
- Brazil, China, India, Mexico, Peru and the United States had the highest volumes of travellers arriving from yellow-fever endemic areas and the largest populations living in cities that appear suitable for yellow fever virus transmission

"Now that we have a global view of how yellow fever virus can travel between the world's cities, countries can reexamine their policies to prevent the importation of yellow fever virus, protect travellers from getting infected with the virus, and in turn prevent its exportation to other parts of the world," Dr. Khan said. "We can't assume that if a yellow fever outbreak has never occurred before in a specific urban area of the world that it will never occur in the future."

In the meantime, Dr. Khan recommends that [travellers](#) maintain awareness of the current requirements for yellow fever vaccination and that they have a thoughtful discussion with their physician about whether or not they should receive the yellow [fever](#) vaccine before they travel.

More information: *Bulletin of the World Health Organization* (2018).
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Provided by St. Michael's Hospital

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