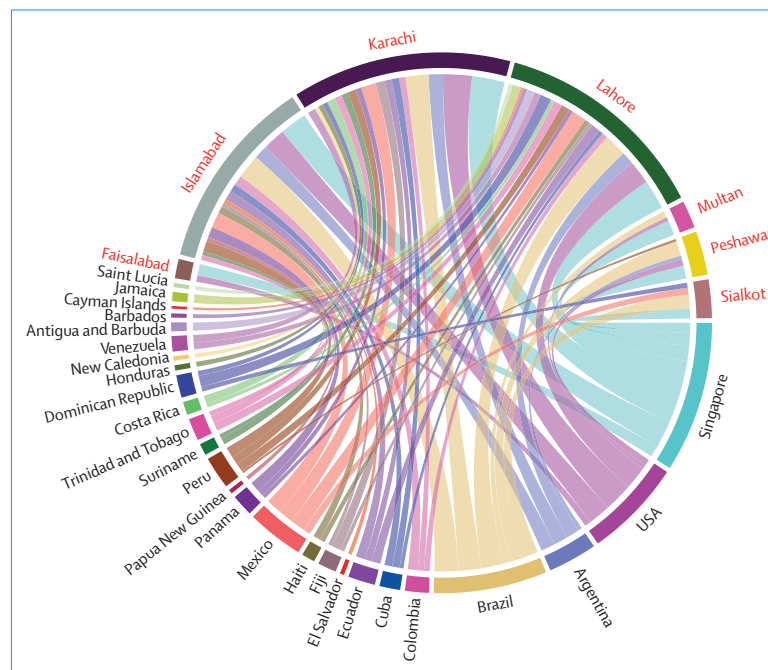


## Zika virus in Pakistan: the tip of the iceberg?

Zika virus, an emerging arbovirus similar to dengue virus and chikungunya virus, is mostly transmitted by *Aedes aegypti* and *A albopictus* mosquitoes. Since the first reported dengue case in 1994, Pakistan has faced multiple outbreaks of dengue and chikungunya.<sup>1</sup> Despite increasing control efforts, breeding sites for *Aedes* vectors are now found in major cities.<sup>2</sup>

Besides exhibiting similar clinical signs to those of dengue and chikungunya, Zika virus disease is associated with congenital microcephaly and Guillain-Barré syndrome (GBS), a matter of utmost concern. Of particular note is a recent increase in GBS cases of unknown aetiology in the Pakistani population.<sup>3</sup> Although no clinical cases of Zika virus disease have been notified in Pakistan, the first serological traces of infection date back to 1983.<sup>4</sup> An important factor that might obscure Zika virus detection is the lack of a national, unified arbovirus surveillance system. Moreover, in patients showing symptoms of arbovirus-like fever, Zika virus diagnostic tests are currently not included in clinical protocols and medical practitioners are more inclined to investigate for dengue virus. Also, 61% of the Pakistani population lives in rural areas where fevers, rashes, or joint pains are not considered as red flag signs for a hospital visit. Although the awareness level has increased following campaigns against dengue, many people remain oblivious to the health threats posed by arboviruses.

We did a qualitative analysis to estimate the potential risk of Zika virus introduction into the country. We used the circlize statistical package<sup>5</sup> for R software to visualise incoming traffic (logarithm of relative passenger volume) to Pakistani airports from countries characterised as Zika-virus-infected by the US Centers for Disease Control and Prevention as of Sept 1, 2016. In a given country,



**Figure:** Qualitative risk analysis of Zika virus introduction into Pakistan via air passengers. Pakistani airports are shown in red.

only infected areas were considered (eg, Miami, FL, in the USA). Data on incoming passenger travel volume were obtained from the International Air Transport Association for 2015 (direct and indirect routes with stopovers).

We found that the highest proportion of high-risk travellers arrived from Singapore (figure). Miami, FL, USA, and Brazil were the next two largest contributors to arrivals. While fewer in numbers, travellers to Pakistan converged from an additional 23 Zika-virus-infected regions. All international Pakistani airports are possible entry routes for Zika virus, and all are located in areas where *Aedes* mosquitoes breed (appendix), indicating the potential for onward transmission.

The presence of *Aedes* in the local environment, together with the multiple modes of Zika virus introduction and spread, highlight the urgent need: to (i) develop an active vector surveillance and early Zika virus detection system, (ii) introduce public health awareness campaigns,

and (iii) establish national preparedness and management guidelines for the local population, especially pregnant women and international travellers, to mitigate the risk of Zika virus introduction and spread in Pakistan, and a subsequent nationwide epidemic. A regional approach is also urgently needed to harmonise surveillance and vector control approaches, and share epidemiological information.

We declare no competing interests.

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See Online for appendix

For countries affected by Zika see <https://www.cdc.gov/zika/geo/>

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