

The When and the Where of Zika Epidemic Potential in Europe - An Evidence Base for Public Health Preparedness.

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▶ **To cite this version:**

Richard E Paul. The When and the Where of Zika Epidemic Potential in Europe - An Evidence Base for Public Health Preparedness.. EBioMedicine, 2016, 9, pp.17-8. 10.1016/j.ebiom.2016.06.020 . pasteur-01370818

HAL Id: pasteur-01370818

https://pasteur.hal.science/pasteur-01370818

Submitted on 23 Sep 2016

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EBioMedicine 9 (2016) 17–18

Contents lists available at ScienceDirect

EBioMedicine

journal homepage: www.ebiomedicine.com

Commentary

The When and the Where of Zika Epidemic Potential in Europe – An Evidence Base for Public Health Preparedness

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ARTICLE INFO

Article history:
Received 14 June 2016
Accepted 14 June 2016
Available online 16 June 2016

Keywords:
Zika
Flavivirus
Aedes
Mosquitoes

Zika virus (ZIKV) is a flavivirus transmitted via the bites of infected *Aedes* mosquitoes, although non-vector-borne transmission has also been documented (sexual and maternofetal transmission and transmission through transfusion) (Musso and Gubler, 2016). Until the recent outbreaks, ZIKV had a known restricted circulation in Africa and Asia, but with only sporadic human cases reported. ZIKV infection was considered relatively benign, with the majority of infections causing no or mild symptoms. The most common clinical manifestations include rash, fever, arthralgia, and conjunctivitis. In 2007, Yap, Micronesia, was the first Zika outbreak outside Africa and Asia, but which was small and with no cases requiring hospitalization (Duffy et al. 2009). However, in 2013 a large Zika outbreak occurred in French Polynesia and then in New Caledonia in 2014 (Cao-Lormeau et al. 2014; Dupont-Rouzeyrol et al. 2015), with first signs of the virus being associated with severe neurological complications, including Guillain-Barré syndrome (Cao-Lormeau et al. 2016) and microcephaly in newborns (Schuler-Faccini et al. 2016), in a small percentage of cases. The virus then spread progressively to the Cook Islands, Easter Island and Solomon Islands prior to the explosive epidemic observed in Brazil and the Americas. In May 2015, the first local cases of Zika were recorded in Brazil and by December the number of cases had surpassed 1.5 million. On February 2016, the World Health Organization declared Zika as a public health emergency of international concern and as of June 1st 60 countries reported on-going transmission.

The prolific spread of ZIKV, its apparent increased virulence and our general lack of knowledge about its epidemiology is causing alarm and panic globally. Currently, we are witnessing serve and volley exchanges between the WHO and the "Rio Olympics later" International Community over the Olympics threat of Zika, bearing testament to the clear lack of an evidence base for predicting and mitigating against further proliferation of Zika throughout the world.

Mosquito-borne disease epidemiology is shaped by the mosquito's capacity to transmit the virus, known as the vectorial capacity, which has been formulated into a quantitative framework (Liu-Helmersson et al. 2016). Temperature is a key factor delimiting this capacity, impacting not only on mosquito population densities but more importantly the speed of viral dissemination within the mosquito. As temperatures decrease, the virus dissemination rate slows and the probability of the mosquito surviving until it becomes infectious decreases. In the tropics, temperatures are sufficiently clement to sustain transmission, whereas in temperate regions temperatures are only sufficiently high in the summer months. The summer in Europe is thus the risk season when autochthonous transmission is sustainable, as observed on several occasions over last few years for dengue virus, a related flavivirus.

Europe is gearing up for the summer, kicking off with the European Football Cup, and increasingly concerned with a ZIKV version of the Madeira 2012 epidemic where the first European dengue epidemic occurred since the 1920s (Alves et al. 2013). In this context, Rocklöv et al., 2016 provide a much needed quantitative assessment of the potential threat of a Zika epidemic in Europe. As outlined in the European Centre for Disease Prevention and Control (ECDC) guidelines, the first step is to assess the location and level of the threat, thereby enabling local health authorities to take appropriate action (ECDC, 2016). Rocklöv et al., 2016 provide exactly this. The minimum requirements for epidemic potential are the occurrence of a competent mosquito species, the virus and temperatures that enable transmission capacity. Human migration from areas with circulating ZIKV into European areas with *Aedes* spp. (notably *Aedes albopictus* and to a rarer extent *Aedes aegypti*) during the warmer summer months offer epidemic potential. The authors combine ZIKV prevalence data in countries currently epidemic for Zika, with international travel volume into Europe embedded in an epidemiological (vectorial capacity based) model of transmission potential. This enables the first quantitative estimates of the potential extent of virus invasion and subsequent epidemic potential in site-specific localities in Europe set within a temporality reflecting seasonal warming – the "when" and the "where" epidemic potential.

Whether there will be an epidemic somewhere in Europe this summer remains to be seen, but at the very least the article by Rocklöv et al., 2016 provides a quantitative basis upon which local authorities can base strategies mitigating against the spread of ZIKV this year and for years to

DOI of original article: http://dx.doi.org/10.1016/j.ebiom.2016.06.009.

http://dx.doi.org/10.1016/j.ebiom.2016.06.020
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come. ZIKV is not going away and has joined the two other currently prevalent arboviruses, Dengue and Chikungunya in going global and thus temperate regions must take the threat of an epidemic seriously and develop long-term strategies. It can only be hoped that local health authorities, aided by ECDC, co-authors of the paper, take heed of the quantitative predictions and develop appropriate, sustainable strategies to prevent and combat the threat of arboviral outbreaks in Europe and elsewhere.

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