

## Yellow fever: is Asia prepared for an epidemic?

Annelies Wilder-Smith, Vernon Lee, Duane J Gubler

Epidemic arboviral diseases are relentlessly increasing, fueled by unplanned urbanization leading to increased breeding sites, lack of effective disease and vector control strategies, and globalization resulting in disease exportation.<sup>1</sup> This decade, the number of travelers exporting yellow fever virus to non-endemic countries is at a record high.<sup>2</sup> Furthermore, in 2016 for the first time in documented history, confirmed yellow fever virus was exported in travelers from Africa to Asia, where approximately 2 billion immunologically-naïve people live in areas inhabited by the *Aedes aegypti* mosquito vector and are at risk for transmission.<sup>3</sup> The case-fatality rate of yellow fever is among the highest of all arboviral diseases, underscoring the threat of a newly emerging epidemic disease problem in Asia.

Why outbreaks of yellow fever have not yet occurred in Asia is unknown. The factors influencing transmission dynamics of yellow fever (e.g. vector competence, magnitude and duration of viremia in humans) are similar to dengue, which aided by human air travel, has spread around the world. In recent decades, most human yellow fever infections have occurred when humans encroach the sylvatic cycle outside urban areas, decreasing the risk of dispersal via air travel. However, major urban epidemics have occurred in both Africa and tropical America in the past 3 years, and recent decades have seen an unprecedented growth in air travel intensity between Africa or Latin America directly to Asia.<sup>4</sup> This increases the probability that travelers infected with yellow fever will introduce the virus to Asia at a time when conditions are aligned: the presence of *Aedes* mosquitoes in an urban area during a suitable seasonal window. Application of the International Health Regulations (IHR) which require mandatory yellow fever vaccination for all travellers from yellow fever endemic areas to permissive non-endemic areas should prevent such introductions. However, hundreds of thousands of persons have circumvented the IHR as evidenced during the yellow fever outbreak in Angola<sup>5</sup> which should serve as a wake-up call.

Is Asia prepared for a yellow fever epidemic? Many countries strengthened their pandemic preparedness capabilities in the wake of the 2009 influenza pandemic, guided by the World Health Organization. Country capacity building under the IHR, supported by the Joint External Evaluation, has increased preparedness and response capabilities to a range of public health threats. However, it is uncertain whether preparedness for epidemic vector-borne diseases such as yellow fever has been increased.

Among the key issues that need to be addressed are the strengthening of laboratory-based surveillance capable of detecting imported yellow fever, effective vector control programs, and plans to scale-up mass-vaccination programs, including the capacity to rapidly import vaccines, training healthcare workers to conduct such programs, and clinical management of severe yellow fever disease.

We advocate for a call to action to urgently identify gaps and develop preparedness plans in all Asia-Pacific countries that are at risk for yellow fever virus introduction.

## References

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