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## Editorial

# Yellow fever outbreak in Brazil, 2017



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Yellow fever virus is a mosquito-borne RNA virus that belongs to the genus *Flavivirus*. The virus causes an acute infection, with clinical manifestations ranging from mild non-specific illness to severe disease including high fever, chills, severe headache, jaundice, bleeding, and failure of multiple organs, shock, and 20% to 50% lethality. Yellow fever has been responsible for urban epidemics devastating populations of South American and African continents since the seventeenth century.<sup>1,2</sup> The sylvatic transmission occurs between non-human primates and sylvatic mosquitoes, mainly those belonging to the genera *Haemagogus* and *Sabethes* abundant in the forest canopy.<sup>3,4</sup> There can be outbreaks of sylvatic yellow fever in cyclical intervals from three to seven years, which result from the epizootics in non-human primates. In these animals, yellow fever is periodically spread with intervals that contribute to the appearance of new vulnerable populations. The urban cycle involves the transmission of the virus between urban mosquitoes, primarily *Aedes aegypti* as transmitters, and humans who originally acquired the infection in rural areas.

No specific treatment exists, and most cases are mild, resolving with only supportive care.<sup>5</sup> A single dose of the 17 D live-attenuated vaccine can provide lifelong immunity within 10 days of vaccination for more than 90% of people vaccinated and within 30 days for 99% of people vaccinated. Serious side effects including cases of vaccine-associated neurotropic and viscerotropic disease. Contraindications include severe hypersensitivity to egg antigens, pregnant women, young infants, and severe immunodeficiency.<sup>6–8</sup>

The disease still affects as many as 200 000 persons annually in tropical regions of Africa and South America and poses a significant hazard to unvaccinated travelers to these

areas.<sup>9</sup> Throughout history, outbreaks, and epizootics have been described in Brazil from time to time. There are no reports of an urban cycle of yellow fever in Brazil since 1942. From December 2016 to February 22, 2017, a yellow fever outbreak has affected Brazil, with 1345 suspected cases, of which 295 have been confirmed, and 215 deaths reported to Brazilian Ministry of Health.<sup>10</sup> Among 295 confirmed cases, 86% were male aged from 30 to 60 years. The demographic and descriptive information of the confirmed cases corresponds with that usually observed in outbreaks of yellow fever in different geographic areas. The majority of cases were reported in male individuals living in the rural areas, in the economically active segment of the population, which have not been previously vaccinated. This population is more frequently exposed to areas and situations of risk, mainly due to their working activities. The majority of confirmed yellow fever human cases are located in the State of Minas Gerais. Despite the efforts to vaccinate the population in risk areas of the state, the virus continues to spread. The upsurge of yellow fever activity in Brazil extends beyond those areas considered to be at risk for yellow fever transmission as described in the WHO publication (International Travel and Health, 2016). In addition to Minas Gerais State, yellow fever cases are expanding to the States of São Paulo, Bahia, and especially to the State of Espírito Santo. This outbreak is considered the largest outbreak of yellow fever in Brazil in the last 10 years. WHO has updated his recommendations for international travelers related to the current situation in Brazil.<sup>11</sup> The reasons for the expansion of the disease are still unknown. Some 80% to 90% of the brown howler monkeys are infected or have already died in this area. Biologists warn that species threatened with extinction can be eliminated because

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vaccine works only in humans. The concern is that yellow fever virus, which is maintained in a transmission cycle involving non-human primates and arboreal mosquitoes, crosses into a far more threatening human-to-human transmission cycle involving urban *Aedes aegypti* mosquitoes. Response to current outbreak relies mainly on mass vaccination campaigns among unvaccinated residents in affected areas, which always poses logistical challenges. The Ministry of Health of Brazil has sent 14.3 million doses of yellow fever vaccines to these states and distributed 650 000 doses of yellow fever vaccine across the country as part of the routine supply of the National Vaccination Calendar in January 2017.<sup>12</sup> Besides catch-up campaigns in unvaccinated adults, achievement of high vaccination coverage incorporating yellow fever vaccination into routine childhood immunizations schedule is necessary on a long-term basis. Nowadays, yellow fever vaccine is included in routine childhood immunizations only in Brazilian municipalities at risk where the vaccine is recommended for the entire population. Additionally, public education is necessary about the risk of disease and indications for vaccination, including contraindications and precautions for individuals who might be at increased risk of severe adverse events. According to WHO travelers 9 months of age and older planning to visit areas at risk of yellow fever transmission in Brazil require vaccination against yellow fever at least 10 days before the travel; implementation of measures to avoid mosquito bites, and awareness of clinical manifestations of yellow fever. A new effort led by WHO to development and implementation of a strategy for Eliminating Yellow Fever Epidemics (EYE) is planned to be adopted during the next years. Meanwhile, outbreaks and endemic zone expansion will continue to arise from the enzootic cycles, with potential spread by urban transmission.

### Conflicts of interest

The author declares no conflicts of interest.

### REFERENCES

1. Monath TP. Yellow fever: an update. *Lancet Infect Dis.* 2001;1:11–20.
2. Monath TP, Barrett AD. Pathogenesis and pathophysiology of yellow fever. *Adv Virus Res.* 2003;60:343–95.
3. Barrett AD, Monath TP. Epidemiology and ecology of yellow fever virus. *Adv Virus Res.* 2003;61:291–315.
4. Vasconcelos PF, Sperb AF, Monteiro HA, et al. Isolations of yellow fever virus from *Haemagogus leucocelaenus* in Rio Grande do Sul State, Brazil. *Trans R Soc Trop Med Hyg.* 2003;97:60–2.
5. Monath TP. Treatment of yellow fever. *Antiviral Res.* 2008;78:116–24.
6. Monath TP, Cetron MS, McCarthy K, et al. Yellow fever 17D vaccine safety and immunogenicity in the elderly. *Hum Vaccin.* 2005;1:207–14.
7. Monath TP. Yellow fever vaccine. *Expert Rev Vaccines.* 2005;4:553–74.
8. Poland JD, Calisher CH, Monath TP, et al. Persistence of neutralizing antibody 30–35 years after immunization with 17D yellow fever vaccine. *Bull World Health Organ.* 1981;59:895–900.
9. Vasconcelos PFC. Yellow fever in Brazil: thoughts and hypotheses on the emergence in previously free areas. *Rev Saude Publica.* 2010;44:1144–9.
10. Ministério da Saúde - Brasil. Secretaria de Vigilância em Saúde - Centro de operações de emergências em saúde pública sobre febre amarela: Informe 23/2017. <http://portalarquivos.saude.gov.br/images/pdf/2017/fevereiro/24/coes-febre-amarela-informe23-atualizacao-23fev2017-13h.pdf>.
11. World Health Organization. International Travel and Health. Updates on Yellow fever vaccination recommendations for International Travelers related to current situation in Brazil (posted 31 January 2017). <http://www.who.int/ith/updates/20170214/en/>.
12. World Health Organization. Yellow Fever – Brazil. Disease outbreak news (cited January 27, 2017). <http://www.who.int/csr/don/27-january-2017-yellow-fever-brazil/en/>.