4 Yuan Z, He C, Yan S, Ke Y, Tang W. Randomized controlled clinical trial on the efficacy of fosfomycin trometamol for uncomplicated gonococcal urethritis in men. *Clin Microbiol Infect* 2016; **22:** 507–12.
5 Hauser C, Hirzberger L, Unemo M, Furrer H, Endimiani A. In vitro activity of fosfomycin alone and in combination with ceftriaxone or azithromycin against clinical *Neisseria gonorrhoeae* isolates. *Antimicrob Agents Chemother* 2015; **59:** 1605–11.

Unprecedented rise in dengue outbreaks in Bangladesh

Dengue is a common mosquito-borne infection that affects millions of people each year. 75% of the world's dengue burden is in Asia, particularly in countries such as the Philippines, Indonesia, and Thailand.[1] Bangladesh, in south Asia, has lower dengue seroprevalence than countries in southeast Asia,[2] but the situation is rapidly changing. We highlight the largest dengue outbreak in Bangladesh on record, which is taking place this year.

Bangladesh had sporadic transmission of dengue virus from 1964 to 1999, but the first outbreak due to dengue virus type 3 occurred in 2000,[2] with dengue outbreaks occurring at increasing frequency and magnitude since then, peaking with 10 148 cases in 2018.[3] In 2019, dengue outbreaks surpassed all previous records, mostly in the capital city of Dhaka. By August, 2019, a total of 70 188 dengue cases had been officially recorded, with 67 dengue-related deaths. The numbers increased to 81 832 cases with 67 deaths as of the last count on Sept 16, 2019 (figure). This high frequency of dengue cases is due to dengue virus type 3, but all other serotypes are co-circulating.[4]

What are the reasons for this unprecedented rise in dengue cases? Bangladesh has had an influx of Rohingya refugees from neighbouring Myanmar, which has led to a rise in many infectious diseases in Bangladesh, such as diphtheria.[4] However, reliable data supporting the importation of dengue via Rohingya refugees do not exist. Given the increasing connectivity of air travel,[5] it is more plausible that dengue outbreaks in Bangladesh are a result of dengue importation from southeast Asia, which is currently also witnessing an unusually elevated dengue prevalence. Climate change, unplanned rapid urbanisation and construction, high population densities, and the struggling health-care system in Bangladesh further compound the magnitude and severity of dengue outbreaks. Additionally, Bangladesh's insufficient preparedness, including inadequate public health infrastructure and suboptimal vector-control programmes, further magnifies the impact of dengue virus importation, resulting in epidemics of escalating severity.

Consequently, there is an urgent need to improve prevention and control strategies in Bangladesh. Communities need to be engaged in community-based measures to reduce mosquito breeding sites. Tools for early detection of dengue infection need to be provided to all health-care facilities, including diagnostic laboratory capability. Finally, clinicians in Bangladesh need to be trained in managing severe dengue to reduce fatality rates.

We declare no competing interests.

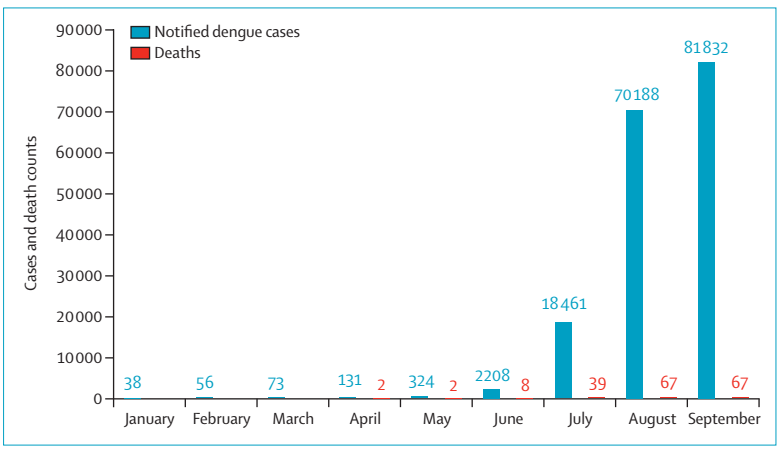

Figure: **Dengue notifications and deaths in Bangladesh in 2019**

*Kamrul Hsan, Md Mahfuz Hossain, Md Shanjid Sarwar, Annelies Wilder-Smith, David Gozal
kamrul.phi.ju@gmail.com

Department of Public Health and Informatics, Jahangirnagar University, Savar, Dhaka 1342, Bangladesh (KH, MMH, MSS); Institute of Allergy and Clinical Immunology of Bangladesh, Savar, Dhaka, Bangladesh (KH); Humanitarian Response Organisation, Dhaka, Bangladesh (KH); Department for Disease Control, London School of Hygiene & Tropical Medicine, London, UK (AW-S); Heidelberg Institute of Global Health, Heidelberg, Germany (AW-S); and Department of Child Health, and the Child Health Research Institute, University of Missouri School of Medicine, Columbia, MO, USA (DG)

1 Wilder-Smith A, Ooi E-E, Horstick O, Wills B. Dengue. *Lancet* 2019; **393:** 350–63.
2 Sharmin S, Viennet E, Glass K, Harley D. The emergence of dengue in Bangladesh: epidemiology, challenges and future disease risk. *Trans R Soc Trop Med Hyg* 2015; **109:** 619–27.
3 Akram A. Alarming turn of dengue fever in Dhaka city in 2019. *Bangladesh J Infect Dis* 2019; **6:** 1–2.
4 Rahman MR, Islam K. Massive diphtheria outbreak among Rohingya refugees: lessons learnt. *J Travel Med* 2019; **26:** tay122.
5 Glaesser D, Kester J, Paulose H, Alizadeh A, Valentin B. Global travel patterns: an overview. *J Travel Med* 2017; **24:** 24.

Dengue infection in Pakistan: not an isolated problem

Up until October, more than 19 000 cases of dengue infection and 30 deaths had been reported by the National Institute of Health, Pakistan,

in 2019. From 1995 to 2019, there were around 147 200 cases of dengue infection and over 800 deaths.[1] Dengue serotype 2 is the most prevalent circulating serotype in Pakistan, with few reported cases of serotype 3. In 2017, the Pakistani northern province of Khyber Pakhtunkhawa faced an epidemic of dengue, with 18 856 cases and multiple deaths, which was attributed to a different lineage of dengue virus serotype 2 circulating in Pakistan. This lineage entered Pakistan from China around 2016 and spread in 2017.[2]

Vectors of dengue virus are mosquitoes in the *Aedes* genus, which are capable of transmitting other viruses, such as chikungunya, Zika, and yellow fever. From 2016 to 2018, chikungunya virus infections were reported in 776 patients in Pakistan.[3] Vector populations are increasing in areas around the world, which as argued by Lydia H V Franklinos and colleagues,[4] is not only a result of climate change. Other global change factors—including the growing population and increasing agriculture, deforestation, and urbanisation—equally and substantially contribute to the spread of mosquitoes. Considering this argument, Pakistan has all the elements required for a rise in the number of infections transmitted by mosquitoes.

Pakistan has a population of more than 216·5 million people, making it the fifth most populous country in the world. The Pakistani urban population increased from 19·7% (of the total population) in 1955 to 34·9% in 2019 (equating to a 15·2% increase), and the total population has increased by 176 million since 1955. The density of the population stands at 281 per km^2.[5]

With an increasing yearly growth rate of 2·04%, the use of resources has increased too.[4] Pakistan, especially the metropolitan cities of Karachi and Lahore, has a humid and hot climate. A drastic increase in population has caused unplanned urbanisation, with a resulting increase of sanitary problems. Stagnant water, open or blocked sewers, and heaps of garbage are found everywhere. Our people are prone to use water excessively (eg, for washing vehicles, car porches, grounds, roads, verandas, and gardens), which causes water to stand still for many days. All of these factors add to increased rates of breeding of *Aedes* mosquitoes. Previously a dweller of greenery, these mosquitoes became domesticated through extensive travel and trade in different areas of the world. This adapted behaviour of *Aedes* mosquitoes has also been observed in Pakistan.[6]

With exponential increase in population numbers and use of resources, eradication of this mosquito is extremely important, particularly in view of the potential for spread of other viral infections. Planning and control measures need to be strictly implemented by authorities to stop further epidemics of infections spread by *Aedes* mosquitoes.

I declare no competing interests.

Zareen Fatima
zfa_11@hotmail.com

Department of Biological Sciences, International Islamic University, Islamabad 44000, Pakistan

1 International Federation of Red Cross and Red Crescent Societies. Emergency plan of action (EPoA); Pakistan: dengue outbreak. http://adore.ifrc.org/Download.aspx?FileId=170525. Oct 11, 2019 (accessed Oct 18, 2019).

2 Ali A, Fatima Z, Wahid B, Rafique S, Idrees M. Cosmopolitan A1 lineage of dengue virus serotype 2 is circulating in Pakistan: a study from 2017 dengue viral outbreak. *J Med Virol* 2019; **91:** 1909–17.

3 Badar N, Salman M, Ansari J, Ikram A, Qazi J, Alam MM. Epidemiological trend of chikungunya outbreak in Pakistan: 2016–2018. *PLoS Negl Trop Dis* 2019; **13:** e0007118.

4 Franklinos LHV, Jones KE, Redding DW, Abubakar I. The effect of global change on mosquito-borne disease. *Lancet Infect Dis* 2019; **19:** e302–12.

5 UN Department of Economics and Social Affairs, Population Division. World Population 2019. https://population.un.org/wpp/Publications/Files/WPP2019-Wallchart.pdf (accessed Oct 18, 2019).

6 Fatima Z, Afzal S, Idrees M, et al. Change in demographic pattern of dengue virus infection: evidence from 2011 dengue outbreak in Punjab, Pakistan. *Public Health* 2013; **127:** 875–77.