Received: 1 July 2023 | Revised: 29 August 2023 | Accepted: 15 September 2023

DOI: 10.1002/hsr2.1598

PERSPECTIVE

Health Science Reports Open Access WILEY

Frequent outbreaks of dengue fever in South Asian countries—A correspondence analyzing causative factors and ways to avert

Taslima Jamal Urmi[1] | Rana Al Mosharrafa[2] | Md. Jamal Hossain[3] | Mohammad Saydur Rahman[4] | Mohammad Fahim Kadir[5] | Md. Rabiul Islam[6]

[1]Department of Pharmacy, University of Asia Pacific, Dhaka, Bangladesh

[2]Department of Business Administration, Faculty of Business Studies, Prime University, Dhaka, Bangladesh

[3]Department of Pharmacy, State University of Bangladesh, Dhaka, Bangladesh

[4]Department of Pharmacy, Jagannath University, Dhaka, Bangladesh

[5]Department of Pharmacology, Lake Erie College of Osteopathic Medicine (LECOM), Erie, Pennsylvania, USA

[6]School of Pharmacy, BRAC University, Dhaka, Bangladesh

Correspondence: Md. Rabiul Islam, School of Pharmacy, BRAC University, 66 Mohakhali, Dhaka 1212, Bangladesh.
Email: robi.ayaan@gmail.com

KEYWORDS

dengue, dengue fever, dengue outbreak, dengue virus, infectious disease, South Asia

Dengue is a viral disease transmitted by the *Aedes aegypti* mosquito and less commonly by *Aedes albopictus*. This infection is caused by the dengue virus (DENV), an RNA virus belongs to the genus Flavivirus in the family Flaviviridae, which has four serotypes DENV1, DENV2, DENV3, and DENV4. In 1943, DENV1 was primarily detected in Japan and French Polynesia followed by reports in Hawaii in 1944 and 1945. DENV2 was initially detected in 1944 in the Philippines, Papua New Guinea, and in Indonesia in 1954 and 1956. DENV3 and DENV4 were first reported in Thailand and the Philippines in 1953. In Malaysia, a new 5th serotype (DENV-5) was first discovered in 2007.[1] After 1950 dengue epidemics became more common in many parts of South Asia, including Pakistan, India, Sri Lanka, and Bangladesh. Now, it is a major public health concern in these regions. Moreover, it is also found in tropical and subtropical regions including the Western Pacific, Africa, the Caribbean, and the Americas. It is most prevalent during the rainy season and typically occurs from June to October.[2] It can cause joint and muscle pain, high fever, and severe headaches, and it can be fatal in some cases.[3] There is no specific treatment for dengue, but early detection and treatment can help to manage the symptoms and prevent complications. Treatment involves rest, hydration, and pain relief medications. In severe cases, hospitalization may be necessary to manage complications, such as bleeding or shock.[4] Dengvaxia, the first vaccine for dengue, was developed by the French pharmaceutical company Sanofi Pasteur. The vaccine was first approved for use in Mexico in 2015 and has been used in several other countries. However, the use of vaccines is controversial, and some countries have suspended or limited its use due to safety concerns.[5]

Dengue is more common in South Asian countries because they have large populations, and the climate and environment are conducive to the breeding of mosquitoes that carry the virus.[6] Additionally, these countries often lack the resources and infrastructure to effectively control mosquito populations and prevent the spread of dengue. While the second world war did contribute to the spread of dengue, it was the urbanization of South Asia that created the ideal conditions for frequent outbreaks of the disease. During the war, military personnel and civilians traveled around the world and brought the virus and the mosquito vector with them. This led to the establishment of new populations of the mosquito in previously unaffected areas. However, it was the postwar urbanization of South Asia that provided the ideal breeding grounds for the mosquito and the virus.[7] Rapid population growth has led to the creation of densely

populated areas with inadequate housing, sanitation, water supply, sewage, and waste management systems. Unplanned urbanization has resulted in the construction of buildings and infrastructure in areas that are prone to flooding. Additionally, the increased movement of people and goods in urban areas facilitated the spread of the virus to new areas. As a result, dengue became endemic in many urban areas of South Asia, and frequent outbreaks of the disease continue to occur.[8]

Climate conditions like temperature, humidity, and rainfall impact the life cycle of mosquitoes and the pathogen it harbors and influences the distribution and prevalence of both the virus and its vector. In South Asia, the peak season for dengue is from June to September, when climate conditions are most favorable for the mosquito to thrive and spread dengue. Dengue cases rise from mid-June to September due to heavy rainfall and humidity.[9] The mean temperature rises above 30°C from April to June is also responsible for an increase in dengue cases as warm temperature is crucial for the growth, development, and survival of vector mosquitoes and affect the length of the gonotrophic cycle, the incubation period.[8] The eggs of the mosquito can survive for several months in dry conditions and will hatch when they come into contact with water.[10] Rainfall provides the perfect breeding ground for the mosquito, as it creates stagnant water pools that are ideal for the mosquito to lay eggs. The larvae of the mosquito live in water and can survive in even the smallest amount of standing water. The pupae of the mosquito can survive even in polluted water, which makes it difficult to control the spread of the disease. So, the disease is more prevalent in the rainy season.[11]

Frequent outbreaks of dengue in South Asia are often attributed to a lack of public awareness, insufficient health infrastructure, and poor vector control measures. Many people in the region are not aware of the risk associated with dengue and do not take appropriate measures to protect themselves from the disease. Additionally, the health infrastructure in many parts of South Asia is inadequate, and there is a shortage of medical supplies and trained personnel. This can make it difficult to diagnose and treat cases of dengue and can lead to delays in the implementation of effective control measures. Finally, vector control measures, such as the use of insecticides and the elimination of breeding sites, are often inadequate or poorly implemented. This allows the mosquito vector to thrive and spread the virus, leading to frequent outbreaks of the disease. Overall, addressing these issues will be critical in reducing the burden of dengue in South Asia.[12]

Several implementable items can be used to prevent dengue in South Asia. Vector control measures involve multiple strategies to reduce the mosquito population and prevent the spread of the virus. This includes the destruction of mosquito breeding sites, improving sanitation, proper disposal of garbage and elimination of stagnant water, and use of mosquito nets and screens.[13] Insecticides are used to control mosquito populations but nowadays they are no longer effective due to the emergence of insecticide-resistant mosquitoes. To overcome these, two strategies have been proposed: the development of insecticides that can target a specific tissue of the insect and the invention of new insecticides that are more effective. Plant-based pesticides have also been developed since plant ingredients are biodegradable and environment-friendly. Another method is to employ a mosquito trap in which Carbon dioxide attracts mosquitos, which are drawn into the trap by the suction fan. Oil and polystyrene beads are also used to suppress mosquito populations. Using bacterial infection, such as Wolbachia, reduces the vector population. Predatory larvivorous fish have also been used to lower Aedes mosquito larvae.[14] Community-based vector control involves the participation of the local community in identifying and eliminating breeding sites for the mosquito vector. Participation of affected communities in source eradication can result in reduced household *Aedes* entomological indices, dengue infection rates, and dengue disease occurrences.[15]

Early detection and treatment of dengue cases can help prevent the spread of the virus. This includes the use of diagnostic tests to identify cases of dengue and the provision of appropriate medical care. Research and development activities are focused on developing modern tools and strategies for preventing and controlling dengue. This includes the development of new vaccines, diagnostic tests, and vector control measures.[16] Overall, a comprehensive approach is needed to prevent dengue in South Asia. These implementable items require the involvement of governments, non-government organizations, and the public to create awareness campaigns to educate people about the risks associated with dengue.

The female Aedes mosquito, which is the primary vector for dengue, is widely distributed in South Asian countries. This means that the risk of transmission is high. High population density, poor sanitation, climate conditions, and urbanization in many parts of South Asia provide ideal breeding grounds for mosquito vectors. Lack of effective vector control measures and limited access to health care in some areas means that the disease can quickly spread and become a major public health issue. The prevalence of dengue in South Asia is high, with frequent outbreaks occurring. All of these factors contribute to the high burden of dengue in South Asia and make it a major concern for public health officials. By taking precautions, we can minimize the spread of dengue and protect ourselves and our communities from this deadly disease.

AUTHOR CONTRIBUTIONS

Taslima Jamal Urmi: conceptualization; writing—original draft. **Rana Al Mosharrafa**: writing—review & editing. **Md. Jamal Hossain**: writing—review & editing. **Mohammad Saydur Rahman**: writing—review & editing. **Mohammad Fahim Kadir**: writing—review & editing. **Md. Rabiul Islam**: conceptualization; supervision; writing—review & editing.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data available on request from the authors.

TRANSPARENCY STATEMENT

The lead author Md. Rabiul Islam affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

ORCID

Md. Jamal Hossain http://orcid.org/0000-0001-9706-207X
Md. Rabiul Islam http://orcid.org/0000-0003-2820-3144

REFERENCES

1. Messina JP, Brady OJ, Scott TW, et al. Global spread of dengue virus types: mapping the 70 year history. *TIM*. 2014;22(3):138-146. doi:10.1016/j.tim.2013.12.011
2. Prapty CNBS, Rahmat R, Araf Y, et al. SARS-CoV-2 and dengue virus co-infection: epidemiology, pathogenesis, diagnosis, treatment, and management. *Rev Med Virol*. 2023;33(1):e2340. doi:10.1002/rmv.2340
3. Das R, Emon MPZ, Shanu SA, Akter D, Islam MR. A haemophilic dengue patient with pleural effusion and earache. *Cureus*. 2020;12(8):e9572. doi:10.7759/cureus.9572
4. Khetarpal N, Khanna I. Dengue fever: causes, complications, and vaccine strategies. *J Immunol Res*. 2016;2016:6803098. doi:10.1155/2016/6803098
5. Wilder-Smith A. Dengue vaccine development by the year 2020: challenges and prospects. *Curr Opin Virol*. 2020;43:71-78. doi:10.1016/j.coviro.2020.09.004
6. Rahman FI, Ether SA, Islam MR. Upsurge of dengue prevalence during the third wave of COVID-19 pandemic in Bangladesh: pouring gasoline to fire. *Clin Patho*. 2022;15:2632010X221076068. doi:10.1177/2632010X221076068
7. Ooi EE, Gubler DJ. Dengue in Southeast Asia: epidemiological characteristics and strategic challenges in disease prevention. *Cadernos de Saúde Pública*. 2009;25(suppl 1):S115-S124. doi:10.1590/s0102-311x2009001300011
8. Sarma DK, Kumar M, Balabaskaran Nina P, et al. An assessment of remotely sensed environmental variables on dengue epidemiology in central India. *PLoS Neglected Trop Dis*. 2022;16(10):e0010859. doi:10.1371/journal.pntd.0010859
9. Shayla TA, Paul M, Sayma NJ, Suhee FI, Islam MR. The dengue prevalence and mortality rate surpass COVID-19 in Bangladesh: possible strategies to fight against a double-punch attack. *Clin Pathol*. 2023;16:2632010X231181954. doi:10.1177/2632010X231181954
10. 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(10):619-627. doi:10.1093/trstmh/trv067
11. Bhatia R, Dash A, Sunyoto T. Changing epidemiology of dengue in South-East Asia. *WHO South East Asia J Public Health*. 2013;2(1):23-27. doi:10.4103/2224-3151.1158301
12. Bostan N, Javed S, Nabgha-E-Amen P, Eqani SAMAS, Tahir F, Bokhari H. Dengue fever virus in Pakistan: effects of seasonal pattern and temperature change on distribution of vector and virus. *Rev Med Virol*. 2017;27(1):e1899. doi:10.1002/rmv.1899
13. Mungall-Baldwin C. Women's participation in the prevention and control of dengue using environmental methods in the global south: a qualitative meta-synthesis. *Int J Equity Health*. 2022;21(1):140. doi:10.1186/s12939-022-01726-0
14. Jasamai M, Yap WB, Sakulpanich A, Jaleel A. Current prevention and potential treatment options for dengue infection. *J Pharm Pharm Sci*. 2019;22(1):440-456. doi:10.18433/jpps30216
15. Katzelnick LC, Coloma J, Harris E. Dengue: knowledge gaps, unmet needs, and research priorities. *Lancet Infect Dis*. 2017;17(3):e88-e100. doi:10.1016/S1473-3099(16)30473-X4
16. Hermann LL, Gupta SB, Manoff SB, Kalayanarooj S, Gibbons RV, Coller BAG Advances in the understanding, management, and prevention of dengue. *J Clin Virol*. 2015;64:153-159. doi:10.1016/j.jcv.2014.08.031

How to cite this article: Urmi TJ, Mosharrafa RA, Hossain MJ, Rahman MS, Kadir MF, Islam MR. Frequent outbreaks of dengue fever in South Asian countries—A correspondence analyzing causative factors and ways to avert. *Health Sci Rep*. 2023;6:e1598. doi:10.1002/hsr2.1598