

# The Dengue Prevalence and Mortality Rate Surpass COVID-19 in Bangladesh: Possible Strategies to Fight Against a Double-Punch Attack

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**ABSTRACT:** Dengue is a vector-borne viral disease caused by multiple serotypes (DENV-1, DENV-2, DENV-3, and DENV-4) of the dengue virus. It has been a public health concern since 2000 in Bangladesh. However, Bangladesh experienced a higher prevalence and death rate in the year 2022 than the previous year surpassing the COVID-19 situation. While climatic factors had always been a prominent reason for dengue incidence, reports stated that DEN 4 serotype was identified for the first time in the country, which made the dengue cases worse. In this article, we presented the 5 years prevalence of hospitalization and death cases owing to dengue fever and also provided a comparison of death cases caused by dengue and COVID-19 in Bangladesh. We described the possible reasons for the sudden surges of dengue infection and mentioned the actions led by the government to deal with this dengue occurrence. Lastly, we recommend a few strategies to counter the future outbreak of dengue infection in the country.

**KEYWORDS:** SARS-CoV-2, COVID-19, dengue, dengue virus, disease outbreaks, public health

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## Background

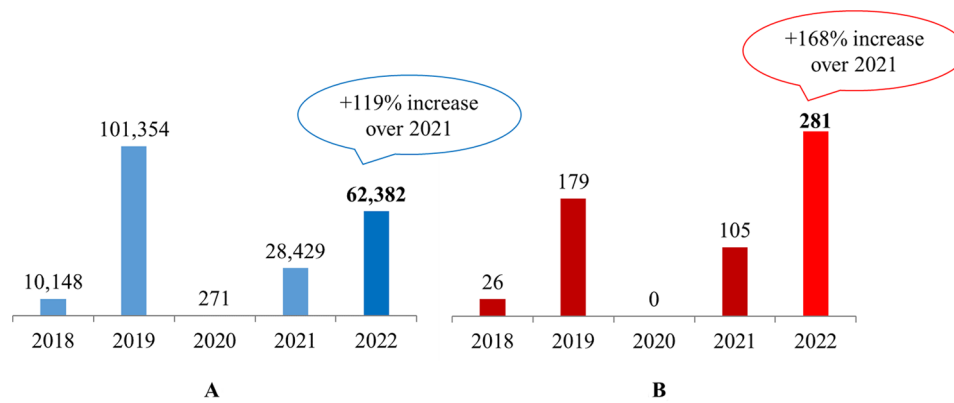
Dengue infection is a vector-borne viral disease spread by a virus from the Flaviviridae family. Four distinct serotypes of the virus, such as DENV-1, DENV-2, DENV-3, and DENV-4, are responsible for causing dengue fever in human. This viral disease is transmitted by female mosquitoes, mainly by *Aedes aegypti* and, in a few cases, by *Aedes albopictus*. The Philippines and Thailand were the first countries that experienced severe dengue during the epidemic in 1950. But nowadays, mostly Asians and Latin Americans are affected by severe dengue, which has eventually increased the number of hospitalized and death cases among children and adults in these regions. A prevalence study suggests that 3.9 billion people are prone to this dengue infection. Although dengue infection is a concern in about 120 countries, Asia carries 70% of the disease burden.<sup>1</sup>

Neighboring countries India and Myanmar are dengue endemic which increases viral importation and transmission into our country. Other than the location, the climate, increased population, and poor control measures during travel may be responsible for the outbreak of dengue across the country. Bangladesh witnessed its first dengue patient in 1964, but the prevalence rate was much lower than in most Southeast Asian states. The outbreak has become more vigorously noticeable in the past 2 decades. According to the report, in 2017, the country had around 2,769 hospital admitted cases, but this rate increased to 10,148 in 2018. The Directorate General of Health Services (DGHS) reported a 10-fold increase in incidence rates in 2019, with 101,354 hospital admitted cases and at least 179 deaths.<sup>2</sup>

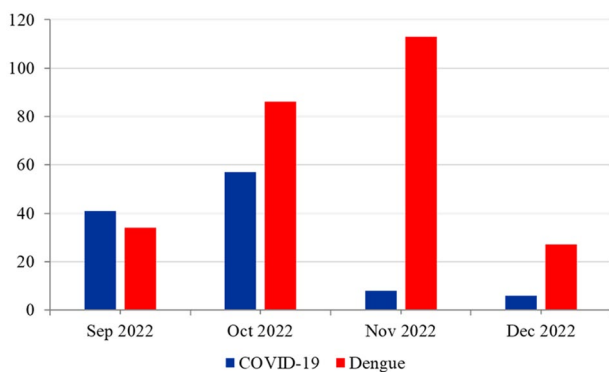
In 2020, there was a drop in the rate of infections, where there were only 271 hospital admitted cases with no death cases.<sup>3</sup> Again, there was a peak in the prevalence rate of dengue in the year 2021.<sup>4</sup> In 2021, the total number of patients admitted to hospitals due to dengue fever was 28,429 with 105 deaths.<sup>4</sup> The scenario has worsened in 2022. As of December 31, 2022, a total of 62,382 patients have got admitted into hospitals due to the complications of dengue fever and among them, 281 had died according to the data published by DGHS.<sup>5</sup> This year, the prevalence rate and death rate of dengue are 119% and 168% higher than the previous year, respectively (Figure 1). Unusual rainfall, higher temperature, and humidity are the major climatic factors responsible for the increased population of *Aedes* mosquitoes in 2022.<sup>6</sup> Moreover, in the current dengue outbreak, along with serotypes DENV-1 and DENV-3, a new dengue serotype DENV-4 has been identified,<sup>7</sup> which seems more severe than other serotypes, which could be a reason for the lower incidence of dengue in 2018 than the current incidence. According to reports, there were 110,473 people affected by dengue from January to October 2022 in India.<sup>8</sup> The other neighboring country Myanmar also experienced a resurgence of dengue cases in May, and from January to July 2022, there were 7,687 cases documented in Myanmar.<sup>9</sup>

However, Coronavirus disease 2019 (COVID-19) is a respiratory tract infection caused by a virus named severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). China witnessed the first human case of COVID-19 in Wuhan in December 2019, and eventually, in the following months, the





**Figure 1.** Five-year prevalence of hospitalization (A) and deaths (B) due to dengue fever in Bangladesh from 2018 to 2022.



**Figure 2.** Comparison monthly deaths due to dengue and COVID-19 in Bangladesh between September 2022 and February 2023.

disease turned into a pandemic.<sup>10</sup> The World Health Organization (WHO) recognized the COVID-19 outbreak as a public health emergency of international concern on January 30, 2020, and declared it a global pandemic on March 11, 2022.<sup>11</sup> Bangladesh became a part of the pandemic after the virus was confirmed to have spread to Bangladesh in March 2020. According to WHO, the first 3 identified cases were detected on March 8, 2020, by the epidemiology institute of the country, IEDCR.<sup>12</sup> Globally, as of March 21, 2023, there are more than 761 million confirmed cases of COVID-19 and more than 6.8 million deaths, as stated in the WHO report. Till March 20, 2023, vaccine doses have been administered to 13 260 401 200 people globally.<sup>13</sup> From January 3, 2020, to March 21, 2023, there are more than 2 million confirmed COVID-19 cases and 29 445 deaths in Bangladesh, according to the WHO. As of March 20, 2023, Bangladeshi people have already received more than 357 million vaccine doses for COVID-19.<sup>14</sup> COVID-19 pandemic has undoubtedly been a global health concern since 2020. However, the deaths due to dengue in last couple of months have crossed death rate of COVID-19 in Bangladesh (Figure 2).

### Possible Reasons for the Recent Dengue Upsurge in Bangladesh

Transmission of the dengue virus into humans primarily depends on the bites of infected female *Aedes* mosquitoes.

Climate influences the abundance of mosquito vectors. Dengue virus is responsible for causing classical dengue fever (DF) and dengue hemorrhagic fever (DHF) in tropical and subtropical regions. Although the first known outbreak of DF in Bangladesh occurred in Dhaka in 1964, accompanied by a few DF cases in 1977-1978 and 1996-1997,<sup>15</sup> the first DHF epidemic erupted in mid-2000 in all major cities.<sup>16</sup> Due to the tropical climate, Bangladesh has become more prone to dengue virus transmission. Climate change can be a driving factor for the survival of the *Aedes* mosquito vector. Several studies have found a strong and consistent relationship between the climate of a region and the occurrence of dengue infection.<sup>17</sup> In Bangladesh, the temperature tends to drop during the monsoon. However, summer and the monsoon merge into one season as the monsoon arrives earlier than usual, and warm temperatures last longer. Continuous increase in the temperature generally favors the reproduction of *Aedes aegypti*, which transmits dengue fever.<sup>18</sup> Every year Bangladesh has more or less similar climatic conditions. A report stated that the increased temperature, rainfall, and improper urbanization were responsible for the higher frequency of dengue infection in the previous years.<sup>19</sup> However, in 2020 the number of reported dengue cases was less, which could be due to the over-empowering COVID-19 situation in the country.

The emergence and frequent occurrence of dengue infections are possible due to increased population growth, urbanization, and a scarcity of human and financial resources.<sup>20-22</sup> Poor infrastructure, such as a lack of sewer systems, waste disposal, and an abundance of slums, provides an optimal environment for mosquitoes and exacerbates the disease spread.<sup>23</sup> In short, a few factors contributing to the breeding of the dengue virus include a suitable environment like warm and humid weather, crowded areas, overpopulation density, water storage systems, and waste storage management.<sup>24</sup> Traveling also leads to the spread of dengue infections by transmitting the dengue virus into non-endemic regions or introducing new serotypes of the virus in endemic places.<sup>25</sup> As a result, poverty, illiteracy, poor urban development, and no traveling restrictions exacerbate the magnitude of the dengue outbreak in our country.

The COVID-19 pandemic imposed a strain on healthcare management systems globally.<sup>26,27</sup> The co-existence of numerous other infectious diseases with the COVID-19 pandemic caused havoc in the world healthcare system.<sup>28,29</sup> Being an underdeveloped country, Bangladesh faced more trouble during the COVID-19 pandemic due to its limited hospital capacity and the further increased number of dengue cases created extensive challenges in controlling the crisis.<sup>30</sup> For instance, critical patients with dengue or COVID-19 need intensive care unit (ICU) support,<sup>31</sup> and as of June 26, 2022, the severe acute respiratory infections treatment centers (SARI ITC) reserve 26% of bed occupancy for COVID-19 treatment. As hospitals become burdened with people affected by the COVID-19 virus, many dengue patients might not receive ICU support due to the strain on healthcare facilities.<sup>32</sup> The available ventilators are less than 2000, designated for more than 16 million people, indicating the shortage of ventilators, as there is only one ventilator reserved for every 93,273 people.<sup>29</sup> Emergency facilities are available in the tertiary hospitals of Dhaka, where 839 ICU beds out of 1217 total beds are located.<sup>33</sup> The upsurge of dengue cases inside and outside Dhaka is creating a strain in terms of receiving emergency treatment. Movement restrictions during the pandemic also hampered the vector control efforts,<sup>34</sup> and now that the restrictions on traveling have been lifted, more emphasis is on COVID-19 testing than on dengue testing. Thus, traveling can also introduce dengue viruses from neighboring countries like Myanmar or India. All of these situations make Bangladesh a hotspot for dengue threats. Besides that, the expenditure required for the COVID-19 vaccines, diagnosis kits, and other protective equipment has created an obstacle to addressing the spike in dengue cases.<sup>25</sup> As many dengue cases remained unaddressed due to COVID-19, the outbreak of dengue cases has created an alarming situation across the country.

### Actionable Items to Fight Dengue Outbreaks in Bangladesh

Dengue is a mosquito-borne viral disease transmitted by the bite of an infected *Aedes* mosquito.<sup>35</sup> COVID-19 is an infectious disease infected by the COV-2 virus, which affects the respiratory tract. There is an overlap between COVID-19 and dengue manifestations such as fever, nausea, vomiting, chills, and headache.<sup>36</sup> As a result, a differential diagnosis would help to distinguish between dengue fever and COVID-19 before undergoing treatment. A characteristic symptom of dengue is pain, such as eye pain occurring behind the eyes or body pain in muscles, joints, or bones.<sup>36,37</sup> A complete blood count (CBC) is frequently assessed for a diagnosis in dengue patients. The CBC test result manifests a significant decrease in the platelet count associated with increasing hematocrit compared with the standard hematocrit.<sup>38</sup> For the diagnosis of dengue, some commonly recommended tests are NS1 (Nonstructural Protein 1), IgM (Immunoglobulin M), IgG (Immunoglobulin G), and NAATs (Nucleic Acid Amplification Test) which detects viral genomic material.<sup>39</sup> After a proper diagnosis, the patient

should be treated under the supervision of a healthcare professional. Some suggestions for dengue patients include complete bed rest, taking acetaminophen to control the fever and pain, and drinking plenty of fluids.<sup>40</sup>

The most important step to limit the surge of dengue infection is vector control.<sup>41</sup> The combination of environmental management methods and chemical methods can help in controlling the breeding of aegypti species.<sup>42</sup> Chemicals, such as insecticides and larvicides, can be used to prevent the breeding of mosquitoes in containers used for storing water.<sup>43,44</sup> Environmental management strategies such as regular container cleaning or destruction of non-essential containers, the construction of water supply systems, and waste management facilities all help to reduce mosquito breeding.<sup>38</sup> There is no specific treatment available for dengue infection yet; however, a few dengue vaccines have been in clinical trials. Dengvaxia is a dengue vaccine approved by the U.S. Food and Drug Administration that is effective in patients with previous dengue infections, but it is available in only 20 countries.<sup>45</sup> However, it is currently unavailable in Bangladesh, so the regulatory authority can consider that when combating the infection in the country.

Public involvement in mosquito-controlling activities would help to prevent dengue outbreaks. The insect repellent sprays, wearing long-sleeved, body-covering dresses, and controlling mosquitoes inside and outside the home can combat dengue infection. Personal prevention, such as wearing light-colored clothes, installing mosquito nets in windows and doors, and hanging mosquito nets around beds during sleeping hours, can be steps to be saved from mosquito bites.<sup>6,46</sup> Community-based programs can help eliminate mosquito breeding opportunities. Environmental cleaning helps hinder the breeding of mosquitoes. Thus, people in the community must be concerned about cleanliness around the places. Stagnant water is the best place for mosquito breeding storage containers must be cleaned or emptied to prevent the growth of mosquitoes. Mosquitoes tend to be in the dark, so there should be an adequate amount of light and air in the house. In monsoons, the risk of dengue is high, so people must be more cautious and take extra precautions during this period.

The government has taken necessary steps to deal with these rising dengue cases, such as allowing a few COVID-specific hospitals to be dedicated to dengue cases, establishing dengue-specific wards in medical colleges and hospitals, and providing training for doctors and nurses on the clinical management of dengue. Furthermore, awareness-raising campaigns for the masses, imposing fines against building landlords, and applying chemical agents like different insecticides, such as Temephos and Deltamethrin, to eliminate breeding sites. In addition, the government has received support from WHO, such as receiving NS1 diagnostic kits, IV saline, and other required medicines to provide immediate treatment to dengue patients. The government has also ensured that platelets are available in blood banks for hemorrhagic dengue cases.<sup>6</sup>

## Policy Recommendations for Future Perspectives

Dengue fever has become a widespread infection in recent years, spreading from endemic to non-endemic areas. The practice of the 4S strategy for dengue prevention is efficient. It includes searching for and destroying mosquito breeding sites, taking self-protection measures, saying no to indiscriminate fogging, and seeking early consultation. Reducing mosquito habitat is the only way to avoid dengue. Healthcare professionals should aim for prompt diagnosis and treatment of the disease, as severe dengue may lead to death. The government should take measures to make the dengue vaccine available in the country and arrange an immunization program. Presumptive diagnosis practice should be avoided, and health experts should implement differential diagnosis methods for dengue as co-infections exist.

It is essential to acknowledge the contributing factors leading to a future outbreak. Government and public health officials can assist in forecasting the likelihood of dengue infection in the country. Here are a few preventive steps mentioned to safeguard the population from dengue infection in the future. Considering the sociodemographic attributes (such as travel and demographic variations) in the forecasts would result in a more accurate estimation of dengue infection in the future.<sup>47</sup> In some areas, local climatic factors can be responsible for dengue transmission other than temperature.<sup>48,49</sup> As a result, it is necessary to identify the significant climatic element and undertake projections at the local level. It is crucial to investigate the non-climatic causes of the existence of *Aedes* species, as well as the critical factors triggering dengue transmission in those climatically favorable places. Some dengue control techniques may help to limit the spread of the disease in some locations.<sup>50</sup> Routine collaboration between the research community and policymakers is required to identify the determinants of dengue transmission and necessitates further concentrated efforts. COVID-19 is a global issue since 2020, the government and other organizations contributed significantly to combating the epidemic. On May 5, 2023, the WHO declared that COVID-19 is no more a public health emergency of international concern.<sup>51-54</sup> However, the world will continue fighting COVID-19 along with other diseases.

## Conclusion

Geography is a factor that contributes to dengue virus dissemination or viral reproduction, and Bangladesh is always at risk of providing an ideal setting for dengue virus habitats. However, due to the deterioration of the situation, the dengue outbreak was eclipsed. Though the prevalence rate dropped in the year 2020, there was a rise in the rate in 2021, and currently, the prevalence rate has become at least 3 times higher in 2022 and can lead to a possible outbreak. As the COVID-19 virus has encountered multiple genetic mutations, and people have already been vaccinated; therefore, the severity and complexities associated with COVID-19 have been tackled extensively, unlike the dengue virus. So, at this time, controlling the dengue outbreak must be considered as the severity, complications, and

alarming prevalence rate are rising continuously. Control methods include raising awareness among the population through social media or broadcasts and by having health workers educate the locals about the preventive strategies against dengue infection. There is no doubt that vector control is the best practice for limiting the surge of dengue; however, it is essential to confirm the efficacy of chemical agents and ensure that all the serotypes don't become resistant to them. As there are multiple serotypes responsible for causing dengue infection, it is better to identify the predominant serotype causing the dengue outbreak. One of the best preventive approaches to combating dengue infection is to develop a universal dengue vaccine effective against all the dengue serotypes.

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## Author Contributions

TAS, MP, NJS, and MRI conceived the study and wrote the first draft. FIS and MRI revised and gave intellectual inputs in the manuscript. All the authors approved the final version for submission.

## Data Availability Statement

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

## Ethics Statement

It was an analysis of online available aggregate data. No Ethical approval was needed.

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