An Analysis of the Dengue Situation in Bangladesh : 2000-2026

Shaila Nazneen*

Abstract: Bangladesh has experienced a growing problem of Dengue for more than two decades. Between 2018 to 2026 the outbreaks have caused heavy morbidity and mortality of all age groups. In very recent years especially in 2023 its highest-ever recorded dengue outbreak occurred which is driven by monsoon related breeding condition and limited mosquito vector control. In 2024, early year case growth and rural transmission signaled a shift in epidemic pattern, in 2025 it showed year round transmission and the type of transmission pattern changed from epidemic to endemic. The objective of this review to analyses 26 years of Dengue situation in Bangladesh and in these time period observation will help to map trends in Dengue outbreak frequency, seasonality change, disease severity on gender and age basis public health response and serotype shifts. The unique epidemiological dynamics of dengue in Bangladesh are shaped by several factors, including climate variability, rapid urbanization, population density, change of Rainfall pattern and inadequate vector control measures. It is essential to address these factors to reduce the dengue burden and improve health outcomes in Bangladesh to control mosquito populations.

Keywords: Dengue, Serotypes, Outbreak, Rainfall, Epidemic, Endemic, Age gender distribution of dengue cases.

Introduction

Dengue, a mosquito-borne viral infection is regarded as a major public health problem globally. The two main clinical manifestations of dengue, namely Dengue Hemorrhagic Fever (DHF) and Dengue Shock Syndrome (DSS), are responsible for exacting heavy morbidity and mortality every year and continue to be serious health problem [1,2].The current WHO estimates suggest that dengue cases up to 400 million infections annually[3], with incidence having increased thirtyfold over the past 50 years[4], now placing 3.9 -5.6 billion people–more than half of the world's population at risk[5,6]. Moreover , the US CDC reports that half of the global population lives in dengue-risk areas, putting both residents and travelers at risk[7].

*Dr. Shaila Nazneen, Associate Professor, Department of Zoology, Eden Mohila College, Dhaka, Bangladesh

Dengue viruses are largely found in tropical and subtropical areas and outbreak of DHF occurs in definite seasons, is more common during the rainy season and tends to be recurrent. The disease maintains a definite seasonal and cyclical epidemic pattern in different areas[8]. Dengue virus is transmitted only by certain species of day biting *Aedes* mosquitoes, particularly *Aedes aegypti*[9].

Dengue was first reported as "Dacca fever" in Bangladesh in 1964 by Aziz and his colleagues. Subsequent reports suggested that dengue fever may have been occurring sporadically in Bangladesh from 1964 to 1999[10]. An outbreak of an acute febrile illness clinically suspected as dengue and DHF occurred in and around Dhaka city during the summer of 1999 when serological evidence of dengue virus infection was found in the majority of the cases. The first epidemic of dengue was reported in the capital city, Dhaka in the year 2000[10]. Since then the disease has shown an annual occurrence in all major cities of the country. Focusing on the dengue situation in Bangladesh from 2000 to 2026 is timely essential, given the country's escalating public health crisis caused by dengue fever. Over the past two decades, dengue has evolved from a sporadic urban problem into a widespread and increasingly severe endemic disease. The catastrophic outbreak of 2019, followed by the record -breaking epidemic in 2023 that surpassed all previous case counts and death, illustrates the urgency of addressing this issue[11]. Bangladesh's rapid urbanization, inadequate water and waste management and increasing population density have intensified mosquito breeding and transmission cycle[12]. The director general of Health services (DGHS) reported a 13.52 –fold increase in *Aedes* mosquito density in 2019 compared to pre monsoon surveys[13], highlighting the challenges of controlling vector proliferation[14]. Urban areas, particularly Dhaka, endure the most of these out breaks, where unplanned urban expansion and limited infrastructure exacerbate mosquito-breeding habitants[15,16]. Dengue disproportionately affects the southern hemisphere, making effective tetravalent vaccines critical for global health[17]. The current vaccine development faces challenges in ensuring protection against all serotypes, addressing varied immune responses, and adapting to emerging strains. The analysis of serotype dynamics and their impact on disease severity is very important.

Materials and Methods

This descriptive analytic study assessed the epidemiological pattern of dengue fever in Bangladesh from 2000 to August 2026, focusing on seasonal variation, geographic distribution, demographic characteristics, and mortality. Data were obtained from the DHIS2 dashboard, a web-based, accurate, and real-time data collection system that

strengthens a country's health information system. The research was conducted in accordance with the ethical standards. Descriptive statistics, including mean, standard deviation, frequencies, and percentages, were calculated. The findings were presented using tables, figures, bar charts, and line charts.

Results and Discussion

Annual trends of Dengue reported cases and deaths

During January 2000 to December 2007, Bangladesh recorded a total of 22, 245 dengue cases and 233 deaths (1.04%). Of these, Dhaka accounted for 20115 cases and 181 deaths (0.9%) [18]. In 2019, Bangladesh faced its largest outbreak to date, with over 100,000 reported cases, followed by another deadly outbreak in 2022[19,20]. The year 2023 was on track to surpass previous records, as hospitals engaged with surging patient loads and the growing need for resources[21]. The most severe outbreak of dengue to date occurred in 2023 with over 321,017 reported cases and 1705 deaths which is higher than the cumulative death toll of the last 23 years (2000-2022)[22,23]. In 2024, early year case elevation and rural transmission signaled a shift in the epidemiological patter, although total case numbers declined[24]. The crisis continues into 2024, with 101214 cases and 575 deaths recorded by the end of the year. Year round transmission of dengue in Bangladesh continues with 105562 cases and 412 deaths in 2025 (Xnhua News Agency, 28 Dec,2025)[25]. While the full year data for 2026 is still evolving –with 22243 cases and 65 deaths recorded up to mid-August 2026 – current midyear trends show an escalating seasonal surge mirroring previous high-transmission years.

Table-1. Annual trends of Dengue cases, deaths and case fatality rate in Bangladesh between 2015 -2025 based on data from the Directorate General of Health Services (DGHS) and WHO

Year	Reported Cases	Reported Deaths	Case Fatality Rate (CFR)
2015	3,162	6	0.19%
2016	6.060	14	0.23%
2017	2,769	8	0.29%
2018	10,148	26	0.26%
2019	1,01,354	164	0.16%
2020	1,405	7	0.50%
2021	28,429	105	0.37%
2022	62,382	281	0.45%
2023	3,21,017	1,705	0.53%
2024	1,01,016	575	0.56%
2025	1,02,562	412	0.40%

In Bangladesh, dengue remained relatively rare before 2018 but surged thereafter, following global trends, briefly paused during the COVID-19 pandemic, and emerged as the deadliest infectious disease in the post-COVID era, peaking in 2023 [Figure 1]. This alarming rise, driven by a combination of meteorological changes and overlooked socioeconomic factors. Between 2000 and 2022, Bangladesh recorded 853 dengue-related deaths[26,27], yet 2023 alone more than doubled that total, with 1,705 fatalities and over 321,000 infections – the largest annual outbreak on record [Figure 1].

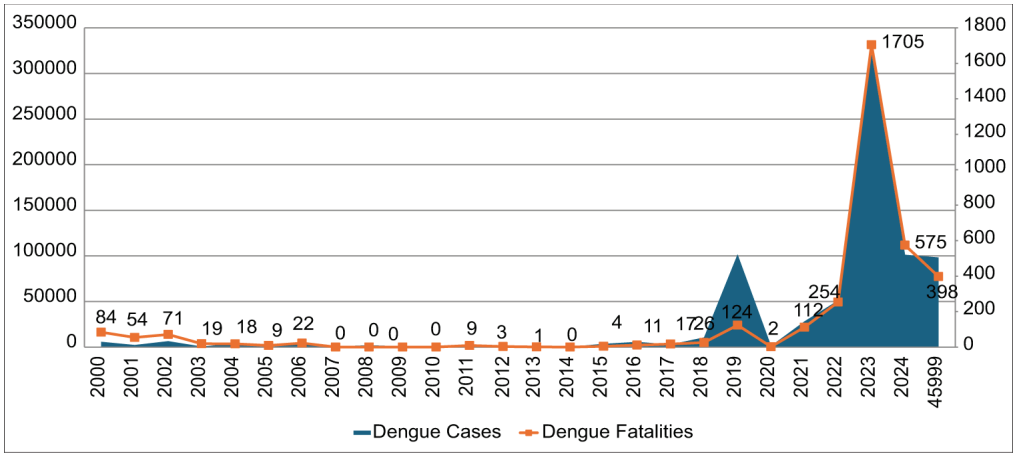


Fig.1. Trends in Dengue Cases and Deaths in Bangladesh, 2000–December 2025 (Source: The Institute of Epidemiology, Disease Control and Research/Directorate General of Health Services). The figure depicts a pronounced increase in dengue cases and deaths in Bangladesh during the post-COVID period, showing a closely aligned temporal pattern between case numbers and fatalities.

Serotypes and Phases of Dengue

Dengue virus has 4 serotypes (DENV-1, DENV-2, DENV-3, DENV-4). Infection with one serotype confers lifelong homologous immunity but only temporary cross-protection against heterologous serotypes. Secondary infection with a different serotype significantly increases the risk of severe dengue through antibody–dependent enhancement, in which pre-existing non- neutralizing antibodies facilitate viral entry into immune cells, leading to higher viral loads and immune dysregulation. In Bangladesh, all the four serotypes of Dengue (DENV-1-4) have been detected, with DEN-3 predominance until 2002. During 2013-2016, DEN-2 was predominant followed by DEN-1. In 2017, there was reemergence of DEN-3 which became predominant in 2019 and 2022 outbreaks and DEN4 was re-introduced into the country after its last detection in 2002[28]. In 2023, DEN-2 again became the predominant

circulating serotype (70.2%)[29]. The severity of 2023 outbreak can partly be explained by frequent replacement of serotypes as re-infection with a different serotype increases the risk of severe disease. In 2024, DEN-2. While 2023 witnessed a unique peak in Dengue incidence, the 2024 trend has been marked by a prolonged transmission season and elevated rural burden, indicating a geographical and progressive transformation of the disease[24]. In 2025 dengue breaks seasonal pattern, the 2025 DEN-2 became the predominant circulating serotype and dengue outbreak this year in Bangladesh demonstrates a concerning epidemiological shift with year-round transmission. Now year 2026 DENV-3 serotype has become the dominant strain of Bangladesh, replacing DENV-2, which was the most prevalent last year, according to the Institute of Epidemiology, Disease control and Research (IEDCR). These serotype transitions are linked to severe clinical manifestations and higher mortality rates, posing new challenges for treatment protocols and vaccine readiness. Furthermore, repeated outbreaks have strained the healthcare system and exposed gaps in vector control and surveillance measures.

The seasonal decomposition of dengue infections and attributable mortality in Bangladesh reveals distinct patterns across two epidemiological periods: 2001–2018 (epidemic period) and 2019–2026 (endemic period)[11].

1 Epidemic Period (2001–2018)

During this epidemic period, dengue transmission was characterized by sporadic outbreaks with several years of low activity (2003, 2007–2010 and 2014).

2 Endemic Period (2019–2026)

During this endemic period, dengue transmission became established throughout the year. This transition from epidemic to endemic transmission represents a critical shift in Bangladesh's dengue epidemiology, with significant implications for public health surveillance, prevention and control strategies. The establishment of endemic transmission suggests that dengue is now a persistent public health challenge requiring year-round vigilance rather than seasonal response effort.

Table 2: Yearly Transmission Phases and Serotypes of Dengue in Bangladesh

Timeline	Type of transmission	Predominant serotypes
1964-1999	Sporadic	Unknown
2000-2018	Epidemic	Denv-3(2000-2002) Denv-1 andDenv-2(2013-2017) Denv-1 andDenv-2(2018)
2019-2026	Endemic	Denv-3(2019-2022) Denv-2(2023) DENV-2(2024)
2025	Endemic(year-round transmission)	Denv-2
2026	Endemic	Denv-3

Age-Gender distribution of dengue cases (admitted) and death

In 2023, women represented roughly 40% of dengue cases but accounted for 57% of deaths[30]. By December 8, 2025, men experienced nearly twice as many cases and over half of all deaths [Figure 2]. Notably, in 2023, older adults faced disproportionately severe dengue and higher mortality due to immune vulnerability and comorbidities, with each additional decade raising fatality by 30%, whereas by 2025, young adults aged 21–30 accounted for over a quarter of both cases and deaths[30,66] However, older adolescents and young adults also represented more than half of all cases during the 2016, 2018, and 2019 outbreaks.[30]

The higher infection rates among males may be attributed to behavioral factors, as males are more likely to engage in outdoor activities, increasing their exposure to *Aedes* mosquitoes, the primary vectors of dengue[31]. Additionally, studies have shown that males were more frequently affected during dengue outbreaks, such as those in 2002 and 2019[32]. On the other hand, the higher mortality rates among females could be linked to differences in healthcare-seeking behavior, potential delays in treatment, and biological factors such as variations in immune responses. Studies have shown that gender-related differences in the hematological and biochemical profiles of dengue patients may influence disease severity, with females exhibiting distinct immune responses that could contribute to higher mortality rates [33,34] Additionally, disparities in healthcare access and cultural norms surrounding treatment-seeking behaviors may further worsen these outcomes, as observed in dengue cases across multiple regions[35].

Dengue is no longer posing the greatest only to children and older adults. This year 2026, the highest number of dengue-related deaths has been recorded among the country's working age people[68]. Data from DGHS shows that of 59 dengue deaths reported so far this year, 33 were people aged between 26 and 50, accounting 56% of the total fatalities. Among 33 deaths in the 26-50 age group, 21 were women and 12 were men.

Hossain. M (2026) explain why dengue deaths are comparatively higher among people aged 25 to 50. Many people in this age group suffer from chronic non-communicable diseases such as diabetes, hypertension and cancer, which can increase the risk of dengue. Pregnancy among women in this age group may also complicate dengue infection. Working age adult spend more time outside their homes for work, increasing their exposure to *Aedes* mosquitoes and consequently, their risk of infection and severe complications. Bashar. K 2026 explained people aged this range are generally more mobile and spend more times outdoors, making them more vulnerable to mosquito bites. By contrast, young children usually spend less time outdoors, maintaining clean homes and surrounding areas can reduce their risk of dengue infection. Eliminating *Aedes* mosquito breeding sites remains the most effective way to prevent dengue and urged authorities to identify high –risk areas as hotspots and implement targeted control measures

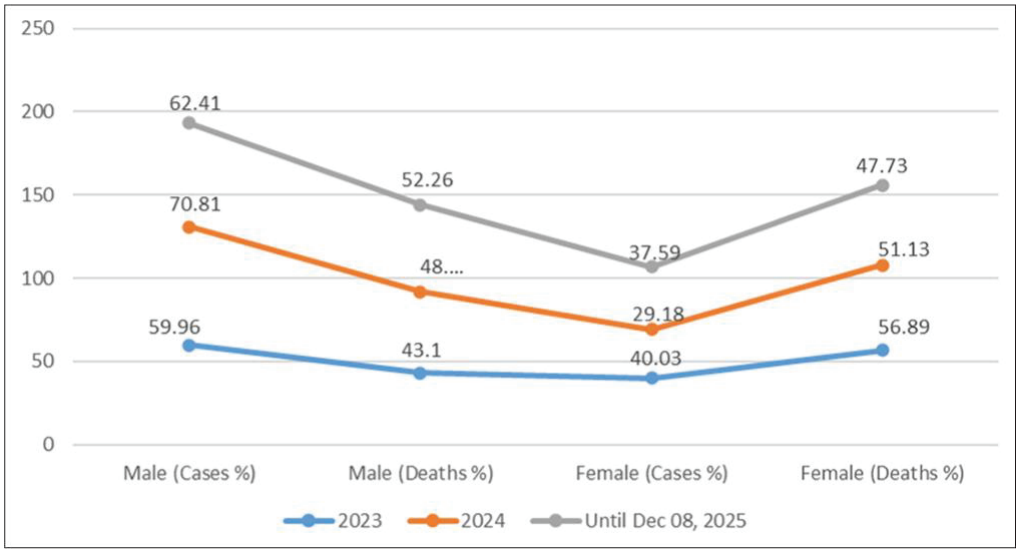


Figure.2. Demographic shifts in male and female cases and deaths, 2023–December 8, 2025 (Data Source: Directorate General of Health Services). The figure illustrates a pronounced demographic transition: male cases surged sharply in 2024 before leveling off in 2025, whereas female cases initially declined and later partially rebounded. Concurrently, male deaths exhibited a steady rise, surpassing female deaths by 2025 – a striking reversal from previous years[66]

Key Risk Factors for Dengue in Bangladesh:

1. Climate and temperature

Bangladesh, a tropical country in South Asia experiences high humidity and heavy rainfall, making it particularly vulnerable to floods and tropical cyclones. Over the past four decades, temperatures in Bangladesh have risen by approximately 0.5°C, which has lengthened the dengue season and accelerated transmission, with case numbers doubling roughly every decade since 1990[36,37]. The World Bank notes that dengue infections increase significantly at temperatures between 25°C and 35°C, peaking around 32°C, while global mosquito transmission capacity has grown by up to 9.5% since 1950[38]

A study published in Oxford Academic on dengue transmission in Bangladesh (2000–2022) found that rising temperatures and shifts in rainfall patterns between 2011 and 2022 were closely linked to increased cases and deaths[39] Recent climatic shifts have further intensified the risk. From 2022 to 2025, October rainfall in Bangladesh has been highly variable, with a trend toward heavier late-monsoon precipitation. Such changes have prompted entomologists to warn of prolonged dengue outbreaks[40-42]. Figure 3 shows that, following the global pattern, dengue cases rise in tandem with increases in temperature, rainfall, and humidity.

2. Improper use of insecticide, lake of public awareness, urbanization, dense population, Change of Rainfall pattern

The recent dengue outbreaks, driven by shifting climate patterns, rapid urbanization, dense populations, insecticide resistance, and low public awareness, have severely strained Bangladesh's healthcare system and economy. While climate change strongly shapes dengue transmission, insecticide misuse and rising resistance also play critical roles. The WHO has warned that fogging is ineffective against *Aedes* mosquitoes, underscoring city corporations' misplaced reliance on mass spraying instead of source reduction, targeted larviciding, and proper vector control.[43] Compounding the problem, widespread metabolic resistance and common kdr mutations have greatly reduced the effectiveness of Pyrethroid insecticides, producing very low mosquito mortality even at elevated doses.[44-46]

Rainfall influences mosquito growth in complex ways. While light rain creates standing water ideal for breeding, heavy rainfall can destroy breeding sites or wash away larvae, limiting mosquito development. In addition, wind speed was found to be weakly positively correlated with dengue incidence in Bangladesh. Although many

attributed the 2025 outbreak to heavy rainfall, the persistence of dengue had already been evident, with over 320,000 infections and 1,700 deaths recorded in 2023 – figures considerably higher than those observed in 2025(Fig-3). Interestingly, a study conducted in Dhaka revealed that dengue cases actually declined with increasing levels of both rainfall and sunshine, contradicting common public perception[47]. Experts warn that prolonged monsoons and poor waste management have created stagnant water and ecological imbalance, enabling mosquitoes to breed more extensively and intensifying the outbreaks.[48]

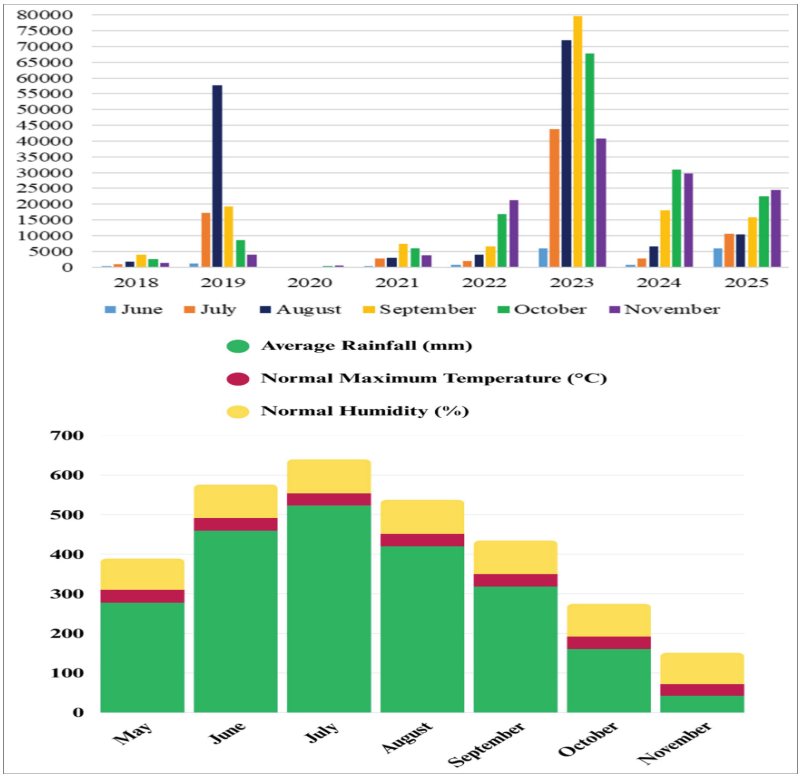


Figure.3. Trend in Dengue Cases in Bangladesh, 2018–November 2025 (Source: Directorate General of Health Services/Bangladesh Meteorological Department). The figure illustrates a clear upward trend in dengue transmission in Bangladesh since 2019, with a brief pause in 2020 consistent with global patterns. From June onwards, cases begin to rise sharply, closely following periods of elevated temperature, humidity, and rainfall. Peaks in dengue incidence consistently occur between September and November in recent years, a pattern that meteorologists attribute to the unusually high rainfall observed in October from 2022 to 2025

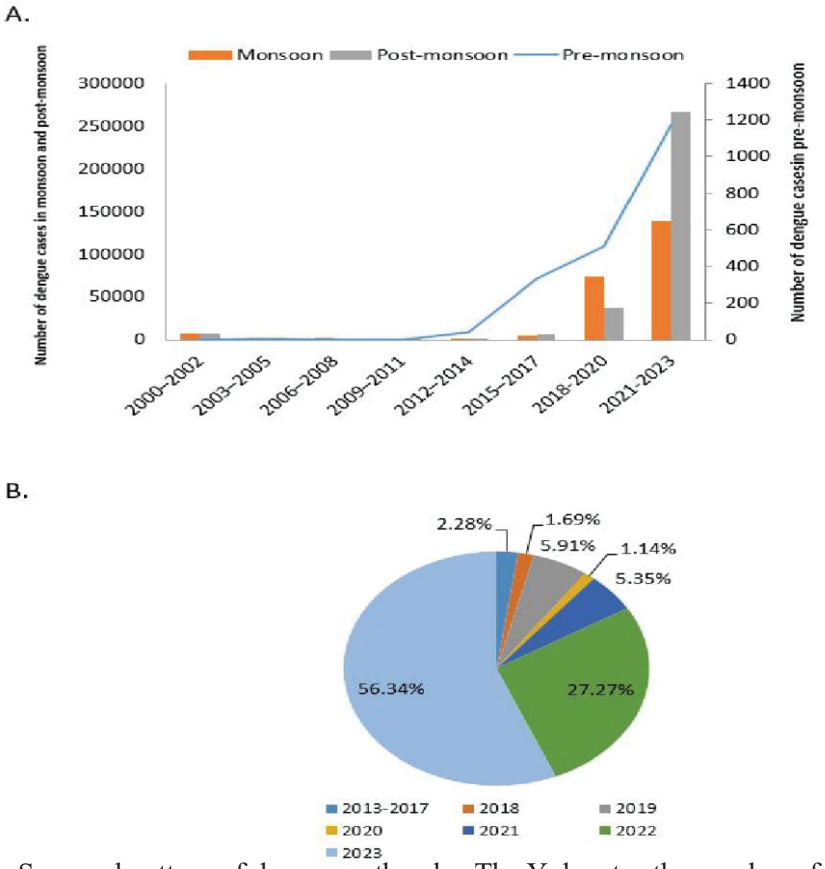


Fig.4.A. Seasonal pattern of dengue outbreaks. The Y denotes the number of dengue cases in monsoon and post-monsoon, whereas the Y'1 axis denotes the number of pre-monsoon cases. Besides the orange bar, the ash bar, and line indicate monsoon, post-monsoon, and pre-monsoon, respectively. Pre-monsoon cases started to appear in 2013 and reached an all-time high in 2023.

B. Distribution of winter (November, December, January, and February) cases by year. About 83% of all winter cases have occurred in the 2022 & 2023.

Examining seasonal dengue patterns (Fig-3 & 4) from January 2008 to November 2024, Alam *et al*. showed that incidence is tightly linked to meteorological conditions, with peaks strongly correlated with higher temperatures, humidity, rainfall, and wind speed[49]

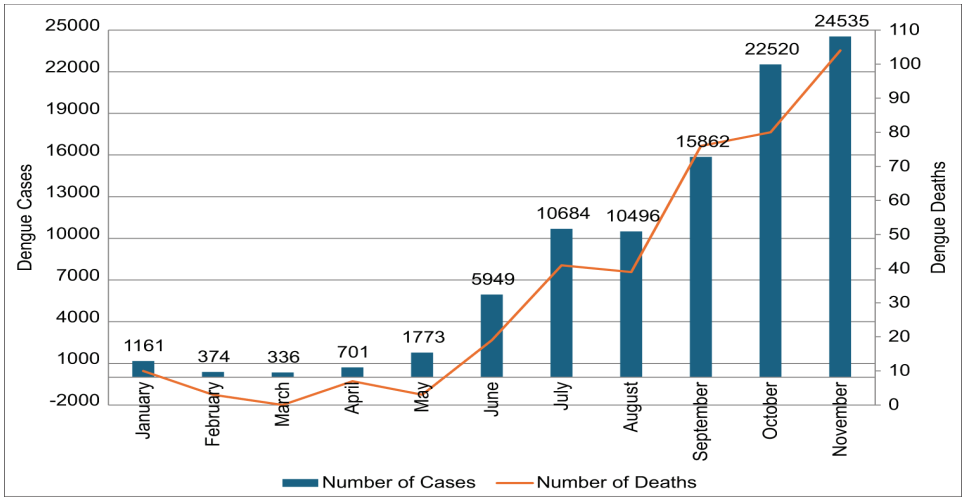


Figure.5. Monthly Incidence of Dengue Cases and Dengue-Related Deaths in Bangladesh up to November 2025 (Source: Directorate General of Health Services). The figure shows a sharp rise in dengue cases and deaths beginning in June, with reported infections nearly quadrupling by October. The situation peaked in November 2025, when more than 24,500 cases and 100 deaths were recorded – over a quarter of the year's total burden concentrated in a single month[65]

3. Rapid human mobility, Vegetation loss, Rising temperature, Population density, poor sanitation and waste disposal, and micro plastics

Islam and Hu identified rapid human movement as a major transmission driver in Bangladesh, with festival gatherings, increased mobility, and post-lockdown shifts all associated with higher case burdens.[50] Ogieuhi *et al*. noted that poor sanitation, insecticide resistance, limited vaccine access, low public awareness, and mounting healthcare pressures, combined with climate change and rapid urbanization, collectively heighten dengue risks, especially for vulnerable populations[51]

Urbanization-driven loss of natural vegetation further elevates dengue risk, as areas with reduced green cover provide ideal conditions for mosquito breeding and disease spread[55] Warmer temperatures accelerate mosquito aging, shortening their lifespan and altering infection patterns[52] Yet, over successive generations, heat-exposed mosquitoes can develop greater tolerance to viruses without losing vitality, a recent study shows[53] .Global warming has thus become a "perfect storm" for mosquito-borne diseases, affecting every stage of transmission.[54]

Rapid urbanization and extreme population density in Bangladesh are creating ideal conditions for intensified dengue transmission. In overcrowded cities with inadequate sanitation, stagnant water accumulates easily, offering abundant breeding sites for

Aedes mosquitoes. Monsoon-season spikes in heat, humidity, and rainfall further amplify this risk, with 2019 data showing that nearly 90% of dengue cases erupted between June and October, overwhelmingly concentrated in the city's hottest, most densely built neighborhoods.[56] Dengue hotspots consistently emerge where population density is highest, particularly in Thanas such as Badda, Jatrabari, Kadamtali, Mirpur, Mohammadpur, Sobujbagh, Shyampur, Tejgaon, Dhanmondi, and Uttara, where close human–mosquito contact further amplifies transmission.[57]

Dhaka's congested neighborhoods, compounded by poor sanitation, provide abundant stagnant water, creating ideal breeding grounds for mosquitoes. More than one-third of the population still lacks access to safely managed sanitation. Poor waste management is a critical driver of dengue risk among both children and adults. Shockingly, 55% of solid waste in urban areas remains uncollected, creating ideal breeding grounds for the mosquitoes that spread the disease.[58] A *Lancet* study reported that improperly discarded plastics accumulate stagnant water, creating ideal breeding sites for *Aedes* mosquitoes that transmit dengue, Zika, chikungunya, and yellow fever, thereby directly increasing vector populations. Indirectly, plastic debris also clogs drainage systems, producing large stagnant pools that promote mosquito proliferation and elevate the risk of diseases such as malaria[59]

In Dhaka, per-capita use reaches 24 kg, and nearly one-eighth of all plastic waste ends up in canals and rivers. An estimated 23,000–36,000 tons of plastic waste accumulate annually across 1,212 dumping hotspots surrounding the Buriganga, Turag, Balu, and Shitalakhsya rivers, a trend highlighted by a former World Bank country director during a program in Dhaka[60] .Beyond environmental degradation, this rising plastic burden may intensify mosquito-borne disease risks: Researchers from the Beijing Institute of Microbiology and Epidemiology show that mosquitoes exposed to micro plastics can transfer them to mammals, develop altered gut microbiomes, experience delayed development, and exhibit reduced insecticide susceptibility – factors that could heighten disease transmission[61,62]. Furthermore, microplastics can adsorb pyrethroid insecticides such as deltamethrin, reducing the concentration available to act on mosquitoes.

4. Construction sites and high-rises: Major breeding grounds driving dengue in Dhaka

Dhaka's rapid and largely unplanned urban expansion has transformed the city into a highly conducive environment for *Aedes* mosquito proliferation. Numerous under-construction buildings, left exposed to the elements, now serve as prime

breeding grounds for the vectors of dengue. A 2021 DGHS study covering 70 areas of Dhaka reported alarming *Aedes* densities, with the Breteau Index–the number of water-holding containers infested with larvae per 100 houses–rising to 23.3 in Lalmatia and Iqbal Road (Ward 32, DNCC) and 20.0 in Sayedabad and Uttar Jatrabari (Ward 48, Dhaka South City Corporation [DSCC]). High-rise buildings accounted for over 45% of breeding sites, followed by under-construction structures at nearly 35%62. In 2024, the former Mayor of DSCC warned that construction would be halted wherever *Aedes* larvae were detected and that dengue control drives would be launched in advance of the rainy season, alongside the government's 7-year National Dengue Prevention and Control Strategy.[63] The most recent pre-monsoon survey, conducted jointly by the DGHS Communicable Disease Control Programme and the IEDCR, presents a similarly concerning picture: multistory buildings accounted for almost 60% of *Aedes* larvae, with a further 20% found in under-construction sites.[64]

Conclusion

In Bangladesh, Climate change, Rainfall pattern, rising temperatures, presence of all serotypes of Dengue virus, unplanned urban expansion, and worsening pollution have created conditions that strongly favor mosquito proliferation, turning rapid development into a relentless battle against mosquitoes. It is important to identify the circulating serotype of dengue virus at the beginning of every season for prediction of disease amplitude and severity of the disease in coming season. Coordinated efforts that combine vector surveillance, robust vector control measures, early clinical care with rigorous scientific investigation and a strong management system are therefore essential to mitigating the country's growing dengue burden. If not handled properly, the virus will continue to intensify and escape the system.

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