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Literature Review

UNDERSTANDING DENGUE RISK IN BANGLADESH AND ONE HEALTH STRATEGIES FOR SUSTAINABLE PUBLIC HEALTH CONTROL

Abdul Kader Mohiuddin[1]*

Author information: *1. Alumnus, Faculty of Pharmacy, Dhaka University, Dhaka-1000, Bangladesh.*

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Abstract: Dengue has emerged as one of the most severe and rapidly escalating public health threats in Bangladesh, reflecting both localized vulnerabilities and broader global transmission dynamics. This study aims to examine the key environmental, climatic, and socioeconomic drivers underlying the country's unprecedented dengue surge since 2018, with particular emphasis on post-COVID trends. The central research questions are: (i) how climate variability and urban environmental changes are reshaping dengue transmission in Bangladesh, (ii) which often-overlooked structural factors are intensifying the severity of outbreaks, (iii) how these local dynamics reflect emerging global risks, and (iv) how global risk management practices can be effectively implemented in the Bangladeshi context. Using a comprehensive narrative review of national surveillance data obtained from official sources, peer-reviewed literature, meteorological records, and validated public reports, the study synthesizes evidence on temperature rise, altered rainfall patterns, humidity, unplanned urban growth, population density, sanitation failures, construction activity, pollution, insecticide resistance, and declining green cover. Findings indicate that dengue transmission in Bangladesh is driven by a convergence of climate stressors and human-made environmental conditions, particularly clogged drainage systems, unmanaged plastic waste, water storage practices, and high-rise construction sites that facilitate *Aedes* mosquito breeding. The study concludes that Bangladesh's dengue crisis represents an early warning of a wider global emergency. Addressing it requires integrated climate-responsive surveillance, urban planning reforms, strengthened vector control, and coordinated public health action grounded in a One Health approach.

Keywords: Dengue epidemiology; *Aedes* mosquito breeding; pandemic outbreaks; climate-driven transmission; urbanization impact; insecticide resistance; public health burden; micro plastic environmental risk

INTRODUCTION Each year, mosquitoes wage a silent yet devastating war—infecting nearly 700 million people and claiming more than a million lives across the globe [1]. Mosquito-borne viruses like dengue, chikungunya, and Zika have devastated 166 countries over the last five decades, costing nearly $100 billion and surging fourteen-fold between 2013 and 2022 [2]. While malaria continues to devastate Africa—accounting for over 90% of cases reported in the WHO African Region [3]—Asia is grappling with dengue, which is responsible for nearly 70% of global infections [4], with Southeast Asia bearing the heaviest burden [5]. Although the COVID-19 pandemic momentarily disrupted this trajectory, the post-pandemic resurgence of dengue infections reveals its persistent grip on the region [6]. 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, forms the central focus of this paper.

*Corresponding author: Abdul Kader Mohiuddin,
Alumnus, Faculty of Pharmacy, Dhaka University, Dhaka-1000, Bangladesh.
OrcID: https://orcid.org/0000-0003-1596-9757,
Email: trymohi@yahoo.co.in
Mobile: 01346809464

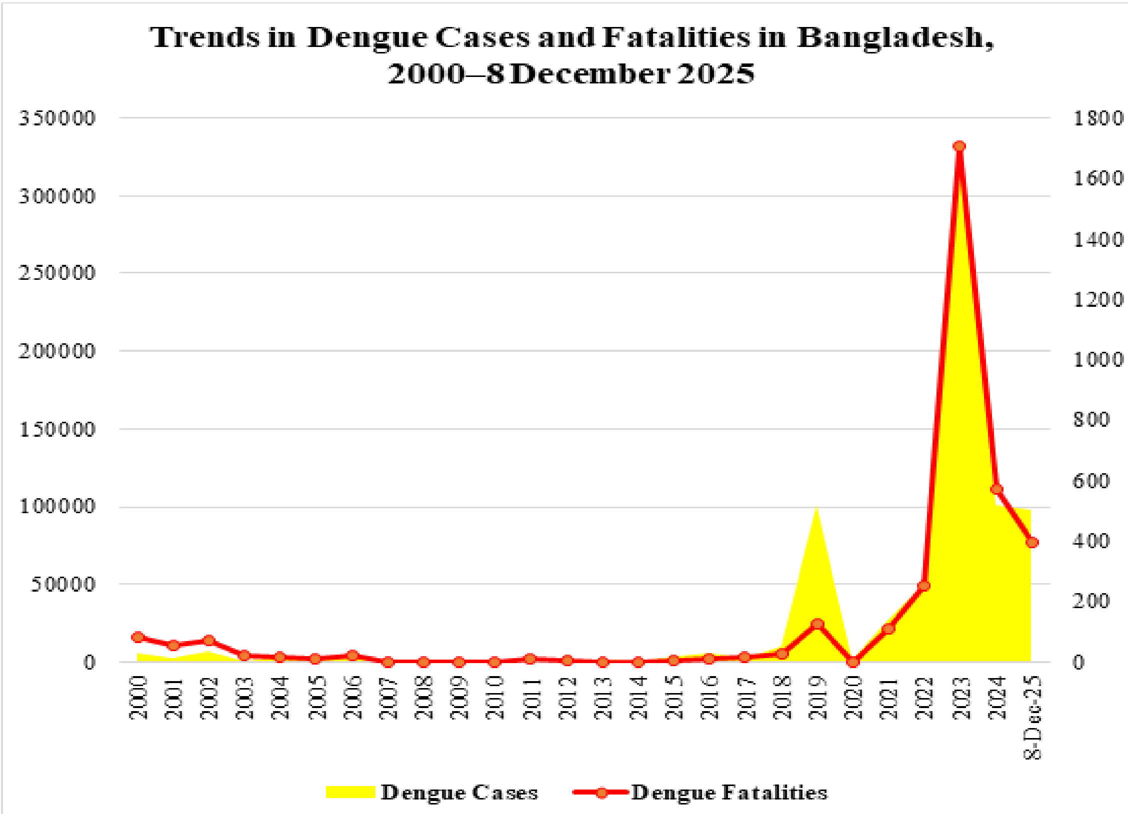

Figure 1. Trends in Dengue Cases and Deaths in Bangladesh, 2000–8 December 2025 (Source: The Institute of Epidemiology, Disease Control and Research, IEDCR) / Directorate General of Health Services, DGHS). The figure depicts a pronounced increase in dengue cases and deaths in Bangladesh during the post-COVID period, showing a closely aligned temporal pattern between case numbers and fatalities.

DATA SOURCES AND METHODOLOGY

Data Sources and Study Design

This study employed a narrative-analytical review design integrating epidemiological, climatic, environmental, and socioeconomic evidence to examine dengue transmission dynamics in Bangladesh. Data were drawn from authoritative national sources, including the Directorate General of Health Services (DGHS), the Institute of Epidemiology, Disease Control and Research (IEDCR), and the Bangladesh Meteorological Department, alongside global datasets from WHO and CDC. Peer-reviewed literature indexed in recently published peer-reviewed studies indexed in established databases, including PubMed, Embase, Scopus, Web of Science, and the Cochrane Central Register, as well as leading journals published by Elsevier, Springer, Wiley Online Library, and Wolters Kluwer. Where recent academic data were unavailable, rigorously verified reports from reputable international and national media were used to contextualize rapidly evolving outbreaks.

Quantitative Analytical Framework

Temporal trends in dengue cases, hospitalizations, and mortality (2000–December 8, 2025) were descriptively analyzed alongside meteorological variables—temperature, rainfall, humidity, and wind speed—since dengue cases and deaths declined significantly from November onward. Patterns were interpreted in relation to established quantitative findings from machine-learning models, time-series analyses, and climate–disease association studies conducted in Bangladesh and comparable tropical settings.

Qualitative Synthesis and Validation

A thematic synthesis was conducted to integrate qualitative evidence on urbanization, sanitation, waste management, pollution, construction practices, insecticide resistance, and public perception. Cross-validation was achieved by triangulating national surveillance data with international studies and multi-country comparisons, ensuring internal consistency with the literature review and coherence with the study's discussion and findings.

LITERATURE REVIEW

The Current Global Landscape of Dengue

Global dengue incidence is rising at an alarming rate. While reported patterns vary, the surge is undeniable. According to WHO, 6.5 million cases and 8,791 deaths were reported globally in 2023 [7], rising to 7.6 million cases and 3,000 deaths by April 2024 [8]. Notably, the US CDC and WHO's

Factor	Key Points	Evidence / Findings
Climate	Shapes dengue ecology by influencing vector dynamics, virus development, and mosquito–human interactions.	Relationships between climate variables and dengue transmission are complex [18].
Temperature	Rising temperatures increase dengue risk.	Regions with notable warming, such as sub-Saharan Africa and Oceania, show higher dengue incidence [19].
Rainfall	Provides breeding sites for mosquitoes.	Excess rainfall can wash away breeding sites, affecting outbreak patterns [20,21].
Humidity	Higher humidity supports mosquito survival and virus transmission.	Humidity ≥60% and temperatures >27°C elevate dengue risk; mosquitoes rarely survive below 60% humidity [21,22].
Wind Speed	Influences mosquito activity and breeding.	Higher wind speeds reduce transmission by limiting mosquito flight, host-seeking, and breeding-site availability [23].
Environmental Conditions	Impact mosquito breeding and dengue transmission.	Key factors include water storage, waste disposal, housing, drainage, vegetation, urbanization, seasonal variation, and water supply [24].
Geography	Vector thrives in tropical and subtropical regions.	Spread is dictated by climate, urbanization, and population movement [12].
Latitude	Determines the global range of dengue.	*Aedes aegypti* thrives between ~35°N–35°S; warming expands risk to higher latitudes, including Africa, South America, southern China, and the U.S. [19, 25].
Altitude	Limits mosquito habitats.	Mosquitoes generally stay below 6,500 ft; common up to 1,700 m, rare between 1,700–2,130 m; warming may increase risk at higher elevations [16,25,26].

Table 1. Determinants of Dengue Transmission: Climatic, Environmental, and Geographic Factors

global dengue surveillance system, launched in May 2024, reported 12–13 million cases and over 7,000 deaths in the Americas alone in 2024 [9,10]. Ranked among WHO's top ten global health threats, dengue affected approximately 90 countries in 2024, with Brazil bearing the highest burden, followed by Argentina and Mexico [11]. Current WHO estimates suggest that dengue causes up to 400 million infections annually [12], with incidence having increased thirtyfold over the past fifty years [13], now placing 3.9–5.6 billion people—more than half of the world's population—at risk [14,15]. Moreover, the US CDC reports that half of the global population lives in dengue-risk areas, putting both residents and travelers at risk [16]. Dengue, primarily transmitted by *Aedes aegypti* and *Aedes albopictus*, disproportionately affects the southern hemisphere, making effective tetravalent vaccines critical for global health [17]. Current vaccine development faces challenges in ensuring protection against all serotypes, addressing varied immune responses, and adapting to emerging strains.

Meteorological and Socioeconomic factors of Dengue Transmission

Environmental and socioeconomic factors jointly drive global dengue transmission, with climate conditions like temperature, rainfall, and humidity shaping mosquito habitats, while urbanization, population density, poverty, and inadequate sanitation increase human exposure and vulnerability, as discussed in Table 1.

Key Risk Factors for Dengue in Bangladesh: Insights from Previous Research

Bangladesh, a tropical country in South Asia situated between 20°–27°N and 88°–93°E, occupies the world's largest and most densely populated delta—the low-lying Ganges–Brahmaputra Delta, formed by rivers originating in the Himalayas. With more than 1,000 rivers spanning roughly 24,140 km and a coastline along the Bay of Bengal, the nation experiences high humidity and heavy rainfall, making it particularly vulnerable to floods and tropical cyclones [27–29]. 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. 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 [30].

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 [31]. 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 [32–34]. A comprehensive review of three major medical databases—PubMed, Embase, and Web of Science—up to December 5, 2024, indicates that climate change is reshaping temperature, rainfall, and humidity patterns, thereby expanding the geographic range of dengue and altering exposure risks across different populations [35]. Figure 2 shows that, following the global pattern, dengue cases rise in tandem with increases in temperature, rainfall, and humidity.

Evaluating the various dengue determinants in Bangladesh from 2000 to 2023, researchers from Begum Rokeya University used XGBoost and LightGBM with explainable AI to identify population density, precipitation, temperature, and land-use as key predictors, aligning with recent studies and supporting early-warning systems [36]. A comparative analysis with Singapore found that rainfall fueled dengue transmission in Bangladesh while humidity and sunshine suppressed it—whereas in Singapore, warmer temperatures drove infections and rainfall and humidity helped curb spread [37]. Hossain et al. (2023) identified rapid urbanization, climatic suitability, and the persistent presence of *Aedes* mosquitoes as key drivers of increased human–vector contact and the expanding geographic reach of dengue. Periodic serotype shifts, weak surveillance, limited healthcare capacity, and low public awareness further intensify these risks [38]. Building on this, Khan et al. (2024) highlighted possible post-COVID immune effects, climate variability, dominant viral serotypes, and systemic failures in patient management as contributors to Bangladesh's recent high fatality rates, underscoring the need for stronger clinical care, more trained personnel, improved vector control, and investment in One Health–based prevention [39].

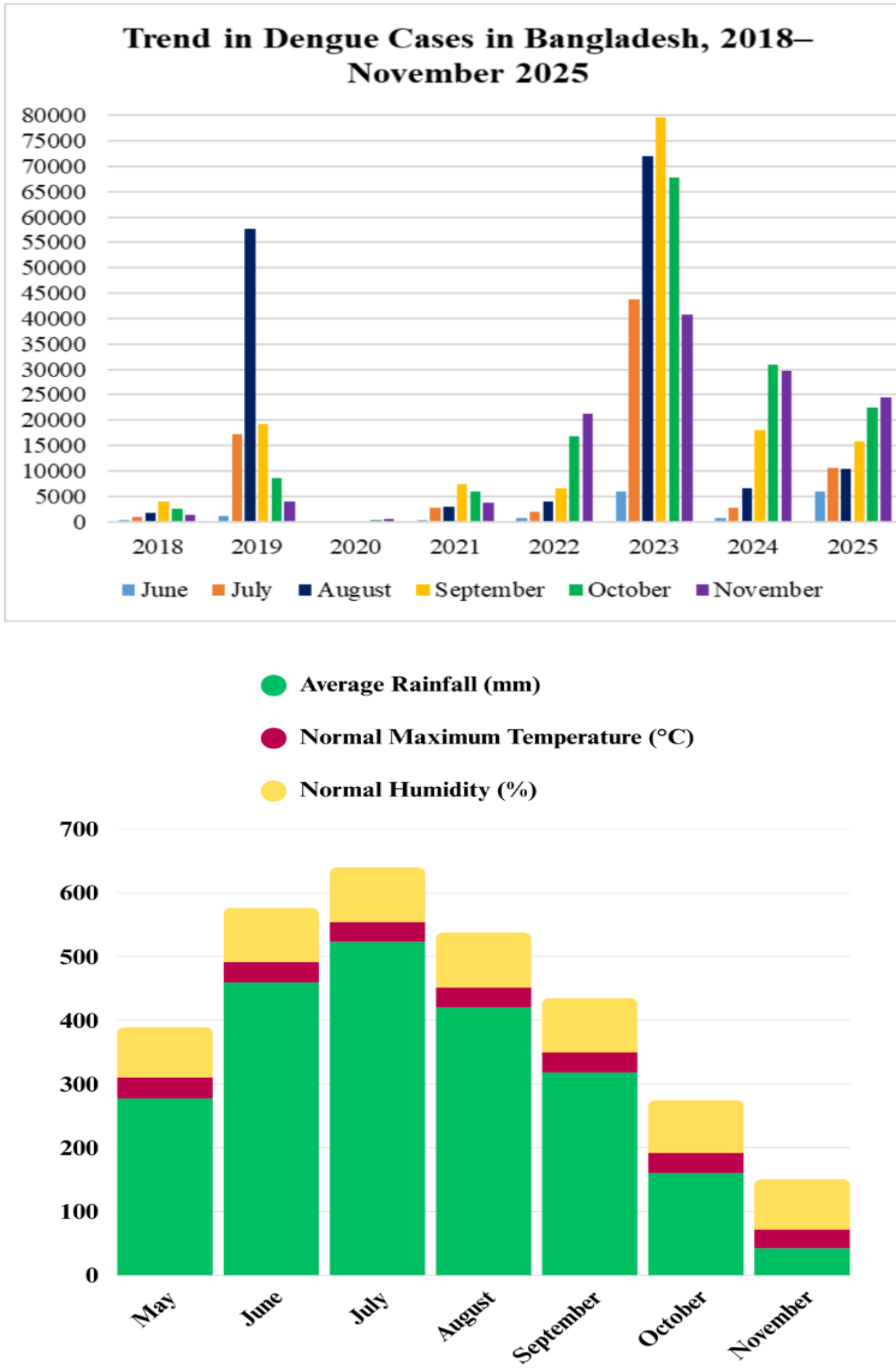

Figure 2. Trend in Dengue Cases in Bangladesh, 2018–November 2025 (Source: DGHS/Bangladesh Meteorological Department). The figure illustrates a clear upward trend in dengue transmission in Bangladesh since 2019, with a brief pause in 2020 consistent with global patterns. From June onwards, cases begin 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 (visualized using Canva Illustrator).

Examining seasonal dengue patterns from January 2008 to November 2024, Alam et al. (2025) showed that incidence is tightly linked to meteorological conditions, with peaks strongly correlated with higher temperatures, humidity, rainfall, and wind speed. Their study emphasized the need for future models to integrate real-time meteorological inputs along with urbanization and socioeconomic factors [40]. Islam et al. (2023) similarly argued that combining climate projections with human mobility and socio-environmental variables is essential for forecasting outbreaks and guiding effective prevention strategies [41]. Supporting this, Islam and Hu (2024) 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 [42]. Ogieuhi et al. (2025) noted that poor

Study Place/ Population	Knowledge	Perception & Attitude
1,358 youths of capital Dhaka	Higher climate change knowledge; links with dengue awareness	Positive attitude toward dengue–climate connection; socio-demographic/lifestyle factors influence awareness [44]
Students via social media survey	Strong climate-change awareness; weak dengue-prevention knowledge	Solid attitudes; past dengue experience predicts preventive behaviors [45]
1,010 respondents across 9 regions	Widespread awareness; educated/urban/better-off had higher knowledge	Misconceptions persist (e.g., *Aedes* breed in dirty water); weak preventive practices [46]
Dhaka university students	Good knowledge/practices; gaps in transmission, breeding sites, pregnancy-related risks	Strong attitudes; mixed-unit residents showed weakest preparedness [47]
745 slum dwellers of Dhaka	Recognized dengue severity and transmission	Low perceived personal risk; 60% inadequate preventive measures [48]
1,905 Northern-region residents	Limited awareness; poor understanding of climate-disease link	Perception and attitude not well-developed [49]
401 rural residents, Savar	Moderate knowledge; influenced by education, age, gender, occupation, health beliefs	High perceived severity; preventive practices unsatisfactory [50]
364 rural adults from Puthia & Paba upazila	48.4% had sufficient knowledge; higher education → better awareness	Gaps in understanding transmission/prevention; attitude not emphasized [51]
Scoping review of 27 studies	Moderate knowledge overall; rural/slum populations lower	Varying perception; rural/slum communities had weak preventive practices [52]
484 adults of Cox's Bazar	Average knowledge (84.3%)	Positive attitude (63%); knowledge/attitude linked to preventive practices [53]

Table 2. Knowledge, Perception, and Attitudes Towards Dengue in Various Bangladeshi Populations.

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 [43].

Common Public Perception *vs.* Reality

In Bangladesh, dengue perception shows a mix of high awareness of its severity (it's deadly) but low personal risk (susceptibility), leading to inconsistent prevention, with educated urban dwellers often better informed than rural populations. Table 2 offers an overview of dengue-related knowledge, perception, and attitudes across different Bangladeshi populations.

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 (*Flavivirus*) transmission, insecticide misuse and rising resistance also play critical roles. 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. 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 [54-56].

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. Additionally, 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 (**Figure 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 [57]. 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 [58].

DISCUSSIONS AND FINDINGS

Escalating Dengue Burden in Bangladesh

Bangladesh is at the epicenter of the crisis, grappling with unprecedented challenges. By 21 September 2025, deaths had surged 150% and cases had doubled from the previous year [59], and just two months later, by 23 November, infections had topped 90,000 with fatalities reaching 364 [60]—70% higher than six weeks earlier [61]. Hospital admissions, according to dynamic data from the Directorate General of Health Services (DGHS) [62], nearly quadrupled from 5,951 in June to 22,520 in October 2025, pushing an already fragile healthcare system to the brink (Figure 3).

November 2025 brought the crisis to a new peak: on 18 November alone, over 900 viral fever patients flooded hospitals, joining nearly 3,000 dengue cases already under treatment [63]. Since 2023, more than half a million Bangladeshis have been infected and over 2,670 have died—marking the deadliest dengue toll in the nation's history. By the end of November, total cases had surpassed 94,300, hospitalizations had exceeded 92,000, and deaths had risen to 382. November alone recorded more than 24,500 cases and 104 fatalities, meaning that over one-quarter of the year's infections and deaths occurred in a single, devastating month [62].

Historical data magnify the crisis. Between 2000 and 2022, Bangladesh recorded 853 dengue-related deaths [39, 64], 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). The demographic landscape is shifting. In 2023, women represented roughly 40% of dengue cases but accounted for 57% of deaths [65]. By December 8, 2025, men experienced nearly twice as many cases and over half of all deaths (Figure 4). 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 [62, 65]. However, older adolescents and young adults also represented more than half of all cases during the 2016, 2018, and 2019 outbreaks [65].

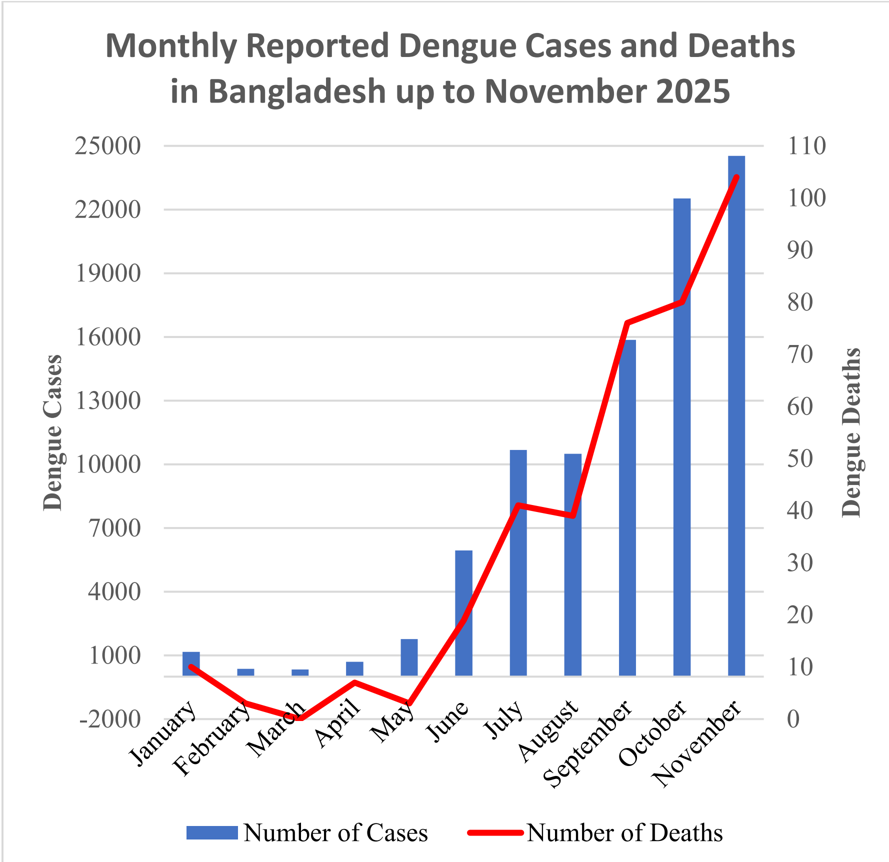

Figure 3. Monthly Incidence of Dengue Cases and Dengue-Related Deaths in Bangladesh up to November 2025 (Source: DGHS). The figure shows a sharp rise in dengue cases and deaths beginning in June, with reported infections nearly quadrupling by October. The situation peaked in November 2025, when more than 24,500 cases and 100 deaths were recorded—over a quarter of the year's total burden concentrated in a single month.

THE OVERLOOKED DRIVERS OF BANGLADESH'S ESCALATING DENGUE CRISIS

The recent dengue outbreaks, fueled by changing climate patterns, rapid urbanization, high population density, insecticide resistance, and low public awareness, have placed a severe strain on Bangladesh's healthcare system and economy. While climate change and urban growth are widely acknowledged as major drivers of the rising dengue burden, several less-discussed factors—often tied to uncontrolled urbanization—have intensified the crisis; these interconnected issues, highlighted in recent international research and media, remain largely overlooked by the public due to limited awareness.

Vegetation Loss, and Rising Temperature

Warmer temperatures accelerate mosquito aging, shortening their lifespan and altering infection patterns [66]. Yet, over successive generations, heat-exposed mosquitoes can develop greater tolerance to viruses without losing vitality, a recent study shows [67]. Global warming has thus become a "perfect storm" for mosquito-borne diseases, affecting every stage of transmission [68].

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, as demonstrated in studies from Mexico [69] and Brazil [70]. In Amazonian Brazil, for example,

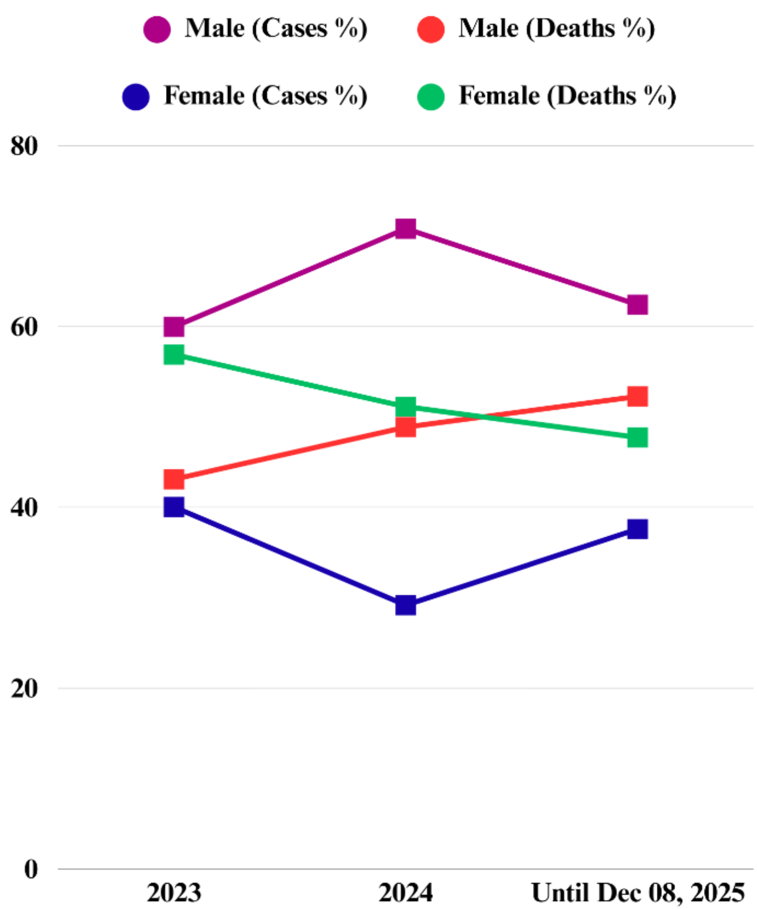

Figure 4. Demographic shifts in male and female cases and deaths, 2023–December 8, 2025 (Data Source: DGHS). The figure illustrates a pronounced demographic transition: male cases surged sharply in 2024 before leveling off in 2025, whereas female cases initially declined and later partially rebounded. Concurrently, male deaths exhibited a steady rise, surpassing female deaths by 2025—a striking reversal from previous years (visualized using Canva Illustrator).

deforestation of just one square kilometer was linked to 27 additional malaria cases [71].

Between 1989 and 2020, Dhaka lost more than half of its green cover due to rapid urban growth, triggering a significant rise in temperatures [72]. Over three decades, the number of extreme heat days (≥35°C) nearly doubled, making Dhaka one of the fastest-warming cities in the world, according to the International Institute for Environment and Development [73]. Furthermore, the World Bank reports that the city's heat index has increased more than 65% faster than the national average [74]. These hotter, denser conditions let *Aedes* mosquitoes adapt to heat, building stronger virus tolerance and becoming even more efficient carriers [63]. A climate projection from a decade ago indicates that, without adaptation, a 3.3 °C increase by 2100 could result in more than 16,000 additional dengue cases [75].

Population Density, Poor Sanitation, and Waste Disposal
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. Dhaka—home to more than 75,000 people per square

mile [76]—is now the world's second most densely populated city [77], and its tightly packed, human-built landscape accelerates *Aedes aegypti* growth, reproduction, and survival far more than suburban or rural settings [78]. 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 [79]. 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 [80].

In Bangladesh, roughly 40% of the population lives in urban areas, with over half residing in densely packed slums [81]. Communities without adequate sanitation—especially in these overcrowded settlements—are highly vulnerable to mosquito-borne diseases such as dengue and chikungunya [82]. 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, and UNICEF estimates that about 230 tons of fecal waste enter Dhaka's 4,500-kilometer drainage network every day. The system is already 70% clogged with trash and debris because of poor infrastructure and longstanding neglect, according to the Institute of Water Modelling [83, 84]. As a result, even moderate rainfall creates stagnant, mosquito-infested pools—a problem further intensified by flooding and extreme weather across both urban and rural areas [85]. Additionally, in many dense urban neighborhoods, inconsistent water supply forces residents to store water in containers [43], a practice well documented in neighboring India, further increasing the risk of mosquito-borne diseases [86].

Poor waste management is a critical driver of dengue risk among both children and adults—and in urban Bangladesh this threat looms large. Shockingly, 55% of solid waste in urban areas remains uncollected, creating ideal breeding grounds for the mosquitoes that spread the disease [87]. Evidence from urban Thiruvanathapuram, South India, indicates that inadequate waste management infrastructure can be associated with a 40% higher incidence of dengue and chikungunya cases [88]. Likewise, studies in informal urban settlements in Indonesia and Fiji reported that by age 4–5, over half of children had already been infected, highlighting how insufficient waste disposal accelerates early exposure to dengue [89].

Pollution as a Trigger for viral resistance and mosquito dynamics The WHO estimates that nearly a quarter of human diseases and deaths stem from long-term exposure to pollution [90]. While research on environmental impacts on dengue in Bangladesh remains limited, international studies underscore their significance. Recent findings from cities in Taiwan [91], Singapore [92], Guangzhou [93], Upper Northern Thailand [94], Melaka, Malaysia [95], and Greater São Paulo [96] demonstrate that air pollutants—such as particulate matter PM2.5, SO_2, O_3, CO, and NOx—interact with climate factors to influence mosquito populations, viral activity, and human immunity to the virus. These impacts, however, vary depending on pollutant type, concentration, and region, often producing complex, non-linear effects on mosquito dynamics. Interestingly, a study covering 76 provinces in Thailand from 2003 to 2021 found that higher surface concentrations of SO_2 and PM2.5 were generally associated with lower incidences of dengue, malaria, chikungunya, and Japanese encephalitis, likely due to adverse effects on mosquito survival and behavior [97]. These findings highlight the need for further research.

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 [98]. Bangladesh is now experiencing an alarming rise in micro plastic pollution. Just three rivers--Meghna, Karnaphuli, and Rupsha discharge nearly one million metric tons of mismanaged plastic each year [99]. In total, 36 rivers in Bangladesh are among the 1,656 waterways worldwide responsible for 80% of global riverine plastic emissions [100]. Per-capita plastic consumption has tripled—from 9 kg in 2005 to 2020—while COVID-19 contributed an additional 78,000 tons in a single year, according to a 2021 report by the

Environment and Social Development Organization (ESDO) [101].

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 to 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 [102]. 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 [103]. Also, micro plastics can adsorb pyrethroid insecticides such as deltamethrin, reducing the concentration available to act on mosquitoes. However, because the findings rely on a single study and other research shows conflicting results, more evidence is needed to clarify how micro plastic exposure influences mosquito dynamics and dengue transmission.

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. Surveys indicate that, in the decade preceding 2016, an average of 95,000 new structures were erected annually within the jurisdiction of the Rajdhani Unnayan Kartripakkha (RAJUK). Over the subsequent fifteen years, at least 64,000 additional buildings were constructed across the capital [104, 105]. In July 2020, inspections conducted by the Dhaka North City Corporation (DNCC) revealed that nearly 70% (8,764 out of 12,619) of homes and construction sites surveyed across 55 wards harbored potential *Aedes* breeding sources [106]. These inspections were carried out in collaboration with the National Malaria Elimination and *Aedes* Transmitted Disease Control Programme under the Directorate General of Health Services (DGHS).

The following year, the situation deteriorated further. A 2021 DGHS study covering 70 areas of Dhaka reported alarming *Aedes* densities, with the Breteau Index (BI)—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, DSCC). High-rise buildings accounted for over 45% of breeding sites, followed by under-construction structures at nearly 35% [107]. 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 seven-year National Dengue Prevention and Control Strategy [108]. The most recent pre-monsoon survey, conducted jointly by the DGHS Communicable Disease Control Programme and the Institute of Epidemiology, Disease Control and Research (IEDCR), presents a similarly concerning picture: multistory buildings accounted for almost 60% of *Aedes* larvae, with a further 20% found in under-construction sites [109].

From Neglect to Epidemic: How Policy Failures Worsened Dengue in Bangladesh

Bangladesh's authorities have repeatedly failed to curb *Aedes* populations, persisting with outdated chemical approaches while neglecting structural determinants and community-level interventions. Government action has remained fragmented and reactive; in 2023, officials proved unable to control *Aedes* mosquitoes, opting instead to fault households and impose ethically questionable fines. Such mismanagement and flawed strategies have allowed dengue transmission to escalate unchecked, rendering official prevention efforts largely performative (Figure 5). Transparency International Bangladesh has identified several drivers of high mortality, including inadequate hospital staffing, delayed diagnoses, false-negative NS1 results, weak vector-control measures, and limited healthcare capacity beyond Dhaka [110]. Experts further warn that the absence of strategic planning, non-adherence to WHO guidelines, and the failure to involve qualified public-health professionals have deepened the crisis. By 2024, South Asia was experiencing its most severe dengue epidemic on record, with Bangladesh and India reporting thousands of deaths as hospitals were overwhelmed. Concerns have mounted over inadequate anti-mosquito measures and the near

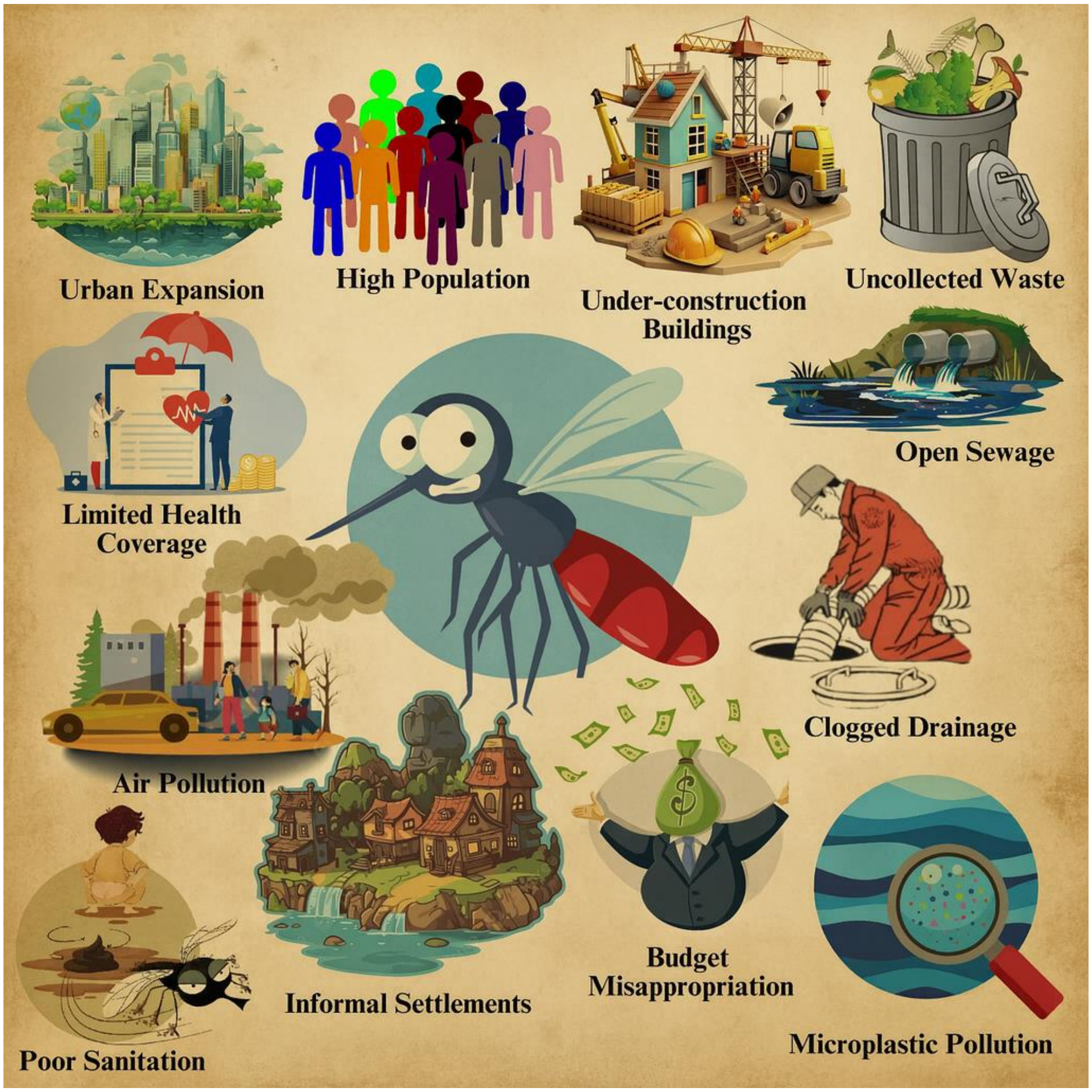

Figure 5. Key Drivers of Bangladesh's Rising Dengue Surge. Bangladesh's dengue surge reflects a dangerous convergence of climate stress, rapid urbanization, dense settlements, and chronic sanitation failures, which together have created ideal conditions for *Aedes* mosquitoes to flourish. Shifting infection patterns—rising male fatalities, high hospital admissions, and a disproportionate burden on young people—underscore a worsening public-health emergency driven by environmental degradation, waste mismanagement, and construction-related breeding sites. The infographic illustrates how these interconnected pressures—heat, overcrowding, poor waste disposal, irregular water supply, declining green cover, and ineffective vector control—are fueling an escalating nationwide epidemic.

absence of public awareness campaigns, shortcomings partly attributed to the lack of elected union parishad leadership under the interim government. Yet Dhaka's two city corporations have spent more than BDT 1,000 crore (over USD 81 million) on mosquito-control programs in the past decade, even as the capital continues to account for the majority of infections and fatalities [111]. In 2023 alone, Dhaka recorded more than half of all cases and nearly 70 per cent of fatalities, underscoring that vector-borne outbreaks transcend partisan boundaries [112]. In FY 2024–25, Dhaka South City Corporation spent less than 40 per cent of its overall budget despite increasing its mosquito-control allocation by 19% [113]. Weak implementation, poor coordination, obsolete operational strategies, and persistent shortages of chemicals and manpower have severely undermined larviciding, mosquito-control, and drain-cleaning activities.

RESULTS AND RECOMMENDATION

Aligned with WHO policy and reflecting the 'think global, act local' approach, addressing Bangladesh's dengue surge requires moving away from reactive, chemical-heavy measures toward a One Health–based Integrated Vector Management (IVM) strategy, which incorporates public health safeguards into urban planning, water storage, sanitation, waste management, drainage, and environmental governance. Strengthening surveillance-led action, evidence-based budgeting, trained frontline health workers, sustained risk communication, and community participation is essential to move from crisis response to prevention, particularly in densely populated and climate-vulnerable urban settings. Given shared climatic risks and population mobility, scientific innovation and cross-border collaboration are critical to ensuring sustainable, regionally coordinated dengue control in Bangladesh.

Urban Planning Reforms Bangladesh's dengue surge has been closely linked to unplanned urban expansion, particularly in Dhaka, where high-rise buildings, dense settlements, and construction sites dominate the landscape. Urban planning reforms must prioritize climate-responsive zoning, mandatory drainage design, and mosquito-safe construction codes, especially for multistory and under-construction buildings that currently account for most *Aedes* breeding sites. In addition, biodiversity favors the regulation of the movement of disease vectors and thus promotes resilience to epidemics [114, 115]. Cities like Singapore and parts of Rio de Janeiro have reduced dengue risk by integrating vector control considerations into building permits, land-use planning, and housing design [116-118]—an approach Bangladesh urgently needs to adopt. Without embedding public-health safeguards into urban development, rapid urbanization will continue to amplify dengue transmission rather than support sustainable growth.

Caution on Water Storage Irregular municipal water supply in many Bangladeshi cities forces most of the households to store water in drums, buckets, and tanks, which are major breeding sites for *Aedes* mosquitoes. Public health guidance must emphasize covering, cleaning, and frequently emptying water containers, particularly during the monsoon and post-monsoon seasons when dengue peaks. Similar initiatives in Chennai [119], Bengaluru [120], Makassar [121], Maros Regency [122], and Yogyakarta [123] have focused on community-based monitoring of household water storage and the promotion of affordable container covers to prevent mosquito breeding. In Bangladesh, caution on water storage must be framed as a necessity driven by infrastructure gaps, not merely as individual negligence.

Ensuring Optimum Sanitation Facilities

Poor sanitation continues to drive dengue risk in Bangladesh, particularly in densely populated urban slums where safely managed sanitation remains inaccessible for many residents. Overflowing latrines, open drains, and leaking wastewater create stagnant water pools, indirectly promoting mosquito breeding. Evidence from Vietnam indicates that expanding sanitation coverage can substantially reduce mosquito breeding habitats even without extensive chemical control [124]. Furthermore, training sanitation workers has been shown to enhance knowledge and practices for dengue prevention, reflecting similar experiences in India, though challenges remain in community engagement and ensuring worker safety [125]. Strengthening sanitation infrastructure in Bangladesh is therefore not only a matter of public health and development but also a vital strategy for dengue prevention.

Proper Disposal of Solid Waste

More than half of urban solid waste in Bangladesh remains uncollected, allowing plastic containers, packaging, and discarded items to trap rainwater and create ideal mosquito breeding sites. Improper waste disposal has been repeatedly identified as a major contributor to dengue outbreaks in Bangladesh, particularly in Dhaka's canals and drainage systems. Evidence from Gampaha district of Sri Lanka [126], urban areas of Malaysia [127], informal urban settlements in Indonesia and Fiji [89] indicates that improved waste segregation and regular collection can lower dengue incidence by reducing mosquito breeding habitats. In Bangladesh, effective solid-waste management must be treated as a public-health intervention rather than a purely municipal service.

Sustainable Drainage System

Dhaka's City Corporations (DNCC and DSCC), together with other responsible authorities, frequently issue tenders for drainage works or interventions on drainage infrastructure—often annually or even multiple times within a single year—raising concerns about repetitive public spending and the potential waste of public funds [127–132]. These recurring projects are widely attributed to poor planning and design, corruption, and inadequate maintenance, which have allowed chronic problems such as waterlogging to persist despite ongoing construction. The repeated disruptions also cause significant inconvenience to daily travel and urban life. Implementing well-planned, modern drainage designs with high-quality standard materials, along with the involvement of trained engineers and skilled labor, can help establish a sustainable sewage system and minimize the need for repeated interventions—measures that have proven effective in controlling vector-borne diseases [133–137], as highlighted in various scholarly articles and WHO guidelines.

Regular Drainage and Clog Prevention

Bangladesh's drainage networks—especially in Dhaka—are heavily clogged with plastic, debris, and fecal waste, causing stagnant water even after moderate rainfall. This chronic drainage failure has turned canals and roadside drains into persistent mosquito reservoirs, extending dengue transmission beyond the monsoon season. Studies in urban areas of Jakarta, Surabaya, Bandung, and Presidente Prudente in São Paulo have found a strong link between dengue incidence and poorly maintained storm drains [138, 139]. In contrast, a simple, community-driven modification of storm drains in Salvador, Brazil, effectively prevented water stagnation and resulted in a substantial reduction in both immature and adult *Aedes aegypti* populations [140]. In Bangladesh, city corporations need to be further strengthened and held more accountable for routinely monitoring waterlogging caused by waste accumulation in drainage systems. However, local authorities alone cannot ensure effective and sustainable drainage without active public participation. Raising strong public awareness about the health consequences of clogged drains, together with consistent and visible enforcement of penalties, is essential for achieving lasting impact. Although privatization may offer a more efficient management solution, bureaucratic obstacles continue to pose significant challenges. For example, the city of Ludhiana in India recently saw its municipal authorities issue tenders for the operation and maintenance of the sewerage system through a small-scale pilot project [141].

Evidence-Based Budget Utilization and Monitoring Framework Development

Despite substantial spending on mosquito control, Bangladesh has achieved limited results because of weak implementation, poor coordination, and an overreliance on ineffective fogging rather than proven source reduction and surveillance-based strategies [54, 111, 142, 143]. A recent systematic review by Low et al. (2025) found insufficient evidence to recommend any single conventional dengue vector control method, underscoring the need for urgent trials of novel approaches [144]. Evidence from Australia, Brazil, and Indonesia shows that Wolbachia-mediated interventions can deliver sustained dengue reduction with major healthcare and productivity savings, making them especially cost-effective in dense urban centers like Dhaka [145]. In parallel, ovitrap-based surveillance is a rapid, low-cost, and sensitive tool, proven effective in settings such as Semarang, Indonesia, and Guangzhou, China [146, 147]. Bangladesh therefore urgently needs a transparent, data-driven monitoring framework to ensure dengue control resources are used efficiently and equitably.

Integrated Vector Management Practices

Bangladesh's heavy reliance on chemicals has been largely ineffective due to widespread insecticide resistance in *Aedes* mosquitoes [55, 56]. Following WHO's Global Technical Strategy, vector control in countries like Bhutan, Malaysia, the Philippines, and Sri Lanka relied on surveillance and interventions but was limited by weak targeting and lack of evidence-based implementation [148]. Since 2001, the WHO has been promoting, and in 2004, it adopted IVM globally for all vector-borne diseases [149]. Combining environmental management, targeted larviciding, biological control, and community participation, IVM offers a more sustainable approach. WHO-guided IVM has succeeded in urban Malaysia [150], Sri Lanka's Gampaha district [151], Tharu village, Chitwan, Nepal [152], and Zambia [153], reducing mosquito-borne illnesses through source reduction and surveillance-driven measures rather than broad chemical use. For Bangladesh, adopting IVM is essential to overcome insecticide resistance and adapt to changing climates. Although included in the *National Dengue Prevention and Control Strategy (2024–2030)* [154], its success will rely on sustained political commitment, sufficient resources, and effective implementation.

Training Health Facilitators The dengue crisis has exposed gaps in frontline health capacity, including delayed diagnosis, mismanagement of cases, and inadequate referral systems outside major cities [155-158]. Recent years have seen dengue cases requiring increased hospitalizations, as reported both globally and in Bangladesh. Notably, during the 2023 outbreak, over two-thirds of dengue-related deaths occurred within a day of hospital admission, suggesting either rapid disease progression or delayed medical care [159]. Training health facilitators—community health workers, nurses, and primary-care providers—in early dengue recognition and case management can significantly reduce mortality [160-162]. Southern Thailand has achieved improved outcomes by integrating dengue-specific training into primary healthcare systems, although continued training for village health volunteers remains necessary [163, 164]. In Bangladesh, strengthening health facilitator capacity is critical, especially during peak transmission months when hospitals are overwhelmed.

Public Awareness Campaigns Although dengue awareness is relatively high in Bangladesh, preventive practices remain inconsistent due to misconceptions and low perceived personal risk [46, 48-50, 165]. Public campaigns should go beyond seasonal messaging and promote year-round behavior change, especially regarding water storage, waste disposal, and early healthcare seeking [43, 166-170]. Successful programs in Indonesia [171], India [172], southern Thailand [173], Singapore [174] combine mass media, neighborhood engagement, videos, social media, mobile apps, and school-based education. A 2024 review by Dapari et al. also found that school-based education effectively raises knowledge and improves dengue prevention practices [175]. In Bangladesh, sustained, evidence-based communication—through schools, health authorities, NGOs, religious institutions, and community leaders—is essential to turn awareness into effective action against dengue.

Environmental management, and community capacity building Environmental degradation—loss of green cover, pollution, and unmanaged urban growth—has intensified dengue risk in Bangladesh by altering mosquito ecology. Community-led environmental management—such as cleaning neighborhood containers and shared spaces, as well as monitoring mosquito breeding sites—has proven effective in Yogyakarta, Indonesia [123]; Fortaleza in northeast Brazil [176]; among Myanmar migrants in Samut Sakhon Province, Thailand [177]; and Singapore [178]. Building community capacity empowers residents to address local risk factors that municipal systems cannot fully cover. In Bangladesh, engaging communities is especially vital in slums and dense neighborhoods where formal services are limited.

Real Time Reporting and Surveillance for Disease Trend
Weak and delayed surveillance has hindered Bangladesh's ability to anticipate and respond to dengue outbreaks effectively. Integrating real-time disease reporting with meteorological and environmental data can enable early warnings and targeted interventions. Countries like Thailand, Singapore and France, among many other countries use climate-linked surveillance systems to predict outbreaks weeks in advance. Both countries use a variety of modeling techniques, including machine learning (like XGBoost and LASSO regression) and statistical models, to analyze the complex relationships between these variables and dengue transmission dynamics [179, 180]. For Bangladesh, strengthening real-time surveillance is crucial to shift from reactive crisis management to proactive prevention.

Scientific Innovation for Mosquito Control
Traditional dengue control methods are becoming increasingly inadequate in Bangladesh due to rising insecticide resistance and environmental changes. Scientific innovations offer promising alternatives, including biological control—such as Wolbachia-based interventions, which have proven effective in Australia, Brazil, and Indonesia [145]; improved larvicides—like biological agents *Bacillus thuringiensis israelensis* and diflubenzuron, which have shown strong efficacy against Aedes larvae and provide sustainable alternatives to conventional chemicals in Lao PDR [181]; and novel mosquito management technologies—such as Sterile Insect Technology, where releasing sterile male mosquitoes in Ortigueira, Paraná, Brazil, significantly reduced *Aedes aegypti* populations and prevented dengue outbreaks [182]. Technology-enabled mosquito monitoring, integrating IoT and machine learning with traditional ovitraps [183], also shows promise. While resource limitations remain, targeted pilot programs could

evaluate feasibility under Bangladeshi conditions. Investing in these innovations is essential to future-proof dengue control strategies against climate-driven transmission.

Cross-border collaboration with neighboring countries
Dengue transmission in Bangladesh does not occur in isolation, as climate patterns, human mobility, and viral circulation extend across borders with India and other South Asian countries. Cross-border data sharing, joint surveillance, and coordinated response strategies have been effective in parts of Southeast Asia [184-187]. Given Bangladesh's dense population and high mobility during festivals and seasonal migration, regional collaboration is particularly important (Figure 6). Strengthening cross-border cooperation can help Bangladesh anticipate emerging risks and align control strategies with regional realities.

CONCLUSIONS
In Bangladesh, rising temperatures, unplanned urban expansion, and worsening pollution have created conditions that strongly favor mosquito proliferation, turning rapid development into a relentless battle against one of the country's deadliest tiny predators. The persistent and evolving threat of dengue underscores the need for timely hospitalization—because the illness can deteriorate quickly—as well as systematic research to understand how environmental pollution, climate

Figure 6. Integrated Strategies for Dengue Prevention in Bangladesh. The figure illustrates a comprehensive, One Health–based approach to dengue prevention in Bangladesh, emphasizing the shift from reactive chemical control to proactive, integrated measures. Key interventions include climate-responsive urban planning, safe water storage, improved sanitation, solid-waste management, and sustainable drainage systems to reduce mosquito breeding habitats. It also highlights the importance of trained health workers, community engagement, real-time surveillance, and innovative mosquito-control technologies, supported by evidence-based budgeting for effective resource allocation. Finally, the diagram underscores the role of cross-border collaboration and regional data sharing to strengthen dengue preparedness and ensure coordinated, sustainable control efforts.

variability, and extensive pesticide use are shaping viral resistance and mosquito behavior. Media coverage has largely failed to capture the severity of the crisis, and domestic research remains limited, often attributing outbreaks only to erratic rainfall, monsoon shifts, and stagnant water.

These grim outcomes point to deeper systemic failures, including a lack of public awareness, inadequate hospital staffing, limited healthcare capacity, delayed diagnoses, weak and poorly coordinated vector-control measures, insecticide resistance, limited access to effective vaccines, the absence of strategic planning, failure to follow WHO guidelines, and persistent corruption and negligence, all compounded by the exclusion of qualified public health professionals from decision-making.

Yet evidence from regions with similar dengue patterns points to several overlooked drivers, including air pollution, pesticide and micro plastic resistance, and the complex interactions between rapid urbanization and mosquito ecology. With low levels of health literacy, even strong research rarely translates into public awareness or policy reform, and progress in evidence-based studies remains slow. Coordinated efforts that combine early clinical care with rigorous scientific investigation are therefore essential to mitigating the country's growing dengue burden.

This national tragedy is part of a much larger global shift. A study in *Nature* warns that by 2080, nearly three in five people could be at risk of dengue [188]. Last year alone, more than fourteen million people were infected worldwide—twice the previous year and twelve times higher than a decade ago [189, 190]. As climate instability, unplanned urbanization, and expanding mosquito habitats intensify, dengue is no longer a regional challenge—it is an emerging pandemic that demands urgent international action. The time to act is now, before a greater catastrophe unfolds and more lives are lost.

ABBREVIATIONS

BI: Breteau Index
DGHS: Directorate General of Health Services
DNCC: Dhaka North City Corporation
DSCC: Dhaka South City Corporation
IEDCR: The Institute of Epidemiology, Disease Control and Research
IVM: Integrated Vector Management
NS1: Nonstructural Protein 1
RAJUK: Rajdhani Unnayan Kartripakkha
WHO: World Health Organization

DATA AVAILABILITY STATEMENT

The data used in this study were obtained from the Dengue Dynamic Dashboard for Bangladesh, maintained by the Directorate General of Health Services (DGHS), Health Emergency Operation Center & Control Room. These data are publicly available at: https://dashboard.dghs.gov.bd/pages/heoc_dengue_v1.php

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CONFLICT OF INTEREST

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N/A

REFERENCES

1. Jackson A. *World mosquito Day 2025 - A Global Health Crisis. World Mosquito Program*. 2025 Aug 11.

2. Roiz D, Pontifes PA, Jourdain F, et al. The rising global economic costs of invasive Aedes mosquitoes and *Aedes*-borne diseases. *Sci Total Environ*. 2024;933:173054. https://doi.org/10.1016/j.scitotenv.2024.173054

3. World Health Organization. *World malaria report 2023*. Geneva, Switzerland: World Health Organization; 2023. ISBN 978-92-4-008617-3. License: CC BY-NC-SA 3.0 IGO.

4. United Nations Office for Disaster Risk Reduction (UNDRR), International Science Council (ISC). *UNDRR–ISC Hazard Information Profiles – 2025 Update: BI0207 Dengue*. United Nations Office for Disaster Risk Reduction; International Science Council; 2025.

5. Ahmad LC, Gill BS, Sulaiman LH, et al. Molecular epidemiology of dengue in Southeast Asia (SEA): Protocol of systematic review and meta-analysis. *BMJ Open*. 2025;15(4):e088890. https://doi.org/10.1136/bmjopen-2024-088890

6. Weng SL, Hung FY, Li ST, et al. Dengue epidemiology in 7 Southeast Asian countries: 24-year, retrospective, multicountry ecological study. *Interact J Med Res*. 2025;14:e70491. https://doi.org/10.2196/70491

7. Bishen S. *The world is in the grip of a record dengue fever outbreak. What's causing it and how can it be stopped?* World Economic Forum. November 5, 2024.

8. World Health Organization. *Dengue - Global situation. Disease Outbreak News*. May 30, 2024.

9. CDC. *Current dengue outbreak. Centers for Disease Control and Prevention*. Updated July 29, 2025.

10. eClinicalMedicine. Dengue as a growing global health concern. 2024;77:102975. https://doi.org/10.1016/j.eclinm.2024.102975

11. Zhang, W.-X., Zhao, T.-Y., Wang, C.-C., He, Y., Lu, H.-Z., Zhang, H.-T., Wang, L.-M., Mao, Z., Li, C.-X., & Deng, S.-Q. (2025). Assessing the global dengue burden: Incidence, mortality, and disability trends over three decades. *PLoS Neglected Tropical Diseases, 19*(3), e0012932. https://doi.org/10.1371/journal.pntd.0012932

12. WHO. *Dengue fact sheet*. World Health Organization. 2025 Aug 21.

13. Wei S, Zhang T, Sun S, et al. The shift in mosquito-borne disease incidence across the Asia-Pacific region (1992–2021): Insights from an age-period-cohort analysis using the Global Burden of Disease Study 2021. *BMC Public Health*. 2025;25:3373. https://doi.org/10.1186/s12889-025-24765-y

14. Kim JH, Lim AY, Kim SH. Evaluating the effectiveness of dengue surveillance in the tropical and sub-tropical Asian nations through dengue case data from travelers returning to the five western Pacific countries and territories. *Travel Med Infect Dis*. 2025;64:102802. https://doi.org/10.1016/j.tmaid.2025.102802

15. Lim A, Shearer FM, Sewalk K, Pigott DM, Clarke J, Ghouse A, Judge C, Kang H, Messina JP, Kraemer MUG, Gaythorpe KAM, de Souza WM, Nsoesie EO, Celone M, Faria N, Ryan SJ, Rabe IB, Rojas DP, Hay SI, Brownstein JS, Golding N, Brady OJ. The overlapping global distribution of dengue, chikungunya, Zika and yellow fever. *Nat Commun*. 2025;16(1):3418. https://doi.org/10.1038/s41467-025-58609-5

16. CDC. *Areas with Risk of Dengue. Centers for Disease Control and Prevention*; Updated December 8, 2025.

17. Ulgheri FM, Bernardes BG, Lancellotti M. Decoding Dengue: A Global Perspective, History, Role, and Challenges. *Pathogens*. 2025;14(9):954. https://doi.org/10.3390/pathogens14090954

18. Morin CW, Comrie AC, Ernst K. Climate and dengue transmission: evidence and implications. *Environ Health Perspect*. 2013;121(11-12):1264-1272. https://doi.org/10.1289/ehp.1306556

19. Fengliu F, Ma Y, Qin P, Zhao Y, Liu Z, Wang W, Cheng B. Temperature-Driven Dengue Transmission in a Changing Climate: Patterns, Trends, and Future Projections. *GeoHealth*. 2024;8(10):e2024GH001059. https://doi.org/10.1029/2024GH001059

20. Benedum CM, Seidahmed OME, Eltahir EAB, Markuzon N. Statistical modeling of the effect of rainfall flushing on dengue transmission in Singapore. *PLoS Negl Trop Dis*. 2018;12(12):e0006935. https://doi.org/10.1371/journal.pntd.0006935

21. Sophia Y, Roxy MK, Murtugudde R, et al. Dengue dynamics, predictions, and future increase under changing monsoon climate in India. *Sci Rep*. 2025;15:1637. https://www.nature.com/articles/s41598-025-85437-w

22. Monintja TCN, Arsin AA, Amiruddin R, Syafar M. Analysis of temperature and humidity on dengue hemorrhagic fever in Manado Municipality. *Gaceta Sanitaria*. 2021;35(Suppl):S330-S333. https://doi.org/10.1016/j.gaceta.2021.07.020

23. Gui H, Gwee S, Koh J, Pang J. Weather Factors Associated with Reduced Risk of Dengue Transmission in an Urbanized Tropical City. *Int J Environ Res Public Health*. 2021;19(1):339. Published 2021 Dec 29. https://doi.org/10.3390/ijerph19010339

24. Chaiyarit J, Sriwongsuk K, Putepapas S, Intarasaksit P. Environmental health factors influencing dengue: a systematic review with thematic categorization. *Int J Environ Health Res*. 2025;1-15. https://doi.org/10.1080/09603123.2025.2589371

25. Nature Education. *Dengue Transmission*. Nature.com. Published 2014.

26. Lozano-Fuentes S, Hayden MH, Welsh-Rodriguez C, et al. The dengue virus mosquito vector Aedes aegypti at high elevation in Mexico. *Am J Trop Med Hyg*. 2012;87(5):902-909. https://doi.org/10.4269/ajtmh.2012.12-0244

27. Sieghart L, Rogers D. *Bangladesh: The Challenges of Living in a Delta Country*. World Bank Blogs. May 19, 2015.

28. Islam MA, Sato T. Influence of Terrestrial Precipitation on the Variability of Extreme Sea Levels along the Coast of Bangladesh. *Water*. 2021;13(20):2915. https://doi.org/10.3390/w13202915

29. Miah D. Sustainable river management in Bangladesh: Challenges and ways forward. The Climate Watch. December 1, 2024.

30. Raza W, Mahmud I, Hossain R. *Bangladesh: Finding it difficult to keep cool*. Washington, DC: World Bank; 2021. https://doi.org/10.1596/36534

31. Hasan MN, Khalil I, Chowdhury MAB, et al. Two decades of endemic dengue in Bangladesh (2000–2022): trends, seasonality, and impact of temperature and rainfall patterns on transmission dynamics. *J Med Entomol*. 2024;61(2):345-353. https://doi.org/10.1093/jme/tjae001

32. Bonna AS, Pavel SR, Mehjabin T, Ali M. Dengue in Bangladesh. *IJID One Health*. 2023;1:100001. https://doi.org/10.1016/j.ijidoh.2023.100001

33. Najmus Sakib SM. *Heavy rains may double dengue cases in Oct*. The Financial Express. October 4, 2025.

34. TBS Report. *Why Bangladesh seeing so much rain in October?* The Business Standard. October 11, 2025.

35. Islam J, Frentiu FD, Devine GJ, Bambrick H, Hu W. A state-of-the-science review of long-term predictions of climate change impacts on dengue transmission risk. *Environ Health Perspect*. 2025;133(5):56002. doi:10.1289/EHP14463

36. Rahman MS, Shiddik MAB. Explainable artificial intelligence for predicting dengue outbreaks in Bangladesh using eco-climatic triggers. *Glob Epidemiol*. 2025;10:100210. https://doi.org/10.1016/j.gloepi.2025.100210

37. Islam MT, Kamal ASMM, Islam MM, Hossain S. Time series patterns of dengue and associated climate variables in Bangladesh and Singapore (2000–2020): A comparative study of statistical models to forecast dengue cases. *Int J Environ Health Res*. 2025;35(9):2289-2299. https://doi.org/10.1080/09603123.2024.2434206

38. Hossain MS, Noman AA, Mamun SMAA, Mosabbir AA. Twenty-two years of dengue outbreaks in Bangladesh: Epidemiology, clinical spectrum, serotypes, and future disease risks. *Trop Med Health*. 2023;51(1):37. https://doi.org/10.1186/s41182-023-00528-6

39. Khan S, Akbar SM, Mahtab MA, et al. Bangladesh records persistently increased number of dengue deaths in recent years: Dissecting the shortcomings and means to resolve. *IJID Regions*. 2024;12:100395. https://doi.org/10.1016/j.ijregi.2024.100395

40. Alam KE, Ahmed MJ, Chalise R, et al. Time series analysis of dengue incidence and its association with meteorological risk factors in Bangladesh. *PLoS*

One. 2025;20(8):e0323238. https://doi.org/10.1371/journal.pone.0323238

41. Islam MA, Hasan MN, Tiwari A, et al. Correlation of dengue and meteorological factors in Bangladesh: A public health concern. *Int J Environ Res Public Health*. 2023;20(6):5152. https://doi.org/10.3390/ijerph20065152

42. Islam J, Hu W. Rapid human movement and dengue transmission in Bangladesh: A spatial and temporal analysis based on different policy measures of COVID-19 pandemic and Eid festival. *Infect Dis Poverty*. 2024;13(1):99. https://doi.org/10.1186/s40249-024-01267-4

43. Ogieuhi IJ, Ahmed MM, Jamil S, et al. Dengue fever in Bangladesh: Rising trends, contributing factors, and public health implications. *Trop Dis Travel Med Vaccines*. 2025;11(1):26. https://doi.org/10.1186/s40794-025-00251-6

44. Siddique AB, Hasan M, Ahmed A, Rahman MH, Sikder MT. Youth's climate consciousness: Unraveling the dengue-climate connection in Bangladesh. *Front Public Health*. 2024;12:1346692. https://doi.org/10.3389/fpubh.2024.1346692

45. Rahman MS, Karamehic-Muratovic A, Baghbanzadeh M, et al. Climate change and dengue fever knowledge, attitudes and practices in Bangladesh: A social media–based cross-sectional survey. *Trans R Soc Trop Med Hyg*. 2020;115(1):85-93. https://doi.org/10.1093/trstmh/traa093

46. Hossain MdI, Alam NE, Akter S, et al. Knowledge, awareness and preventive practices of dengue outbreak in Bangladesh: A countrywide study. *PLoS One*. 2021;16(6):e0252852. https://doi.org/10.1371/journal.pone.0252852

47. Rahman MM, Khan SJ, Tanni KN, et al. Knowledge, attitude, and practices towards dengue fever among university students of Dhaka City, Bangladesh. *Int J Environ Res Public Health*. 2022;19(7):4023. https://doi.org/10.3390/ijerph19074023

48. Rahman MM, Tanni KN, Roy T, et al. Knowledge, attitude and practices towards dengue fever among slum dwellers: A case study in Dhaka City, Bangladesh. *Int J Public Health*. 2023;68:1605364. https://doi.org/10.3389/ijph.2023.160536

49. Rahman MS, Amrin M, Chowdhury AH, Suwanbamrung C, Karamehic-Muratovic A. Knowledge and beliefs about climate change and emerging infectious diseases in Bangladesh: Implications for one health approach. *J Health Popul Nutr*. 2025;44(1):360. https://doi.org/10.1186/s41043-025-01112-w

50. Banik R, Islam MS, Mubarak M, Rahman M, Gesesew HA, Ward PR, Sikder MT. Public knowledge, belief, and preventive practices regarding dengue: Findings from a community-based survey in rural Bangladesh. *PLoS Negl Trop Dis*. 2023;17(12):e0011778. https://doi.org/10.1371/journal.pntd.0011778

51. Chowdhury NF, Haque MJ, Jahan MS, Rashid MAM, Mostafa MG, Rashid F. Knowledge, beliefs, and preventive practices regarding dengue among rural communities in Bangladesh. *KYAMC J*. 2024;15(3). https://doi.org/10.3329/kyamcj.v15i3.75223

52. Chowdhury SMMH, Rashid MA, Trisha SY, Ibrahim M, Hossen MS. Dengue investigation research in Bangladesh: Insights from a scoping review. *Health Sci Rep*. 2025;8(3):e70568. https://doi.org/10.1002/hsr2.70568

53. Pure E, Husna ALA, Rokony S, Thowai AS, Moulee ST, Jahan A, Khatun A, Sarkar M, Bibi S, Tabassum TT, Nurunnabi M. Knowledge, attitude, and practices regarding dengue infection: A community-based study in rural Cox's Bazar. *J Commun Dis*. 2025;57(1):121-130. https://doi.org/10.24321/0019.5138.202516

54. Mohiuddin AK. Dengue protection and cure: Bangladesh perspective. *Eur J Sustain Dev Res*. 2019;4(1):em0104. https://doi.org/10.29333/ejosdr/6260

55. Al-Amin HM, Johora FT, Irish SR, et al. Insecticide resistance status of Aedes aegypti in Bangladesh. *Parasit Vectors*. 2020;13(1):622. https://doi.org/10.1186/s13071-020-04503-6

56. Al-Amin HM, Gyawali N, Graham M, et al. Insecticide resistance compromises the control of Aedes aegypti in Bangladesh. *Pest Manag Sci*. 2023;79(8):2846-2861. https://doi.org/10.1002/ps.7462

57. Hossain S, Islam MdM, Hasan MdA, Chowdhury PB, Easty IA, Tusar MdK, Rashid MB, Bashar K. Association of climate factors with dengue incidence in Bangladesh, Dhaka City: A count regression approach. *Heliyon*. 2023;9(5):e16053. https://doi.org/10.1016/j.heliyon.2023.e16053

58. Paul R, Fincher C. *Bangladesh sees worst single-day surge in dengue cases and deaths this year*. Reuters. 2025 Sep 21.

59. Rahman A. *Dengue deaths up 150%, cases double compared to last year*. Bonik Barta. 2025 Sep 22.

60. UNB. *8 more dead, 778 hospitalised as Bangladesh fails to curb dengue*. United News of Bangladesh. 2025 Nov 23.

61. Paul R. *Dengue cases surge across Bangladesh as experts call for urgent action*. Reuters. 2025 Oct 7.

62. DGHS/UNICEF. Dengue Dynamic Dashboard for Bangladesh. Health Emergency Operation Center & Control Room, Directorate General of Health Services. Accessed 2025 Dec 8.

63. News Desk. *Dengue: Four more die, 920 hospitalised in 24Hrs*. Daily Sun. 2025 Nov 18.

64. Asaduzzaman M, Khan EA, Hasan MN, et al. The 2023 dengue fatality in Bangladesh: Spatial and demographic insights. *IJID Regions*. 2025;15:100654. https://doi.org/10.1016/j.ijregi.2025.100654

65. Hossain MS, Noman AA, Mamun SMAA, Mosabbir AA. Twenty-two years of dengue outbreaks in Bangladesh: Epidemiology, clinical spectrum, serotypes, and future disease risks. *Trop Med Health*. 2023;51(1):37. https://doi.org/10.1186/s41182-023-00528-6

66. Barr JS, Martin LE, Tate AT, Hillyer JF. Warmer environmental temperature accelerates aging in mosquitoes, decreasing longevity and worsening infection outcomes. *Immun Ageing*. 2024;21:61. https://doi.org/10.1186/s12979-024-00465-w

67. Perdomo HD, Khorramnejad A, Cham NM, Kropf A, Sogliani D, Bonizzoni M. Prolonged exposure to heat enhances mosquito tolerance to viral infection. *Commun Biol*. 2025;8:168. https://doi.org/10.1038/s42003-025-07617-8

68. Jacobo J. *Mosquitoes found in Iceland for 1st time as temperatures in the region rise*. ABC News. 2025 Oct 22.

69. Galeana-Pizaña JM, Cruz-Bello GM, Caudillo-Cos CA, Jiménez-Ortega AD. Impact of deforestation and climate on spatio-temporal spread of dengue fever in Mexico. *Spat Spatio-Temporal Epidemiol*. 2024;50:100679. https://doi.org/10.1016/j.sste.2024.100679

70. Andrade AC, Falcão LA, Borges MA, Leite ME, Espírito Santo MM. Are land use and cover changes and socioeconomic factors associated with the occurrence of dengue fever? A case study in Minas Gerais State, Brazil. *Resources*. 2024;13(3):38. https://doi.org/10.3390/resources13030038

71. Chaves LS, Conn JE, López RV, Sallum MA. Abundance of impacted forest patches <5 km2 is a key driver of the incidence of malaria in Amazonian Brazil. *Sci Rep*. 2018;8(1):7077. https://doi.org/10.1038/s41598-018-25344-5

72. Nawar N, Sorker R, Chowdhury FJ, Mostafizur Rahman Md. Present status and historical changes of urban green space in Dhaka City, Bangladesh: A remote sensing driven approach. *Environ Chall*. 2022;6:100425. https://doi.org/10.1016/j.envc.2021.100425

73. IIED. *Hot Cities: Dhaka*. International Institute for Environment and Development, London. 2024 June.

74. World Bank. *Bangladesh faces health and economic risks from rising temperature*. Press Release. 2025 Sep 16.

75. Banu S, Hu W, Guo Y, Hurst C, Tong S. Projecting the impact of climate change on dengue transmission in Dhaka, Bangladesh. *Environ Int*. 2014;63:137-142. https://doi.org/10.1016/j.envint.2013.11.002

76. Quam J, Campbell S. South Asia: Urban Geography I – Dhaka. In: *The Eastern World: Daily Readings on Geography*. College of DuPage Digital Press; 2022.

77. UNB. *Dhaka world's 2nd largest city with 36.6 million: UN*. The Daily Star. 2025 Nov 26.

78. Sultana A, Islam A, Hosna A, Tahsin A, Islam A. The impact of urbanization on the proliferation of *Aedes aegypti* (Diptera: Culicidae) mosquito population in Dhaka Mega City, Bangladesh. *Bangladesh J Zool*. 2024;52(2):201-215. https://doi.org/10.3329/bjz.v52i2.77460

79. Kamal AS, Al-Montakim MdN, Hasan MdA, et al. Relationship between urban environmental components and dengue prevalence in Dhaka City—An approach of spatial analysis of satellite remote sensing, hydro-climatic, and census dengue data. *Int J Environ Res Public Health*. 2023;20(5):3858. https://doi.org/10.3390/ijerph20053858

80. Roy S, Biswas A, Shawon MT, Akter S, Rahman MM. Land use and meteorological influences on dengue transmission dynamics in Dhaka City, Bangladesh. *Bull Natl Res Cent*. 2024;48:32. https://doi.org/10.1186/s42269-024-01188-0

81. Inspira Advisory and Consulting Limited. *Challenges of slum living in Bangladesh: A closer look at WASH inequities in Bangladesh's slums*. Inspira-bd.com. 2023 Jul 17.

82. Paulson W, Kodali NK, Balasubramani K, et al. Social and housing indicators of dengue and chikungunya in Indian adults aged 45 and above: Analysis of a nationally representative survey (2017–18). *Arch Public Health*. 2022;80(1):125. https://doi.org/10.1186/s13690-022-00868-5

83. UNICEF. *230 tons of fecal waste end up in open water bodies in Dhaka daily — UNICEF and WaterAid call for stronger sanitation management*. UNICEF Bangladesh. 2025 Feb 25.

84. Alam HMN. *Dhaka's drains, dengue, and denial*. The Daily Star. 2025 Jul 10.

85. Islam J, Asif MH, Rahman S, Hasan M. Exploring mosquito hazards in Bangladesh: Challenges and sustainable solutions. *IUBAT Rev*. 2024;7(2):1–29. https://doi.org/10.3329/iubatr.v7i2.78792

86. *Nature India*. Poor access to tap water linked to dengue risk. 2021. doi:10.1038/nindia.2021.27

87. UN Bangladesh. *A roundtable discussion on 'Solid Waste Management – Challenges and Solutions for Bangladesh'*. United Nations Bangladesh. 2024 Oct 3.

88. Sasi MS, Lal N. The impact of solid waste management practices on vector-borne disease risk in Thiruvananthapuram. *Int J Multidiscip Res*. 2024;6(4):1-10. https://doi.org/10.36948/ijfmr.2024.v06i04.26724

89. Rosser JI, Openshaw JJ, Lin A, et al. Seroprevalence, incidence estimates, and environmental risk factors for dengue, chikungunya, and Zika infection amongst children living in informal urban settlements in Indonesia and Fiji. *BMC Infect Dis*. 2025;25(1):51. https://doi.org/10.1186/s12879-024-10315-1

90. World Health Organization. *Climate change, pollution and health: Impact of chemicals, waste and pollution on human health*. Executive Board EB154/24. Geneva: WHO; 2023 Dec 18.

91. Lu HC, Lin FY, Huang YH, Kao YT, Loh EW. Role of air pollutants in dengue fever incidence: Evidence from two southern cities in Taiwan. *Pathog Glob Health*. 2022;117(6):596-604. https://doi.org/10.1080/20477724.2022.2135711

92. Mailepessov D, Ong J, Aik J. Influence of air pollution and climate variability on dengue in Singapore: A time-series analysis. *Sci Rep*. 2025;15(1):13467. https://doi.org/10.1038/s41598-025-97068-2

93. Ju X, Zhang W, Yimaer W, et al. How air pollution altered the association of meteorological exposures and the incidence of dengue fever. *Environ Res Lett*. 2022;17(12):124041. doi:10.1088/1748-9326/aca59f

94. Thongtip S, Sapbamrer P, Chaichanan P, Chiablam S, Pimonsree S. Association of meteorology and air quality with dengue fever incidence in upper northern Thailand. *EnvironmentAsia*. 2025;18(1):164-173. https://doi.org/10.14456/ea.2025.13

95. Mohammad AKH, Che Dom N, Do Camalxaman S, Syed Ismail SN. Correlational analysis of air pollution index levels on dengue surveillance data: A retrospective study in Melaka, Malaysia. *J Sustain Sci Manag*. 2020;15(8):1-9. https://doi.org/10.46754/jssm.2020.12.012

96. Carneiro MAF, Alves BCA, Gehrke FS, et al. Environmental factors can influence dengue reported cases. *Rev Assoc Med Bras*. 2017;63(11):957-961. https://doi.org/10.1590/1806-9282.63.11.957

97. Tewari P, Ma P, Gan G, et al. Non-linear associations between meteorological factors, ambient air pollutants and major mosquito-borne diseases in Thailand. *PLoS Negl Trop Dis*. 2023;17(12):e0011763. https://doi.org/10.1371/journal.pntd.0011763

98. Maquart P-O, Froehlich Y, Boyer S. Plastic pollution and infectious diseases*. Lancet Planet Health*. 2022;6(10):e842-e845. https://doi.org/10.1016/S2542-5196(22)00198-X

99. Afroze CA, Ahmed MN, Azam MN, Jahan R, Rahman H. Microplastics pollution in Bangladesh: A decade of challenges, impacts, and pathways to sustainability. *Integr Environ Assess Manag*. 2025 Aug 11. https://doi.org/10.1093/inteam/vjaf108

100. Meijer LJJ, van Emmerik T, van der Ent R, Schmidt C, Lebreton L. More than 1000 rivers account for 80% of global riverine plastic emissions into the ocean. *Sci Adv*. 2021;7(18):eaaz5803. https://www.science.org/doi/10.1126/sciadv.aaz5803

101. Environment and Social Development Organization (ESDO). *Huge use of poly bag: 78 thousand tons of waste in a year*. ESDO. 2021 Jun 5.

102. Hamid H. Bangladesh's Plastic Tide: A Nation Grappling with a Mounting Crisis. International Society for Human Rights. June 4, 2025.

103. Li JH, Liu XH, Liang GR, et al. Microplastics affect mosquito from aquatic to terrestrial lifestyles and are transferred to mammals through mosquito bites. *Sci Total Environ*. 2024;917:170547. https://doi.org/10.1016/j.scitotenv.2024.170547

104. Shopon HU-R. *Dhaka: Unplanned city faces a grand spectacle of risks* (Article in Bengali). Deutsche Welle. 2025 Jul 23.

105. Hassan A. *Building faults overlooked if officials are appeased*. Prothomalo. 2024 Mar 9.

106. Tribune Desk. Potential *Aedes* breeding grounds found in 70% DNCC homes. Dhaka Tribune. 2020 Jul 4.

107. Staff Correspondent. *Greetings and promises on our 15th anniversary. Aedes reproduction--High rises mainly responsible*. Daily Sun. 2021 May 6.

108. TBS Report. Construction work will be halted if *Aedes* larvae found on site: Mayor Taposh. The Business Standard. 2024 Apr 25.

109. Staff Correspondent. *Dengue infection: 13 Dhaka wards at high risk*. The Daily Star. 2025 Jun 19.

110. Kamal M, Sultana R, Julkarnayeen M. Dengue crisis prevention and control: Governance

challenges and way forward. Transparency International Bangladesh. 2023 Oct 30.

111. Islam MdJ. Dengue rages as TK1,000CR lost to futile mosquito control efforts. The Business Standard. 2025 Nov 16.

112. Hossain M, Rakib MS, Hasan MM, Powshi SN, Islam E, Islam NN. The 2023 dengue outbreak in Bangladesh: An epidemiological update. Health Sci Rep. 2025;8(5):e70852. https://doi.org/10.1002/hsr2.70852

113. TBS Report. Dhaka south increases mosquito control budget amid rising dengue infections, reports revenue growth. The Business Standard. 2025 Aug 6.

114. Vourc'h G, Plantard O, Morand S. How Does Biodiversity Influence the Ecology of Infectious Disease?. New Frontiers of Molecular Epidemiology of Infectious Diseases. 2011;291-309. Published 2011 Jun 28. https://doi.org/10.1007/978-94-007-2114-2_13

115. Sommese F. Nature-Based Solutions to Enhance Urban Resilience in the Climate Change and Post-Pandemic Era: A Taxonomy for the Built Environment. Buildings. 2024; 14(7):2190. https://doi.org/10.3390/buildings14072190

116. World Health Organization. Chapter 3, Vector Management and Delivery of Vector Control Services. In: Dengue: Guidelines for Diagnosis, Treatment, Prevention and Control: New Edition. Geneva, Switzerland: World Health Organization; 2009:57-86.

117. Sim S, Ng LC, Lindsay SW, Wilson AL. A greener vision for vector control: The example of the Singapore dengue control programme. PLoS Negl Trop Dis. 2020;14(8):e0008428. Published 2020 Aug 27. https://doi.org/10.1371/journal.pntd.0008428

118. de Oliveira Lemos L, Oscar Júnior AC, de Assis Mendonça F. Urban climate maps as a public health tool for urban planning: The case of dengue fever in Rio de Janeiro/Brazil. Urban Climate. 2021;35:100749. https://doi.org/10.1016/j.uclim.2020.100749

119. Arunachalam N, Tyagi BK, Samuel M, et al. Community-based control of Aedes aegypti by adoption of eco-health methods in Chennai City, India. Pathog Glob Health. 2012;106(8):488-496. https://doi.org/10.1179/2047773212Y.0000000056

120. Times of India. Bengaluru deploys 700 volunteers, 240 inspectors to curb rising dengue cases. May 22, 2025.

121. Ane RL, Herbuela VRDM, Wahid I, et al. Influence of water supply conditions and water storage containers on Aedes mosquito abundance in Makassar City, Indonesia. Preprint. Research Square. Published 2021. https://doi.org/10.21203/rs.3.rs-189214/v1

122. Agus Nurjana M, Srikandi Y, Wijatmiko TJ, et al. Water containers and the preferable conditions for laying eggs by Aedes mosquitoes in Maros Regency, South of Sulawesi, Indonesia. J Water Health. 2023;21(11):1741-1746. https://doi.org/10.2166/wh.2023.270

123. Tana S, Umniyati S, Petzold M, Kroeger A, Sommerfeld J. Building and analyzing an innovative community-centered dengue-ecosystem management intervention in Yogyakarta, Indonesia. Pathog Glob Health. 2012;106(8):469-478. https://doi.org/10.1179/2047773212Y.0000000062

124. Gibb R, Colón-González FJ, Lan PT, et al. Interactions between climate change, urban infrastructure and mobility are driving dengue emergence in Vietnam. Nat Commun. 2023;14(1):8179. Published 2023 Dec 11. https://doi.org/10.1038/s41467-023-43954-0

125. Jency PJ, Rishla KE, Jabir MM, Vijayakumar B, Dinesh RJ, Dhanalakshmi R. Anti-Dengue Sanitation Practices: A Health Education Approach for Municipal Sanitary Workers in Puducherry, India. Cureus. 2024;16(7):e65227. Published 2024 Jul 23. https://doi.org/10.7759/cureus.65227

126. Abeyewickreme W, Wickremasinghe AR, Karunatilake K, Sommerfeld J, Axel K. Community mobilization and household level waste management for dengue vector control in Gampaha district of Sri Lanka; an intervention study. Pathog Glob Health. 2012;106(8):479-487. https://doi.org/10.1179/2047773212Y.0000000060

127. Database of Government Tenders of Dhaka North City Corporation. Dhaka North City Corporation active tender list. Accessed January 6, 2026.

128. Hossain S, Mostafa M. Huge funds to prevent water logging go down the drain. Prothom Alo. July 27, 2020.

129. UNB. Despite multiple master plans and spending over Tk 750 crore, Dhaka's waterlogging crisis persists. The Business Standard. September 20, 2024.

130. Nandy, D. "Tk 10cr for a food court, Tk 1cr for toilet!" The Daily Star, 5 April, 2025.

131. Roney M. Dhaka's drainage problem. The Financial Express. July 30, 2024.

132. Al Amin M. WASA investment to solve waterlogging goes down the drain. The Business Standard; January 26, 2021.

133. WHO. Dengue: Guidelines for Diagnosis, Treatment, Prevention and Control. New ed. Geneva, Switzerland: World Health Organization; 2009. Chapter 3: Vector Management and Delivery of Vector Control Services.

134. Mowla QA, Islam MS. Natural drainage system and water logging in Dhaka: measures to address the problems. Journal of Bangladesh Institute of Planners. 2013;6:23-33.

135. Alam S, Rahman A, Yunus A. Designing stormwater drainage network for urban flood mitigation using SWMM: a case study on Dhaka City of Bangladesh. Am J Water Resour. 2023;11(2):65-78. https://doi.org/10.12691/ajwr-11-2-3

136. Castro MC, Kanamori S, Kannady K, Mkude S, Killeen GF, Fillinger U. The importance of drains for the larval development of lymphatic filariasis and malaria vectors in Dar es Salaam, United Republic of Tanzania. PLoS Negl Trop Dis. 2010;4(5):e693. Published 2010 May 25. https://doi.org/10.1371/journal.pntd.0000693

137. Charlesworth SM, Kligerman DC, Blackett M, Warwick F. The potential to address disease vectors in favelas in Brazil using sustainable drainage systems: Zika, drainage and greywater management. Int J Environ Res Public Health. 2022;19(5):2860. https://doi.org/10.3390/ijerph19052860

138. Rania P, Junaid Y. Analysis of the Relationship Between Waste Management Systems and Dengue Fever Cases in Urban Areas. Magenta Journal De Healthymedi. 2025;2(4):179-192. https://doi.org/10.37899/mjdh.v2i4.291

139. Bertacco EAM, Prestes-Carneiro LE, de Araújo RR, D'Andrea LAZ, Pinheiro LS, Flores EF. Impact of storm drains on the maintenance of dengue endemicity in Presidente Prudente, São Paulo, Brazil: a geospatial and epidemiologic approach. Front Public Health. 2024;12:1442622. Published 2024 Sep 10. https://doi.org/10.3389/fpubh.2024.1442622

140. Souza RL, Mugabe VA, Paploski IAD, et al. Effect of an intervention in storm drains to prevent Aedes aegypti reproduction in Salvador, Brazil. Parasites Vectors. 2017;10:328. https://doi.org/10.1186/s13071-017-2266-6

141. Bhardwaj N. After water, MC to privatise sewerage maintenance. The Times of India. September 13, 2025.

142. Kayesh MEH, Khalil I, Kohara M, Tsukiyama-Kohara K. Increasing Dengue Burden and Severe Dengue Risk in Bangladesh: An Overview. Trop Med Infect Dis. 2023;8(1):32. Published 2023 Jan 3. https://doi.org/10.3390/tropicalmed8010032

143. Dhaka Tribune. WHO expert: Fogging won't help destroy Aedes. April 8, 2025.

144. Low GK, Jiee SF, Lim SH, Omosumwen OF, Shanmuganathan S. The effectiveness of dengue vector control: A Meta-review. Tropical Medicine & International Health. 2025;30(10):1069-1086. https://doi.org/10.1111/tmi.70018

145. Al Noman A, Das D, Nesa Z, et al. Importance of wolbachia-mediated biocontrol to reduce dengue in Bangladesh and other dengue-endemic developing countries. Biosafety and Health. 2023;5(2):69-77. https://doi.org/10.1016/j.bsheal.2023.03.003

146. Martini M, Adi MS. Ovitrap Training Improves Dengue Hemorrhagic Fever (DHF) Control. Jurnal Empathy Pengabdian Kepada Masyarakat. 2025;6(1):23-29. https://doi.org/10.37341/jurnalempathy.v6i1.315

147. Guo X, Liu S, Liu X, et al. An improved ovitrap-based surveillance framework: facilitating cost-efficient monitoring and efficacy assessment of integrated vector management strategies for dengue outbreak control. Parasites Vectors. 2025;18:380. https://doi.org/10.1186/s13071-025-07002-8

148. Smith Gueye C, Newby G, Gosling RD, et al. Strategies and approaches to vector control in nine malaria-eliminating countries: a cross-case study analysis. Malar J. 2016;15:2. Published 2016 Jan 4. https://doi.org/10.1186/s12936-015-1054-z

149. Beier JC, Keating J, Githure JI, Macdonald MB, Impoinvil DE, Novak RJ. Integrated vector management for malaria control. Malaria Journal. 2008;7(Suppl 1):S4. https://doi.org/10.1186/1475-2875-7-S1-S4

150. Saadatian-Elahi M, Rabilloud M, Möhlmann TWR, et al. Effectiveness of integrated vector management on the incidence of dengue in urban Malaysia: a cluster-randomised controlled trial. Lancet Infect Dis. 2025;25(9):977-985. https://doi.org/10.1016/S1473-3099(25)00086-6

151. Hapugoda M, Gunawardene NS, Ranathunge T, et al. Suppression of Aedes albopictus in Sri Lanka using the Sterile Insect Technique (SIT) with a sustained effect. Suppression d'Aedes albopictus au Sri Lanka grâce à la Technique de l'Insecte Stérile (TIS) avec un effet persistant. Parasite. 2025;32:59. https://doi.org/10.1051/parasite/2025050

152. Sapkota S. Effectiveness of integrated vector management for controlling Aedes aegypti and Aedes albopictus mosquitoes and managing dengue in Tharu Village, Chitwan, Nepal. Intergovernmental Research and Policy Journal (IRPJ). July 21, 2025.

153. Chanda E, Masaninga F, Coleman M, et al. Integrated vector management: The Zambian experience. Malar J. 2008;7:164. Published 2008 Aug 27. https://doi.org/10.1186/1475-2875-7-164

154. Alam KF, Islam T. A critical analysis of the Bangladesh national dengue prevention and control strategy (2024-2030): a comprehensive roadmap in an era of climate change. SSB Global J Med Sci. 2025;6(02):26-29. https://doi.org/10.61561/ssbgjms.v6i02.99

155. Osail SM, Sanny SI, Zerin T. A narrative review of dengue disaster in Bangladesh: Unprecedented outbreak and Management Failure. Journal of Bacteriology and Virology. 2024;54(2):63-75. https://doi.org/10.4167/jbv.2024.54.2.063

156. FE Report. Fragile health care fails to address dengue crisis: TIB. The Financial Express. October 31, 2023.

157. Alam H, Adhikary TS. Dengue outbreak: Patients from outside swarm city hospitals. The Daily Star. June 24, 2025.

158. Editorial. Barguna's dengue crisis is exposing public health gaps. The Daily Star. June 26, 2025.

159. Billah M, Shampa N, Henderson A. Escalating dengue burden and emerging hotspots in Bangladesh: A Decade of Trends and 2025 Forecast. International Journal of Data Science and Analysis.

2025;11(5):136-142. https://doi.org/10.11648/j.ijdsa.20251105.12

160. WHO. Dengue clinical management: facilitator's training manual. Geneva, Switzerland: World Health Organization; 2013. ISBN-13: 978-92-9061-622-1.

161. Salehi M, Mousa Farkhani E, Moghri J, Ghasemian A, Tabatabaee SS, Hooshmand E. Global dengue fever management in health systems: identifying strategies, challenges and solutions - a scoping review protocol. BMJ Open. 2025;15(4):e097085. Published 2025 Apr 25. https://doi.org/10.1136/bmjopen-2024-097085

162. Ambas J, Kamesyworo K, Lidiyawati H. The role of community health nurses in handling dengue fever outbreaks in residential areas. Oshada. 2024;1(4):45-60. https://doi.org/10.62872/yaf58r34

163. Suwanbamrung C, Le CN, Maneerattanasak S, et al. Developing and using a dengue patient care guideline for patients admitted from households to Primary Care Units and the District Hospital: A community participatory approach in southern Thailand. One Health. 2020;10:100168. https://doi.org/10.1016/j.onehlt.2020.100168

164. Nontapet O, Maneerattanasak S, Jaroenpool J, et al. Understanding dengue solution and larval indices surveillance system among village health volunteers in high- and low-risk dengue villages in southern Thailand. One Health. 2022;15:100440. Published 2022 Oct 7. https://doi.org/10.1016/j.onehlt.2022.100440

165. Usmani NG, Chandra P, Hassan T, et al. Exploring Knowledge, Attitudes, and Practices Regarding Dengue Fever Among University Students in Bangladesh: A Cross-Sectional Study. Health Sci Rep. 2025;9(1):e71714. Published 2025 Dec 30. https://doi.org/10.1002/hsr2.71714

166. Billah AHM. Dengue Fever Awareness: Combating the Menace in Bangladesh. Press Information Department, Government of the People's Republic of Bangladesh; August 9, 2023.

167. Sarkar SR, Ray NC. Dengue fever: a public health threat to Bangladesh. Community Based Med J. 2024;13(2):282-289. https://doi.org/10.3329/cbmj.v13i2.75323

168. Sarker R, Roknuzzaman AS, Emon FA, Dewan SM, Hossain MdJ, Islam MdR. A perspective on the worst ever Dengue Outbreak 2023 in Bangladesh: What makes this old enemy so deadly, and how can we combat it? Health Science Reports. 2024;7(5):e2077. https://onlinelibrary.wiley.com/doi/10.1002/hsr2.2077

169. Reza SB, Shoukhin MdM-U-R, Khan SA, Rahman Dewan SM. Dengue outbreak 2023 in Bangladesh: From a local concern to a global public health issue. Science Progress. 2024;107(4):1-18. https://doi.org/10.1177/00368504241289462

170. WHO. Fighting dengue together: how community engagement is transforming health in Khulna City, Bangladesh. World Health Organization. September 26, 2025.

171. Kurniawati RD, Martini M, Wahyuningsih NE, Sutiningsih D. Integration of Dengue Fever Prevention Into School Learning: An Experimental Study-Interactive Media for Dengue Fever Prevention. Media Publikasi Promosi Kesehatan Indonesia (MPPKI). 2025;8(12):1590-1601. https://doi.org/10.56338/mppki.v8i12.8723

172. Dsouza RP, Rodrigues DE, Saldanha PM. Effectiveness of school-based video-assisted health education program on mosquito-borne disease among upper primary children. Journal of Health and Allied Sciences NU. 2022;13(01):98-102. https://doi.org/10.1055/s-0042-1749181

173. Jaroenpool J, Maneerattanasak S, Adesina F, et al. A primary school-based dengue solution model for post-COVID-19 in southern Thailand: Students understanding of the dengue solution and larval indices surveillance system. PLoS One. 2024;19(12):e0313171. Published 2024 Dec 31. https://doi.org/10.1371/journal.pone.0313171

174. Soo WF, Gunasekaran K, Ng DX, Kwek K, Tan NC. Literacy and attitude of Asian youths on dengue and its prevention in an endemic developed community. Front Public Health. 2024;12:1361717. Published 2024 Mar 8. https://doi.org/10.3389/fpubh.2024.1361717

175. Dapari R, Jumidey AQ, Manaf RA, et al. School-based health education effect on knowledge, attitude, and practices of dengue prevention among school children: A systematic review. Discover Social Science and Health. 2025;5(1):31. https://doi.org/10.1007/s44155-025-00181-w

176. Caprara A, Lima JW, Peixoto AC, et al. Entomological impact and social participation in dengue control: a cluster randomized trial in Fortaleza, Brazil. Trans R Soc Trop Med Hyg. 2015;109(2):99-105. https://doi.org/10.1093/trstmh/tru187

177. Oo TS, Lin C-Y, Tsai Y-T, et al. Socio-ecological factors of dengue preventive practices among Myanmar migrants in Samut Sakhon Province, Thailand. BMC Infectious Diseases. 2025;25(1):1586. https://doi.org/10.1186/s12879-025-12017-8

178. Ho SH, Lim JT, Ong J, Hapuarachchi HC, Sim S, Ng LC. Singapore's 5 decades of dengue prevention and control-Implications for global dengue control. PLoS Negl Trop Dis. 2023;17(6):e0011400. Published 2023 Jun 22. https://doi.org/10.1371/journal.pntd.0011400

179. Methiyothin T, Ahn I. Forecasting dengue fever in France and Thailand using XGBoost. In: 2022 Asia-Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA ASC); 2022; Chiang Mai, Thailand. pp. 677-680. https://doi.org/10.23919/APSIPAASC55919.2022.9979936

180. Finch E, Chang CC, Kucharski A, et al. Climate variation and serotype competition drive dengue outbreak dynamics in Singapore. Nat Commun. 2025;16:11364. https://doi.org/10.1038/s41467-025-66411-6

181. Marcombe S, Chonephetsarath S, Thammavong P, Brey PT. Alternative insecticides for larval control of the dengue vector Aedes aegypti in Lao PDR: insecticide resistance and semi-field trial study. Parasit Vectors. 2018;11(1):616. Published 2018 Dec 3. https://doi.org/10.1186/s13071-018-3187-8

182. de Castro Poncio L, Apolinário dos Anjos F, de Oliveira DA, et al. Prevention of a dengue outbreak via the large-scale deployment of sterile insect technology in a Brazilian city: A prospective study. The Lancet Regional Health - Americas. 2023;21:100498. https://doi.org/10.1016/j.lana.2023.100498

183. Aira J, Olivares T, Delicado FM, Vezzani D. Mosquiot: A system based on IOT and machine learning for the monitoring of Aedes aegypti (Diptera: Culicidae). IEEE Transactions on Instrumentation and Measurement. 2023;72:1-13. https://doi.org/10.1109/TIM.2023.3265119

184. Singapore National Environment Agency. Singapore facilitates collaboration on new mosquito suppression techniques on ASEAN Dengue Day. National Environment Agency (NEA) Singapore. June 7, 2018.

185. Mphande-Nyasulu FA, Yap NJ, Teo CH, Chang LY, Tay ST. Outbreak preparedness and response strategies in ASEAN member states: a scoping review. IJID Reg. 2024;12:100430. Published 2024 Aug 22. https://doi.org/10.1016/j.ijregi.2024.100430

186. SEA-ROADS. One Health Regional Approach for Integrated and Interconnected Urban Dengue Surveillance in Southeast Asia. UMR Espace-Dev; 2025.

187. Phommasack B, Jiraphongsa C, Ko Oo M, et al. Mekong Basin Disease Surveillance (MBDS): a trust-based network. Emerg Health Threats J.

2013;6:10.3402/ehtj.v6i0.19944. https://doi.org/10.3402/ehtj.v6i0.19944

188. Messina JP, Brady OJ, Golding N, et al. The current and future global distribution and population at risk of dengue. Nat Microbiol. 2019;4(9):1508-1515. https://doi.org/10.1038/s41564-019-0476-8

189. Haider N, Hasan MN, Onyango J, et al. Global dengue epidemic worsens with record 14 million cases and 9000 deaths reported in 2024. Int J Infect Dis. 2025;158:107940. https://doi.org/10.1016/j.ijid.2025.107940

190. US CDC. Dengue on the rise: Get the facts. Centers for Disease Control and Prevention. 2025 May 29.