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Addressing the Dual Threat of Dengue and Influenza in Bangladesh: A Perspective on the Prevention and Preparedness Strategies

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ABSTRACT

Background and Aim: In Bangladesh, dengue fever and influenza pose serious public health risks due to their high rates of morbidity and fatality. Frequent outbreaks have been caused by dengue, a virus spread by mosquitoes that causes flu-like symptoms, particularly during the monsoon season. Another infectious respiratory illness that varies every year is influenza. Both illnesses frequently co-circulate in tropical areas like Bangladesh, raising the possibility of co-infection and putting vulnerable groups at higher risk. The purpose of the article is to explore the effects of dengue and influenza co-infection in Bangladesh, looking at present issues and possible solutions to this dual health burden.

Methodology: This perspective piece gathers data from authoritative sources, including PubMed, the World Health Organization, Directorate General of Health Services, Ministry of Health and Family Welfare, Bangladesh, and the European Center for Disease Prevention and Control. Relevant literature on dengue and influenza incidence, control measures, and co-infection dynamics was reviewed.

Discussion: In Bangladesh, dengue incidence are still on the rise, while influenza infections have climbed, especially during the winter. The country's healthcare system may be overburdened by the simultaneous spread of both diseases, particularly if dengue rates keep rising and influenza cases rise. To lessen the effects of these illnesses, effective community awareness campaigns, vector control initiatives, and early diagnosis techniques are crucial.

Conclusion: Bangladesh must emphasize increased preventative and preparation measures, such as better monitoring, public health communication, and vaccine development research, given the twin danger posed by dengue and influenza. To lower the likelihood of co-infection and avert future public health emergencies, coordinated actions are essential.

1 | Background

Dengue virus is spread by female Aedes mosquitoes, mostly by *Aedes aegypti* and to a lesser extent by *Aedes albopictus* [1, 2]. The 10.7 kb positive-sense, single-stranded RNA virus belongs to the Flaviviridae family. There are usually four DENV serotypes, which are genetically related but antigenically different. Recently, DENV serotype 5 was found to have been present in the sylvatic cycle. Both *Ae. aegypti* and *Ae. albopictus* mosquitoes bite during the day, but *Ae. Albopictus* can also bite at night [2]. In Bangladesh, dengue cases peak in September during the monsoon and post-monsoon seasons. The peak has shifted from August to September in recent years. Climate change may lead to year-round transmission by the end of the 21st century [3]. In Bangladesh, the influenza virus plays a significant role in the burden of acute respiratory illness. Influenza, caused by

influenza viruses (types A, B, C, and D), is a contagious respiratory infection that is found worldwide. IAV is a virus with a diameter of approximately 100 nm and is part of the Orthomyxoviridae family and Alphainfluenzavirus genus. It is an enveloped virus with eight RNA segments, which are negative-sense, single-stranded. The IAV can be categorized into various subtypes based on the antigenic properties of the HA and NA proteins. In Bangladesh, a total of 30 IAV subtypes have been identified in humans, avian species, and the environment. Some of these subtypes, such as H5N1, H7N9, and H9N2, can infect both birds and humans. The incidence and severity of influenza vary from year to year due to the circulation of different viral strains [4]. In tropical nations where the peak season for dengue frequently overlaps with that of influenza, co-infections of dengue and influenza may occur. This article piece focuses on the effects of dengue and influenza coinfection in Bangladesh and discusses strategies and potential future approaches for managing these dual diseases burden.

2 | Methodology

This paper provides a well-informed perspective on the relationship between dengue and flu in Bangladesh, with a particular emphasis on data reporting methods and diagnostic difficulties. According to the nature of a perspective, this study offers insight based on the authors' experience and the available data rather than attempting to conduct a systematic evaluation. The European Center for Disease Prevention and Control (ECDC), the World Health Organization (WHO), the Directorate General of Health Services (DGHS), the Ministry of Health and Family Welfare in Bangladesh, the Institute of Epidemiology Disease Control and Research (IEDCR), PubMed, and other reliable sources were used to compile the data. Keywords like “dengue,” “influenza,” “viral infection,” “co-infection,” and “Bangladesh” were included in the search to set the scene and bolster the argument made in this article.

3 | Current Scenario of Dengue in Bangladesh

In 2019, Bangladesh faced a major dengue epidemic, with 101,354 cases and 164 deaths. However, this year's situation is worse, with more cases and the highest recorded death toll [5]. A recent study estimated that around 40 million people in the country are affected, with 2.4 million new infections occurring annually. The first dengue outbreak in Bangladesh was reported in 1964 in East Pakistan, and the official documented outbreak was in 2000, with 5551 cases and 93 deaths reported [2]. This year, the upsurge in cases began earlier, around the last week of April, compared to previous years. As of September 2023, the country had reported a total of 187,725 dengue cases and 909 deaths. During the week of September 18–24, 2023, there were 20,041 new cases, a 3.5% increase compared to the previous week, with the highest number of daily hospitalized cases, 10,572, reported on September 2023. According to the data from IEDCR (source: https://tinyurl.com/3jzwnc9a), in 2023, the dengue serotype distribution among affected individuals in Bangladesh was as follows: DENV 1 accounted for 3.3% of cases, DENV 2 for 70.2%, DENV 3 for 23.9%, DENV 2 + 3 (co-infection) for 2.2%, and DENV 4 for 0.4%. In comparison, the distribution in 2024 showed a slight variation: DEN 1 accounted for 1.9% of cases, DENV 2 for 70.2%, DENV 3 for 20.2%, and DENV 2 + 3 (co-infection) for 7.7%, while DENV 4 was not significantly represented. These percentages highlight the dominance of DENV 2 in both years, with a notable increase in co-infections in 2024. In terms of gender, 61% of cases were male and 39% were female, with the most affected age group being 16–35 years, accounting for 50% of cases. The highest number of deaths occurred in the age group of 31–60 years, representing 48% of the total. Currently, Dhaka accounts for approximately 57% of reported dengue cases and 667 deaths [6] (p5). In the epidemics of 2019 and 2021, DENV-3 was the most common serotype [2].

According to IEDCR (source: https://tinyurl.com/3jzwnc9a) and DGHS (source: https://tinyurl.com/yvxah93s), the yearly dengue cases and deaths in Bangladesh indicate significant fluctuations over the 5-year period from 2020 to 2024. In 2020, there were 1405 reported cases and 7 deaths. The numbers surged in subsequent years, reaching 28,429 cases with 105 deaths in 2021, and 62,382 cases with 281 deaths in 2022. The most dramatic increase was observed in 2023, with 321,017 cases and 1678 deaths, followed by a decline in 2024 to 100,469 cases and 467 deaths. This trend underscores the critical public health challenge posed by dengue in the region.

Due to a high number of cases, the DGHS has taken various measures, including repurposing hospitals for dengue cases and establishing dengue wards, conducting hospital-based surveillance and mass awareness campaigns. Diagnostic kits (184000), IV saline, and supportive medications have been distributed, and vector control activities are carried out by using alternative insecticides [7].

The current outbreak exposes gaps in monitoring early warning systems and, data collection. It highlights the need for improving healthcare services and conducting vital research. The existing weak surveillance and risk management systems are insufficient to address the impending dengue risk in Bangladesh [8]. Currently, dengue cases are only officially recorded when patients are hospitalized [2]. The recent outbreak in Bangladesh may be attributed to various factors, including the country's geographic location, rapid urbanization, deforestation, high population density, stagnant water and sewage effluent, storage of water in household utilities, inadequate education, knowledge gaps, insufficient legislative rules, ineffective mosquito control strategies, and favorable climate conditions. These combined factors create an environment conducive to the propagation of mosquitoes and the spread of dengue [3, 9]. Additionally, genetic mutations and changes in serotypes may contribute to the increased severity of the disease in recent years [9]. Moreover, international tourists visiting Bangladesh may contribute to the spread of the disease beyond the country's borders.

4 | Influenza and Dengue Co-Infection: A Potential Health Hazard Looms in Bangladesh

In areas where dengue is prevalent, both dengue and influenza cause similar febrile illness, making diagnosis difficult [2]. In 2022, there were 270 confirmed cases of the flu, with a rate of

2.67%. In 2023, as of August, there have been 356 flu-positive cases, with a rate of 32.28%. The influenza cases and circulating strains in Bangladesh over the years 2022 to 2024 reveal important epidemiological insights. In 2022, there were 270 confirmed influenza cases, with 267 caused by Flu A and 3 by Flu B. The year 2023 saw a substantial increase to 906 cases, with 445 caused by Flu A, 437 by Flu B, and 24 co-infections of Flu A + B. In 2024, the total number of cases rose further to 1331, predominantly caused by Flu A with 1329 cases, along with 1 case each of Flu B and Flu A + B co-infection. These statistics highlight the variability and prevalence of influenza strains in the country, with Flu A being the predominant strain [10].

In Bangladesh, the first outbreak of H5N1 in poultry occurred in March 2007, and the first human case was identified in January 2008. As of April 30, 2020, there were eight reported cases of H5N1 infection in humans, resulting in one fatality [11]. In temperate regions, influenza outbreaks typically occur during winter in both the northern and southern hemispheres [12]. However, in tropical areas like Bangladesh, infections are prevalent throughout the year, with major peaks during the rainy seasons. Influenza viruses are linked to respiratory infections in young children (< 5 years) and older adults (≥ 65 years) [13]. In Bangladesh, the influenza burden is relatively elevated, with an estimated yearly incidence of 458 cases per 100,000 individuals and six to eleven influenza-related fatalities per 100,000 individuals across all age demographics. [14]. Factors such as advancements in farming and animal rearing, virus mutation, animal-to-human transmission, intermingling of wild and domestic animals, dietary changes, and urbanization can contribute to the emergence of influenza in humans [11].

The main drivers of influenza epidemics and pandemics are high viral load, transmissibility, susceptibility, and symptomatic patients. Each year, only Hajj Pilgrims receive free vaccination as mandated by the Saudi Health Ministry. However, the current vaccine offers partial protection and may not be effective against mutated variants [15]. Elderly individuals, children, pregnant women, those with pre-existing health issues, and healthcare personnel are at increased risk of contracting influenza and experiencing its complications. Leading public health organizations strongly advocate for vaccine administration among these high-risk groups [16]. To prevent morbidity and mortality, it should be provided free of charge to those at high risk.

Managing dengue outbreaks in Bangladesh is challenging due to favorable climate conditions for mosquito breeding and viral replication year around [2]. The healthcare, especially at the district level, is ill-prepared to handle large-scale dengue outbreaks [3]. In tropical regions where the peak seasons for dengue and influenza often overlap, instances of co-infection with both viruses can occur. Such occurrences have been reported in several studies [17–19]. Without proper preventative strategies, inadequate healthcare infrastructure, limited outbreak preparedness, and a lack of community awareness, Bangladesh may face serious public health disasters if dengue cases continue to rise or if there is a co-infection with influenza.

5 | Discussion

Bangladesh faces a frequent risk level for dengue, according to the CDC, which is particularly concerning given the absence of a widely available treatment or vaccine [8]. However, a dengue vaccine by Sanofi Pasteur has been licensed in 24 countries, excluding Bangladesh [3]. To effectively control the increasing number of dengue cases, it is essential to strengthen both community awareness and vector control programs. Both active and passive surveillance are crucial for obtaining accurate case numbers. While an effective vector control strategy can limit outbreak spread, developing a universal dengue vaccine should be a priority. It is important to identify the cause, and predominant serotype of outbreaks, describe clinical presentations, and identify associated factors.

There are national guidelines for preventing various mosquito-borne diseases, including dengue, in Bangladesh, and their effective implementation should help reduce the frequency of outbreaks. Continuous virological surveillance is essential for early detection of new serotype emergence in circulation and for public health preparedness. Community-based mosquito elimination programs, proven effective in regions such as Kerala, India, Mexico, and Cuba, highlight the importance of sustained community involvement in enhancing vector control efforts [2]. Notably, insecticide resistance has been reported in several countries, including Bangladesh; thus, the effectiveness of specific insecticides at recommended dosages should be regularly evaluated. Although the biological approach of Wolbachia-mediated control of DENV infection remains to be investigated in Bangladesh, it holds promise as a strategy for controlling dengue in the country [20]. To ensure the success of vector control efforts in Bangladesh, it is crucial to identify and implement the most effective strategies, taking into account local ecological and socioeconomic factors. There is a lack of conclusive evidence regarding the effectiveness of any dengue vector control method, highlighting the need for further research to assess and compare approaches to optimize cost-effective dengue prevention.

For some respiratory viruses without approved interventions, a combination of social and physical measures is crucial to reduce outbreaks [15]. In Bangladesh, influenza prevention and control efforts can be timed based on seasonal patterns, considering regional variations for health resource planning [21]. Physical interventions like mask usage, physical distancing, and limiting mass gatherings can help prevent virus transmission. Hand hygiene and proper biosafety measures are also important in limiting viral spread [15]. Enhancing biosafety protocols, strengthening biosecurity measures, wildlife conservation and the effect of deforestation are crucial through widespread communication [11]. Surveillance, vaccines, and antiviral medications are vital to combat and eliminate influenza in Bangladesh [4]. Patients who are coughing and anyone suspected of having influenza should wear a mask at all times until they can be isolated in a private room. If these symptomatic individuals cannot remain at home, they should be encouraged to wear a mask in public places. Individuals at higher risk for influenza complications who are unvaccinated and choose to wear masks can achieve the best protection by wearing a mask [22]. Unlike N95 masks, surgical masks cannot prevent the

inhalation of very small airborne particles due to the lack of a filtration mechanism. However, both types of masks have shown protective effects against large droplets and sprays. There is limited evidence that N95 respirators provide enhanced protection against aerosol viral transmission compared to surgical masks. N95 respirators are recommended for medical professionals and healthcare workers who encounter viral respiratory diseases. For the general public, surgical masks are a cost-effective option that can still offer a degree of protection [23].

For efficient disease control in Bangladesh, a precise diagnosis of dengue and influenza is essential. Serological procedures such RT-PCR, NS1 antigen testing, and IgM and IgG antibody detection are the main methods used to diagnose dengue. The availability of these diagnostic instruments at all healthcare levels is still problematic, though, particularly in rural regions. Viral cultures, RT-PCR, and fast antigen assays are used to diagnose influenza [24]. Faster diagnosis has been made possible by the growing use of fast influenza testing; nevertheless, these techniques can occasionally provide false negative results, making prompt treatments more difficult.

To track the spread of these diseases, the DGHS in Bangladesh oversees the data reporting system, which aggregates diagnostic data from several healthcare institutions. However, under-reporting can result from reporting gaps and uneven access to diagnostic tests, making it more difficult to precisely track co-infections. Enhancing the monitoring system's integration of diagnostic technologies is crucial for early co-infection detection and more efficient public health actions.

Annual vaccination against influenza is necessary because immunity diminishes over time, and various strains may circulate each year. This indicates that the timing of vaccination is crucial to ensure that individuals are safeguarded during the peak periods of influenza season [25]. Bangladesh currently lacks a national influenza vaccination strategy for high-risk populations [15]. Further research is crucial to develop country-specific influenza vaccination guidelines and more effective vaccines that provide longer-lasting protection [25].

As dengue and influenza viruses circulate concurrently in many areas, there is a possibility of individuals experiencing co-infection with both viruses. Managing co-infection with dengue and influenza requires intensive care, including fluid hydration, antipyretics, antibiotics for secondary infections, oxygen support, and critical care interventions. Both dengue and influenza can be life-threatening, so healthcare providers must maintain a high level of suspicion for early diagnosis and optimal outcomes [17]. Co-infection with dengue and influenza viruses could elevate the risk of both illnesses in the most vulnerable populations, making it crucial to emphasize the need for enhanced protection through the administration of the influenza vaccine.

6 | Conclusion

Bangladesh is currently facing a dengue outbreak, and despite the efforts to control it, the number of cases is still increasing. Factors such as favorable conditions for mosquito breeding contribute to the rise in dengue cases. Additionally, 2024 has had an increased incidence of influenza cases relative to prior years. If the influenza cases continue to rise or co-infection occurs, it could have severe consequences. Hence, Bangladesh should stay prepared with an enhanced, quick diagnostic, and continuous monitoring system. This will help limit the spread and impact in case of co-infections or if influenza case rises along with dengue cases. It is crucial for us to be prepared and implement measures to combat future outbreaks.

Author Contributions

Taslima Jamal Urmi: conceptualization, writing – original draft. **Syed Masudur Rahman Dewan:** conceptualization, supervision, writing – review and editing. **Md. Rabiul Islam:** writing – review and editing.

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Ethics Statement

The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The authors have nothing to report.

Transparency Statement

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

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