**Spreading out of Severe Dengue: Clinico-laboratory Characteristics and Comorbidities in Dhaka City**

Mohammad Nayeem Hasan1,2, Mahfujur Rahman Himel2,3, Mahzabin Hoque4, Shakera Begum1, Md Jewel Rana1, Sahidur Rahman5, Ahmed Nawsher Alam6, Md. Aminul Islam7, Hosneara Parvin8,Kanis Fatema Ferdushi1,\*

1. Department of Statistics, Shahjalal University of Science and Technology, Sylhet-3114, Bangladesh; [nayeem5847@gmail.com](mailto:nayeem5847@gmail.com) (MNH); [shakerabegum@gmail.com](mailto:shakerabegum@gmail.comu) (SB); [kanis-sta@sust.edu](mailto:kanis-sta@sust.edu) (KFF); [jranik.sust@gmail.com](mailto:jranik.sust@gmail.com) (MJR)
2. UNITY Bangladesh, Sylhet, Bangladesh.
3. Department of Social Work, Shahjalal University of Science and Technology, Sylhet-3114, Bangladesh; [mrhimelsust@gmail.com](mailto:mrhimelsust@gmail.com) (MRH)
4. Department of Public Health, North South University, Dhaka, Bangladesh; [hoquemahzabin@gmail.com](mailto:hoquemahzabin@gmail.com) (MH)
5. Eastern Mediterranean Public Health Network, Bangladesh Country Office, Dhaka, [srahman@emphnet.net](mailto:srahman@emphnet.net) (SR)
6. Institute of Epidemiology Diseases Control and Research, [anawsher@yahoo.com](mailto:anawsher@yahoo.com) (ANA)
7. Department of Microbiology, President Abdul Hamid Medical College, Kishoreganj, Bangladesh, [aminulmbg@gmail.com](mailto:aminulmbg@gmail.com) (MAI)
8. Shaheed Suhrawardy Medical College, Dhaka, Bangladesh, [dr.parvin369@gmail.com](mailto:dr.parvin369@gmail.com) (HP)

\*Correspondence: (KFF)

\*\*Corresponding Author

Address:

Kanis Fatema Ferdushi, Ph.D.

Professor, Department of Statistics, Shahjalal University of Science and Technology, Sylhet-3114, Bangladesh

Phone: +8801818824338

Email: [kanis-sta@sust.edu](mailto:kanis-sta@sust.edu)

ORCID ID: <https://orcid.org/0000-0003-4393-9491>

Lead Author’s ORCID ID: [https://orcid.org/000-0002-2383-0459](https://orcid.org/0000-0002-1706-5615)

**Acknowledgments**

We acknowledge the Institute of Epidemiology, Disease Control, and Research (IEDCR) for allowing the research team to collect data from a particular hospital in the Dhaka city.

**Abstract**

**Background and Aims:** The prevalence of dengue in Bangladesh has markedly risen, resulting in the most lethal epidemic in 2023 and persistently elevated levels in 2024. Notwithstanding stringent control measures, dengue persists, especially in Dhaka city, accompanied by an increase in comorbidities and novel symptoms. This study seeks to assess the correlation between laboratory and clinical parameters and severe dengue infections to facilitate early identification and successful treatment, particularly in regions with high transmission rates.

**Methods:** Case-control study was performed on 435 dengue patients hospitalised in medical college hospitals in Dhaka from July to December 2024. Univariate and multivariable logistic regression analyses were conducted to establish determinants of illness severity utilising demographic and clinical dengue data.

**Results:** Of the patients, 60.92% were male, and 53.16% were under the age of 30. Comorbidities, including diabetes (AOR: 2.79; 95% CI: 1.84–3.15) and hypertension (AOR: 2.67; 95% CI: 1.23–5.63), were strongly correlated with elevated risks of severe dengue. Symptoms such as abdominal pain (AOR: 1.97), vomiting (AOR: 1.68), and headache (AOR: 1.36) were associated with increased disease severity. Severe dengue cases exhibited an elevation in serum creatinine, AST, ALT, pulse rate, and temperature, but thrombocyte, total bilirubin, albumin, and globulin levels were associated with a reduced risk of severity.

**Conclusions:** This study delineates essential characteristics linked to severe dengue, including age, comorbidities (diabetes and hypertension), and particular symptoms including stomach discomfort, vomiting, and headache. Laboratory results indicating higher serum creatinine, liver enzymes, and body temperature, coupled with decreased platelet and albumin levels, were significantly associated with severity. These findings emphasise the significance of early surveillance, especially in patients with comorbidities, and offer critical insights for enhancing the management of severe dengue. Future studies should investigate the transition from non-severe to severe dengue.

**Keywords:** Case-control, Dengue, Retrospective Study, Severe dengue, Bangladesh

**Background**

Humans get dengue, a disease caused by the dengue virus (DENV), by the bite of an infected mosquito (WHO, 2018). Dengue fever is widespread in urban and semi-urban areas in tropical and subtropical countries, endangering more than 50% of the global population (Bhowmik et al., 2023). This development underscored the disease's increasing prevalence, especially in tropical and subtropical regions where Aedes mosquito vectors flourish (Ong et al., 2022; Urcuqui-Inchima et al., 2010). In 2024, from January to December, the WHO Global dengue monitoring reported a total of 14,284,310 cases and 10,554 deaths worldwide (WHO, 2024). Dengue fever predominantly occurs in 128 countries, encompassing Southeast Asia, the Eastern Mediterranean, and the Western Pacific (Bhatt et al., 2013). In 2023, the two principal hotspots for dengue virus circulation are South America and South and Southeast Asia (Haider et al., 2024). Similar to other tropical and subtropical nations, dengue fever poses a significant public health challenge in Bangladesh.

During its time as East Pakistan, Bangladesh encountered its first dengue outbreak in 1964, corresponding with the emergence of the phrase "Dacca fever." In recent years, Bangladesh has been profoundly afflicted by dengue viruses, ranking among the most affected nations (Sharmin et al., 2015). Government surveillance systems have recorded mortality associated with major epidemics. In 2019, Bangladesh experienced a significant dengue epidemic, reporting 101,354 cases and 164 fatalities linked to the disease (Ullah et al., 2024). of 2024, the Ministry of Health & Family Welfare of Bangladesh officially reported 101,214 laboratory-confirmed dengue infections and 575 related fatalities (DGHS, 2025). Between the first decade (2000–2010) and the following one (2011–2022), dengue cases in Bangladesh increased 8.3 times, alongside a 2.2-fold escalation in annual deaths (Hasan et al., 2024). This tendency disproportionately affected males and primarily impacted younger age groups (Haider et al., 2023). Although Dhaka has historically been the most impacted division, it has reported the highest number of cases outside of Dhaka, accounting for 64.82% (n=193,216) of the total cases. Dhaka continues to have a significant number of dengue-related fatalities, with 980 reported deaths and a case fatality rate of 0.89%, in contrast to 0.34% (deaths = 725) in areas outside Dhaka (Hasan et al., n.d.). The nation has experienced abnormally elevated temperatures, excessive humidity, erratic precipitation, and a notable rise in dengue cases, leading to an increase in mosquito populations across the country (Islam et al., 2023).

Previous reports indicated infections displaying clinical characteristics aligned with dengue fever (Gubler, 1998). The majority of individuals with dengue remain asymptomatic; however, prevalent indicators encompass elevated fever, cephalalgia, myalgia, nausea, and exanthema. The majority recover within 1-2 weeks; however, some may progress to severe dengue and necessitate hospitalisation, which can be lethal. Recognising individuals progressing from mild to severe disease poses challenges; yet, it is a critical issue since appropriate intervention might avert the advancement of increasingly severe clinical problems (WHO, 2023a)Consistent diagnoses of dengue illnesses and campaigns can be regarded as effective in significantly reducing fatality rates (Pilot et al., 2019). Regrettably, it appears that the authorities are insufficiently addressing the issue. This was demonstrated by the lack of comprehensive public health awareness programs. It is essential to promptly commence campaigns, concentrating on early detection and the delivery of supportive therapeutic therapy. Facilitating timely access to suitable care for dengue patients via primary healthcare providers can reduce mortality rates to around 1% while also decreasing unnecessary hospital admissions (Yeh et al., 2017).

However, there is a scarcity of literature examining the interaction between demographic characteristics, clinical features, comorbidities, and the prognosis/complications of dengue in Bangladesh during recent epidemics. The topic appears to lack focus following the 2019 outbreaks; yet, in recent years, dengue has exceeded all cumulative records since 2000, necessitating further research to draw the attention of policymakers. Understanding this link is crucial for identifying high-risk dengue patients. The use of several warning indicators is crucial for swiftly identifying potentially severe cases, enabling appropriate treatment, preventing unnecessary hospitalisations, and reducing the case fatality rate of the disease. The major objective of this study is to examine the correlation between several clinical and laboratory features, as well as comorbidities, and severe instances of dengue among 2024 dengue patients.

**Materials and Methods**

We complied with the STROBE guidelines for reporting case-control studies in epidemiology (Table S1).

**Study settings**

This study was conducted at four government hospitals in Dhaka, Bangladesh (Dhaka Medical College Hospital, Shaheed Suhrawardy Medical College and Hospital, Mugda Medical College Hospital, and Mohakhali DNCC Hospital) during the peak months of dengue outbreaks (July 2024 to December 2024), focussing on the healthcare support provided to dengue patients in Dhaka. The study region chosen is Dhaka city, as it is one of the districts in Bangladesh with a significant dengue burden, accounting for about 40% of the nation's total cases, according to the 2024 database. The distribution details of dengue have been documented elsewhere (DGHS, 2025).

**Sampling design and sample size**

The study was structured to include 435 patients, comprising 145 cases and 290 controls, to analyse variables intended to investigate potential risk factors linked to severe dengue fever. All cases were confirmed dengue patients diagnosed with the antigen (NS1) test and were hospitalised to the designated hospital until sample collection was completed. 145 individuals were classified as severe instances, while 290 patients, identified as controls, were non-severe dengue patients selected using frequency matching based on age, gender, and geographic region.

This study recruits’ volunteers aged 18 and older diagnosed with severe and non-severe dengue according to the 2009 Dengue Classification established by the World Health Organisation (WHO, 2023a). For clarification, it is essential to mention that all severe dengue cases in our study received treatment in the intensive care unit at specified research locations. The control group consists of persons aged 18 and older diagnosed with non-severe dengue, who did not progress to severe dengue during their hospitalisation. Participants with non-severe dengue in the control group get care in a designated general medical ward at our study facility. Pregnant individuals diagnosed with dengue will be excluded from the trial.

**Data collection**

Research assistants with medical training conducted data extraction, subsequently followed by rule-based validation of the complete dataset by healthcare specialists. Electronic medical records from the hospital were utilised to collect administrative, laboratory, and microbiological data. Furthermore, 10% of the cases were randomly chosen for duplicate data entry by a different research assistant, and any inconsistencies were resolved through an independent examination of medical case notes by one of the authors. The extracted data was anonymised for analysis. A validated and standardised questionnaire was employed, and all clinical records were examined by healthcare specialists.

**Variables**

***Outcome variables***

To establish our outcome variable representing severity level, patients were classified as 1 or "yes" for "severe" dengue, whereas "non-severe" dengue was assigned as 0 or "no." The formulation of the outcome variable depends on severe and non-severe dengue patients according to the 2009 Dengue Classification established by the World Health Organisation (WHO, 2023a), based on the haematology and biochemical test findings of the patients, a comprehensive evaluation of all records was performed by medical specialists.

***Independent variables***

A variety of potential risk factors linked to severe dengue have been examined, including demographic variables such as age, gender, marital status, educational attainment, and monthly income. Furthermore, pre-existing medical problems such as obesity, diabetes, hypertension, chronic lung disease, and ischaemic heart disease were examined. The study also examined the signs and symptoms exhibited upon admission, including abdominal discomfort, diarrhoea, vomiting, lethargy, headache, rash, chills and/or rigour, nausea, haemorrhage, and musculoskeletal pain. The WHO Guidelines define obesity as a body mass index (BMI) of 27.5 kg/m² or above, based on admission statistics (WHO, 2023b).

**Statistical Analysis**

Categorical data were represented as numbers and percentages, whilst continuous variables were portrayed as median and interquartile range (IQR). We employed bivariate analysis (chi-square test) for categorical variables and the Wilcoxon rank-sum test (Mann-Whitney U test) for continuous variables to investigate the relationship. We employed univariate logistic regression models to investigate the correlation between severe dengue and its related risk factors. We employed all possible factors in univariate models. An arbitrary p-value threshold of < 0.20 was employed as a criterion for the inclusion of covariates in the multivariable models (Hasan et al., 2020). We employed systematic approaches to select the optimal model. Consequently, all pertinent variables and several critical outcome-related factors were incorporated into our final model. In univariate analysis, each variable is separately included in the logistic regression model, yielding a crude odds ratio (COR). The multivariable logistic regression model was employed to provide an adjusted odds ratio (AOR), considering numerous variables concurrently. All tests were conducted at a 5% significance level, with the crude odds ratio (COR), adjusted odds ratio (AOR), p-value, and 95% confidence interval (CI) presented in the tables, respectively. We utilised the statistical tool R, version 3.6.0 and RStudio, version 3.5.2.2 for the analyses (R Core Team, 2020).

**Variable Selection**

To evaluate multicollinearity in the final model, we utilised a threshold of 4.00 for the variance inflation factor (VIF), adhering to the methods specified by (Kim, 2019). All variables were incorporated in this phase of the model, as the VIF value for each variable was below 4.00.

**Model evaluation**

To assess the accuracy of the best model, we utilised various metrics, including the Hosmer-Lemeshow goodness-of-fit test and the Area Under the Receiver Operating Characteristic (AUROC). Improved model performance is shown by elevated AUROC values. A diminished P-value within the ROC curve indicates the model's proficient differentiation between two categories, with an area under the curve beyond 0.50 signifying enhanced discrimination (Wu et al., 2021). The Hosmer-Lemeshow goodness-of-fit test assesses the concordance between model-derived probabilities and actual outcomes. A Hosmer-Lemeshow test, generally evaluated via a goodness-of-fit assessment, produces a P-value over 0.05, signifying the model's proficiency in accurately classifying data into outcome categories (Hasan et al., 2022).

**Ethical Considerations**

The Declaration of Helsinki (1964) and its later revisions' criteria for research with human subjects were followed in the conduct of this study. Prior to data collection, all patients were informed about the study's goals and their verbal agreement was obtained. As part of a continuing partnership, the Institute of Epidemiology, Disease Control and Research (IEDCR) obtained the data from a particular hospital in Dhaka city. Every procedure that involved human subjects complied with the IEDCR study committee's and Shahjalal University of Science and Technology, Sylhet's ethical guidelines.

**Results**

This study included 145 patients and 290 controls, revealing that severe dengue cases had unique socio-demographic, clinico-laboratory, and comorbidity patterns. In this study, 56.52% of severe cases were those older than 29 years, while 43.48% were 29 years or younger (p-value = 0.005). Severe dengue affected males more (51.72%) than females (48.28%), with a p-value of 0.006. Regarding marital status, 59.44% of severe patients were married (p-value <0.001). No significant difference in educational level and monthly income between severe and non-severe individuals (Table 1).

According to Table 1, diabetes was observed in 7.59% of severe cases (p-value = 0.044). Chronic pulmonary disease was significantly more common in severe cases (15.86%), with a p-value of 0.011. The distinction between severe and non-severe cases concerning obesity, hypertension, and ischaemic heart disease was not statistically significant. Severe dengue cases were more likely to exhibit stomach discomfort (58.3%) and diarrhoea (77.2%), with a p-value of <0.001. Vomiting occurred in 9.66% of severe instances (p-value = 0.004), while the remaining 90.34% of severe patients did not experience vomiting. Lethargy was observed in 19.44% of severe cases, while the remainder did not exhibit this symptom (p-value<0.001). Nausea occurred in 18.62% of severe cases, with the majority of severe cases not exhibiting nausea (p-value = 0.011). Nonetheless, headache, rash, chills/rigors, haemorrhage, and musculoskeletal discomfort exhibited no significant changes.

Table 2 delineates the laboratory findings between severe dengue cases and non-severe controls, highlighting considerable disparities in various clinical parameters. Severe cases exhibited a higher median age of 32 years, in contrast to 25 years in the non-severe group. The median white blood cell (WBC) count was markedly reduced in severe cases (4.90) relative to non-severe cases (5.51). Platelet counts were markedly reduced in the severe group, with a median of 85.54, in contrast to 94.49 in the non-severe group. Moreover, severe individuals exhibited markedly elevated median serum creatinine levels (132.11) in contrast to non-severe cases (104.80). Total bilirubin levels were elevated in the severe group, with a median of 10.34, in contrast to 12.46 in the non-severe group. The liver enzyme indicators, AST and ALT, were markedly elevated in severe instances. The median AST was 171.13 in the severe group, in contrast to 127.76 in the non-severe group, and the median ALT was 123.17 in severe instances compared to 114.32 in non-severe cases. Severe cases demonstrated markedly reduced median albumin levels (39.78) relative to non-severe cases (42.36), and globulin levels were similarly diminished in severe cases (24.72) compared to non-severe cases (27.53). The median pulse rate was marginally elevated in severe cases (89.68) compared to the non-severe group (88.14). Finally, body temperature was markedly elevated in severe instances, with a median of 38.68°C, in contrast to 37.99°C in non-severe cases. Haemoglobin levels exhibited no significant disparity between the two groups, although all other clinical and laboratory parameters were markedly different in this investigation.

In this study from Figure 1, serum creatinine and age (r = 0.117), AST and age (r = 0.147), ALT and total bilirubin (r = 0.159), and globulin with thrombocytes (r = 0.296) and total bilirubin (r = 0.310) all showed positive relationships. On the other hand, globulin and serum creatinine (r = -0.452), serum creatinine and total bilirubin (r = -0.403), and haemoglobin and serum creatinine (r = -0.309) all showed negative relationships. Furthermore, there were weak negative relationships between temperature and both thrombocytes (r = -0.143) and WBC count (r = -0.113).

Table 3 displays the outcomes of a multivariable logistic regression study examining the relationship between socio-demographic parameters, clinical-laboratory features, comorbidities, and severe dengue. The analysis indicated that age, diabetes, hypertension, abdominal pain, vomiting, lethargy, headache, and rash were significantly correlated with severe dengue, whereas gender, marital status, education level, monthly income, obesity, chronic pulmonary disease, ischaemic heart disease, diarrhoea, chills and rigours, nausea, haemorrhage, and musculoskeletal pain did not exhibit significant correlations. Individuals older than 29 years had 1.34 times greater odds (AOR: 1.34; 95% CI: 1.12-4.72, p=0.028) of developing severe dengue in comparison to those aged 29 years or younger. Diabetes was substantially correlated with severe dengue, with persons suffering from diabetes exhibiting 2.79 times greater chances (AOR: 2.79; 95% CI: 1.84-3.15, p=0.034) of acquiring severe dengue compared to those without the condition. Hypertension was substantially correlated, with persons with hypertension having 2.67 times greater chances (AOR: 2.67; 95% CI: 1.23-5.63, p=0.037) of severe dengue. stomach pain was significantly correlated with severe dengue, as persons experiencing stomach pain exhibited 1.97 times greater odds (AOR: 1.97; 95% CI: 1.15-2.85, p<0.001) of developing severe dengue compared to those without abdominal pain. Vomiting was strongly associated with severe dengue, with persons who vomited having 1.68 times greater odds (AOR: 1.68; 95% CI: 1.03-2.19, p=0.031) of developing severe dengue compared to those who did not vomit. Lethargy was linked to 1.55 times greater odds (AOR: 1.55; 95% CI: 1.01-2.22, p=0.022), and headache to 1.36 times greater odds (AOR: 1.36; 95% CI: 1.14-2.65, p<0.001) of severe dengue, in comparison to patients devoid of both symptoms. Finally, the presence of a rash was associated with a 1.68-fold increase in the likelihood of severe dengue (AOR: 1.68; 95% CI: 1.13-1.91, p=0.013) relative to patients without a rash.

Table 4 illustrates the correlation between diverse laboratory results and the probability of developing severe dengue in contrast to non-severe cases, as determined by multivariable logistic regression analysis. The thrombocyte (platelet) count exhibited an inverse correlation with severe dengue, indicating a 14% reduction in the likelihood of severe dengue for each unit increase in thrombocyte count (AOR: 0.86; 95% CI: 0.75-0.95, p=0.007). Serum creatinine levels exhibited a positive correlation with severe dengue, where each unit increase in serum creatinine was linked with a 25% increase in the risks of developing severe dengue (AOR: 1.25; 95% CI: 1.14-1.44, p<0.001). Elevated total bilirubin levels were inversely correlated with severe dengue, indicating that greater bilirubin levels corresponded to a 65% reduction in the likelihood of severe dengue (AOR: 0.35; 95% CI: 0.18-0.58, p<0.001). Liver enzyme indicators, including AST and ALT, exhibited a favourable correlation with severe dengue. For each unit increase in AST, the probabilities of severe dengue escalated by 2% (AOR: 1.02; 95% CI: 1.01-1.05, p=0.035), whereas for ALT, the risks surged by 9% (AOR: 1.09; 95% CI: 1.04-1.17, p=0.003). Both albumin and globulin levels exhibited a negative correlation with severe dengue. A reduction in albumin levels correlated with a 47% increased likelihood of severe dengue (AOR: 0.53; 95% CI: 0.34-0.74, p=0.001), while diminished globulin levels were associated with a 44% heightened probability of severe dengue (AOR: 0.56; 95% CI: 0.32-0.88, p=0.024). Finally, body temperature exhibited a significant correlation with severe dengue, presenting 4.45 times greater chances of severe dengue for each 1°C elevation in body temperature (AOR: 4.45; 95% CI: 1.96-7.39, p=0.005).

The Variance Inflation Factor (VIF) study reveals that all variables possess values below 5, signifying the lack of multicollinearity in the dataset. Furthermore, the AUC value of 72.46% in Table 5 indicates that the classification accuracy is considered satisfactory in Figure 2. The model successfully passed the Hosmer and Lemeshow goodness-of-fit test, yielding a value of 10.46 with 8 degrees of freedom (P = 0.234), indicating no lack of fit in the model.

**Discussion**

This research assessed the risk factors linked to severe dengue in 145 cases and 290 controls admitted during the 2024 dengue outbreak in Bangladesh. This study sought to identify risk factors for severe dengue during the outbreak, uncovering a complicated interaction of demographic characteristics, comorbidities, and symptoms. The results highlight the importance of demographic characteristics, comorbidities, and clinical symptoms in forecasting the severity of dengue, consistent with previous research while providing new perspectives relevant to the setting of Bangladesh.

A notable correlation between age and dengue severity was identified, indicating that persons over 29 years are more prone to severe results. This finding aligns with prior research emphasising the susceptibility of elderly groups to severe dengue complications. The physiological alterations associated with ageing, including diminished immunological responses, may partially elucidate this heightened risk (Huang et al., 2023; Lin et al., 2017). Notably, although a greater number of males were affected in both cases and controls, females exhibited elevated odds of severe dengue in the unadjusted analysis. This finding aligns with prior literature indicating that men are more vulnerable to dengue infection during outbreaks, whereas women are more frequently linked to severe cases in Bangladesh (M. J. Hossain et al., 2025; M. S. Hossain et al., 2023; Sami et al., 2023) and other countries (Sangkaew et al., 2021; Srisuphanunt et al., 2022). Sex-specific disparities may be associated with variations in healthcare-seeking behaviour, visitation patterns, and types of care received. Nonetheless, this effect became non-significant after controlling for additional variables, indicating that although gender may affect dengue infection rates, it does not independently forecast severity.

Our investigation confirmed the documented association of comorbid illnesses, including diabetes, chronic pulmonary disease, and ischaemic heart disease, with an increased risk of severe dengue. Diabetes proved to be a significant predictor of adverse outcomes. This corresponds with international research highlighting diabetes as a significant risk factor due to its effects on immunological regulation and endothelial dysfunction, which may aggravate problems related to dengue and prior studies conducted in Bangladesh (Bhowmik et al., 2023; M. S. Hossain et al., 2023). Chronic lung disease and ischaemic heart disease, although notable in univariate analysis, lost their independent predictive significance in multivariate analysis. This underscores the necessity for more intricate investigation into the particular pathways through which these diseases interact with dengue pathogenesis.

Abdominal pain, vomiting, and fatigue were strongly correlated with severe dengue in both unadjusted and adjusted models. These symptoms have long been acknowledged as indicators of development to severe dengue. Abdominal pain demonstrated a significant correlation with severe outcomes, aligning with prior research indicating it serves as a marker for plasma leakage and approaching shock (Akram et al., 2023; Al-Araimi et al., 2011; Gupta et al., 2017). In contrast, the occurrence of headache was linked to reduced probabilities of severe dengue, an intriguing finding supported by recent studies indicating that headache may inversely relate to disease severity. A retrospective cohort study in Singapore, comprising 82 patients with dengue hemorrhagic fever (DHF) and 1855 individuals with dengue fever, indicated that the presence of headache at presentation was associated with decreased likelihood of developing DHF (Ng et al., 2022).

Our research exhibits multiple significant strengths. Initially, we employed the most recent WHO 2009 Dengue Classification Criteria, which classifies dengue patients into two primary categories: severe and non-severe dengue. This facilitated a clear differentiation in the severity of the condition. Moreover, less research has examined the correlation between obesity and severe dengue in adults, as several previous studies overlooked obesity as a comorbid factor. Our research aimed to address this deficiency by investigating this possible correlation. Measures were implemented to reduce missing data by conducting a comprehensive examination of clinical information recorded in the medical records, which were meticulously examined by physicians and nursing personnel. Notwithstanding its merits, our study possesses multiple drawbacks. The study was performed at a single location, perhaps constraining the generalisability of the results. Furthermore, due to the retrospective nature of the study, we depended on pre-existing medical records, which may not have documented all pertinent risk factors or comorbidities. The study was done as a case-control investigation with convenience sampling in four specialised dengue hospitals in Dhaka, selected from approximately twenty hospitals in the city. Consequently, the sample may not adequately represent the whole population of Dhaka. Moreover, the study's results may not be applicable to other locations or nations. Future research ought to use numerous centres and prospective designs to validate these findings and further investigate additional risk factors for severe dengue.

**Conclusion**

This study delineates numerous critical parameters linked to severe dengue, emphasising essential socio-demographic, clinico-laboratory, and comorbidity patterns. Age, diabetes, hypertension, abdominal discomfort, vomiting, lethargy, headache, and rash were all substantially correlated with severe dengue, suggesting that both pre-existing illnesses and particular symptoms are pivotal in ascertaining disease severity. Moreover, test results included platelet count, serum creatinine, total bilirubin, liver enzymes (AST and ALT), albumin, globulin levels, and body temperature were significantly associated with severe dengue. Significantly, increased blood creatinine, liver enzymes, and body temperature, coupled with decreased platelet, albumin, and globulin levels, were more evident in severe cases. These findings underscore the necessity for prompt clinical surveillance, especially for those with comorbidities such as diabetes and hypertension, as well as those exhibiting symptoms including abdominal discomfort, vomiting, lethargy, headache, or rash. These results provide significant insights into the therapeutic management of dengue and establish a foundation for future research on the determinants of severe disease progression. This research provides new insights into identifying key risk factors for severe dengue, enhancing our comprehension of early detection and treatment. Future research should investigate the transition from non-severe to severe dengue more comprehensively, expanding upon the results of this study.

**Funding:** This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

**Author Contribution**

**Mohammad Nayeem Hasan:** formal analysis, investigation, methodology, project administration, validation, writing–original draft.

**Mahfujur Rahman Himel:** investigation, methodology, validation, writing–original draft.

**Mahzabin Hoque:** data curation, investigation, validation, writing–original draft.

**Shakera Begum:** formal analysis, investigation, methodology, writing–original draft.

**Md Jewel Rana:** formal analysis, investigation, methodology, writing–review and editing.

**Sahidur Rahman:** investigation, methodology, validation, writing–review and editing.

**Ahmed Nawsher Alam:** data curation, investigation, methodology, validation, writing–review and editing.

**Md. Aminul Islam:** investigation, methodology, validation, writing–review and editing.

**Hosneara Parvin:** data curation, methodology, validation, writing–review and editing.

**Kanis Fatema Ferdushi:** formal analysis, investigation, methodology, project administration, validation, writing–review and editing.

**Data Availability**

Data will be available from the corresponding author upon request.

**Conflicts of Interest**

The authors declare no conflicts of interest.

**Transparency Statement**

The lead author Kanis Fatema Ferdushi 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.

**References**

Akram, A., Akram, L., Ghosh, U. K., Abiduzzaman, M., & Rahman, S. (2023). Gastrointestinal Manifestations of Dengue Fever among Children: A Multicenter Cross-Sectional Study in Bangladesh. *Bangladesh Journal of Medical Microbiology*, *17*(2), 66–70. https://doi.org/10.3329/BJMM.V17I2.69294

Al-Araimi, H., Al-Jabri, A., Mehmoud, A., & Al-Abri, S. (2011). Dengue Haemorrhagic Fever presenting as Acute Abdomen. *Sultan Qaboos University Medical Journal*, *11*(2), 265. https://pmc.ncbi.nlm.nih.gov/articles/PMC3121033/

Bhatt, S., Gething, P. W., Brady, O. J., Messina, J. P., Farlow, A. W., Moyes, C. L., Drake, J. M., Brownstein, J. S., Hoen, A. G., Sankoh, O., Myers, M. F., George, D. B., Jaenisch, T., William Wint, G. R., Simmons, C. P., Scott, T. W., Farrar, J. J., & Hay, S. I. (2013). The global distribution and burden of dengue. *Nature 2013 496:7446*, *496*(7446), 504–507. https://doi.org/10.1038/nature12060

Bhowmik, K. K., Ferdous, J., Baral, P. K., & Islam, M. S. (2023). Recent outbreak of dengue in Bangladesh: A threat to public health. *Health Sci Rep*, *6*(4), e1210. https://doi.org/10.1002/hsr2.1210

Gubler, D. J. (1998). Dengue and dengue hemorrhagic fever. *Clin Microbiol Rev*, *11*(3), 480–496. https://doi.org/10.1128/CMR.11.3.480

Gupta, B., Nehara, H., Parmar, S., Meena, S., Gajraj, S., & Gupta, J. (2017). Acute abdomen presentation in dengue fever during recent outbreak. *Journal of Acute Disease*, *6*(5), 198. https://doi.org/10.4103/2221-6189.219612

Haider, N., Asaduzzaman, M., Hasan, M. N., Rahman, M., Sharif, A. R., Ashrafi, S. A. A., Lee, S. S., & Zumla, A. (2023). Bangladesh’s 2023 Dengue outbreak - age/gender-related disparity in morbidity and mortality and geographic variability of epidemic burdens. *International Journal of Infectious Diseases : IJID : Official Publication of the International Society for Infectious Diseases*, *136*, 1–4. https://doi.org/10.1016/J.IJID.2023.08.026

Haider, N., Hasan, M. N., Onyango, J., & Asaduzzaman, M. (2024). Global Landmark: 2023 Marks the Worst Year for Dengue Cases with Millions Infected and Thousands of Deaths Reported. *IJID Regions*, 100459. https://doi.org/10.1016/J.IJREGI.2024.100459

Hasan, M. N., Abdul Baker Chowdhury, M., Jahan, J., Jahan, S., Ahmed, N. U., & Uddin, M. J. (2020). Cesarean delivery and early childhood diseases in Bangladesh: An analysis of Demographic and Health Survey (BDHS) and Multiple Indicator Cluster Survey (MICS). *PLOS ONE*, *15*(12), e0242864. https://doi.org/10.1371/JOURNAL.PONE.0242864

Hasan, M. N., Khalil, I., Chowdhury, M. A. B., Rahman, M., Asaduzzaman, M., Billah, M., Banu, L. A., Alam, M. U., Ahsan, A., Traore, T., Jamal Uddin, M., Galizi, R., Russo, I., Zumla, A., & Haider, N. (2024). Two decades of endemic dengue in Bangladesh (2000–2022): trends, seasonality, and impact of temperature and rainfall patterns on transmission dynamics. *Journal of Medical Entomology*, *61*(2), 345–353. https://doi.org/10.1093/JME/TJAE001

Hasan, M. N., Rahman, M., Uddin, M., Ashrafi, A. A., Rahman, K. M., Paul, K. K., Ferdous, M., Sarker, R., Haque, F., Sharma, A., Papakonstantinou, D., Paudyal, P., 11, A., Zumla, A., & Haider, N. (n.d.). *The 2023 fatal dengue outbreak in Bangladesh highlights a paradigm shift of geographical distribution of cases*. https://doi.org/10.1017/S0950268824001791

Hasan, M. N., Tambuly, S., Trisha, K. F., Haque, M. A., Chowdhury, M. A. B., & Uddin, M. J. (2022). Knowledge of HIV/AIDS among married women in Bangladesh: analysis of three consecutive multiple indicator cluster surveys (MICS). *AIDS Research and Therapy*, *19*(1), 1–10. https://doi.org/10.1186/S12981-022-00495-8/TABLES/3

Hossain, M. J., Das, M., Shahjahan, M., Islam, M. W., & Towhid, S. T. (2025). Clinical and Hematological Manifestation of Dengue Patients in 2022 Outbreak: A Tertiary Care Hospital-Based Cross-Sectional Study. *Health Science Reports*, *8*(1). https://doi.org/10.1002/HSR2.70356

Hossain, M. S., Noman, A. Al, Mamun, S. A. Al, & Mosabbir, A. Al. (2023). Twenty-two years of dengue outbreaks in Bangladesh: epidemiology, clinical spectrum, serotypes, and future disease risks. *Tropical Medicine and Health*, *51*(1), 1–14. https://doi.org/10.1186/S41182-023-00528-6/FIGURES/4

Huang, N., Shen, Y. J., Chou, Y. J., Tsai, T. F., & Lien, C. E. (2023). Advanced Age and Increased Risk for Severe Outcomes of Dengue Infection, Taiwan, 2014–2015. *Emerg Infect Dis*, *29*(8), 1701–1702. https://doi.org/10.3201/eid2908.230014

Islam, M. A., Hasan, M. N., Tiwari, A., Raju, M. A. W., Jannat, F., Sangkham, S., Shammas, M. I., Sharma, P., Bhattacharya, P., & Kumar, M. (2023). Correlation of Dengue and Meteorological Factors in Bangladesh: A Public Health Concern. *International Journal of Environmental Research and Public Health*, *20*(6), 5152. https://doi.org/10.3390/IJERPH20065152/S1

Kim, J. H. (2019). Multicollinearity and misleading statistical results. *Korean Journal of Anesthesiology*, *72*(6), 558. https://doi.org/10.4097/KJA.19087

Lin, R. J., Lee, T. H., & Leo, Y. S. (2017). Dengue in the elderly: a review. *Expert Review of Anti-Infective Therapy*, *15*(8), 729–735. https://doi.org/10.1080/14787210.2017.1358610

Ng, W. Y., Atan, R., Yunos, N. M., Bin Md Kamal, A. H., Roslan, M. H., Quah, K. Y., Teh, K. X., Zaid, M., Kassim, M., Mariapun, J., Ngim, C. F., Dhanoa, A., & Yeo, T. W. (2022). A double whammy: The association between comorbidities and severe dengue among adult patients—A matched case-control study. *PLoS ONE*, *17*(9). https://doi.org/10.1371/JOURNAL.PONE.0273071

Ong, E. P., Obeles, A. J. T., Ong, B. A. G., & Tantengco, O. A. G. (2022). Perspectives and lessons from the Philippines’ decades-long battle with dengue. *Lancet Reg Health West Pac*, *24*, 100505. https://doi.org/10.1016/j.lanwpc.2022.100505

Pilot, E., Nittas, V., & Murthy, G. V. S. (2019). The Organization, Implementation, and Functioning of Dengue Surveillance in India—A Systematic Scoping Review. *International Journal of Environmental Research and Public Health*, *16*(4). https://doi.org/10.3390/IJERPH16040661

R Core Team. (2020). *R: A Language and Environment for Statistical Computing*.

Sami, C. A., Tasnim, R., Hassan, S. S., Khan, A. H., Yasmin, R., Monir-uz-Zaman, M., Sarker, M. A. S., & Arafat, S. M. (2023). Clinical profile and early severity predictors of dengue fever: Current trends for the deadliest dengue infection in Bangladesh in 2022. *IJID Regions*, *9*, 42–48. https://doi.org/10.1016/J.IJREGI.2023.09.001

Sangkaew, S., Ming, D., Boonyasiri, A., Honeyford, K., Kalayanarooj, S., Yacoub, S., Dorigatti, I., & Holmes, A. (2021). Risk predictors of progression to severe disease during the febrile phase of dengue: a systematic review and meta-analysis. *The Lancet. Infectious Diseases*, *21*(7), 1014–1026. https://doi.org/10.1016/S1473-3099(20)30601-0

Sharmin, S., Viennet, E., Glass, K., & Harley, D. (2015). The emergence of dengue in Bangladesh: epidemiology, challenges and future disease risk. *Transactions of The Royal Society of Tropical Medicine and Hygiene*, *109*(10), 619–627. https://doi.org/10.1093/TRSTMH/TRV067

Srisuphanunt, M., Puttaruk, P., Kooltheat, N., Katzenmeier, G., & Wilairatana, P. (2022). Prognostic Indicators for the Early Prediction of Severe Dengue Infection: A Retrospective Study in a University Hospital in Thailand. *Tropical Medicine and Infectious Disease*, *7*(8). https://doi.org/10.3390/TROPICALMED7080162

Ullah, M. A., Mim, A. S., Hasan, M. N., & Sadik, M. R. (2024). Deep Learning Based Forecasting Models of Dengue Outbreak in Bangladesh: Comparative Analysis of LSTM, RNN, and GRU Models Using Multivariate Variables with a Two-Decade Dataset. *International Conference on Smart Systems for Applications in Electrical Sciences, ICSSES 2024*. https://doi.org/10.1109/ICSSES62373.2024.10561382

Urcuqui-Inchima, S., Patiño, C., Torres, S., Haenni, A.-L., & Díaz, F. J. (2010). Recent developments in understanding dengue virus replication. *Adv Virus Res*, *77*, 1–39. https://doi.org/10.1016/B978-0-12-385034-8.00001-6

WHO. (2018). *Dengue: a mosquito-borne disease*. https://www.who.int/bangladesh/news/detail/28-05-2018-dengue-a-mosquito-borne-disease

WHO. (2023a). *Dengue and severe dengue*. https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue

WHO. (2023b). *Obesity*. https://www.who.int/health-topics/obesity#tab=tab\_1

WHO. (2024). *Global dengue surveillance*. https://worldhealthorg.shinyapps.io/dengue\_global/

Wu, F., Zhang, Y., Cui, W., Dong, Y., Geng, Y., Liu, C., Li, Z., Xie, Y., Cai, X., Shang, J., Xiao, J., & Zhao, Z. (2021). Development and validation of a discrimination model between primary PLA2R-negative membranous nephropathy and minimal change disease confirmed by renal biopsy. *Scientific Reports*, *11*(1), 18064. https://doi.org/10.1038/S41598-021-97517-8

Yeh, C.-Y., Chen, P.-L., Chuang, K.-T., Shu, Y.-C., Chien, Y.-W., Perng, G. C., Ko, W.-C., & Ko, N.-Y. (2017). Symptoms associated with adverse dengue fever prognoses at the time of reporting in the 2015 dengue outbreak in Taiwan. *PLOS Neglected Tropical Diseases*, *11*(12), e0006091. https://doi.org/10.1371/journal.pntd.0006091

DGHS. (2025). *DGHS*. https://old.dghs.gov.bd/index.php/bd/home/5200-daily-dengue-status-report