

# Gender Differences In Clinical Outcomes Of Hospitalized Dengue Patients In Bangladesh

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## Abstract

**Background:** Gender, a demographic factor, was observed to be associated with diagnosis of dengue infection and its clinical outcome. This study aimed to assess gender differences in the clinical presentation and in-hospital outcomes of dengue patients in Bangladesh.

**Methods:** The single centered hospital-based observational study was conducted among 100 dengue infected patients from June to October 2025. Only laboratory-confirmed dengue infection (NS1 antigen or IgM antibody positive) patients were included consecutively. A pretested semi-structured case record form including demographic information, clinical features, laboratory parameters, and in-hospital outcomes, was collected from each patient. Disease severity was categorized according to the 2009 World Health Organization dengue guidelines.

**Results:** Males constituted the majority (69%) of the patient, while females accounted for 31%. Female patients were significantly older than male patients ( $34.1 \pm 12.6$  vs  $28.9 \pm 11.5$  years,  $p = 0.046$ ). Fever, headache, and vomiting were the most common presenting symptoms, with similar distribution between genders. Warning signs such as abdominal pain and ascites were observed in a minority of patients without significant gender differences. Male patients had significantly higher hematocrit ( $p = 0.010$ ) and hemoglobin levels ( $p < 0.001$ ). Severe dengue was identified in 11% of patients, occurring more frequently among males (13.0%) than females (6.5%), although there were no statistically significant differences. Most patients recovered and were discharged, while two deaths occurred among male patients.

**Conclusion:** These findings indicate that gender alone does not appear to be a strong determinant of disease severity or in-hospital outcomes.

**Keywords:** Bangladesh; Dengue; Gender differences; Disease severity; Clinical outcomes

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## I. Introduction

Dengue infection remains a significant health burden in Bangladesh, with recurrent eruptions. Only a few studies across the world have reported significant gender-related differences for patients with dengue fever.(1,2) Globally, dengue infection was projected among 390 million people mostly from Southeast Asia region.(3,4) Several factors surged the frequency including urbanization, changing climate, and international travel. All these factors helps to spread Aedes mosquitoes which is the primary vector of the dengue virus (DENV).(4,5) The epidemiological dynamics of dengue virus are complicated by the circulation of four antigenically distinct serotypes, which increase the likelihood of severe disease during secondary infections and pose challenges for effective control.(6,7)

Bangladesh experiences severe dengue epidemics over the years, among them 2023 outbreak had affected over 321,179 cases and caused 1,705 deaths.(8) The urban areas such as Dhaka, Chattagram and other city corporation areas of Bangladesh are mostly suffered with outbreaks of dengue during the monsoon season, as this season is an ideal condition for breeding of Aedes mosquitoes. Thus, hospitals throughout the country struggle to handle the great inflow of patients where they frequently present with severe manifestations including shock syndrome and plasma leakage, resulting in hemorrhagic fever and dengue shock syndrome (DSS). To limit mosquito proliferation, public health authorities expanded control strategies including community mobilization, vector control interventions, and awareness campaigns.(9) Recent 2024 data indicate 6,751 cases by early August, with males comprising 61% but females 52% of deaths, especially in semi-urban/rural settings.(10) Epidemiological studies consistently report higher dengue incidence in males (60-62% of cases), attributed to greater outdoor exposure, yet females exhibit elevated mortality, possibly due to delayed healthcare access, hormonal immune differences, or sociocultural barriers.(9,11) In hospitalized cohorts from Chattogram, female CFR reached 1.86% compared to 0.61% in males among 3,304 admissions. However,

several studies found minor gender differences in the baseline characteristics once admitted, highlighting the need for targeted research on progression to severity.(12,13)

The dengue outbreaks in Bangladesh highlight the complex dynamics of infectious disease transmission and the need for integrated public health responses. The gender differences observed in several outbreaks further indicate that biological, behavioral, and social factors may influence disease patterns. Addressing these disparities requires gender-responsive public health policies that ensure reasonable access to prevention, diagnosis, and treatment. This research aims to assess the gender differences in clinical outcomes of hospitalized dengue patients in Bangladesh.

## **II. Methods**

### ***Study design and setting***

This study was conducted from June to October 2025 in a single tertiary referral center, Dhaka Medical College Hospital, in Bangladesh. The study period extended from June to October 2025, corresponding to the peak dengue transmission season in the country. The hospital serves both urban and surrounding rural populations and routinely manages a high volume of dengue admissions during outbreak periods. The study aimed to examine gender-related differences in clinical characteristics and its outcomes among the hospitalized dengue patients.

### ***Study population and sample size***

Among all admitted dengue patients within the study period, 100 consecutive laboratory-confirmed patients were included in this study. Dengue diagnosis was established on either positive NS1 antigen or dengue-specific IgM antibody test, according to the criteria outlined in the World Health Organization 2009 dengue guidelines.(14) Patients aged  $\geq 18$  years who required hospital admission for dengue management were eligible for inclusion. Individuals with confirmed co-infections (e.g., malaria or enteric fever), pre-existing chronic liver or renal disease unrelated to dengue infection, or incomplete clinical records were excluded to minimize potential confounding.

### ***Data collection procedures***

To collect all the data from the selected dengue patients, a semi-structured case record form (CRF) was developed for this study from previous study and literatures available. The CRF captured demographic characteristics, clinical presentation, comorbid conditions, laboratory findings, and in-hospital outcomes. The instrument was pilot-tested among 10 hospitalized dengue patients to assess clarity and feasibility, and minor modifications were incorporated before the commencement of the main study.

All the data were collected through face-to-face interviews from the included patients. They were asked about demographic details, presenting symptoms, prior medical conditions, and recent travel history. When patients were unable to provide information because of severe illness or altered consciousness, relevant history was obtained from accompanying caregivers.

### ***Clinical assessment***

All enrolled patients underwent a thorough clinical evaluation performed by attending physicians following standard hospital protocols. General examination included assessment of temperature, respiratory rate, pulse rate, and blood pressure, along with overall clinical status. Then, a detailed systemic examination was also conducted, covering cardiovascular, respiratory, abdominal, neurological, and integumentary systems. Particular attention was given to clinical features suggestive of dengue severity, including mucosal bleeding, hepatomegaly, signs of plasma leakage, and hemodynamic instability.

### ***Laboratory investigations***

All participants were subjected to perform routine laboratory investigations and venous blood was collected at the time of admission. An automated hematology analyzer (Siemens ADVIA® 2120, Munich, Germany: Siemens) was used to measure the parameters within complete blood count. Liver function tests were performed using a semi-automated biochemistry analyzer (Humalyzer 3000, Human Diagnostics, Germany) with commercially available reagent kits. Key laboratory parameters included platelet count, hematocrit level, white blood cell count, and serum transaminase levels. Patient outcomes were subsequently documented at discharge, referral, or death.

### ***Disease severity classification and patient's Body mass index (BMI)***

Confirmed cases of dengue infection were classified into three categories: dengue without warning signs, dengue with warning signs, and severe dengue. In this study, patients with and without warning signs were grouped together as non-severe dengue. The warning signs included abdominal pain or tenderness,

persistent vomiting, clinical fluid accumulation, mucosal bleeding, lethargy or restlessness, liver enlargement greater than 2 cm, and an increase in hematocrit (>20%) accompanied by a rapid decrease in platelet count. Severe dengue was defined by the presence of severe plasma leakage, severe bleeding, or significant organ impairment.

The Body mass index (BMI) of the participants was calculated and categorized using the Asian-specific BMI cutoff values recommended by the World Health Organization (WHO). According to these criteria, individuals with a BMI of <18.5 kg/m<sup>2</sup> were classified as underweight, those with a BMI of 18.5–22.9 kg/m<sup>2</sup> as having normal weight, 23.0–24.9 kg/m<sup>2</sup> as overweight, and ≥25.0 kg/m<sup>2</sup> as obese (15).

### **Ethical considerations**

The study was approved by the Ethical Review Committee. Formal permission was taken from respective authority of study hospitals prior data collection. Written informed consent was obtained from all participants.

### **Statistical analysis**

After data cleaning and coding, data were analyzed via IBM SPSS Statistics (IBM Corp., Armonk, NY, USA; version 26.0). The demographic and clinical characteristics of the study population were summarized using descriptive statistics. Continuous data were assessed for normality check and reported as the means ± standard deviations (SDs). Categorical data were expressed as frequencies and percentages. Comparative analyses were conducted to examine differences between male and female patients. For categorical variables, the chi-square test was applied as appropriate. Continuous variables were compared using the independent samples *t*-test. A *p* value of less than 0.05 was considered significant.

## **III. Result**

Among 100 laboratory-confirmed dengue affected patients, majority were male (69%) and rest of them were female (31%) as illustrated in **Figure 1**. The mean age was 34.1 ± 12.6 years among female and 28.9 ± 11.5 years of male with majority of patients belonged to the young adult age group (18–30 year). Most participants were urban residents (71%). Regarding nutritional status, the BMI was mostly normal among both male and female.

Comorbid conditions were relatively uncommon among the study participants. Diabetes mellitus was present in 13% of patients and hypertension in 6%, with no significant gender differences observed. Similarly, 26 male participant reported recent travel within 30 days in comparison with only 8 female participant in **Table 1**.

Fever was the predominant presenting symptom (male: 69.5% vs. female: 30.5%), reported in the vast majority of patients. Other commonly reported symptoms included headache (male:67.5% vs. female:32.5%) and acute vomiting (male:47.8% vs. female:10.0%). Respiratory symptoms (cough, respiratory distress) were observed in over one-third of the patients, while gastrointestinal manifestations including diarrhea were less frequent. Cutaneous manifestations, including rash (male: 13% vs. female:16.1%) and redness of the eyes (male: 24.6% vs. female:9.7%), were reported in a smaller proportion of cases. However, none of these distribution of clinical features differs significantly between genders.

Among warning signs, abdominal pain (male:76.2% vs. female:23.8%) was the most frequently observed warning sign, followed by ascites and respiratory distress. Bleeding manifestations such as gum bleeding and epistaxis were relatively uncommon. Although gum bleeding appeared more frequent among female patients, the difference was not statistically significant.

Laboratory parameters demonstrated several notable gender-related differences. Male patients had significantly higher hematocrit levels compared with females (39.6 ± 6.01 vs 36.23 ± 5.61%, *p* = 0.010). Similarly, hemoglobin levels were significantly (*p* <0.001) higher among males (13.3 ± 1.93 g/dL) compared with females (11.7 ± 1.71 g/dL). However, no statistically significant differences were observed between genders in terms of white blood cell counts, platelet counts, or liver enzyme levels (**Table 2**).

The majority of patients were classified as having non-severe dengue (89%). Severe dengue was identified in 11% of cases only. Although severe dengue appeared more frequent among male patients (13.0%) compared with female patients (6.5%) without any statistical significance (**Table 3**).

Most patients recovered and were discharged with medical advice (female: 87.1% vs male: 63.8%). Referral to higher-level care was uncommon; a few patients required transfer to a higher dependency unit (male: 7.2% vs female: 3.2) or intensive care unit (male: 2.9% vs. no female). Two deaths were recorded during the study period among male patients as in **Table 4**.

## **IV. Discussion**

Dengue virus is presently threatening half of the population of the world (16,17). The 2025 dengue outbreak in Bangladesh is also being marked with increasing cases and mortality (18,19). This observational study examined gender-related differences in the clinical characteristics and outcomes of hospitalized dengue patients in Bangladesh. Male patients constituted the majority of dengue admissions, showed comparable clinical manifestations between genders and exhibited significantly higher hematocrit and hemoglobin levels at admission. However, mortality was observed in males while disease severity and overall clinical outcomes between genders were not statistically significant.

Previous studies have reported a significant association between dengue seropositivity and female gender, with a male-to-female ratio of 0.65:1.(20) However, several studies from India conducted by Murhekar et al., Sarker et al., and Srinivas et al. reported nearly twice as many dengue infections among males compared with females. As these investigations were hospital-based, the findings may reflect healthcare-seeking behavior rather than the true distribution of infection in the community.(21–23) Thus, In many Asian settings, the lower reported incidence among women may therefore partly result from underreporting, particularly when care is sought from traditional practitioners who are not included in formal surveillance systems. In this study, male patients observed consistent with findings from several dengue-endemic regions. This pattern has often been attributed to greater occupational and environmental exposure among males, particularly in settings where outdoor activities increase the likelihood of contact with *Aedes* mosquitoes. In Bangladesh and other South Asian countries, men are more likely to engage in outdoor work, which may partially explain the higher proportion of male infections.(10,13)

In this study, female patients in the present study were significantly older than male patients. This observation may reflect differences in health-seeking behavior and healthcare access between genders. In many low- and middle-income settings, women may delay seeking medical care until symptoms become more severe or persistent, which could result in a higher mean age among hospitalized female patients.(24) Sociocultural factors, caregiving responsibilities, and economic constraints may further influence the timing of hospital presentation among women. Moreover, three-fourth of the study patients hailed from urban area which points out to expand of infection from urban to rural area of the country observed since 2019 where young male with recent travel history points out as transmission cause.(7,25). At admission, the most common symptoms of dengue infection were fever, headache, and vomiting. These findings are consistent with the typical clinical spectrum of dengue infection reported in previous hospital-based studies.(26). These presentation showed similar clinical spectrum and severity reported in 2023 and 2024 outbreaks in Bangladesh (27–31). Although, the distribution of most symptoms and warning signs did not differ significantly between male and female patients in this study. This suggests that the initial clinical presentation of dengue may be broadly similar across genders, at least among hospitalized individuals.

However, differences were observed in some laboratory parameters. Male patients demonstrated significantly higher hematocrit and hemoglobin levels compared with females. These findings may partly reflect baseline physiological differences between genders, as males typically have higher hemoglobin concentrations. Elevated hematocrit is also a recognized indicator of plasma leakage in dengue infection. Although the present study demonstrated no statistical difference in severe dengue amid genders, the higher hematocrit levels among males indicated a greater tendency toward hemo-concentration during the course of illness.

Despite the higher proportion of severe dengue among male patients, the difference between genders did not reach statistical significance. Thus, this finding aligns with several studies suggesting that while males may experience higher infection rates, gender alone may not be a strong independent predictor of disease severity.(32,33)

In terms of clinical outcomes, the majority of patients recovered and were discharged from the hospital. Female patients demonstrated a higher proportion of recovery and discharge compared with males, whereas deaths occurred only among male patients. Other study have reported findings, indicating higher mortality among female without any significant difference with male.(8)

The findings of this study have multiple important clinical and public health implications. Understanding gender-related patterns in dengue infection can help inform targeted prevention strategies and improve risk assessment during outbreaks. Public health interventions aimed at reducing dengue transmission should consider occupational exposure patterns, while clinical management protocols should remain attentive to potential differences in disease progression across demographic groups.

This study has several strengths. It provides detailed clinical and laboratory data from hospitalized dengue patients during an active transmission period and offers insight into gender-related patterns in a dengue-endemic setting. This study has several limitations. First, as the study was conducted in a single tertiary level hospital, the findings may not be fully generalizable to other healthcare settings or regions of Bangladesh. Second, the small sample size may have reduced the statistical power to detect significant gender differences in severe disease and mortality. Finally, the observational design does not allow for causal inference regarding the association between gender and clinical outcomes.

## V. Conclusion

This study explored gender-related differences among hospitalized dengue patients and found male patients constituted the majority of dengue admissions. Although female patients were older on average, the overall clinical presentation of dengue was largely similar between genders. Some significant differences were observed in selected laboratory parameters, severe dengue and mortality among males without any statistically significant. These findings suggest that while gender differences in dengue infection patterns may exist, gender alone may not be a strong determinant of disease severity or in-hospital outcomes. Large multicenter studies are needed to further clarify the role of biological and sociocultural factors influencing dengue outcomes in endemic settings.

### Declaration

**Ethics approval and consent to participate:** The study was approved by the Ethical Review Committee. All the authors declare that no human subjects were harmed and that the procedures followed were in accordance with the ethical standards and regulations established by the Helsinki Declaration of the World Medical Association. Informed written consent was obtained from all the participants involved in the study.

**Consent for publication:** Not applicable.

**Availability of data and materials:** Patient-level data will be available upon request from the corresponding author.

**Conflict of interest:** The authors declare that they have no competing interests.

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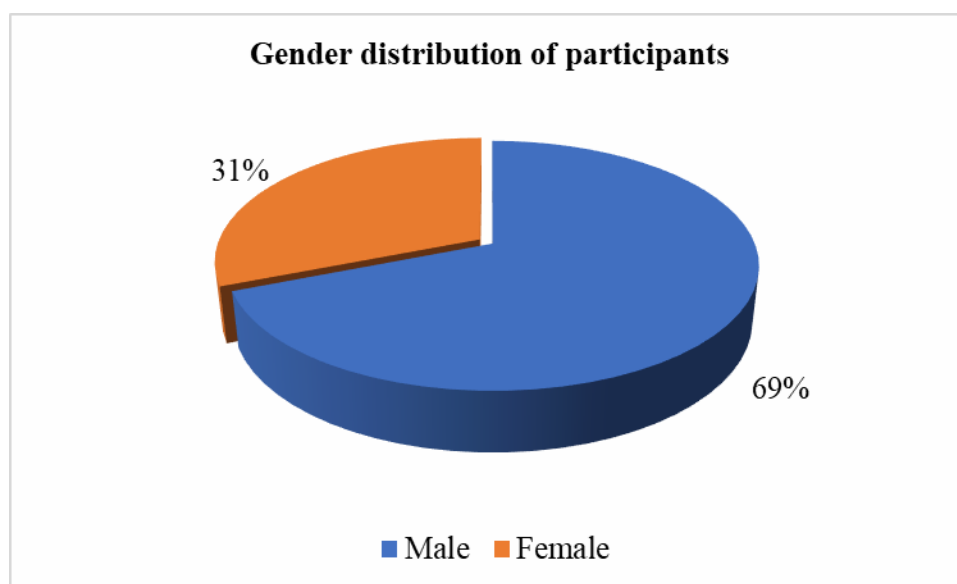
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**Figure-1: Gender distribution of the study participants (N=100)**

**Table 1: Baseline characteristics of the study participants diagnosed with dengue (N=100)**

Characteristics of the patients	Male n (%)	Female n (%)	p-value
Age group (years)			0.097
18-30	50 (76.9)	15 (23.1)	
31-40	8 (50.0)	8 (50.0)	
41-50	6 (66.7)	3 (33.3)	
51-60	5 (50.0)	5 (50.0)	
Mean±SD*	28.9±11.5	34.1±12.6	0.046
Residence			0.056
Urban	53 (74.6)	18 (25.4)	
Rural	16 (55.2)	13 (44.8)	
BMI category			0.482
Underweight	9 (56.3)	7 (43.8)	
Normal	51 (69.9)	22 (30.1)	
Overweight	7 (77.8)	2 (22.2)	
Obese	2 (100.0)	0 (0.0)	
Comorbidities			

*Gender Differences In Clinical Outcomes Of Hospitalized Dengue Patients In Bangladesh*

Diabetes Mellitus	8 (61.5)	5 (38.5)	0.533
Hypertension	3 (50.0)	3 (50.0)	0.299
Peptic Ulcer Disease	1 (50.0)	1 (50.0)	0.557
History of travelling in last 30 days	26 (76.5)	8 (23.5)	0.266

BMI: body mass index.

\*Data are presented as mean ± standard deviation.

**Table 2: Clinical presentations of the study participants on the day of admission (N=100)**

Clinical presentations	Male n (%)	Female n (%)	p-value
<b>Clinical features</b>			
Fever	66 (69.5)	29 (30.5)	0.644
Headache	54 (67.5)	26 (32.5)	0.517
Acute vomiting	33 (47.8)	10 (10.0)	0.146
Cough	25 (36.2)	12 (38.7)	0.812
Redness of eye	17 (24.6)	3 (9.7)	0.084
Diarrhea	9 (13.0)	5 (16.1)	0.681
Palpitation	8 (57.1)	6 (42.9)	0.681
Rash	9 (13.0)	5 (16.1)	0.758
<b>Warning signs</b>			
Abdominal pain	32 (76.2)	10 (23.8)	0.199
Ascites	13 (76.5)	4 (23.5)	0.456
Respiratory distress	8 (72.7)	3 (27.3)	>0.99
Gum bleeding	4 (40.0)	6 (60.0)	0.066
Epistaxis	1 (33.3)	2 (66.7)	0.175
Features of plasma leakage	4 (80.0)	1 (20.0)	>0.99
<b>Laboratory findings</b>			
Hematocrit (%)*	39.6±6.01	36.23±5.61	0.010
Hemoglobin (g/dl)**	13.3±1.93	11.7±1.71	<0.001
White blood cell (cells/μL)**	6,632 ± 3,100	8,970 ± 3,900	0.180
Platelet (cells/μL)**	96,075 ± 52,000	112,774 ± 49,000	0.299
Alanine Aminotransferase (U/L)**	104.7 ± 96.0	179.1 ± 120.0	0.168
Aspartate Aminotransferase (U/L)**	150.0 ± 130.0	130.8 ± 115.0	0.842

Data were presented as mean ± standard deviation\*

**Table 3: Disease severity among hospitalized dengue patients (N=100)**

Severity category	Male (n=69)	Female (n=31)	P-value
Non-severe dengue	60 (87.0%)	29 (93.5%)	0.330
Severe dengue	9 (13.0%)	2 (6.5%)	

**Table 4: In-hospital outcome of the study participants (N=100)**

In-hospital outcome	Male (n=69)	Female (n=31)	P-value
Discharge with advice	44 (63.8)	27 (87.1)	0.214
Discharge on risk bond	10 (14.5)	3 (9.7)	
Absconded	6 (8.7)	0 (0)	
Referred to HDU	5 (7.2)	1 (3.2)	
Referred to ICU	2 (2.9)	0 (0)	
Death	2 (2.9)	0 (0)	

HDU= higher dependency unit, ICU= higher dependency unit