**Abstract**

The world is currently witnessing the largest recorded arbovirus outbreak in history, with Bangladesh being one of the countries most severely affected by the dengue epidemic. In Bangladesh, the Chikungunya virus (CHIKV) caused a significant outbreak in 2017 but subsequently nearly disappeared from the country. This study reports an outbreak of CHIKV in Dhaka and its surrounding areas, detailing the clinical characteristics of the virus and the disease it causes.

The Institute of Epidemiology, Disease Control and Research (IEDCR) enrolled patients through event-based surveillance between 19 October and 31 December 2024. Following enrolment, patients were contacted via telephone for follow-up between 21 and 28 days to record updates on their condition.

A total of 138 confirmed CHIKV patients were identified through RT-PCR. The majority were male (64.49%) and aged over 30 years (83.33%). Most patients (98.55%) resided within the Dhaka City Corporation area. Common clinical symptoms included fever (100%), arthralgia (97.81%), myalgia (83.21%), and headache (64.96%). Of the 48 patients with follow-up data, 56% (n=40) reported persistent symptoms. No fatalities were recorded; however, 20 patients (14.49%) required hospitalisation, with an average hospital stay of 5.94 days (range: 2–18 days). On average, patients lost 10.01 working days (range: 3–30 days) due to the illness. Disease severity was associated with a higher risk in males (IRR: 1.08, 95% CI: 0.94–1.25), individuals with comorbidities (IRR: 1.02, 95% CI: 0.91–1.16), and those aged 30 years or older (IRR: 1.14, 95% CI: 1.02–1.28) compared to females, those without comorbidities, and individuals under 30 years of age, respectively. Phylogenetic analysis of the CHIKV E gene revealed a mutation in the xxx gene.

CHIKV is likely to re-emerge in Bangladesh, amidst the ongoing and severe dengue outbreak. The country may face a significant CHIKV outbreak in 2025 or 2026. Strengthened efforts to control the dengue virus are critical for managing arboviruses, and hospitals must be prepared to handle a surge in patients effectively.

**Methodology**

**Variables**

The daily chikungunya cases and hospitalization were used as the primary outcome variable. Two climatic variables- temperature and rainfall, and socio-economic factors (age of the patients, sex, employment status, occupation, location), clinical features like test delay from onset, any types of clinical signs, patient status and co-morbidities were used as the covariates for the regression analysis. "Test delay after symptoms onset" refers to the period of time that passes between the moment someone starts experiencing symptoms of an illness and when they actually get tested for it, meaning there is a delay in testing after the first signs of the disease appear.

**Statistical analysis**

We analyzed the daily incidence of chikungunya, as well as socio-economic and meteorological data, over a 54-day period from October 19th to December 11th, 2024. In the first stage, descriptive analysis was performed to determine the characteristics of confirmed chikungunya cases. For each numeric variable, we calculated the mean, standard deviation, median, and interquartile range, while for categorical variables, we used frequency and percentage distributions over the entire period. Some numeric variables were categorized based on median splits for the analysis. Next, we compared all variables based on hospitalization status and examined the associations using a chi-square test and modified poisson regression model. A generalized estimating equation-modified Poisson regression approach with a robust error variance option was employed to directly assess risk ratios (RRs) in the modified Poisson regression model. Adjusted models were developed using this approach for various binary outcome variables with different predictors. Results from a limited simulation study demonstrated that this method remains reliable even with total sample sizes as small as 100 [1]. Risk ratios were calculated to evaluate the strength of association, accompanied by 95% confidence intervals (CIs) for significance testing. Statistical significance was determined at p < 0.05 in all analyses. Data analysis was performed using the latest version of R software.

Results

**Table 1: Demographic profile, symptoms, and co-morbidities of chikungunya cases (n=138)**

|  |  |  |
| --- | --- | --- |
|  | **Mean (SD)** | **Median (IQR)** |
| **Delay in test (in days)** | 2.89 (1.39) | 3.00 (1.00) |
|  | **n** | **%** |
| **Delay in test (in categories)** |  |  |
| Yes (median≤3) | 106 | 77.37 |
| No (median>3) | 31 | 22.63 |
| **Hospitalized** |  |  |
| Yes | 20 | 14.49 |
| No | 118 | 85.51 |
| **Age groups** |  |  |
| <30 | 23 | 16.67 |
| ≥30 | 115 | 83.33 |
| **Sex** |  |  |
| Female | 49 | 35.51 |
| Male | 89 | 64.49 |
| **Employment Status** |  |  |
| No | 53 | 39.55 |
| Yes | 81 | 60.45 |
| **Location** |  |  |
| Dhaka North City Corporation | 64 | 46.38 |
| Dhaka South City Corporation | 72 | 52.17 |
| Outside of Dhaka | 2 | 1.45 |
| **Symptoms presenta** |  |  |
| Fever | 137 | 100.00 |
| Generalized Rash | 33 | 24.09 |
| Arthralgia | 134 | 97.81 |
| Arthritis | 2 | 2.02 |
| Conjunctivitis | 64 | 46.72 |
| Myalgia | 114 | 83.21 |
| Headache | 89 | 64.96 |
| Vomiting | 41 | 29.93 |
| Diarrhea | 2 | 1.46 |
| Others | 4 | 2.90 |
| **Clinical signs (in categories)** |  |  |
| Low (median ≤4) | 64 | 46.38 |
| High (median >5) | 74 | 53.62 |
| **Patient status** |  |  |
| ICU | 2 | 1.50 |
| OPD | 102 | 76.69 |
| Ward/Cabin | 29 | 21.80 |
| **Co-morbiditiesa** |  |  |
| COPD | 7 | 5.11 |
| Asthma | 10 | 7.30 |
| ILD | 1 | 0.73 |
| DM | 36 | 26.28 |
| IHD | 13 | 9.49 |
| HTN | 36 | 26.28 |
| CLD | 5 | 3.65 |
| Cancer | 2 | 1.46 |
| Pregnancy | 1 | 0.73 |
| CKD | 2 | 1.46 |
| **Any Co-morbidities** |  |  |
| Yes | 65 | 47.45 |
| No | 72 | 52.55 |

aMultiple response

The study included 138 confirmed cases of chikungunya, with a mean delay of 2.89 days (SD: 1.39) and a median delay of 3 days (IQR: 1.00) in testing after symptom onset. Among these cases, 77.37% (n=106) sought testing within 3 days, while 22.63% (n=31) delayed testing beyond this period. A small proportion of patients (14.49%, n=20) required hospitalization, whereas the majority (85.51%, n=118) managed their illness on an outpatient basis.

Regarding employment, 60.45% (n=81) of participants were employed, while 39.55% (n=53) were not.

Patient status was predominantly outpatient (76.69%, n=102), with fewer patients admitted to wards or cabins (21.80%, n=29) and only 1.50% (n=2) requiring ICU care.

**Table 2: Follow up patients’ conditions (n=48)**

|  |  |  |
| --- | --- | --- |
|  | **Mean (SD)** | **Median (IQR)** |
| **Duration of hospital stay (in days)** | 5.94 (4.36) | 4.00 (4) |
| **Loss of working days** | 10.01 (5.32) | 8.5 (3.5) |
|  | **n** | **%** |
| **Patient Status** |  |  |
| Persistent symptoms | 40 | 85.1 |
| Recovered | 7 | 14.9 |
| **Symptoms presenta** |  |  |
| Joint Pain | 39 | 95.12 |
| Joint Swelling | 9 | 21.90 |
| Fatigue | 13 | 31.7 |
| Others | 8 | 25.00 |
| **Any Symptoms** |  |  |
| Yes | 41 | 87.20 |
| No | 6 | 12.80 |

A follow-up of 48 patients revealed that the mean duration of hospital stay was 5.94 days (SD: 4.36), with a median stay of 4 days (IQR: 4). Patients experienced an average loss of 10.01 working days (SD: 5.32), with a median of 8.5 days (IQR: 3.5).

Regarding recovery, 85.1% (n=40) of patients reported persistent symptoms during the follow-up period, while only 14.9% (n=7) had fully recovered. Among those with ongoing symptoms, joint pain was the most prevalent, affecting 95.12% (n=39) of patients. Other reported symptoms included fatigue (31.7%, n=13), joint swelling (21.9%, n=9), and miscellaneous symptoms (25.0%, n=8).

Overall, 87.2% (n=41) of patients experienced at least one symptom during follow-up, while 12.8% (n=6) reported no symptoms.

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| **Fig 1: Daily cases of chikungunya** |

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| **Fig 1: Daily cases (top) and onset (bottom) of chikungunya** |

The data summarizes the timeline of symptom onset and case collection for chikungunya cases from October to December 2024. In October, case collections were relatively low, with a total of 5 cases collected on four dates (October 19, 24, 26, and 31). The highest daily collection during this period was 2 cases on October 19, while the other dates recorded single cases. Symptom onset data for October also revealed low numbers, with one case reported on each of four dates (October 16, 18, 22, and 24).

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| **Figure 2: The gender (left) and age (right) distribution of chikungunya virus infection (CHIKV), Oct 19th – Dec 11th, 2024** |

The age distribution revealed that 83.33% (n=115) of cases were 30 years or older, with males comprising 64.49% (n=89) of the sample.

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| **Figure 3: Chikungunya cases in Dhaka and outside City (Oct 19th – Dec 11th, 2024)** |

Geographically, most cases were reported from Dhaka South City Corporation (52.17%, n=72) and Dhaka North City Corporation (46.38%, n=64), with only 1.45% (n=2) residing outside Dhaka.

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| **Figure 4: Clinical Symptoms of the chikungunya patients, Oct 19th – Dec 11th, 2024** |

Symptom analysis showed that fever was present in all cases (100%, n=137), followed by arthralgia (97.81%, n=134), myalgia (83.21%, n=114), headache (64.96%, n=89), and conjunctivitis (46.72%, n=64). Less common symptoms included vomiting (29.93%, n=41), generalized rash (24.09%, n=33), arthritis (2.02%, n=2), diarrhea (1.46%, n=2), and other miscellaneous symptoms (2.90%, n=4). Clinical severity, categorized by symptom burden, indicated 46.38% (n=64) with low severity (median ≤4 symptoms) and 53.62% (n=74) with high severity (median >5 symptoms).

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| **Figure 5: Comorbidities of the chikungunya patients** |

Comorbidity analysis revealed that 47.45% (n=65) of patients had at least one comorbid condition, with hypertension (26.28%, n=36) and diabetes mellitus (26.28%, n=36) being the most common. Other comorbidities included ischemic heart disease (9.49%, n=13), asthma (7.30%, n=10), chronic obstructive pulmonary disease (COPD, 5.11%, n=7), chronic liver disease (3.65%, n=5), chronic kidney disease (1.46%, n=2), cancer (1.46%, n=2), interstitial lung disease (0.73%, n=1), and pregnancy (0.73%, n=1).

Table 3: Factor associated with hospitalization

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | **Hospitalized** | |  |
| **Yes**  **n (%)** | **No**  **n (%)** | **P-value** |
| **Age groups** | <30 | 1 (4.35) | 22 (95.65) | 0.130 |
|  | ≥30 | 19 (16.52) | 96 (83.48) |  |
| **Sex** | Female | 6 (12.24) | 43 (87.76) | 0.578 |
|  | Male | 14 (15.73) | 75 (84.27) |  |
| **Employment Status** | No | 10 (18.87) | 43 (81.13) | 0.300 |
|  | Yes | 10 (12.35) | 71 (87.65) |  |
| **Location** | Dhaka North City Corporation | 5 (7.81) | 59 (92.19) | <0.001 |
|  | Dhaka South City Corporation | 2 (100.00) | 0 (0.00) |  |
|  | Outside of Dhaka | 13 (18.06) | 59 (81.94) |  |
| **Clinical signs** | Low (median ≤4) | 14 (21.88) | 50 (78.12) | 0.022 |
|  | High (median >5) | 6 (8.11) | 68 (91.89) |  |
| **Delay in test** | Yes (median≤3) | 15 (14.15) | 91 (85.85) | 0.784 |
|  | No (median>3) | 5 (16.13) | 26 (83.87) |  |
| **Comorbidity** | No | 8 (11.11) | 64 (88.89) | 0.224 |
|  | Yes | 12 (18.46) | 53 (81.54) |  |
| **Total** | | 20 (14.49) | 118 (85.51) |  |

In terms of **age groups**, patients aged ≥30 years were more likely to be hospitalized (16.52%) compared to those under 30 years (4.35%), though this difference was not statistically significant (p=0.130). **Sex** did not show a significant association with hospitalization, as 12.24% of females and 15.73% of males required hospitalization (p=0.578). Similarly, **employment status** showed no significant difference, with 18.87% of unemployed patients and 12.35% of employed patients being hospitalized (p=0.300).

**Location** showed a statistically significant association with hospitalization (p<0.001). Patients from Dhaka South City Corporation had the highest hospitalization rate (100%), though the sample size was small. Patients outside Dhaka also had a higher hospitalization rate (18.06%) compared to those from Dhaka North City Corporation (7.81%).

**Clinical signs** were significantly associated with hospitalization (p=0.022). Patients with lower clinical scores (median ≤4) were more likely to be hospitalized (21.88%) compared to those with higher scores (median >5, 8.11%). **Delay in testing** and **comorbidities** did not show significant associations with hospitalization. Patients tested within the median delay of ≤3 days had a hospitalization rate of 14.15%, while those tested after 3 days had a slightly higher rate of 16.13% (p=0.784). Similarly, patients with comorbidities had a higher hospitalization rate (18.46%) compared to those without (11.11%), but the difference was not statistically significant (p=0.224). Overall, 14.49% of patients were hospitalized, with significant associations observed for location and clinical signs, highlighting their potential role in predicting hospitalization risk.

Table 4: Factor associated with hospitalization using modified poisson regression model

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | **IRR** | **95% CI** | **P-value** |
| **Age groups** | <30 | Reference |  |  |
|  | ≥30 | 1.14 | 1.02 - 1.28 | 0.027 |
| **Sex** | Female | Reference |  |  |
|  | Male | 1.08 | 0.94- 1.25 | 0.269 |
| **Employment Status** | No | Reference |  |  |
|  | Yes | 0.87 | 0.75 – 1.01 | 0.062 |
| **Clinical signs** | Low (median ≤4) | Reference |  |  |
|  | High (median >5) | 0.87 | 0.77 – 0.98 | 0.017 |
| **Delay in test** | Yes (median≤3) | Reference |  |  |
|  | No (median>3) | 1.03 | 0.90 - 1.18 | 0.665 |
| **Comorbidity** | No | Reference |  |  |
|  | Yes | 1.02 | 0.91 - 1.16 | 0.703 |

**Age** showed a significant association with hospitalization. Patients aged ≥30 years had a 14% higher risk of hospitalization compared to those aged <30 years (IRR: 1.14, 95% CI: 1.02–1.28, p=0.027). **Sex** did not demonstrate a statistically significant relationship with hospitalization, with males having a slightly higher, but nonsignificant, risk compared to females (IRR: 1.08, 95% CI: 0.94–1.25, p=0.269). Similarly, **employment status** was not significantly associated with hospitalization, although employed individuals showed a marginally lower risk (IRR: 0.87, 95% CI: 0.75–1.01, p=0.062).

**Clinical signs** were significantly associated with hospitalization. Patients with higher clinical scores (median >5) had a 13% lower risk of hospitalization compared to those with lower scores (median ≤4) (IRR: 0.87, 95% CI: 0.77–0.98, p=0.017). **Delay in testing** and **comorbidities** did not show significant associations. Patients with a testing delay of more than 3 days had a slightly higher, but nonsignificant, risk of hospitalization compared to those tested earlier (IRR: 1.03, 95% CI: 0.90–1.18, p=0.665). Similarly, the presence of comorbidities was not a significant predictor of hospitalization (IRR: 1.02, 95% CI: 0.91–1.16, p=0.703).

**References**

[1] G. Zou, A modified poisson regression approach to prospective studies with binary data, Am J Epidemiol 159 (2004) 702–706. https://doi.org/10.1093/AJE/KWH090.