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Original Article

# Study of Dengue Outbreak During 2022 Floods Among Patients Presenting to a Tertiary Level Hospital in Nowshera, Pakistan

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## ABSTRACT

***Objective***: To assess the disease burden of dengue due to outbreak during floods among patients presenting to a tertiary level hospital facility.

***Study Design***: Cross-sectional study.

***Place and Duration of Study***: Department of Medicine, Combined Military Hospital, Nowshera Pakistan, from Jul to Nov 2022.

***Methodology***: A sample size of 385 was calculated using the World Health Organization sample size calculator (95% confidence interval, 5% margin of error). Consecutive universal sampling was employed to collect data from confirmed dengue patients in inpatient and outpatient departments. Inclusion criteria encompassed individuals of all ages and genders with clinical and laboratory-confirmed dengue. Patients with negative dengue tests, malaria, typhoid, or Immune Thrombocytopenic Purpura were excluded. Data on monthly dengue cases, comorbidities, recovery, and mortality were analyzed using descriptive statistics through Statistical Package for the Social Sciences software v23.0.

***Results***: Out of the total 925 dengue patients, 583(63.0%) were males, 245(26.4%) were females and 97(10.6%) were children. Dengue occurred most frequently among the age group of 20-35 years (38.1%). Only 6 cases were reported in July 20222 after the first reported case on 25th July 2022. Number of positive cases increased in subsequent months, with 223 cases in August, 425 in September, 210 in October and 61 cases in November, which represent a drastic increase as compared to the same time frame from last year.

***Conclusion***: In the aftermath of the 2022 floods, an increase in dengue cases in Nowshera during August to September 2022 was noted, as compared to the same time frame in 2021.

**Keywords**: Aedes Aegypti, Aedes Albopictus, Dengue Fever, Dengue Hemorrhagic Fever, Flood.

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## INTRODUCTION

Dengue, a mosquito-borne viral illness transmitted by Aedes aegypti and Aedes albopictus, is a major public health threat in tropical and subtropical regions, particularly Asia.[1] Climate change has exacerbated its incidence, with outbreaks peaking during monsoon months (July–September) due to favorable breeding conditions for mosquitoes.[2] The dengue virus (DENV 1-4) causes a spectrum of disease,[3] ranging from asymptomatic or self-limiting classic dengue fever (DF) to severe forms like dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS).[4] While DF presents with fever, headache, myalgia, and rash, severe cases involve warning signs such as mucosal bleeding, thrombocytopenia, vascular leakage, and organ failure, with DSS mortality reaching 12–44%.[5] Globally, over 2.5 billion people are at risk annually, with Asia bearing 70% of the burden.[6] In Pakistan, dengue emerged as a crisis after the 2006 outbreak, with recurrent epidemics causing significant morbidity and mortality when a 2011 outbreak in Punjab province infected 21,597 individuals and claimed 365 lives.[7] In Khyber Pakhtunkhwa (KP), dengue cases surged from 2013 onward, with 9,024 cases and 70 deaths reported in Swat (2013), followed by province-wide outbreaks in 2017 followed by a 2019 outbreak in Peshawar, which recorded 47,120 confirmed cases and 75 deaths.[8] Thus, this study aimed to evaluate the post-flood dengue burden following Pakistan's catastrophic 2022 floods. By assessing comorbidities, symptom profiles, and outcomes, the study sought to inform public health strategies and precautionary measures to mitigate future outbreaks as these findings would emphasize

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the urgent need for climate-resilient surveillance, vector control, and healthcare preparedness in flood-prone regions vulnerable to dengue's expanding footprint.

## METHODOLOGY

This was a cross-sectional study carried out in Department of Medicine, CMH Nowshera, Pakistan from July to November 2022, over a period of 5 months, following approval from Ethical Committee of hospital (EC-26- dt 21/10/22). Sample size was calculated using online World Health Organization (WHO) sample size calculator, taking confidence interval as 95% and margin of error as 5% with which sample size came out to be 385. Quantitative data of confirmed dengue patients was obtained from both in-door and out-door departments, using consecutive universal sampling technique. Any person coming from flood affected area of Nowshera, with complaints of sudden onset fever (>38°C) for 2-7 days with at least one of the clinical symptoms of dengue (body-ache, vomiting, severe headache, retro-orbital pain, myalgia or arthralgia) was considered as a dengue suspect, and later confirmed by laboratory testing either positive Dengue NS1 or IgM.

**Inclusion criteria**: Patients of all ages and either gender, presenting to the hospital with clinical symptoms and signs of dengue infection with subsequent laboratory confirmed dengue fever were included in the study.

**Exclusion criteria**: Patients with negative/suspected dengue (Negative NS1 and IgM), malaria, typhoid and Immune Thrombocytopenic Purpura (ITP) were excluded from the study.

The data was assessed as month wise number of dengue cases and associated co-morbid conditions in relation to recovery and mortality, then summarized as mean, frequency, and percentage and analyzed via Statistical Package for the Social Sciences (SPSS) version 23.0.

## RESULTS

A total of 925 patients of confirmed dengue reported to our hospital during study period which was 4.7 folds higher incidence as compared to 2021, in which only 194 Dengue cases were reported (July to December 2021). In our study, out of total 925 cases, 583(63.0%) patients were males, 245(26.5%) were females and 97(10.5%) were children, with mean age of 35±15.07 years, with youngest being 6 years and oldest being 78 years of age. Dengue occurred frequently among different age groups, with 38.1% in 20-35 years, 26.3% in 36-50 years, and 19.0% in 51-65 years as shown in Table-I. Out of total 925 reported cases, 584(63.1%) were treated as in-door cases, of which 427(73.1%) were male, 103(17.6%) were female and 54(9.2%) were children while the rest 341(36.9%) were asymptomatic or with mild Dengue, who were treated as out-door cases as shown in Figure-1.

**Table-I: Demographic Distribution of Dengue Cases Over Time (n=925)**

| | **In-door 584(63.1%)** | **Out-door 341(36.9%)** |
|---|---|---|
| Male: 583(63.0%) | 427(73.2%) | 156(26.7%) |
| Female: 245(26.4%) | 103(43.1%) | 142(57.9%) |
| Children: 97(10.6%) | 54(55.6%) | 43(44.3%) |
| Month: | July | 6(0.6%) |
| | Aug | 223(24.1%) |
| | Sept | 425(45.9%) |
| | Oct | 210(22.7%) |
| | Nov | 61(6.6%) |
| **Total (n)** | | 925 |

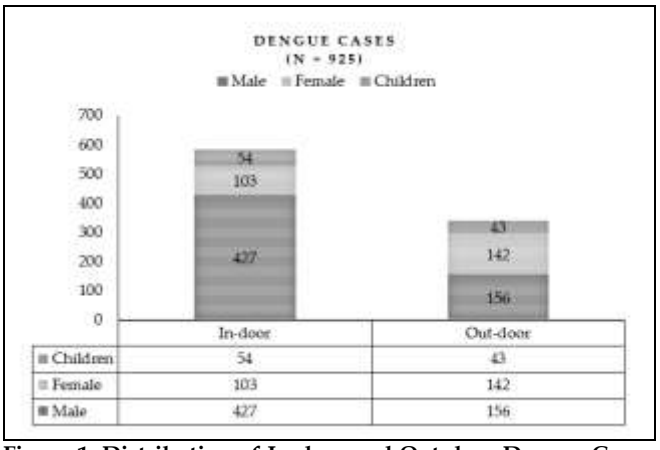


**Figure-1: Distribution of In-door and Out-door Dengue Cases (n=925)**

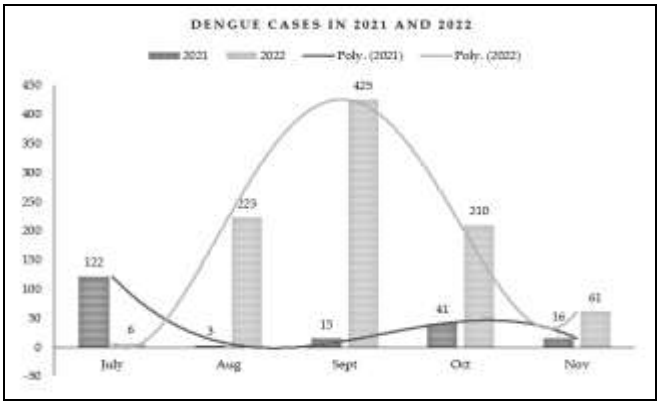


**Figure-2: Comparison of Dengue Cases in 2021 and 2022 (n=925)**

As per hospital records, the first case of Dengue reported to our hospital on 25 July 2022 with month-wise record of dengue cases during our study period, showing sudden rise in months of August and September, due to flood conditions, as compared to 2021. Only 6 cases were reported in the last week of July, which increased drastically in subsequent months as shown in Figure-2.

It has been noted that most common clinical symptom at presentation, along with fever, was body ache and backache in 493(53.3%) patients along with retroorbital pain 238(25.7%), vomiting and abdominal pain 134(14.5%) while 60(6.5%) patients had mucosal bleed with or without petechial rash at the time of presentation as shown in Figure-3.

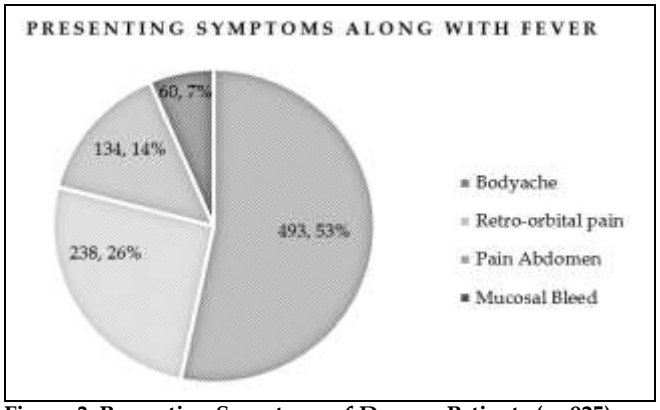


**Figure 3: Presenting Symptoms of Dengue Patients (n=925)**

Out of total 925 patients, 296(32%) developed warning signs, out of which 162(54.7%) patients required platelets transfusion. We recorded 6(0.7%) deaths due to Dengue Shock Syndrome secondary to severe capillary leak causing hemodynamic collapse and alveolar hemorrhage. Out of these, 5(83.3%) were in age group of 65-75 years with multiple comorbid conditions including Type-2 Diabetes Mellitus in 4 patients, Ischemic Heart Disease in 2 patients and Chronic Liver Disease in 1 patient, however, 1(16.7%) patient with no comorbid conditions and of 41 years of age, developed alveolar and retinal hemorrhages leading to death.

## DISCUSSION

The findings of our study showed that there was sudden rise in dengue cases after flooding due to favorable breeding conditions of dengue virus. There was gradual decrease in cases in subsequent months due to insecticide spray, elimination of breeding spots, awareness campaign and when flood water was cleared. In this study, disease control measures were applied to control spread of dengue in response to previous outbreaks with one study noting that there was an enormous decline in dengue after protective and disease control measure taken in response to previous outbreaks.[9] Similar to our findings, another study also found that males were more prone to get symptomatic dengue infection as compared to females with similar age distribution.[10] Similarly, studies have concluded that no flood control or water disposal system during rainfall season led to increased risk of dengue outbreak.[11,12] The collection of stagnant water in dengue prevalent areas is the main cause of mosquito breeding and spread and available data has shown a direct link between the increasing number of dengue cases and average rainfall during flood conditions.[13] The literature has already established that underreporting, misdiagnosed cases, late detection, late response, and delayed insecticidal spray are associated with the absence or deficiency of active surveillance monitoring system[14] with dengue control measures, such as, insecticide sprays and clearance of stagnant water, are active means to eradicate mosquito breeding and ultimately, reducing dengue cases.[15] Importantly, public education and awareness campaigns, prophylactic measures and management training activities are advised at community level, in public as well as private setups, to improve the understanding and knowledge regarding dengue spread.[16]

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## LIMITATIONS OF STUDY

The limited sample size and single-center nature of our study limits its generalizability. As it was carried out during extraordinary condition of natural calamity, we encountered limited resources and overburdened staff which restricted us from following up on patients in the long-term.

## CONCLUSION

Dengue was more prevalent due to flood conditions followed by stagnant water which created favorable conditions for mosquito breeding and led to increased disease burden but dengue cases reduced after implementation of preventative measures.

**Conflict of Interest: None.**

**Funding Source: None.**

**Authors' Contribution**

Following authors have made substantial contributions to the manuscript as under:

HAS & SWA: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

WA & MA: Conception, data analysis, drafting the manuscript, approval of the final version to be published.

FN, AS & HI: Data acquisition, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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