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Prevalence of Dengue Patients in Birgunj Metropolitan City, Nepal

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Abstract

Dengue is a viral infection transmitted by female Aedes aegypti and Aedes albopictus mosquitoes (Vasilakis et al., 2011). The causative agent, dengue virus (DENV), belongs to the genus Flavivirus of the Flaviviridae family, which comprises single-stranded RNA viruses (Gould et al., 2008). DENV has four main serotypes: DENV-1, DENV-2, DENV-3, and DENV-4(Takasaki et al., 2008). Most dengue infections (up to 60%) are self-limiting (Bhatt et al., 2013), characterized by acute fever, frontal headache, vomiting, myalgia, joint pain, and a macular skin rash (Simmons et al., 2012). This report lists and examines dengue cases in Birgunj Metropolitan City, Nepal, based on a dataset of 26 confirmed patients. Among them, young adults aged 20–30 years were found to be the most affected age group, with 13 patients, which is 50% of cases, suggesting elevated exposure due to occupational and behavioral factors. Based on gender, males were found to be more affected compared to females, with 19 patients, likely linked to lifestyle patterns and outdoor activity. Temporally, cases were concentrated in the months of Falgun (n=14) and Chaitra (n=12), indicating active transmission during the late dry season and differences seen due to the weather patterns.

Keywords: Aedes aegypti, Aedes albopictus, DENV, Complete blood counts, Rapid diagnostic tests

Introduction

Dengue is a viral infection transmitted by female *Aedes aegypti* and *Aedes albopictus* mosquitoes (Vasilakis *et al*., 2011). The causative agent, dengue virus (DENV), belongs to the genus *Flavivirus* of the Flaviviridae family, which comprises single-stranded RNA viruses (Gould *et al*., 2008). DENV has four main serotypes: DENV-1, DENV-2, DENV-3, and DENV-4(Takasaki *et al*., 2008). Infection with any one of these serotypes likely confers lifelong immunity to that specific serotype (Salje *et al*., 2018). Infection by a new serotype may result in severe disease (Pang et al., 2007). Most dengue infections (up to 60%) are self-limiting (Bhatt et al., 2013), characterized by acute fever, frontal headache, vomiting, myalgia, joint pain, and a macular skin rash (Simmons *et al*., 2012).

However, some patients may develop life-threatening conditions such as acute dengue hemorrhagic fever (DHF), dengue shock syndrome (DSS), and (multi-)organ failure. In the absence of effective vaccines and antiviral drugs, symptomatic treatment and vector control programs are currently the only viable strategies for dealing with dengue infections (Gubler DJ., 2012). The studies had suggested that timely diagnosis and clinical management with intravenous rehydration are critical to mitigate the severity of infection (Gibbons *et al*., 2002). Transmission can be reduced through protection from blood-feeding *Aedes* mosquitoes

The laboratory diagnosis of dengue is supported by the clinical suspicion followed by diagnostics that include rapid diagnostic tests (RDT), enzyme-linked immunosorbent assay (ELISA), and complete blood counts (CBC) (Pun SB., 2011). A CBC profile demonstrating leucopenia, thrombocytopenia, increased hematocrit, and liver enzymes are some of the parameters that aid in clinical suspicion (Pun SB., 2011). More specific and sensitive diagnostic tools, such as viral isolation and culture, and detection of viral genome by polymerase chain reaction (PCR), are not routinely performed in Nepal (Pun SB., 2011). Moreover, serological tools are used even during epidemic outbreaks, which further limits the proper diagnosis of disease in Nepal, as such tests are not the gold standard, and DENV virus may not be detected before the development of antibodies, severely limiting diagnosis during outbreaks (Malla *et al*.,2008).

Rapid and unplanned urbanization, poor waste management, and stagnant water collections have also created ideal breeding sites, particularly in urban centers like Kathmandu (LWW Journal, 2023). Furthermore, the expansion of Aedes aegypti and Aedes albopictus mosquitoes to elevations of 2,100 meters has widened the geographical range of the disease (LWW Journal, 2023). Open borders with India, where dengue is also highly prevalent, facilitate cross-border transmission, while increased human mobility during festivals and migration seasons accelerates virus spread (LWW Journal, 2023).

Risk factors and transmission

Several factors contribute to the rising incidence of dengue in Nepal, are mentioned below:

- Climate conditions: rising temperature, increased rainfall, and high humidity provide favorable conditions for breeding for Aedes mosquitoes (Dhimal *et al.*, 2018)

- Urbanization and population density: Poor drainage systems and water storage practices in urban areas contribute to mosquitoes' proliferation (EDCD,2020)
- Travel and migration: Cross-border movement between Nepal and India facilitates the introduction and spread of the virus (Pun and Bastola,2019)

Dengue infection presents with a spectrum of symptoms ranging from mild febrile illness to severe dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS). Symptoms include high fever, severe headache, joint and muscle pain, rash, and mild bleeding tendency (WHO, 2021)

Prevention and control strategies:

- Mosquito control measures: eliminating breeding sites using insecticide spray and introducing biological control agents (EDCD, 2020)
- Community engagement and public awareness: education campaigns to encourage the use of mosquito nets, protective clothing, and proper waste disposal (Gautam and Adhikari, 2020)
- Vaccination: Although the vaccine is available, its implementation in Nepal requires further research. (WHO,2021)

Materials and Methods

Study area

Birgunj is a metropolitan city in Parsa district in Madesh province in southern Nepal. It lies 135 Km south of Kathmandu, attached to the north of Raxaul on the border of the indian state of Bihar, with a total area of 75.24 km^2. Birgunj is also known as the 'Gateway of Nepal' and the 'Commercial Capital of Nepal'. Its coordinates are $27^0 0'$N $84^0 52'$E. The map of the study area is made using ArcGIS version 10.7.1.

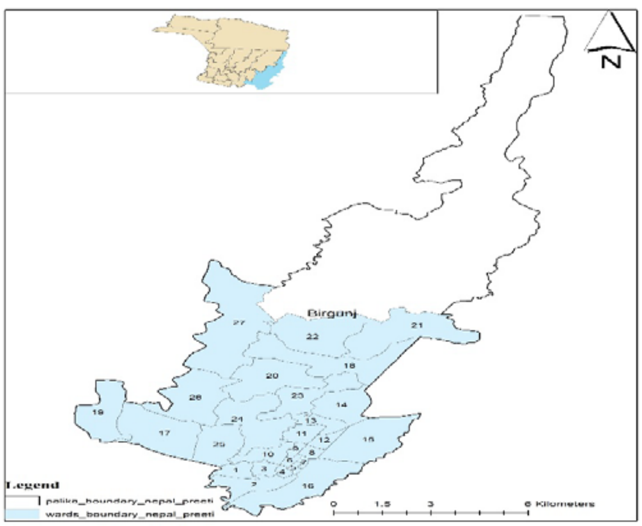

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Figure 1: Map of study area

Methods

This study employs a descriptive cross-sectional research design to assess the prevalence of dengue patients in Birgunj Metropolitan City, Nepal. Data were collected from hospitals, health centers, and laboratories in the region, focusing on dengue cases reported in Falgun and Chaitra months. Secondary data from governmental and non-governmental health institutions, including epidemiological surveillance reports, were also analyzed. Structured information was gathered, including patient demographic and clinical information, including the age and gender of the patient.

Data analysis

Statistical analysis was included, estimating the number of cases, different age groups, and gender of the Birgunj Metropolitan City. The outcomes were compared with the past Epidemiology and Disease Control division survey to understand the current situation of dengue in that place.

Result

Variation of dengue patients based on age group

There are altogether 26 patients, among whom the largest number of patients belongs to the 20-30 age group, i.e., 13 patients, and the smallest number of patients belongs to the 0-10 age group, i.e., three patients (Table 1 and Figure 2).

Table 1: Observation of the number of patients based on age group

Age Groups	Number of patients
0-10	3
10-20	6
20-30	13
30-40	4

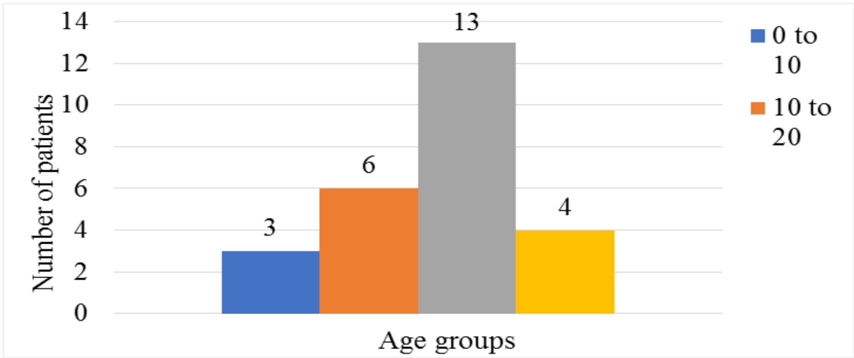

Figure 2: Bar graph showing variation of dengue in different age groups

Variation of dengue patients based on gender

Totally 26 number of dengue patients, of which 19 are male and seven are female (Figure 3).

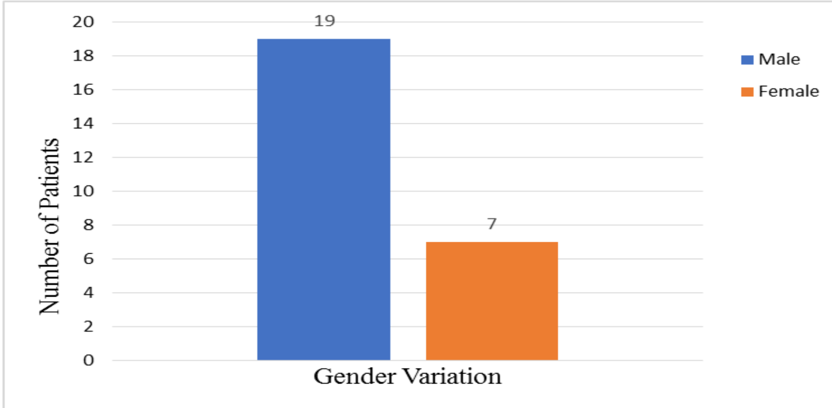

Figure 3: Bar graph showing male and female patients of dengue

Monthly variation of dengue patients

Out of 26 tested positive dengue patients, 14 tested positive in Falgun (54%) and 12 tested positive in Chaitra (46%) (Table 2 and Figure 3).

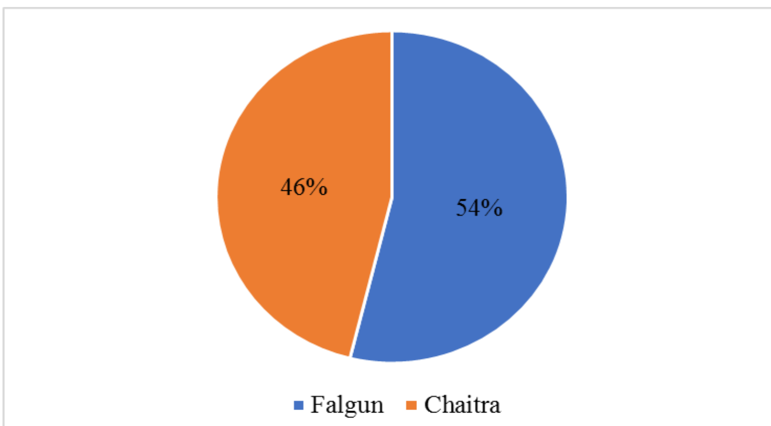

Figure 4: Pie chart showing the monthly percentage of patients with dengue

Discussion

In the collected data of 26 dengue patients from Birgunj Metropolitan City, young adults between the ages of 20-30 were found to be the most affected group, with 13 cases, exactly half of the total. This concentration of cases may point to behavioral patterns typical of this age group, such as increased time spent outdoors for work, education, or recreation, all of which maximize the risk of mosquito exposure. Meanwhile, children aged 0-10 were found to be the least affected age group, with only three cases, suggesting that younger age groups may either have lower exposure or benefit from parental protective measures during peak transmission periods**.**

Out of the 26 recorded dengue cases in Birgunj Metropolitan City, a significant gender difference was observed: 19 of the patients were male and only seven were female. This finding suggests that men may have a higher exposure risk to dengue vectors, possibly due to occupational and behavioral factors such as spending more time outdoors or working in mosquito-prone environments. Gender-based infection can vary depending on lifestyle, local ecology, and socio-cultural patterns, which influence the likelihood of contact with *Aedes* mosquitoes.

Similar trends have been reported in previous studies, which documented a similar male dominance in dengue cases in urban Nepal, linking it to increased mobility and engagement in outdoor activities among men (Pun *et al*., 2021). Such insights emphasize the need for targeted groups, including awareness campaigns and protective strategies that consider gender-specific risk factors to reduce transmission rates more effectively. According to the data of Birgunj Health Department, Narayani Hospital and Clinic, the total number of dengue cases of 2023-2024 is 1250. According to that data, the most affected age groups are 20-40 years, which is 45% of the total cases of dengue and the number of deaths is seven.

Among the 26 confirmed dengue cases in Birgunj Metropolitan City, a slightly higher number of patients 14 individuals were tested positive during the month of Falgun, while the remaining 12 tested positive in Chaitra. This near-even distribution over two consecutive months suggests that dengue transmission remained consistently active during the late dry season, a period that can still support *Aedes* mosquito breeding due to residual water sources and favorable temperatures.

This monthly pattern aligns with regional studies highlighting that dengue outbreaks in Nepal often persist into the pre-monsoon period, influenced by urban water storage practices and climatic variability (Pun *et al*., 2021). Keeping track of dengue cases month-wise helps us know when outbreaks are likely to happen, so we can take action in time to control mosquitoes. Health programs should also continue spreading awareness and taking preventive steps even after the rainy season, since the risk of dengue can last longer

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