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Epidemiological Trends of Dengue Fever among Children of Gandaki Province

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ABSTRACT

Background

Dengue fever is an emerging public health concern in Nepal, with rising incidence and frequent outbreaks. In Gandaki Province, it affects all age groups, including children who are particularly vulnerable to severe forms. This study aims to assess the demographic patterns, geographical distribution, seasonal variation, and temporal trends of dengue among children in Gandaki Province, Nepal.

Methods

This study analyzed secondary surveillance data from the Early Warning and Reporting System (EWARS) and District Health Information System 2 (DHIS2) from January 2021 to December 2024. Laboratory-confirmed dengue cases among children aged 0–14 years were included. Descriptive statistics summarize demographics, while temporal, seasonal, and district-level analyze identified trends and geographical clustering.

Results

A total of 7,412 dengue cases were reported among children during the study period, increasing from 233 in 2021 to 3,508 in 2024. Males accounted for 60.2% (4,461) and females 39.8% (2,951), with a male-to-female ratio of 1.5:1. The highest burden occurred in Kaski district, followed by Tanahun and Gorkha, while Manang reported the fewest cases. A distinct seasonal peak was observed in September (1,324 cases) and October (1,278 cases) following the monsoon.

Conclusions

Dengue fever among children in Gandaki Province showed a steady increase over four years, with geographical clustering in high burden areas with peaks during September and October. These findings highlight sociocultural, environmental and geographical influence on transmission of dengue among children of Gandaki Province.

Keywords: dengue fever; Gandaki province; geographical; outbreak; seasonal; variation.

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INTRODUCTION

Dengue fever is a mosquito-borne viral infection causing around 400 million cases and over 20,000 deaths worldwide each year.[1–3] In Nepal, it is a public health concern, with rising annual incidence and several recent outbreaks.[4] In Gandaki Province, cases are steadily rising including children, clinically varying from mild fever to severe forms.[5,6] The disease is caused by dengue virus serotypes and transmitted by Aedes mosquitoes, typically progressing through febrile, critical, and recovery phases.[7,8] Common manifestations include fever, headache, joint pain, and rash, although some patients exhibit atypical features, and severe cases may progress to hemorrhage, shock, and multi-organ failure.[9–11] Children are highly susceptible to shock due to increased vascular permeability posing a diagnostic and treatment challenge, especially in resource-limited settings.[12] This study aims to analyze demographics, seasonal patterns, and geographical distribution of dengue fever among children in Gandaki Province to inform policymakers and enhance surveillance and control strategies.

METHODS

This study analyzed secondary data on dengue fever among children aged 0–14 years in Gandaki Province, Nepal, reported between January 2021 and December 2024. The data were obtained from the Early Warning and Reporting System (EWARS) and District Health Information System 2 (DHIS2), the national health management information system that routinely collects case-based surveillance data from public and private hospitals, and health posts across the province. All data used in this study were fully anonymized to ensure patient confidentiality. Since the research involved only secondary analysis of routinely collected surveillance data and did not involve direct interaction with human participants, formal informed consent was not required. Additionally, in accordance with national guidelines for research involving de-identified data, formal ethical approval was not sought. A formal and written administrative permission and clearance to use the data for this study was obtained from the Ministry of Health, Gandaki Province (Ref. No. 313/82-83). Children with a laboratory-confirmed diagnosis of dengue during the study period were included in the study. Cases with incomplete demographic or clinical information or unconfirmed diagnoses and children more than 15 years were excluded from the study. Extracted variables included age, sex, district, and month of diagnosis. Data were initially managed and cleaned using Microsoft Excel and subsequently analyzed using Stata version 17.0. Descriptive statistics summarized demographic characteristics, while temporal trends were analyzed annually and by month to identify seasonal peaks. Geographic distribution of cases was visualized to highlight district-wise burden. Results were presented using tables and graphs.

RESULTS

A total of 7,412 dengue cases were reported among children in Gandaki Province between January 2021 and December 2024. The incidence of dengue in Gandaki Province increased markedly over the study period, with reported cases rising from 233 in 2021 to 3,508 in 2024, reflecting a consistent upward trend each year.

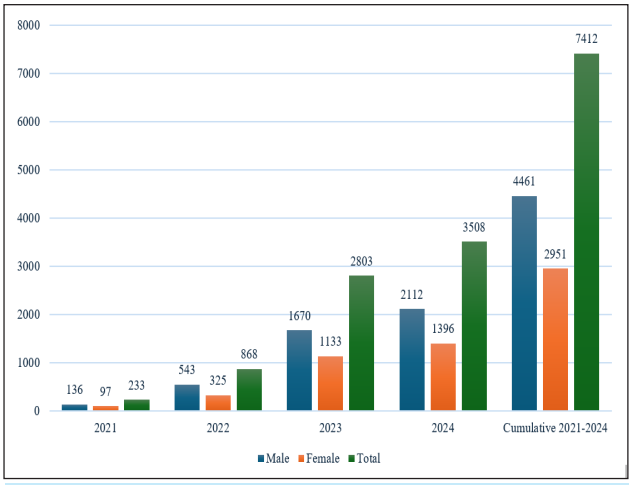

Figure 1. Sex distribution of dengue fever.

Figure 1 shows that, males consistently accounted for a higher proportion of cases than females. In 2021, 136 males (58.4%) and 97 females (41.6%) were reported, while in 2024, the male-to-female ratio remained similar with 2,112 males (60.2%) and

1,396 females (39.8%). Overall, 4,461 cases (60.2%) occurred in males and 2,951 cases (39.8%) in females, indicating a clear male predominance throughout the study period. This sex distribution pattern suggests that male children were more frequently affected by dengue in Gandaki Province during the four-year period.

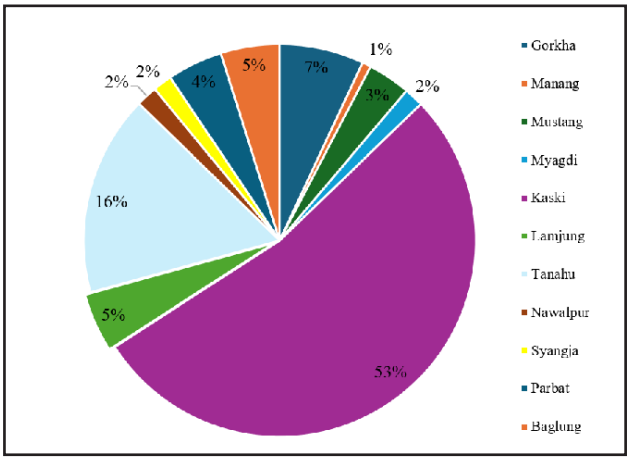

Figure 2. District wise distribution of dengue fever.

Figure 2 illustrates the cumulative proportion of dengue cases among children across 11 districts of Gandaki Province during the study period. Kaski district accounted for the highest burden of pediatric dengue, representing the largest proportion of cases. Tanahu contributed 16% of total cases, followed by Gorkha with 7%. Baglung and Lamjung each reported 5% of cases, while Parbat accounted for 4%. Mustang contributed 3% of cases, and Myagdi, Nawalpur, and Syangja each accounted for 2%. Manang reported the lowest proportion, with 1% of pediatric dengue cases. These findings highlight a marked geographical variation in the distribution of dengue across the province, with a clear predominance in Kaski District.

Figure 3 illustrates the cumulative monthly distribution of dengue fever among children of Gandaki Province. Dengue fever was reported throughout the year, with a clear seasonal peak during the monsoon and immediate post-monsoon months. The number of cases began to increase in July (573 cases), rose further in August (767 cases), and reached the highest levels in September (1,324 cases) and October (1,278 cases). A gradual decline followed, with 593 cases in

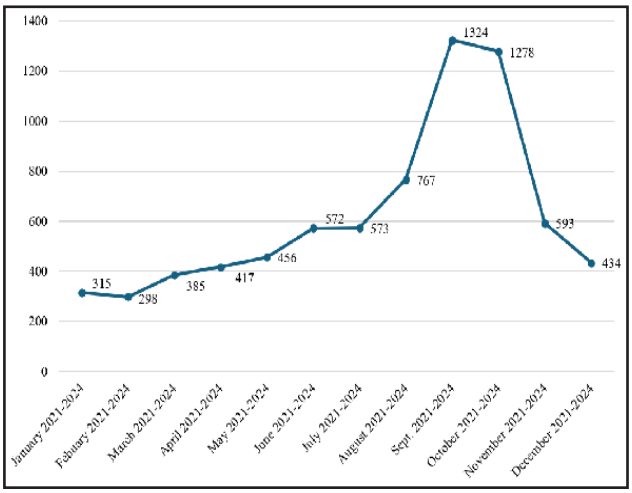

Figure 3. Seasonal distribution of dengue fever.

November and 434 cases in December. In the earlier months of the year, case counts remained relatively low, with 316 in January, 298 in February, 385 in March, 417 in April, and 572 in May.

DISCUSSION

In the present study, a male preponderance was observed, with a male-to-female ratio of 1.5:1 among children diagnosed with dengue fever. This finding is consistent with a study conducted by Ghosh et al which reported a higher proportion of cases in males with male-to-female ratio of 1.2:1, potentially reflecting differences in exposure risk, or healthcare-seeking behavior.[13] However, a study by Kittugil et al. reported a nearly equal sex distribution, with a male-to-female ratio of 1.02:1.[14] In yet another study by Mishra et al, there is significantly higher proportion of males affected by dengue as compared to females with male-to-female ratio 3.4:1.[15] These variations suggest that dengue incidence may be influenced by regional and temporal factors. Additionally, the observed male predominance in Gandaki Province may reflect the influence of sociocultural factors on healthcare-seeking behavior by parents within the community.

In this study, dengue fever demonstrated notable geographical variation, with the highest incidence observed in Kaski district, followed by Tanahun. These differences are likely influenced by multiple factors, including variations in vector density, climatic

and environmental conditions conducive to mosquito breeding, population density, and sociocultural practices that affect exposure risk and healthcare-seeking behavior. Comparable patterns of district-wise variation have been reported in other settings, such as in Kerala, India, where Indu et al. observed similar disparities in dengue incidence across different districts, highlighting the role of local ecological and social factors in shaping disease distribution.[16] Moreover, Haider et al. reported marked geographical variation in epidemic burdens and mortality due to dengue fever between Dhaka and other regions of Bangladesh.[17] These findings highlight the risk of dengue fever outbreaks in geographical areas with thermal conditions favorable for vector breeding and disease transmission, a process further facilitated by rapid urbanization.[18]

In this study, the incidence and outbreak of dengue fever in Gandaki province demonstrated seasonal variation. Although cases were reported throughout the year, a marked increase was observed during September and October, typically following the monsoon season, suggesting that vector breeding is facilitated by post-rainfall conditions. In a study by Wibawa et al., climate variability was strongly associated with dengue outbreaks, with significantly higher prevalence reported during the rainy season months of November to March compared to the drier months in Indonesia.[19] Seasonality of dengue fever observed in this study is consistent with findings from BB et al., who reported peak incidence during June and July in South West India, further highlighting the critical role of climatic factors, particularly rainfall and humidity, in shaping the seasonal dynamics of dengue transmission.[20]

Strengths and Limitations

This study is based on secondary data obtained from EWARS and DHIS2 in Gandaki Province, Nepal. The findings of this study may not be generalizable to other regions of Nepal due to geographical, ecological, and healthcare system differences. Furthermore, underreporting and incomplete entry of dengue cases in EWARS and DHIS2 may have introduced biases affecting case counts accuracy, thereby limiting the internal validity of the study. This is the first study to analyze dengue fever among children in Gandaki Province, providing valuable insights into epidemiological trends and seasonality to guide public health strategies.

CONCLUSIONS

This study provides the first analysis of dengue in children in Gandaki Province, Nepal, revealing a clear male predominance, marked geographical clustering with the highest burden in Kaski district, and distinct seasonal peaks during and immediately after the monsoon. These findings underscore the influence of sociocultural, environmental, and climatic factors on dengue transmission and highlight the need for strengthened surveillance, timely preventive measures, and targeted public health interventions to reduce the burden of pediatric dengue in the region.

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