OPEN ACCESS

ORIGINAL ARTICLE

Endemicity of dengue in Mamund Subdivision, District Bajaur, Pakistan, in 2022

Khan Zeb

Government Category D Hospital Mamund, Bajaur Pakistan

ABSTRACT

Background: Dengue, a rapidly rising mosquito-borne viral disease, threatens nearly half of the global population. It is endemic in many regions of Pakistan, including Khyber Pakhtunkhwa. Despite frequent reports from Mamund, District Bajaur, its endemic status has not been evaluated, raising the question of whether cases originate locally or are imported.

Material and Methods: A descriptive cross-sectional study was conducted at Government Category-D Hospital Mamund from September to December 2022. A total of 230 patients aged 10–70 years with suspected or confirmed dengue were enrolled through consecutive non-probability sampling. Data on demographics, travel history, and dengue NS1 results were collected, while patients without consent, outside the age range, or lacking NS1/travel history were excluded. Analysis was performed using SPSS.

Results: Of the 230 patients, 144 (62.6%) were male and 86 (37.4%) female. Mean age was 30.9 ± 11 years. Travel history outside Mamund was present in 129 (56.1%) and absent in 101 (43.9%). NS1 positivity was found in 110 patients (47.8%), all of whom had recent travel history. No patient without travel history tested NS1 positive. The association between travel history and NS1 positivity was statistically significant ($p < 0.001$).

Conclusion: Dengue cases in Mamund subdivision appear imported, with no evidence of endemic local transmission. Findings emphasize the need for vector surveillance studies to confirm the presence or absence of Aedes mosquitoes in Mamund and to guide preventive strategies.

Keywords: Aedes, Bajaur, Dengue, Endemicity, Epidemiology, Mamund, NS1 Protein, Pakistan.

BACKGROUND

Dengue is a mosquito-borne viral disease transmitted by *Aedes aegypti* and *Aedes albopictus.* It has an incubation period of 4–10 days and can progress to severe dengue, characterized by thrombocytopenia, plasma leakage, and organ impairment.[1] Diagnosis during the first 5 days of illness relies on NS1 antigen detection, while IgM and IgG serology are useful later.[2] NS1 protein testing is highly specific and confirms acute infection.[3,4] Infection with one serotype renders lifelong immunity and secondary infection by another serotype increases the risk of severe dengue.[5]

Globally, dengue incidence has risen eight-fold in the last two decades, with 390 million estimated infections annually; Asia accounts for 70% of the burden.[6] Pakistan reports year-round transmission with seasonal peaks.[7] The first confirmed outbreak occurred in 1994, and since 2010 the country has faced repeated epidemics.[8] Between 2000–2019, 201,269 cases were reported nationally, with 23.3% from KP, which holds 11.9% of Pakistan's population.[9,10] In 2022, nearly 26,000 confirmed cases were reported countrywide, one-fourth from KP.[7] All four serotypes circulate in Pakistan .[11]

A cross-sectional study in Khyber Pakhtunkhwa during 2021 highlighted epidemiological risk factors, community awareness, and preventive practices across hotspot and non-hotspot districts, emphasizing the need for district-specific surveillance strategies.[12]

Mamund subdivision of Bajaur District, bordering Afghanistan, has a population of 311,373.[13] Although dengue cases are reported, the absence of entomological surveys raises uncertainty about local transmission. Neighboring Swat and Peshawar are endemic[14–16], yet no published data exist for Bajaur's subdivisions. This study was therefore designed to evaluate dengue endemicity in Mamund.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted at Government Category-D Hospital Mamund between 1st September–30th December 2022. Patients aged 10–70 years of either sex presenting with suspected or

Correspondence: Dr Khan Zeb, Government Category-D Hospital Mamund, District Bajaur Pakistan

Email: miankhanzeb50@yahoo.com

This article can be cited as: Zeb K. Endemicity of dengue in Mamund Subdivision, District Bajaur, Pakistan, in 2022. Infect Dis J Pak. 2025; 34(3): 232-235

DOI: https://doi.org/10.61529/idjp.v34i363

Receiving date: **31 Dec 2024** Acceptance Date: **24 Sep 2025**
Revision date: **04 Sep 2025** Publication Date: **30 Sep 2025**

confirmed dengue were eligible. All consecutive patients fulfilling case definition and providing consent. Patients <10 or >70 years, those who refused consent, and cases lacking NS1 testing or travel history records. Ethical approval was obtained from the Ethical Committee of Government Category-D Hospital Mamund. Informed written consent was obtained from participants.

Demographic details, travel history within 10 days (maximum incubation period[1], and laboratory data were recorded. Patients without prior NS1 testing but within first 5 febrile days were tested by the strep method in hospital laboratory.

Data was analyzed by using Statistical Package for Social Sciences (SPSS) 22.00. Quantitative data was represented using mean ± standard deviation and qualitative data was represented by using percentage and frequency. Chi square test was applied and p-value of ≤ 0.05 was considered as statistically significant

RESULTS

Of 230 patients, 144 (62.6%) were male and 86 (37.4%) female. Mean age was 30.9 ± 11 years. Travel history outside Mamund was positive in 129 (56.1%) and negative in 101 (43.9%).

The table-I results show a significant difference in NS1 antigen positivity between males and females. Among males, 87 (60.42%) tested positive compared to only 23 (26.7%) of females, indicating that NS1 positivity was markedly higher in males. Conversely, the majority of females (n= 63, 73.3%) were negative for NS1.

Table-II demonstrates a strong association between travel history and NS1 antigen positivity (p value < 0.001). Among individuals with a positive travel history, 83.3% tested NS1 positive, whereas none of those without travel history tested positive. Conversely, all patients without travel history (100%) were NS1 negative. This highlights that travel history is a major risk factor for NS1 positivity.

Table No: 1 Association of NS1 protein positivity by gender (n=230)

NS1	Male (n=144)	Female (n=86)	Total (n=230)	p-value
Positive	87 (60.42%)	23 (26.74%)	110 (47.83%)	
Negative	57 (39.58%)	63 (73.26%)	120 (52.17%)	< 0.001
Total	144 (100%)	86 (100%)	230 (100%)	

Table No: 2 Association of NS1 protein positivity by travel history (n=230)

NS1	Travel History Positive (n=132)	Travel History Negative (n=98)	Total (n=230)	p-value
Positive	110 (83.33%)	0 (0%)	110 (47.83%)	
Negative	22 (16.67%)	98 (100%)	120 (52.17%)	< 0.001
Total	132 (100%)	98 (100%)	230 (100%)	

DISCUSSION

This study demonstrates that all NS1-positive dengue cases in Mamund subdivision had a recent travel history outside the area, with no confirmed cases among residents who had not traveled. This finding strongly suggests that dengue in Mamund is not endemic but rather imported from neighboring endemic regions.

Evidence from other districts of Khyber Pakhtunkhwa supports this interpretation. Swat, following its large epidemic in 2013, has documented sustained local transmission and persistence of anti-dengue antibodies, establishing endemicity.[14,15] Peshawar, the provincial capital, has also been confirmed as endemic, with repeated seasonal outbreaks and entomological evidence of *Aedes aegypti* and *Aedes albopictus* populations.[16] In contrast, no entomological surveys or epidemiological studies have been conducted in Bajaur, including Mamund, to establish the presence of vectors or local transmission.

These findings are consistent with a mixed-methods study from KP that examined dengue outbreak response and control strategies, underscoring the challenges of vector control, public awareness, and inter-district coordination.[17]

For the adjacent districts of Mohmand, Dir, Charsadda, and Mardan, published literature is scarce. Reported cases from these areas are often linked to travel from endemic hotspots such as Swat and Peshawar, suggesting a similar pattern to Mamund, where imported rather than indigenous cases dominate. The absence of systematic entomological and sero-epidemiological studies in these districts represents a critical gap in understanding the regional epidemiology of dengue.

The geographic proximity of Mamund to both endemic districts (Swat, Peshawar) and under-researched ones (Mohmand, Dir, Charsadda, Mardan) highlights the importance of coordinated surveillance. Without integrated vector surveillance and case reporting across these districts, there is a risk of delayed recognition if dengue were to establish endemic transmission in new areas.

National outbreak reports, such as the WHO 2019 update, documented circulation of multiple dengue serotypes in Pakistan, including KP, yet did not confirm endemicity in all districts, reinforcing the importance of local entomological studies.[18]

RECOMMENDATIONS

From a public health standpoint, these findings underscore the need to prioritize:

1. Establishing entomological surveillance in Bajaur and its neighboring districts to detect the presence and carrier status of Aedes mosquitoes.
2. Strengthening border and inter-district travel monitoring to identify and manage imported cases early.
3. Focusing vector control resources in confirmed endemic districts such as Swat and Peshawar, while simultaneously initiating preventive surveillance in currently non-endemic but vulnerable areas like Bajaur and Mohmand.

LIMITATIONS OF THIS STUDY

Include its cross-sectional design, reliance on NS1 antigen detection without PCR confirmation, and lack of entomological data. Nonetheless, this is the first study from Mamund subdivision and provides valuable baseline information suggesting that dengue cases are imported rather than locally transmitted. Future research combining clinical, epidemiological, and entomological approaches is necessary to clarify the risk of dengue becoming endemic in Bajaur and its neighboring districts.

CONCLUSION

This study suggests that dengue is not endemic to Mamund subdivision of Bajaur District. All confirmed cases were imported from endemic regions. Further vector surveillance and longitudinal studies are needed to confirm these findings and guide prevention strategies.

CONFLICT OF INTEREST

None

GRANT SUPPORT & FINANCIAL DISCLOSURE

Declared none

AUTHOR CONTRIBUTION

Khan Zeb: Study conception, acquisition, analysis and interpretation of data, manuscript drafting, final approval, accountable for all aspects of publication.

REFERENCES

1. WHO. Dengue and severe dengue [Internet]. Geneva: World Health Organization; [cited 2023 Mar 7]. Available from: https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue
2. Wilkinson IB, Raine T, Wiles K, Goodhart A, Hall C, O'Neill H. Oxford handbook of clinical medicine. 10th ed. Oxford: Oxford University Press; 2017. Chapter 9, Infectious diseases; p. 378–443. DOI:https://doi.org/10.1093/med/9780199689903.003.0009
3. Chaterji S, Allen JC Jr, Chow A, Leo YS, Ooi EE. Evaluation of the NS1 rapid test and the WHO dengue classification schemes for use as bedside diagnosis of acute dengue fever in adults. Am J Trop Med Hyg. 2011; 84(2): 224-8. DOI: https://doi.org/10.4269/ajtmh.2011.10-0316
4. CDC. Dengue virus antigen detection (NS1) [Internet]. Atlanta: Centers for Disease Control and Prevention; [cited 2023 Mar 11]. Available from: https://www.cdc.gov/dengue/healthcare-providers/testing/antigen-detection.html
5. Tayal A, Kabra SK, Lodha R. Management of dengue: an updated review. Indian J Pediatr. 2023; 90(2): 168-77. DOI: https://doi.org/10.1007/s12098-022-04394-8
6. Bhatt S, Gething PW, Brady OJ, Messina JP, Farlow AW, et al. The global distribution and burden of dengue. Nature. 2013; 496(7446): 504-7. DOI: https://doi.org/10.1038/nature12060
7. WHO. Dengue-Pakistan [Internet]. Geneva: World Health Organization; [cited 2023 Mar 8]. Available from: https://www.who.int/emergencies/disease-outbreak-news/item/2022-DON414
8. WHO. Pakistan: dengue fever. The current epidemic [Internet]. Cairo: World Health Organization Regional Office for the Eastern Mediterranean; [cited 2024 Jun 19]. Available from: https://www.emro.who.int/pak/programmes/dengue-fever.html
9. Khattak A, Khan S, Ali I, Gul A, Khabir MN, Javed B, et al. Burden and distribution of dengue infection in Pakistan (2000-19): a review. Braz J Biol. 2024; e267982. DOI: https://doi.org/10.1590/1519-6984.267982
10. Government of Khyber Pakhtunkhwa. About Khyber Pakhtunkhwa [Internet]. Peshawar: KP Government; [cited 2024 Jun 18]. Available from: https://kp.gov.pk/page_type/message/page/welcome
11. Suleman M, Faryal R, Alam MM, Sharif S, Shaukat S, Aamir UB, et al. Dengue virus serotypes circulating in Khyber Pakhtunkhwa province, Pakistan, 2013-2015. Ann Lab Med. 2017; 37(2): 151-4. DOI: https://doi.org/10.3343/alm.2017.37.2.151
12. Khan J, Adil M, Wang G, Tsheten T, Zhang D, Pan W, et al. A cross-sectional study to assess the epidemiological situation and associated risk factors of dengue fever;

knowledge, attitudes, and practices about dengue prevention in Khyber Pakhtunkhwa Province, Pakistan. Front Public Health. 2022; 10: 923277. DOI: https://doi.org/10.3389/fpubh.2022.923277

13. Pakistan Bureau of Statistics. Population census: district-wise tables, Bajaur [Internet]. Islamabad: Government of Pakistan; [cited 2023 Mar 9]. Available from: https://www.pbs.gov.pk/census-2017-district-wise/results/032
14. Ahmad N, Khan T, Jamal SM. A comprehensive study of dengue epidemics and persistence of anti-dengue virus antibodies in District Swat, Pakistan. Intervirology. 2020 ;63(1-6): 46-56. DOI: https://doi.org/10.1159/000510347
15. Gul R, Tabassum I, Ullah I, Rahman F. Incidence of dengue in the highland district Swat, Pakistan: A major shift in the geographical prevalence of the disease. Proc Pak Acad Sci B Life Environ Sci. 2019; 56(2): 27-38. Available from: https://paspk.org/wp-content/uploads/2020/02/LS-523.pdf
16. Tanzila G, Rasheed SB, Khan NH, Kausar A, Jahan F, Wahid S. Insecticide susceptibility and detection of kdr-gene mutations in *Aedes aegypti* of Peshawar, Pakistan. Acta Trop. 2023; 242: 106919. DOI: https://doi.org/10.1016/j.actatropica.2023.106919
17. Mohamud MA, Qazi U, Latif A, Khan IU, Anwar S. Dengue Outbreak Response and Control in Khyber Pakhtunkhwa, Pakistan: A Mixed Methods Study. J Epidemiol Glob Health. 2020; 10(1): 74-81. DOI: https://doi.org/10.2991/jegh.k.191125.001
18. World Health Organization. Dengue fever – Pakistan. Outbreak update 2019. WHO Disease Outbreak News [Internet]. Geneva: World Health Organization; [cited 2025 Sep 17]. Available from: https://www.who.int/emergencies/ disease-outbreak-news/item/2019-DON206