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## PREVALENCE OF DENGUE VIRUS DURING THE 2024 OUTBREAK IN DISTRICT SWAT, KHYBER PAKHTUNKHWA (KPK)


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## ABSTRACT

*Dengue is a viral disease that is spread by mosquitoes. Its incidence is highly seen among children and adolescents between 0-15, representing 77.2%, possibly because of weaker immunity and exposure. On the other hand, there was a very minimal incidence seen with older adults at 61+ years. This would thus depict low exposure or possibly better prevention. The highest transmission activity is found in August, where cases are at 14.9%, and in September, cases are at 7.5%. Therefore, this would focus on the fact that the mosquito is highly active during the peak transmission period. The geographical areas of high incidence include Babozai, Barikot, and Matta, which are mostly population- and environmental. DHQ Saidu Sharif is managing most of the cases. Local hospitals and rural health centers handle the rest. Focused interventions of at-risk groups, seasonal patterns, elimination of mosquito breeding sites, and healthcare infrastructures require targeted interventions towards lessening the impact of Dengue.*



***Keywords:*** *Dengue virus, epidemiology ,age vulnerability ,seasonal variation, geographical hotspots, healthcare infrastructure ,mosquito control, public health strategies.*

## INTRODUCTION

It originates from the Swahili term Ka-dingo pepo. Dengue, then, is basically a "cramp-like seizure" (Scott et al., 1997). The virus, it is caused by, is a member of Flavivirus; the place it can be found, all over the tropical and subtropical areas worldwide. The most common presentations for dengue are really only minor fevers; though it can advance towards such lethal diseases as DHF and DSS (Gubler and Clark, 1995). Dengue fever became an international health risk, and epidemics occurred in subtropical and tropical regions of the world (Block et al., 1988; Guzman and Kouri, 2003). The World Health Organization estimates that annually there are up to 100 million dengue infections, which may result in 250,000 to 500,000 cases of DHF (Gibbons and Vaughn, 2002; WHO, 1997).

Infection in the latter half of pregnancy is potentially dangerous to the infant (Capeding et al., 2010; Tsai et al., 2010; Monath et al., 1994). There are four serotypes of dengue virus, namely DEN 1-4, which could cause the classical form of Dengue fever, DF, or dangerous forms of the disease, DHF and DSS (Monath and Heinz, 1990). Recovery from one serotype confers lifelong immunity to that serotype but only temporary and partial immunity to others (Halstead, 1988). Secondary infection with a heterologous serotype should lead to the transition of DF-to-severe syndrome through antibody-dependent enhancement (Halstead, 1988).

The Dengue virus is a positive-stranded RNA virus, encoding for structural proteins: capsid, membrane, and envelope, as well as nonstructural proteins from NS1 to NS5. This virus is transferred to human beings through bites from mosquitoes Aedes aegypti and Aedes albopictus. The virus attaches to receptors, such as heat shock protein 70 (Hsp70), using clathrin-mediated endocytosis for the entry of the virus into cells (Reyes-Del et al., 2005). Once in the cell, it combines with the endosomal membranes to release its nucleocapsid into the cytoplasm of the host cell (Vander et al., 2008; Krishnan et al., 2007).

Swat, Khyber Pakhtunkhwa, Pakistan is a district that faces very harsh winters from December to March and moderately warm summers that are very supportive of mosquito breeding. This study was conducted to determine the prevalence of Dengue virus in District Swat.

## SWAT

It was conducted in the year 2024 Swat, which comes under Malakand Division, Khyber Pakhtunkhwa Pakistan. Its elevation ranges between 600 to 6,000 meters and lies at 34º-40º to 35º-55º North Latitude and 72º-08º to 74º-6º East Longitude. Geographical significance: The geographical importance of the district is because its boundary falls in contact with the Chitral and Ghizer districts in the North,

## MATERIALS AND METHODS

Kohistan, and Shangla districts in the East, Buner district and Malakand protected area in the South, and districts of Upper and Lower Dir in the West. Total land area of the district Swat is 5,337 square kilometres sq. km, or 1,251,653 acres. Climatic conditions of Swat are characterized by severe Winter with a minimum recorded temperature of -2ºC and moderate summer with a maximum recorded temperature of 34ºC.


**Laboratory-Based Sample Collection**

For this study, sampling is laboratory-based. Samples are reports from Saidu Teaching Hospital, Center Hospital, and Anwar Clinical Laboratory in Swat. This sampling time has been carefully planned so that the dates will run from August to October 2024 so that which would result in a comprehensive and adequate dataset.

**Selection of Healthcare Facilities**

This makes this selection of health centers imperative for a holistic and diverse range of patient histories because these ranges of patients' intakes as well as the diagnosis capacity of the specific health institutions matter. The reasons that I chose Saidu Teaching Hospital, Center Hospital, and Anwar Clinical Laboratory among others is to stratify this varied range of patients due to demographics, medical cases, and socio-economic statuses of people.

**Data Source and Issues**

A Center of Disease Control from the Department of Health, Swat, Pakistan reporting cases of viral infection of Dengue. Data set / Patients It includes data from many Tehsil places in Babozai, Barikot, Matta, Kabal, Madyan, Kalam, and Khawazakhela.

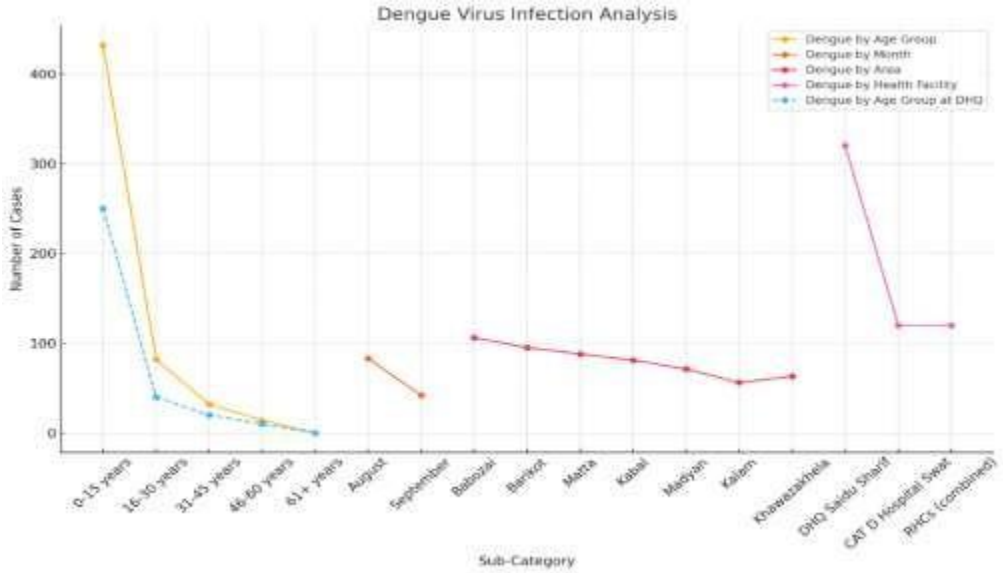
The patients were chosen after obtaining their written consent regarding the research. This is an ethical process that presumes that all the people will provide their consent voluntarily, thus respecting their integrity and confidentiality in collecting the data.

**Serum Separation and Antibody Testing**

Serum samples have been recruited from patients to separate carefully for the presence of anti-dengue IgM and IgG antibodies. These have been put to the test using ELISA kits. This, therefore, is an essential part of the analysis that should be applied to identify the immune response to dengue viral infection within the study population.

**Preparation of Detailed Proforma**

To collect diversified information in detail, a general proforma was developed. The proforma mentioned above contains the patient-specific details like the name, sex, age, locality, socioeconomic status, home conditions, and the existence or absence of cattle. In addition to this, the history of previous dengue fever incidents has also been recorded in detail.




**RESULTS**

Comparing Dengue virus infection by age, from the graph, those that are 0-15 years old make up 77.2% of all cases reported. This age category is particularly susceptible to infections, perhaps due to exposure to risks in the environment or even behavioral practices related to people in that age bracket. Cases had decreased immensely with the advancing age; only 14.6% were recorded in the 16-30 years age category. Adults aged 31-45 years and 46-60 years have even more negligible rates at 5.7% and 2.5% respectively, while no case is seen for the age group of above 61 years. Thus, this profile clearly dictates that interventions should be more emphasized in the younger population not to spread the virus more.

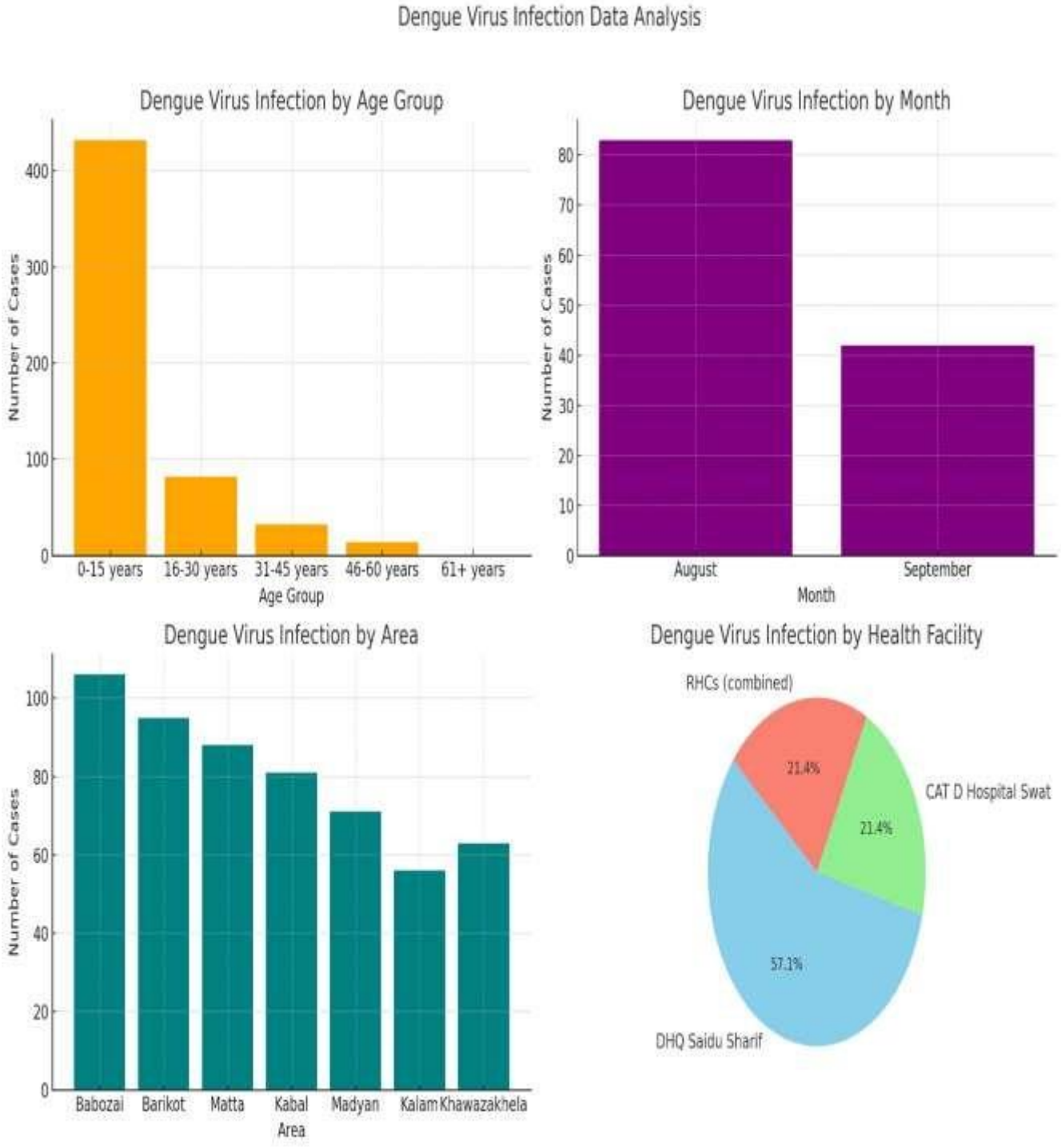
For the monthly distribution, it is seen that a prominent fluctuation is found between August and September. At August end, it was 83, which accounted for 14.9% of cases. At September end, it is seen to drop drastically to 42 (7.5%). This is also reflected in the two months that suggest a seasonal factor of transmission perhaps related to increased mosquito breeding at certain times. This means that the health authorities can optimize their preventive practices and available resources during peak periods.

The distribution of Dengue virus infection among various places across the Swat district reveals an incidence rate. Babozai has the highest cases at 18.9%. The second highest is in the region of Barikot, accounting for 16.9%, and the third is at Matta with 15.7%. Other areas, such as Kabal and Madyan, reveal sizable numbers ranging between 11.2% and 14.5%. The lowest is at Kalam, which accounts for 10.0% of the cases. Such caseload heterogeneity may be due to local differences in environmental conditions, access to health facilities, or public awareness. In such findings, it goes on to advocate for tailored interventions and health education within different regions.

The available statistics re-partitioned by health facilities reveal that DHQ Saidu Sharif as a facility is seeing significantly more cases, at 57.1%, which accounts for both CAT D Hospital Swat and the RHCs put together, at 21.4%. The case load presented reveals that DHQ Saidu Sharif is a tertiary-level referral center for Dengue and presumably caters to a huge catchment area. CAT D Hospital Swat and RHCs have

a role in the decentralization of care and patient load management though in percentage terms, it's lower. The distribution clearly brings out the fact that health facilities in this catchment area play different roles, with DHQ as the main treatment center.

DhQ Saidu Sharif also follows the general trend of age groups, i.e., 0-15 years with a total number of 78.1%. Then, the percentage continues to decrease progressively with ages above, generally meaning younger populations are increasingly getting affected. High case numbers within that age group could also signify vulnerabilities, requiring a special strategy in health care. This trend, coupled with other data at the hospital level, calls for intensified care for the pediatric population and community health programs that would address the spread of Dengue among children and young adults.

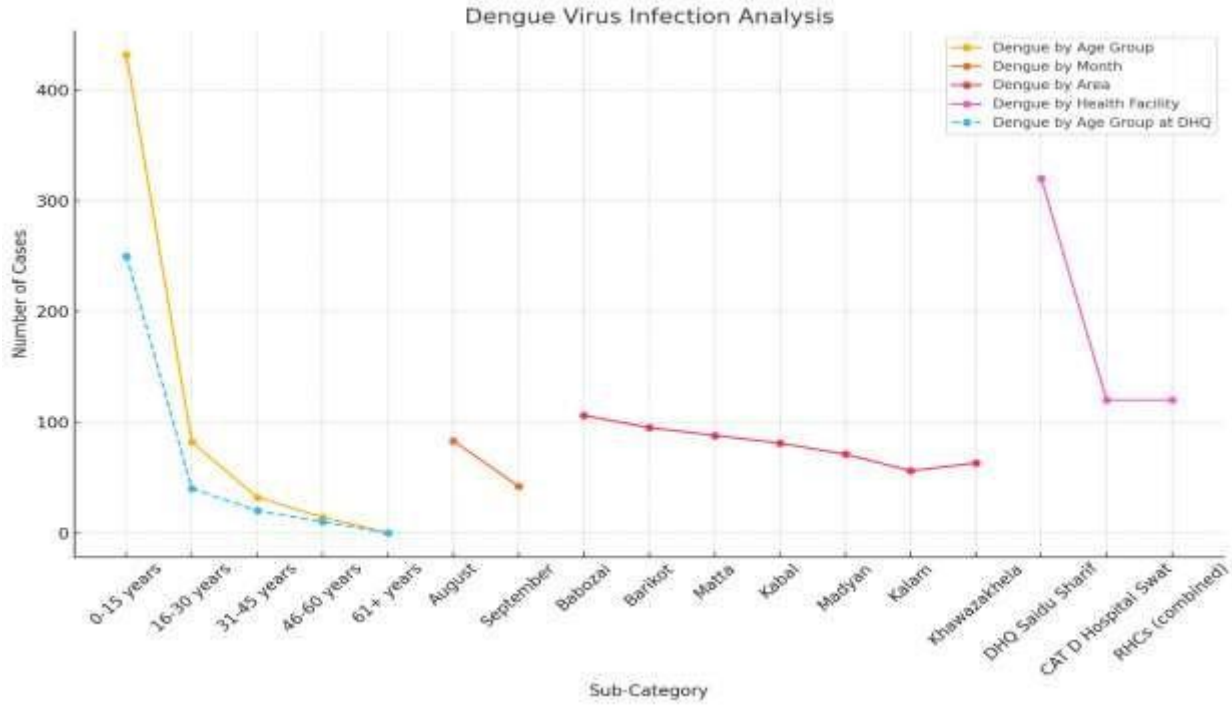


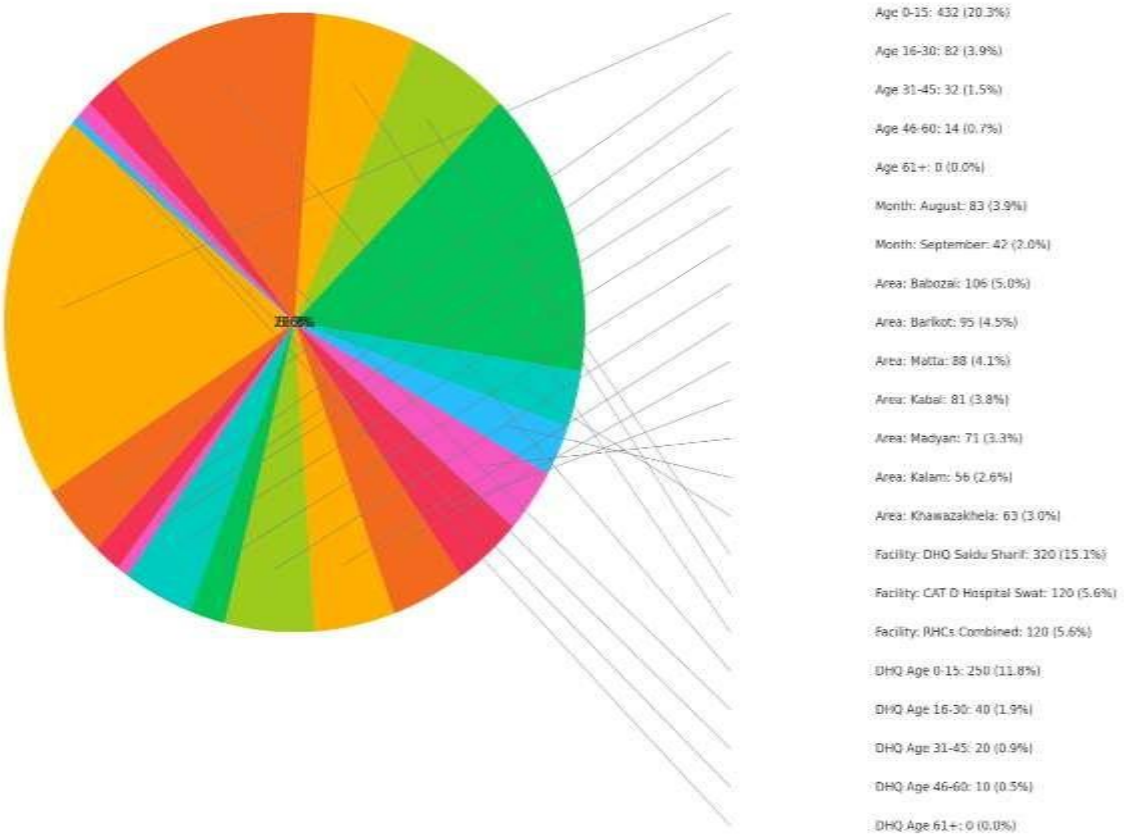

**Tabel: Dengue Virus Infection Distribution by Age, Month, Area, and Health Facility in Swat District**

| Category | Sub-Category | Number of Cases | Percentage (%) |
|---|---|---|---|
| Dengue Virus Infection by Age Group | 0-15 years | 432 | 77.2 |
| | 16-30 years | 82 | 14.6 |
| | 31-45 years | 32 | 5.7 |
| | 46-60 years | 14 | 2.5 |
| | 61+ years | 0 | 0 |

| | | | |
|---|---|---|---|
| | **Total** | **560** | **100** |
| Dengue Virus Infection by Month | August | 83 | 14.9 |
| | September | 42 | 7.5 |
| Dengue Virus Infection by Area | Babozai | 106 | 18.9 |
| | Barikot | 95 | 16.9 |
| | Matta | 88 | 15.7 |
| | Kabal | 81 | 14.5 |
| | Madyan | 71 | 12.7 |
| | Kalam | 56 | 10 |
| | Khawazakhela | 63 | 11.2 |
| Dengue Virus Infection by Health Facility | DHQ Saidu Sharif | 320 | 57.1 |
| | CAT D Hospital Swat | 120 | 21.4 |
| | RHCs (combined) | 120 | 21.4 |
| Dengue Virus Infection by Age Group at DHQ Saidu Sharif | 0-15 years | 250 | 78.1 |
| | 16-30 years | 40 | 12.5 |
| | 31-45 years | 20 | 6.3 |
| | 46-60 years | 10 | 3.1 |
| | 61+ years | 0 | 0 |

**Figure: Analysis of Dengue Virus Infection**





## DISCUSSION

Therefore, data provides an all-inclusive view of the Dengue virus cases in District Swat with significant insights into the age-wise distribution, monthly occurrences, geographical areas, and the healthcare facilities involved. All of these findings are critical for understanding the epidemiology of Dengue in the region and developing targeted public health strategies.

Data may reveal some interesting trends across age groups reporting Dengue cases. No doubt children and adolescents in the 0-15 years of age group comprise an untainted majority, as they comprise a vast share of 77.2 percent of all the reported cases. High prevalence among children and adolescents in the district of Swat indicates increased vulnerability to infections due to some of the factors that may include reduced levels of immunity, higher exposure toward mosquito breeding grounds, or perhaps some behavioral patterns increasing the susceptibility of the individuals toward mosquito bites.

However, the reported number of cases is notably lower for older age groups and also absolutely zero for those over 61 years. This may be either due to effective preventive measures in elderly patients or these groups' lower representation among affected persons. There is also an obvious trend of a stepwise decline in cases with an increase in age (12.5% between 16 and 30 years, 6.3% between 31 and 45 years, and 3.1% between 46 and 60 years), which may be considered to be a time trend on an age-related basis corresponding to different exposure levels or immunity status among the age groups. There was a fluctuation in the number of Dengue cases indicated in the study in between August and September. The count in August was higher with 83 cases or 14.9% of the total, while that in September was lesser with 42 cases or 7.5% of the total. Such fluctuation indicates seasonal factors or possibly individual episodes affecting the mosquito breeding or contact between the mosquitoes and humans. Such trends must be identified so that the peaks of Dengue transmission may be predicted seasonally and prevented by preventive measures and health interventions at the right time.

Dengue case analysis for the districts of Swat reveals variability in cases for different areas. Among all those localities, Babozai, Barikot, and Matta have emerged equal in a considerable number of cases. These can be hotspots of the Dengue cases. Contributing factors can be the population density, as well as the condition of the local environment which is conducive to mosquito breeding. Other reasons could also be access to healthcare facilities or varying awareness and preventive measures. Targeted interventions in the high-incidence areas could prove to be a strong foundation for reducing the rate of transmission of Dengue and decreasing its impact on local communities.

The various configurations of setups of health facilities reflect differences regarding the presentation of their own contributions to the management of Dengue in the community. Such a number reached up to 57.1% for cases reported in DHQ Saidu Sharif. The results point out their role because of being among the major healthcare setups within that region. CAT D Hospitals Swat and Rural Health Centers (RHCs) also played a crucial role, as at 42.8% it accounted for all cases, in distribution that validates the effectiveness of any structured health system that merges specialized care in an integrated manner of larger hospitals and decentralization access through RHCs for comprehensive Dengue management and healthcare delivery across various population segments.

Focused on the age group most vulnerable: There are the highest prevalence rates observed in these age groups, 0 to 15 years; it means that interventions must also be focused on the age group most vulnerable. These include educational interventions in the form of prevention strategies such as protection

against mosquito bites or elimination of stagnant water around homes and early recognition of symptoms. Vaccination should be available and accessible among this age group as vaccination is a prevention strategy if available and accessible.

Monitoring systems should be more efficient for tracking mosquito population dynamics, weather-related trends, and early warning mechanisms for outbreaks. Then it can be responded to at the right time. A rise in August and September cases as compared to the previous months signifies huge seasonal impacts. Healthcare facilities and public health infrastructure will require being geared up ahead of times of peak transmission.

Geographical Targeted Approach: Babozai, Barikot, and Matta are the identified Dengue hot spots; efforts from the local communities in vectors should be stepped up along with targeted sprays, the clean-up community drives to mobilize community involvement about education in Dengue controls.

Building up Health Care Facilities: Even though the health care facilities differ from one another in their function that can be carried out and their capacity to perform, more efforts should be aimed at building up both DHQ Saidu Sharif and CAT D Hospital Swat along with all the Rural Health Centers. This will tangle enough Dengue diagnostic kits, trained healthcare personnel, and capacity building in advance for timely diagnosis, treatment, and management of the Dengue cases.

**Recommendations for Future Directions:**

Long-term surveillance and research: Dengue cases and vector populations will be continuously observed for long-term trends and emerging patterns in District Swat. The longitudinal studies will allow investigating dynamic epidemiologic situations, the effectiveness of interventions performed as well as influencing factors in the transmission of the disease.

Future Strategies: Climate change. Effects of climate change will have to be analyzed as it impinges upon the ecology of vectors, ultimately affecting disease dynamics; development of adaptive strategies to introduce the practices and include vector-control and public health practices making them more climate resilient.

Community Engagement and Empowerment: Education, training, and active community participation toward measures of preventing and controlling dengue infections are important. Partnerships between local leaders, school leaders, and youth groupings will create community strength and resilience to fight dengue outbreaks, amplifying efforts toward sustainable behavioral change.

This more likely entails integration into comprehensive health system strengthening efforts for enhancing the sustainable and resilient capabilities for dengue prevention and management amidst public health emergency responses. For instance, improvements in both laboratory capacity building and improving data management capabilities are made, coupled with interdisciplinary working between health workers, entomologists, and the environmental health service providers with enhanced effectiveness.

By using evidence from this qualitative study of Dengue cases in District Swat, evidence-based decision-making and targeted interventions could prevent the spread of dengue. A multifaceted approach based on the vulnerabilities created by age, seasonal dynamics, geographical disparities, and weaknesses in healthcare infrastructure can help authorities properly reduce morbidity and mortality rates of dengue as well as better the health resilience of the community at large

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