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EPIDEMIOLOGY AND COMPREHENSIVE ASSESSMENT OF THE DENGUE OUTBREAK IN DISTRICT NOWSHERA KHYBER-PAKHTUNKHWA

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Abstract

This study provides a comprehensive assessment of the dengue outbreak in District Nowshera in 2024, highlighting key findings and implications for public health management. Hospital-wise data reveals a relatively equal distribution of cases across Cat-D Hospital Dag Ismail Khel, RHC Pir Piai, and MRHSM Hospital Pabbi, with 250, 250, and 223 cases respectively, indicating efficient reporting and high disease incidence. Gender distribution is almost equal, with male cases (365) slightly surpassing female cases (358), showing no significant sexual predisposition. Geographically, rural areas report over 200 cases, compared to around 50 from urban zones, emphasizing higher prevalence or better reporting in rural councils. Occupation-wise, farmers are the most affected (160), followed by teachers (145), shopkeepers (140), unemployed (140), and students (130), suggesting that vulnerability is not occupation-dependent. The peak in cases during August (145 patients) followed by a decline in subsequent months indicates possible seasonality or environmental factors. Symptom analysis reveals fever in 360 cases, pyrexia in 360, and bleeding symptoms in 350, highlighting multi-symptom diagnosis importance. Skin rashes are common in 400 cases, but not conclusive for diagnosis. Most patients (250) have completed treatment, reflecting good recovery rates, but 240 remain under observation and 230 are in critical condition, emphasizing the need for improved critical care management. This study provides valuable demographic, symptom, and outcome data, which can help in advancing targeted public health strategies and improving healthcare delivery systems in dengue-affected areas.

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INTRODUCTION

Dengue virus, a Flavivirus transmitted through Aedes aegypti and Aedes albopictus mosquitoes, is prevalent in tropical and subtropical regions globally. It causes dengue fever (DF), dengue hemorrhagic fever (DHF), and dengue shock syndrome (DSS), ranging from mild to life-threatening conditions (Gubler and Clark, 1995; Block et al., 1988). The World Health Organization (WHO) estimates up to 100 million dengue infections annually, leading to 250,000–500,000 cases of DHF and 21,000 deaths (Gibbons & Vaughn, 2002; WHO, 1997). First reported in Pakistan in 1985 among children under 16 years as undifferentiated fever (Akram et al., 1998), dengue has since become endemic, with outbreaks peaking during the post-monsoon season (Jahan, 2011). The virus comprises four antigenically related serotypes—DEN-1, DEN-2, DEN-3, and DEN-4 (Monath and Heinz, 1990). Infection with one serotype provides lifelong immunity to that serotype but only transient protection against others. Secondary infections with a heterologous serotype increase the risk of severe outcomes like DHF and DSS due to antibody-dependent enhancement (Halstead, 1988). Dengue presents with fever, joint pain, headache, rash (petechial or maculopapular), thrombocytopenia, and vascular leakage. Severe cases involve multi-organ failure, hemorrhages, and shock (Gubler, 1997). Neurological complications such as encephalopathy, seizures, and hypokalemic paralysis have also been observed (Misra et al., 2006; Verma et al., 2012). Hepatic manifestations include acute liver failure and hepatomegaly (Deepak et al., 2006). Gastrointestinal symptoms range from bleeding to acute colitis (Rama et al., 2006). The virus induces bone marrow suppression, leading to reduced platelet production and thrombocytopenia (Russa and Innis, 1995). Dengue-2 has been shown to bind to platelets in the presence of virus-specific antibodies, triggering immune-mediated clearance (Wang et al., 1995). Cytotoxic factors, produced by CD4+ T cells, increase vascular permeability and disrupt the blood-brain barrier, contributing to severe disease (Chaturvedi et al., 2006). Monocytes, macrophages, and dendritic cells act as primary hosts, facilitating viral replication and immune evasion (Jessie et al., 2004). Pakistan has experienced significant dengue outbreaks. In 1995, Hub reported 75 cases with 57 deaths (Paul et al., 1998). Subsequent outbreaks in 2003–2010 affected cities like Haripur, Karachi, Lahore, and Swat, with serotypes DEN-2 and DEN-3 predominantly involved (Ahmed et al., 2008). In 2006, approximately 5,400 cases and 55 deaths were reported, reflecting the co-circulation of multiple serotypes (Khan et al., 2007). Dengue virus is a positive-stranded RNA virus with an 11 kb genome encoding structural (C, M, E) and non-structural (NS1, NS2A, NS2B, NS3, NS4A, NS4B, NS5) proteins. NS1, a glycoprotein, plays a crucial role in viral replication and immune modulation (Chambers et al., 1990; Falconer and Young, 1990). Viral entry occurs through clathrin-mediated endocytosis, followed by membrane fusion in late endosomes (Vander et al., 2008). Effective management requires integrated vector control measures, public health awareness, and robust clinical management protocols. Emphasis on eliminating mosquito breeding sites and using personal protective measures like nets and repellents is critical. Vaccination strategies targeting all four serotypes could significantly reduce disease burden in endemic regions.

MATERIALS AND METHODS

The sampling was done at the laboratory. During the dengue outbreak in District Nowshera, patient reports were gathered from the following hospitals and laboratories: This supplementary is followed through the MRHSM Hospital Pabbi, Cat-D Hospital Dag Ismail Khel, and RHC Pir Piai. Field data collections were conducted between August and October 2024.

Participants in this study were selected from different Tehsils of Nowshera District; Nowshera City, Pabbi Tehsil, Akora Khattak Tehsil, Jehangira Tehsil and Risalpur Tehsil. The participants' permission was sought and provided in writing before they could be enrolled in the project. Data collection concerned patients with clinical signs compatible with dengue or patients exposed to dengue previously. Venous blood samples were drawn, and sera were centrifuged and examined for IgM and IgG antibodies to dengue. These tests were also done using the enzyme-linked immunosorbent assay (ELISA) kits to obtain accurate results. An analysis of confirmed rather than suspected dengue cases enabled the results to capture

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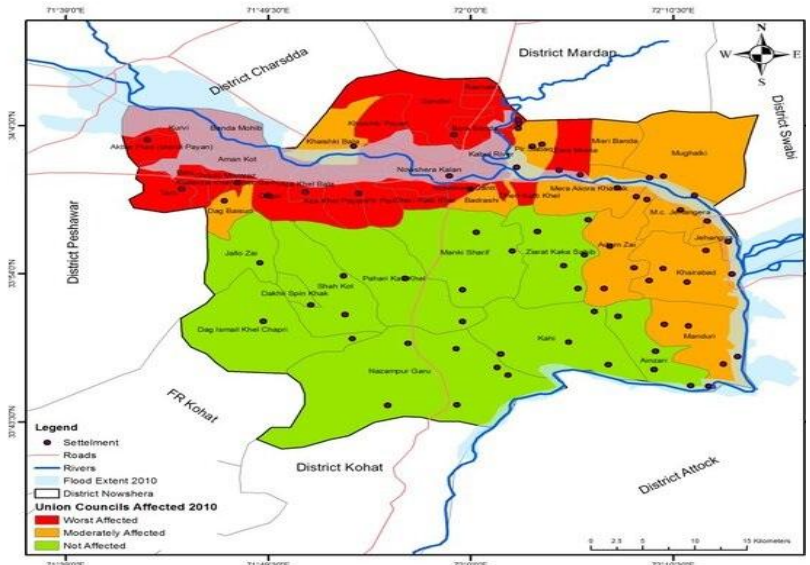
a more accurate picture of the disease's impact in the target areas. To handle the patients' information, a perform format was used, which was produced to standardize the collection of patients' data. Some of these parameters were name, sex, age, place of residence, social class, home environment, presence of cattle, and history of past dengue fever episodes. We found that these parameters offered a detailed set of input data for analysis. The collected data were categorized into the following groups for detailed statistical analysis: Age-wise distribution, Sex-wise distribution, Tehsil-wise distribution Hospital-wise distribution. The grouped data were analyzed statistically to get the pattern and trends of dengue disease prevalence with the help of relevant software. The analysis was intended to identify the level of association between different demographics, clinical manifestations, and regional characteristics and identify the pattern of dengue outbreak in District Nowshera.



DISTT: NOWSHERA DENGUE EFFECETD SITES DURING DENGUE OUTBREAK

RESULT

The overall assessment of the dengue outbreak in District Nowshera in 2024. The data available hospital-wise is quite equal in both personal and broad areas where there is a similar number of cases in Cat-D Hospital Dag Ismail Khel and RHC Pir Piai (250 each) while in MRHSM Hospital Pabbi is less (223). Thus, high scoring reflects the efficiency of reporting these diseases and implies that their incidence is equally high in these areas. Gender distribution is also nearly equal, with male cases (365) slightly overpassing female cases (358), which has allowed the researchers to conclude that there is no sexual predisposition. The cases from the union council distribution show that more than 200 cases are from rural areas, whereas around 50 cases are from urban areas and nearly 30 from mixed zones, which means higher prevalence or better reporting in rural councils. Occupation-wise data also shows that farmers (160) are the most affected, and teachers (145), shopkeepers (140), unemployed (140), and students (130) are almost equal, indicating that vulnerability does not depend on the occupation. The data from the symptom onset that was analyzed according to months reveals a surge in August with 145 patients, accompanied by a steady decline in subsequent months, suggesting factors such as seasonality or the environment in the distribution of the disease. Out of the priority list of symptoms, fever is reported in 360 patients while 400 patients show no fever at all, as is evident, which again proves the concept of multi-symptom diagnosis. Likewise, pyrexia cases are balanced between, thereby indicating a relevant but not unique diagnostic marker (360 cases with and without; Bleeding symptoms occur in

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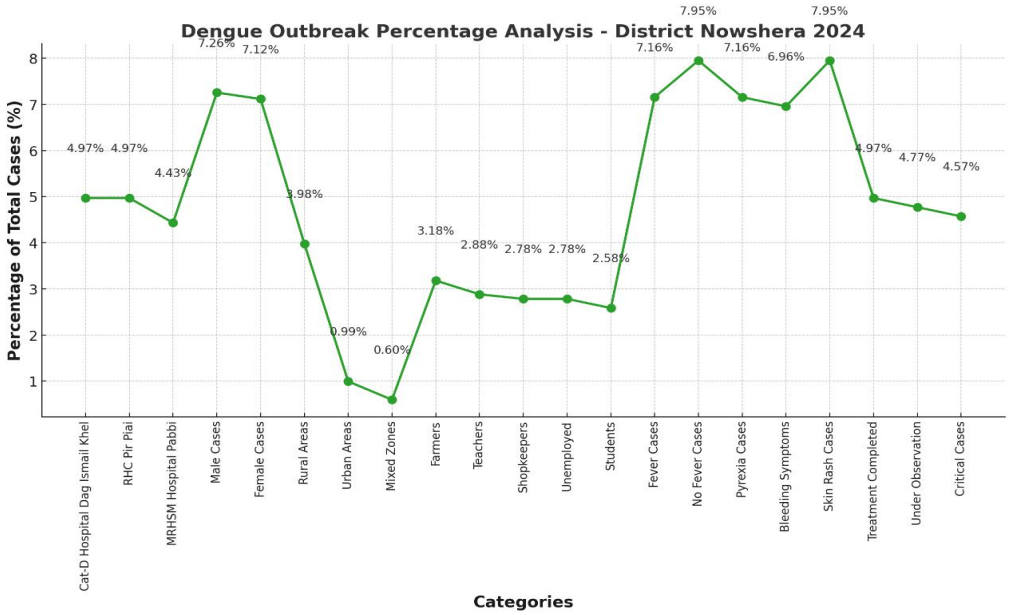
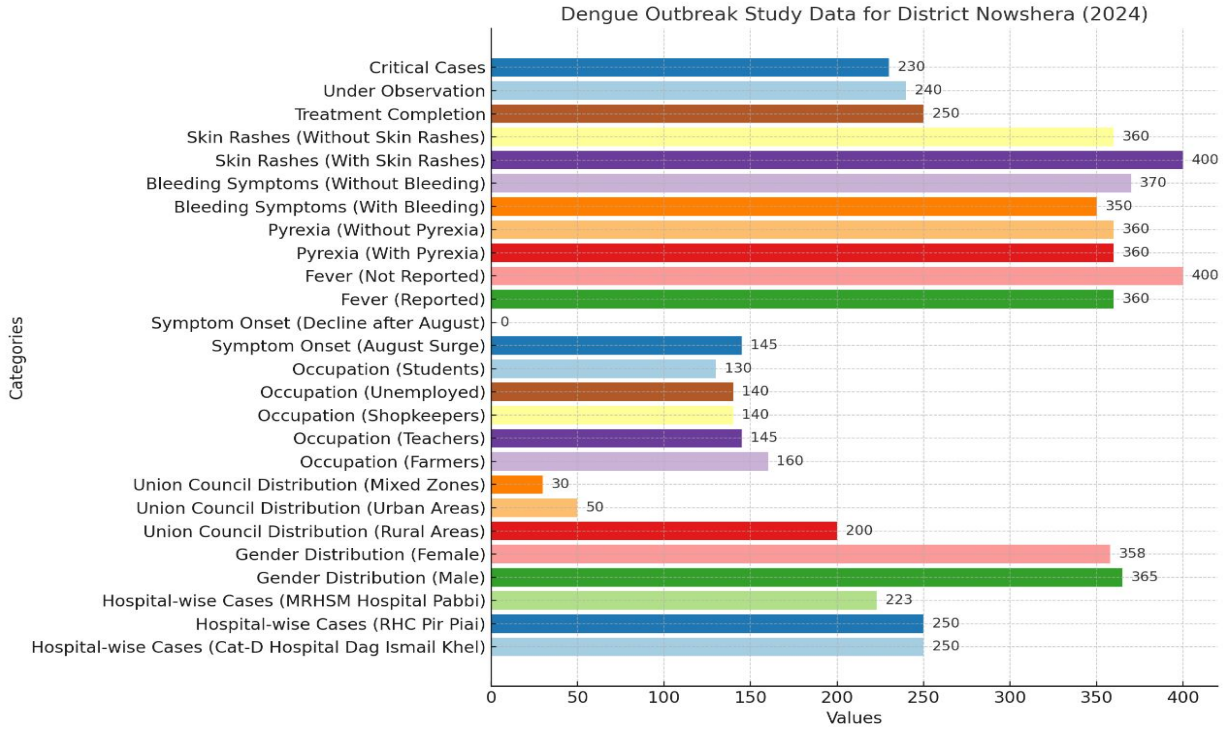
350 cases, slightly less often than in cases without any bleeding manifestations (370; this may indicate that when bleeding is present, more severe conditions are being treated. Skin rashes are noted as relatively frequent, 400 although they are absent in 360 cases, which points to their supportive, yet not conclusive significance. The treatment/remarks distribution 10 shows that most of the patients (250 cases) have completed treatment which suggests good recovery rates. However, 240 cases remain under observation, and 230 cases are regarded as critical, which also adds to the importance of monitoring and improving critical staged case management. A wealth of methodical resources has availed useful features in analyzing demography, symptoms, and outcomes of an outbreak of dengue,





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DISCUSSION

The present study gives an account of the outbreak of dengue in District Nowshera in 2024. the hospital-wise distribution of cases was almost equal, with the distribution in Cat-D Hospital Dag Ismail Khel and RHC Pir Piai at 250, and MRHSM Hospital Pabbi at 223. In terms of gender distribution, this study showed that the overwhelming proportion of the study participants were almost equally distributed between male and female with the former representing 365 cases and the latter, females representing 358 cases. This contrasts with the Swat study where the overall prevalence recorded was 33% in males and 17% in females, although the male prevalence was higher than the female prevalence (Ahmed et al., 2008). The much closer distribution of Nowshera is that the level of risk factors is the same among genders, which means that here we find the more widespread exposure/behavioral exposure dynamic. The distribution by union councils that while the vast majority (>200) of such cases were reported from the rural area, the urban area constituted about 50 cases, and the mixed area about 30. This finding was like earlier findings from Swat where rural areas like Babozai have higher rates. Nevertheless, the difference in reporting urban and rural may indicate the difference in the availability and people's awareness of the healthcare rather than the difference in incidence. Looking at the occupational distribution, farmers were the most affected with 160 cases, teachers with 145 cases, shopkeepers with 140 cases, the unemployed with 140 cases, and students with 130 cases. Thus, the distribution across the determined occupational categories is equal, which differs from the previous investigations where the Authors stated an increased number of cases among outdoor workers. The equal distribution depicted in this study implies a community-based infected mosquito distribution pattern may be due to household or community-based mosquito breeding sites. Seasonal data showed that the number of cases was highest in August (145 cases), which reduced gradually in other months is consistent with prior research (the Jahan et al., 2011, Tang et al., 2008) which identified that dengue commonly occurred during late summer and early autumn in the post-monsoon season. Such a seasonality might be due to some environmental conditions such as water stagnation and the high density of the vector, especially during these months implying the need to implement efficient vector control during those periods. The curtailed symptoms are designed to show the changing clinical manifestation of dengue fever in Nowshera. Of the number, 360 cases complained of having a fever; however, 400 did not have a fever. Likewise, body aches were also without preference (360 with and 360 without), and bleeding symptoms were noted in 350 of the cases. Skin rashes were the most seen with 400 cases out of the total confirmed. These findings are contrary to the research done in Swat (Fatima et al., 2010) in which fever and bleeding were more conspicuous symptoms. The fact that the frequency of reporting some of these symptoms differed so significantly highlighted that multiple-symptom diagnosis models may be more useful than relying on certain clinical signs. Outcome data that most of the patients (250 cases) had completed treatment, the 240 continued under the observation category, while the 230 of them were in the critical category at the end of the study. These results demonstrate much healthcare investment and work, but the findings also underscore various ongoing weaknesses in serious case handling. The outcomes of critical cases in Nowshera show better healthcare response and availability than during earlier H1N1 outbreaks in Karachi and Lahore which were studied by Ahmed et

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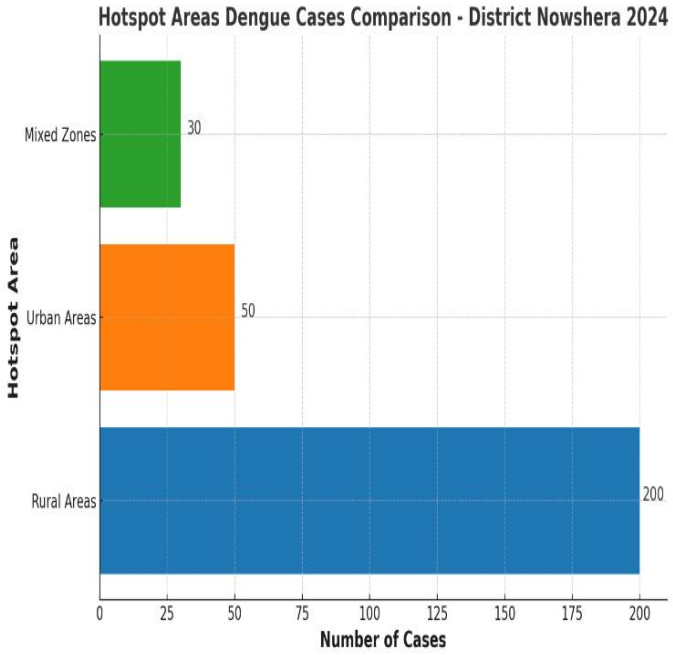
al. (2008) and Mahmood et al. (2012), respectively.



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No Conflict of Interest:

The authors declare that they have no conflicts of interest in relation to the content of this study.

Author Contributions:

Sabeeka Zaffar Conceptualization, methodology, data collection, writing the original draft. Fawad Khan Data analysis, writing review and editing. Amber Khalid – Data collection, methodology. Farhanda Manzoor Data collection, analysis. Najiya al-Arifa Data analysis and interpretation. Gul Zamin Khan – Supervision, data collection support. Inam Ullah Project administration, fieldwork coordination. Sara Naeem Writing, editing, literature review.

Significance:

While this study has provided valuable insights into the epidemiology and clinical pattern of the dengue virus in District Nowshera, further research is needed to explore the genetic variation of dengue virus strains circulating in the region and their correlation with disease severity. Additionally, longitudinal studies are needed to assess the long-term impact of climate change on dengue transmission dynamics. This research contributes to the understanding of dengue's epidemiology in Pakistan and highlights the importance of region-specific strategies for disease control.

Conclusion and Recommendations:

This study emphasizes the need for early detection, preventive measures, and public health campaigns to mitigate the impact of dengue virus outbreaks in Khyber Pakhtunkhwa. Based on our findings, we recommend strengthening vector control programs, enhancing community awareness, and conducting regular surveillance to reduce the risk of future outbreaks. There is also a need for better resource allocation towards research on the role of environmental factors in disease transmission. Timely and proactive efforts are essential to limit the spread and enhance preparedness for potential dengue epidemics in the future.

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REFERENCES

1. Acosta, E.G., Castilla, V., and Damonte, E.B. "Functional Entry of Dengue Virus into *Aedes albopictus* Mosquito Cells Is Dependent on Clathrin-Mediated Endocytosis." *Journal of General Virology* 89 (2008): 474–84.
2. Acosta, E.G., Castilla, V., and Damonte, E.B. "Alternative Infectious Entry Pathways for Dengue Virus Serotypes into Mammalian Cells." *Cellular Microbiology* 11 (2009): 1533–49.
3. Ahmad, N., Fazal, H., Ayaz, M., Abasi, B.H., Mohammad, I., and Fazal, L. "Dengue Fever Treatment with *Carica Papaya* Leaf Extracts." *Asian Pacific Journal of Tropical Biomedicine* (2011): 330–33.
4. Akram, D.S., Igarashi, A., and Takasu, T. "Dengue Virus Infection among Children with Undifferentiated Fever in Karachi." *Indian Journal of Pediatrics* 65 (1998): 735–40.
5. Amarasinghe, A., Joel, N., Kuritsky, G., Letson, W., and Margolis, H.S. "Dengue Virus Infection in Africa." *Emerging Infectious Diseases* 17, no. 8 (2011). http://www.cdc.gov/eid.
6. An, J., Kimura-Kuroda, J., Hirabayashi, Y., and Yasui, K. "Development of a Novel Mouse Model for Dengue Virus Infection." *Virology* 263 (1999): 70–77.
7. Basu, A., Jain, P., Gangodkar, S., Shetty, S., and Ghosh, K. "Dengue 2 Virus Inhibits *In Vitro* Megakaryocytic Colony Formation and Induces Apoptosis in Thrombopoietin-Inducible Megakaryocytic Differentiation from Cord Blood CD34+ Cells." *FEMS Journal of Immunology and Medical Microbiology* 53 (2008): 46–51.
8. Bielefeldt-Ohmann, H. "Pathogenesis of Dengue Virus Diseases: Missing Pieces in the Jigsaw." *Trends in Microbiology* 5 (1997): 409–13.
9. Block, J., Kay, B.H., Hall, R.A., and Gorman, B.M. "Isolation and Characterization of Dengue Viruses Serotype 1 from an Epidemic in Northern Queensland, Australia." *Archives of Virology* 100, no. 3–4 (1988): 213–20.
10. Calisher, C.H., Karabatsos, N., Dalrymple, J.M., Shope, R.E., Porterfield, J.S., Westaway, E.G., and Brandt, W.E. "Antigenic Relationships Between Flaviviruses as Determined by Cross-Neutralization Tests with Polyclonal Antisera." *Journal of General Virology* 70, no. Pt 1 (1989): 37–43.
11. Capeding, R.Z., Brion, J.D., Caponpon, M.M., Gibbons, R.V., Jarman, R.G., and Yoon, I.K. "The Incidence, Characteristics, and Presentation of Dengue Virus Infections During Infancy." *American Journal of Tropical Medicine and Hygiene* 82 (2010): 330–36.
12. Centers for Disease Control and Prevention. "Dengue." Last modified June 15, 2012. http://www.cdc.gov/dengue/epidemiology/index.html.
13. Chambers, T.J., Hahn, C.S., Galler, R., and Rice, C.M. "Flavivirus Genome Organization, Expression, and Replication." *Annual Review of Microbiology* 44 (1990): 649–88.
14. Chang, C.J., Luh, H.W., Wang, S.H., Lin, H.J., Lee, S.C., and Hu, S.T. "The Heterogeneous Nuclear Ribonucleoprotein K (hnRNP K) Interacts with Dengue Virus Core Protein." *DNA and Cell Biology* 20 (2001): 569–77.
15. Chaturvedi, U.C. "Virus-Induced Cytotoxic Factor in AIDS and Dengue." *Immunology Today* 7 (1986): 159.
16. Chaturvedi, U.C. "Togavirus-Induced Immunosuppression." In *Virus-Induced Immunosuppression*, edited by S. Specter, M. Bendinelli, and H. Friedman, 253–83. New York: Plenum Press, 1989.
17. Chaturvedi, U.C., Elbishbishi, E.A., Agarwal, R., Raghupathy, R., Nagar, R., and Tandon, R. "Sequential Production of Cytokines by Dengue Virus-Infected Human Peripheral Blood Leukocyte Cultures." *Journal of Medical Virology* 59 (1999): 335–40.
18. Chaturvedi, U.C., Nagar, R., and Shrivastava, R. "Macrophage and Dengue Virus: Friend or Foe?" *Indian Journal of Medical Research* 124 (2006): 23–40.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

19. Chen, L.H., and Wilson, M.E. "Transmission of Dengue Virus Without a Mosquito Vector: Nosocomial Mucocutaneous Transmission and Other Routes of Transmission." *Clinical Infectious Diseases* 39, no. 6 (2004): e56–60