

Original Article

Seroprevalence of Dengue Among Healthcare Workers: Assessing Infection Risk and Preventive Strategies in a Tertiary Care Hospital.

Seemab Abid¹, Muhammad Umar², Saima Ambreen¹, Mujeeb Khan¹, Mehwish Iqbal³, Kehkshan Jabeen³ & Misbah Nadeem¹

¹Department of Medicine, Rawalpindi Medical University, Rawalpindi- Pakistan.

²Department of Gastroenterology, Rawalpindi Medical University, Rawalpindi- Pakistan.

³Department of Pathology, Rawalpindi Medical University, Rawalpindi- Pakistan.



Doi: 10.29052/IJEHSR.v13.i1.2025.15-21

Corresponding Author Email:

Mehwish.iqbal@rmur.edu.pk

Received 02/11/2024

Accepted 25/01/2025

First Published 14/02/2025



© The Author(s). 2025 Open Access This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>)

Abstract

Background: Dengue fever is a significant public health concern, particularly in endemic regions like Pakistan. Healthcare workers (HCWs) are at an increased risk of infection during outbreaks due to their close proximity to infected patients. Effective vector control and preventive measures are crucial in minimizing disease transmission in healthcare settings. This study aimed to assess the seroprevalence of dengue among healthcare personnel and evaluate the effectiveness of preventive strategies implemented in a tertiary care hospital.

Methodology: A cross-sectional study was conducted among 110 healthcare workers, including house officers, postgraduate trainees, consultants, nurses, ward attendants, and sanitary staff from the Department of Infectious Diseases at Holy Family Hospital. Blood samples were tested for the presence of the NS1 antigen, IgM, and IgG antibodies. Statistical analyses, including chi-square tests, were performed to determine associations between serological results and sociodemographic factors.

Results: The study population was predominantly female (66.4%), with nurses constituting the largest professional group (59.1%). All participants tested negative for NS1 antigen and IgM antibodies, indicating no active dengue infections. However, 3.6% tested positive for IgG antibodies, suggesting past dengue exposure. There was no statistically significant association between IgG positivity and gender ($p = 0.480$) or professional category ($p = 0.336$).

Conclusion: The low seroprevalence of dengue among healthcare workers in this study suggests that effective vector control and preventive measures may have contributed to minimizing infection risk. Strengthening hospital-based mosquito control strategies and ongoing education for healthcare personnel remain essential to further reducing dengue transmission in clinical settings.

Keywords

Dengue, Healthcare Personnel, Seroprevalence, Infection Control, Vector Control.



Check for
updates

Introduction

Dengue infection is one of the most prevalent arthropod-borne diseases worldwide, with an estimated 50 to 100 million cases reported annually¹. The dengue virus, a member of the Flaviviridae family, exists in four distinct serotypes (DEN-1, DEN-2, DEN-3, and DEN-4), each capable of causing infection. Transmission occurs primarily through the bites of infected *Aedes aegypti* and *Aedes albopictus* mosquitoes, making dengue endemic in tropical and subtropical regions, including Southeast Asia, Africa, the Caribbean, South America, and the Eastern Mediterranean².

Dengue outbreaks typically peak during the rainy season, when mosquito breeding sites proliferate. The clinical spectrum of dengue fever varies from a mild febrile illness to severe, life-threatening conditions. The disease is broadly classified into three categories i.e. Dengue fever, a self-limiting illness characterized by sudden onset of high fever, severe headache, retro-orbital pain, arthralgia, myalgia, and a distinctive skin rash, often referred to as "breakbone fever", Dengue hemorrhagic fever (DHF) marked by increased vascular permeability, thrombocytopenia, and a tendency to bleed and Dengue shock syndrome (DSS) which is the most severe form, leading to circulatory failure and multi-organ dysfunction.

Diagnosis is primarily clinical but is confirmed through laboratory testing, including dengue serology (IgG and IgM antibodies), polymerase chain reaction (PCR) for viral RNA detection, and hematological markers such as thrombocytopenia, leukopenia, and hemoconcentration³. Despite ongoing research, no specific antiviral treatment for dengue exists, and management remains supportive, focusing on fluid therapy, analgesics, and monitoring of hematological and hepatic parameters. Given the absence of a universally effective vaccine for all serotypes, prevention through vector control and personal protective measures remains the primary strategy.

Healthcare workers (HCWs) are at heightened risk of dengue infection, particularly in countries with recurrent outbreaks such as Pakistan, India, the

Philippines, and several Latin American nations. In Pakistan, dengue cases surge during the monsoon season (July to November), straining the healthcare system with an overwhelming patient influx⁴.

Hospitals and clinics face increased workload demands, prolonged shifts, and higher patient-to-staff ratios, contributing to stress, burnout, and compromised adherence to protective measures. These conditions can reduce productivity, elevate the risk of medical errors, and further exacerbate the spread of infection among frontline workers.

Despite the occupational risks, there is a significant gap in data on dengue seroprevalence among HCWs in Pakistan. Most existing studies focus on general community transmission rather than frontline medical staff⁵. This oversight is critical, as healthcare workers previously exposed to one dengue serotype face an increased risk of severe disease upon reinfection with a different serotype due to antibody-dependent enhancement (ADE)⁶. The compounded effects of physical exhaustion, stress, and inadequate protective measures in clinical settings may also weaken immune defenses, increasing susceptibility to infection⁷.

A prior study reported that only 49.6% of healthcare workers demonstrated proper dengue prevention practices, underscoring the need for targeted interventions⁸. Training HCWs to recognize early dengue symptoms, implement personal protective measures, and practice self-care is crucial to minimizing infection risks and preventing severe disease outcomes⁹.

Given the recurring dengue outbreaks in Pakistan and the vulnerability of frontline medical personnel, this study aims to assess dengue seroprevalence and associated risk factors among healthcare workers. By analyzing serological markers and exposure patterns, the study will provide valuable insights for developing effective prevention strategies, improving occupational health policies, and safeguarding healthcare personnel from dengue infection.

Methodology

Study Design

This study employed a cross-sectional design to assess the seroprevalence of dengue among healthcare workers at Holy Family Hospital. The cross-sectional approach was chosen to provide a snapshot of dengue exposure across different professional categories at a single point in time. This methodology allowed for the evaluation of potential associations between occupational roles and dengue seropositivity.

Ethics

Prior to participant recruitment, ethical approval was obtained from the hospital's Institutional Review Board (IRB). All participants provided written informed consent before blood sample collection. Confidentiality and anonymity were strictly maintained throughout the study, and all data were used solely for research purposes. Individuals had the right to withdraw at any stage without any consequences.

Setting

The study was conducted at the Department of Infectious Disease within Holy Family Hospital, a tertiary care facility. The hospital serves a diverse patient population, including individuals with vector-borne diseases like dengue, making it a suitable location for assessing occupational exposure to dengue virus among healthcare professionals and support staff.

Participants

The inclusion criteria encompassed house officers, postgraduate trainees, consultants, staff nurses, student nurses, ward attendants, and sanitary workers. These participants were selected to ensure a broad representation of exposure levels and awareness regarding dengue fever. The categorization was based on differing levels of patient interaction and responsibilities, which could influence their risk of exposure:

- House officers and postgraduate trainees: Directly involved in patient care and clinical decision-making.

- Consultants: Senior physicians overseeing treatment and management of severe cases.
- Staff nurses and student nurses: Engaged in routine patient care and direct interaction with infected individuals.
- Ward attendants and sanitary workers: Though not involved in direct clinical management, they contribute to hospital hygiene and infection control, making them vulnerable to dengue exposure.

Exclusion criteria included individuals with pre-existing psychiatric or medical conditions that could compromise immune responses, leading to an increased risk of dengue infection or confounding study results.

Variables

The variables in the study included independent variables like Occupation, age, gender, duration of employment, history of dengue exposure, and use of protective measures. While dependent variable include Dengue seropositivity (IgM/IgG antibodies detected via serological testing).

Data Sources and Measurement

Blood sample collection was carried out by the Department of Pathology at Holy Family Hospital. The samples were analyzed using enzyme-linked immunosorbent assay (ELISA) or rapid diagnostic tests (RDTs), depending on availability. These methods detected IgM and IgG antibodies, which helped differentiate between recent and past dengue infections. Data on demographic characteristics and occupational details were collected through structured questionnaires administered to participants before sample collection.

Bias

Several measures were implemented to minimize potential biases:

- Selection bias was reduced by ensuring diverse representation across different healthcare roles.

- Measurement bias was mitigated by employing standard serological testing procedures with validated kits.
- Recall bias was minimized by collecting current serological data rather than relying solely on self-reported history of dengue exposure.

Study Size

The sample size of 110 participants was determined based on the hospital's capacity and feasibility while ensuring adequate statistical power to analyze dengue seroprevalence among different healthcare worker groups. This number allowed for meaningful subgroup comparisons while maintaining logistical feasibility within the study setting.

Statistical Methods

Data were analyzed using SPSS version 25, registered for Microsoft Windows. Descriptive statistics including Mean, standard deviation, and frequency distributions were calculated for demographic and occupational variables. Chi-square test was used to assess the association between categorical variables (e.g., occupation, gender, history of dengue exposure) and dengue seropositivity. A p -value < 0.05 was considered statistically significant.

Results

Participants

The study included a total of 110 participants, with a gender distribution of 66.4% female and 33.6% male, indicating a predominance of female respondents. This gender imbalance may reflect the workforce composition in healthcare settings, where women often outnumber men in roles such as nursing and administrative support.

Descriptive Data

Participants were categorized into doctors, nurses, and other healthcare staff. Nurses formed the largest group, with 65 participants (59.1%), highlighting their pivotal role in patient care. Doctors comprised 31 participants (23.6%), representing various specialties and career stages, including consultants, residents, and general

practitioners. The remaining 14 participants (17.3%) were classified as other healthcare staff, encompassing laboratory technicians, administrative personnel, and allied health professionals, all of whom contribute significantly to hospital operations.

Outcome Data

Serological testing assessed the presence of dengue virus markers among the participants. Results indicated that all participants tested negative for the NS1 antigen and IgM antibodies, confirming an absence of active dengue infection at the time of testing. These findings suggest no participants were undergoing an acute phase of dengue virus infection. Notably, IgG antibodies were detected in four participants (3.6%), indicating prior exposure to the dengue virus. The presence of IgG antibodies suggests that these individuals had been infected or exposed previously but had since recovered. The low prevalence of IgG antibodies may reflect the local epidemiological trends or suggest limited circulation of the virus within this population.

Main Results

Gender-Based Analysis

A cross-tabulation analysis explored associations between IgG antibody positivity and demographic variables. Gender-based analysis (Table 1) revealed no statistically significant difference in IgG positivity between male and female participants (p -value = 0.480). This suggests that prior exposure to the dengue virus was evenly distributed across genders, without any evidence of gender-specific susceptibility or differential exposure.

Profession-Based Analysis

A similar cross-tabulation by professional category (Table II) demonstrated no significant differences in IgG antibody positivity across doctors, nurses, and other healthcare staff (p -value = 0.102). This suggests that prior exposure to the dengue virus was not strongly associated with a specific profession, further reinforcing the likelihood that exposure patterns reflect community-wide trends rather than occupational risk factors.

Table 1: Distribution of IgG antibodies by gender.

Variable		Gender		p-value
		Male	Female	
IgG antibodies	Yes	2(5.4)	2(2.7)	0.480
	No	35(94.6)	71(97.3)	

Chi-square test was applied; *p-value<0.05 is considered statistically significant.

Table 2: Distribution of IgG antibodies across professional categories.

Variable		Profession			p-value
		Doctor	Nurse	Others	
IgG antibodies	Yes	3(9.70)	1(1.50)	-	0.102
	No	28(90.30)	64(98.50)	14(100)	

Chi-square test was applied; *p-value<0.05 is considered statistically significant.

Discussion

Dengue fever has emerged as one of the most significant arboviral diseases in Pakistan, posing a major public health challenge. In Pakistan, the ongoing dengue epidemic has placed an immense burden on the healthcare system, with hospitals operating at full capacity to manage the influx of patients. During these outbreaks, healthcare personnel, including doctors and paramedical staff, serve as frontline responders. However, the demanding work environment, long hours, and high patient load often make it difficult for them to adhere strictly to preventive measures, increasing their risk of contracting dengue.

In hospital settings, particularly during dengue outbreaks, strict implementation of preventive and precautionary measures is essential¹⁰⁻¹⁵. Effective vector control is a key strategy for reducing mosquito breeding, including the elimination of standing water in flowerpots, coolers, drains, and water tanks^{16,17}. The use of insecticides, larvicides, and mesh screens on windows and doors plays a crucial role in preventing mosquito entry. Maintaining cleanliness and sanitation by regularly clearing drains, waste bins, and storage areas is equally important¹⁸. Hospitals should also conduct frequent fogging and fumigation, particularly in areas near patient wards, to reduce the adult mosquito population. To reinforce these measures, hospitals must display clear written guidelines for

protective actions, such as using mosquito nets around patient beds and applying insect repellents, especially for healthcare staff working in high-risk areas. Healthcare personnel should be advised to wear protective, long-sleeved clothing and be well-informed about dengue symptoms, prevention strategies, and the importance of avoiding mosquito bites. Establishing designated dengue wards for infection containment and specialized care, along with protocols for rapid triage and treatment, particularly for severe cases like DHF and dengue shock syndrome (DSS), is critical for minimizing complications and mortality. Additionally, public awareness campaigns, including leaflets, posters, and educational videos, can play a crucial role in informing visitors about dengue prevention, while collaboration with local health authorities can help extend these efforts beyond hospital settings.

Given these risks and the necessity for robust preventive strategies, this study was conducted in the Department of Infectious Diseases (DID) at Holy Family Hospital, which was managing a high volume of dengue patients. The increased exposure risk for healthcare workers in this setting underscored the importance of stringent infection control measures. Without adequate preventive interventions, healthcare workers remain vulnerable to mosquito bites within the hospital

environment, increasing their risk of contracting dengue¹⁹.

A total of 110 healthcare workers, including doctors, nurses, and paramedical staff, participated in this study and were tested for dengue serological status. The results revealed that none of the participants tested positive for NS1 antigen or IgM antibodies, indicating the absence of active dengue infection. Only 3.6% of participants tested positive for IgG antibodies, suggesting prior exposure to the virus. Among the study participants, 66.4% were female and 33.6% were male. Nurses constituted the largest professional group (59.1%), followed by doctors (28.2%) and paramedical staff (12.7%). Statistical analysis showed no significant difference in IgG antibody prevalence between genders ($p = 0.480$) or professional categories ($p = 0.336$), indicating that the risk of exposure was comparable across all groups.

These findings highlight the effectiveness of the preventive measures implemented by the Department of Infectious Diseases at Holy Family Hospital. The hospital adopted comprehensive vector control strategies, including regular fumigation, strict sanitation protocols, and the use of mosquito control sprays, which helped reduce mosquito breeding. Additional measures such as a dedicated dengue ward, provision of bed nets, and strict hygiene enforcement contributed to minimizing the risk of dengue transmission among healthcare workers. Awareness campaigns using posters and video materials further educated healthcare personnel on prevention, management, and control of the disease. The combination of these precautionary measures and strict adherence to hygiene protocols likely played a crucial role in preventing cross-infection from dengue patients to healthcare workers²⁰.

Despite these positive findings, this study has several limitations. The relatively small sample size may limit the generalizability of results. Additionally, the single-center study design restricts the applicability of findings to broader healthcare settings. Potential reporting biases, such as inaccuracies in self-reported data or selection

bias, could also influence the conclusions. Future research should focus on tracking seroprevalence trends over time and assessing seasonal variations in dengue exposure among healthcare workers. Expanding the study to multiple hospitals across Pakistan would provide a more comprehensive understanding of the occupational risk of dengue among healthcare professionals.

Conclusion

This study provides valuable insights into the effectiveness of dengue prevention strategies among healthcare personnel. The low incidence of cross-infection suggests that the infection control measures at Holy Family Hospital were successful in protecting healthcare workers during the dengue outbreak. Continued efforts in vector control, strict adherence to preventive protocols, and ongoing education of healthcare personnel remain essential to further minimize dengue transmission risks in hospital settings. Given the nature of their work, healthcare workers face unique challenges, including an increased risk of infection, heavy workloads, mental health strain, and the physical demands of outbreak response. Prioritizing their health and safety is crucial—not only for their well-being but also for ensuring the resilience of the healthcare system in effectively managing public health crises.

Conflicts of Interest

The author(s) have no conflicts of interest.

Acknowledgement

The authors would like to acknowledge the study participants for their support and cooperation.

Funding

None.

References

1. Kuhn JH, Peters CJ. Arthropod-borne and rodent-borne virus infections. HPIM. 2015;2:21
2. Chakravarti A, Matlani M, Kashyap B, Kumar A. Awareness of changing trends in epidemiology of dengue fever is essential for epidemiological

- surveillance. *Indian J Med Microbiol.* 2012;30(2):222-226. Doi: 10.4103/0255-0857.96699.
3. World Health Organization, Special Programme for Research, Training in Tropical Diseases, Department of Control of Neglected Tropical Diseases, Epidemic and Pandemic Alert. Dengue: guidelines for diagnosis, treatment, prevention and control. Geneva: World Health Organization; 2009.
 4. Gubler DJ. Dengue and dengue hemorrhagic fever. *Clin Microbiol Rev.* 1998;11(3):480-496. Doi: 10.1128/CMR.11.3.480.
 5. Shepard DS, Undurraga EA, Halasa YA, Stanaway JD. The global economic burden of dengue: a systematic analysis. *Lancet Infect Dis.* 2016;16(8):935-941. Doi: 10.1016/S1473-3099(16)00146-8.
 6. Brady OJ, Hay SI. The global expansion of dengue: how *Aedes aegypti* mosquitoes enabled the first pandemic arbovirus. *Annu Rev Entomol.* 2020;65(1):191-208. Doi: 10.1146/annurev-ento-011019-024918
 7. Wilder-Smith A, Ooi EE, Vasudevan SG, Gubler DJ. Update on dengue: epidemiology, virus evolution, antiviral drugs, and vaccine development. *Curr Infect Dis Rep.* 2010;12:157-164. Doi: 10.1007/s11908-010-0102-7.
 8. Nikookar SH, Moosazadeh M, Fazeli-Dinan M, Zaim M, Sedaghat MM, Enayati A. Knowledge, attitude, and practice of healthcare workers regarding dengue fever in Mazandaran Province, northern Iran. *Public Health Front.* 2023;11:1129056. Doi: 10.3389/fpubh.2023.1129056.
 9. Adams J, Lee P, Selig S. Impact of dengue infections on public health care workers. *Am J Trop Med.* 2020;15(3):233-240.
 10. Ehelepola NDB, Wijesinghe WMCM. An Analysis of a Dengue Outbreak at a Large Hospital and Epidemiological Evidence for Nosocomial Dengue. *J Trop Med.* 2018;2018:9579086. Doi:10.1155/2018/9579086.
 11. Rathnayake D, Sinclair R, Booy R. Hospital surge capacity: The importance of better hospital pre-planning to cope with patient surge during dengue epidemics – A systematic review. *Global Health Action.* 2019;12(1):1692517. Doi:10.1080/20479700.2019.1692517.
 12. Kunwar R, Rathore BS, Seth P, Mahen A. Dengue outbreak in a large military station: Have we learnt any lesson? *Med J Armed Forces India.* 2015;71(1):11-15. Doi:10.1016/j.mjafi.2014.09.011. [IJCPH](#)
 13. Fatima K, Lakhani S. Dengue Fever: In-Hospital Management of Critically ill Adult Patients. *Life Sci.* 2021;3(1):4-9. Doi:10.37185/LnS.1.1.93.
 14. Jain AR, Somani S, Parikh P, Singhal R, Joshi D. A Clinico-Hematological Profile of Dengue Outbreak Among Healthcare Professionals in a Tertiary Care Hospital of Ahmedabad with Analysis on Economic Impact. *Natl J Community Med.* 2013;4(2):286-290.
 15. Ingram PR, Mahadevan M, Fisher DA. Dengue management: practical and safe hospital-based outpatient care. *Trans R Soc Trop Med Hyg.* 2009;103(2):203-205. Doi:10.1016/j.trstmh.2008.07.007.
 16. Parande MA, Kamble VS, Patil RS, et al. An outbreak investigation of dengue in medical students and health care workers in a tertiary care hospital, Pune. *Indian J Forensic Community Med.* 2021;8(4):188-192.
 17. Khan AT, Hayat AS, Masood K, et al. Presentation and Prevention of Dengue Fever. *J Univ Med Dent Coll.* 2014;5(2):1-5.
 18. Malavige GN, Fernando S, Fernando DJ, Seneviratne SL. Dengue viral infections. *Postgrad Med J.* 2004;80(948):588-601. Doi: 10.1136/pgmj.2004.019638.
 19. Stuart HR, Ian DP, Mark WJ, Richard PH. Davidson's principles and practice of medicine. 23rd ed. Elsevier; 2018.
 20. Chughtai AA, Seale H, Macintyre CR. Effectiveness of cloth masks for protection against severe acute respiratory syndrome coronavirus 2. *Emerg infect dis.* 2020;26(10):e200948. Doi: 10.3201/eid2610.200948.