***Original Research Article***

# Dengue status during covid pandemic– An overlooked endemic disease?


## Abstract

**Background:** Dengue is an endemic disease in tropical and sub-tropical regions across the globe with South-east Asian countries showing an increasing prevalence over the years. **Objective:** To observe changes in the disease pattern of Dengue during pre and post pandemic periods.

**Study Design:** A retrospective observational study was performed. The laboratory-based study retrieved data for the test routinely performed for detection of Dengue infection and Covid-19 infection. The positivity rate was calculated for Dengue (2019-21) and for Covid (2020-21). The impact of the Covid-19 pandemic on Dengue was studied.

**Observations:** It was observed that Dengue infection peaked during the monsoon and post monsoon period. The testing and positivity rates were dramatically low when the Covid-9 pandemic struck in 2020. The number of Dengue cases seen in 2021 far exceeded that of 2019.

**Conclusion:** In the wake of Covid-19 pandemic, as the healthcare system became focused on managing the emergency-like situation the routine diagnostic protocols and control measures for vector borne diseases were disrupted. Therefore, it is prudent to incorporate measures to ensure the control and management of other diseases continues to run seamlessly even during emergence of future epidemics/pandemics.



Keywords: Covid-19 pandemic, Dengue fever, Delhi, Epidemiology


## 1.Introduction

Dengue is a mosquito-borne viral disease which causes a broad spectrum of illnesses from self-limiting Dengue Fever (DF) to Dengue Shock Syndrome (DSS) or Dengue Haemorrhagic Fever (DHF). Dengue is currently prevalent across the world and is an endemic disease in India with episodes of periodic epidemics occurring in various parts of the country [1,2]. Despite the pandemic the National Vector Borne Disease Control Programme

(NVBDCP) is gradually progressing towards its target of prevention and control of vector-borne diseases [3].

The dengue virus (DENV) is classified into four different serotypes viz. DENV-1, DENV-2, DENV-3 and DENV-4 which are further categorized into several genotypes based on genetic constitution. All 4 serotypes of Dengue virus have been reported during different epidemics over the years across the country [4-6]. The symptoms of dengue include fever, myalgia, arthralgia, sore throat, skin erythema, conjunctivitis, nausea, vomiting and thrombocytopenia. The pathogenesis of Dengue, Chikungunya and Zika share many mechanisms and pathways resulting in similar presentation and challenging diagnostic predictability based on clinical suspicion alone. Even though diagnosis of viral co-infection is rare, it may remain undiagnosed or underdiagnosed without laboratory confirmation [7-11]. Dengue infection may also coincide with malaria although the probability is less. Such co-infections may cause an increased severity in clinical symptoms [12].

With the emergence of the Covid -19 Pandemic caused by SARS CoV-2, the possibility of co-circulation of DENV and SARS CoV-2 cannot be ignored. This could especially pose an increased threat in establishing the disease aetiology without laboratory confirmation, when overlapping symptoms may result in misdiagnosis especially in dengue endemic regions. Simultaneous surges in both diseases may over burden the healthcare system, which may pose a challenge especially, in developing countries. [13] It may also delay the appropriate treatment and raise the risk of complications. Several studies have reported co-circulation and co-infection of both viruses in various countries across the world [14-16].

Co-circulation of two viruses warrants a constant vigilance and preparedness. Hence a high suspicion of cohabiting pathogens causing similar patterns of disease should be kept in mind for better case management.

During the pandemic the focus of entire health-care system towards Covid-19, which possibly led to a neglect of other endemic diseases. This observational study compares the patterns between the surges in Dengue and SARS CoV-2 cases in a tertiary care hospital in Delhi during the Covid-19 pandemic.

**2.Methodology**

A retrospective observational study was planned to observe changes in disease pattern of Dengue in the pre and post pandemic period.

Serum samples of patients suspected with DENV infection are routinely tested for dengue specific Immunoglobulin M (IgM) antibodies and virus expressed soluble non-structural protein 1 (NS1) antigen as per manufacturer's instructions. Serological data of Dengue for the period 2019-2021 was retrieved and analyzed for the purpose of the study.

Covid-19 detection was done by real time reverse transcriptase polymerase chain reaction (RT-PCR) for detection of SARS CoV-2 (as per manufacturer's instructions). The data was obtained for the years 2020 and 2021. All the demographic data were recorded in MS Excel (version 2017).

**3.Results**

A total of 3921 samples were tested for Dengue during the year 2019-2021. Table 1 depicted highest number of samples tested in the month of September - November with the peak in October for 2019 and 2021.

The total samples tested for Covid-19 via RT-PCR in 2020 and 2021 were 24,433 and 29.862 respectively, with highest number of cases observed in September in the year 2020 and April in the year 2022. The highest positivity rate was observed in November in 2020 and in April for the year 2021. (Table 2).

## 4.Discussion

Dengue, is the most common arboviral disease in the tropical and sub-tropical regions of the world with the potential to present as an outbreak. A rising trend in dengue has been observed in India over the years, where 82,237 cases were reported in the period 1998-2009 which increased to 213,607 in 2010-2014 [17]. The states that showed highest prevalence of dengue in 2017-18 were Delhi, Punjab, Haryana, Dadar and Nagar Haveli followed by Uttar Pradesh, Rajasthan and Madhya Pradesh [18].

In our study, an uneven rise of dengue cases was observed from year 2019 to 2021. According to NVBDCP, in 2020, a total of 13,089 cases were reported. East Delhi contributed to 6.05% of total cases [3].

India saw an evident decrease in dengue cases in 2020, approximately 70% decline compared to 2019 [19]. The possible factors that could have contributed to the massive reduction in number of cases could be attributed to the lower transmission of the vector due to lockdown and social distancing and protocols followed during Covid-19 pandemic. The diversion of manpower of resources towards the mandatory testing for SARS CoV-2 was so overwhelming that it probably led to underreporting of Dengue cases during that period. [20].

Based on the National data, a surge in Dengue cases is expected from August onwards reaching peak during October-November and gradually declining in December. Maximum number of cases is usually observed during post-monsoon season indicating high vertical transmission of dengue virus. [21] The positivity rate observed in our study in the year 2019 was higher than the previous years. Studies have reported a similar observation for the year 2019 [22,23].

In the year 2020, laboratory confirmed dengue cases were first reported in the month of October unlike previous years partially because of the lockdown as well as the environmental dominance of Covid-19 virus. The lockdown imposed during the pandemic may have played a dual role causing decreased testing for Dengue as well as decreased transmission due to

restricted socializing among masses causing a reduced exposure to arbo-virus. A decrease in Dengue cases was seen all states of India as well as all over the World. [23-25]. During this period, the laboratory was observing a high positivity rate for COVID cases which started rising from July upto November followed by a decline. However a study by Plasencia-Duenas et al (2022) reported an increased incidence of Dengue in Peru and other regions of Latin America during the Covid-19 pandemic in 2020. This study presented a contrasting view to the pattern observed in our study [26].

Our study shows that peak of both viral illnesses was seen at different times during the year. This observation highlights the hypothesis that one virus predominates a population at a time causing interference in establishment of simultaneous infection by other viruses.

Studies have reported co-infection of Dengue and Covid-19 associated with worse clinical outcomes [27]. Studies have reported cross-reactivity between the DENV antibodies and SARS CoV-2 antigen which may lead to misdiagnosis of either disease especially when tested using rapid antigen testing. Hence, it would be prudent to consider cross-reactivity before a final diagnosis especially in Dengue endemic areas. [28,29]

In the year 2021, the dengue cases began to rise during the monsoon as observed during previous years (apart from 2020) and peaked during October and November. The total number of samples tested as well as positives not only increased as compared to the year 2020 but also surpassed the cases reported for 2019. One possible reason for this could be higher testing among infected population due to greater prudence after onset of pandemic. Also, patients presenting with fever may have undergone testing for both dengue and Covid-19 hence resulting in a larger number of samples being tested.

The pattern of increase/ decrease in dengue infection observed in our study is in accordance with the data presented by NCVBDC which reported a total of 1,57,315 cases in 2019 44,585

cases in 2020 and 1,93,245 cases in 2021. Similar trend was also seen in cases reported in Delhi which was 5077 cases in 2019, 1269 and 13,089 cases in 2020 and 2021 respectively [3].

A study by Khan et al (2022) demonstrated that different countries across the globe showed a different pattern of Dengue disease burden during the Covid-19 pandemic years i.e. 2020 and 2021. All countries in the Asian sub-continent showed a decrease in Dengue cases in 2020 whereas on the contrary South / Latin American countries showed an increase in Dengue cases in 2020 and a decrease in cases during 2021. [30]

The onset of pandemic brought about a reduction in the utilization of existing healthcare services and derailed the global vector control efforts. Deficient planning for medical emergencies on a national/ global level made it challenging to integrate the load brought upon by the pandemic on the existing healthcare system. The Government of India took appreciable efforts and issued National Guidelines for Dengue Case Management during Covid-19 pandemic.

A systematic review of the impact of pandemic on utilization of healthcare services revealed a 31% reduction in diagnostic services. This led to a comprise in the surveillance and management of other diseases.

Segregation of resources to each disease separately maybe beneficial as well as setting up separate portals focused on nationwide management of medical emergencies so that routine health programmes remain relatively unaffected. Setting up of nationwide Virus Research and Diagnostic Laboratories was an initiative by the Government towards better preparedness in the future.

In 2021, a few countries in Asia (India, Pakistan, Bangladesh) showed a dramatic increase in Dengue cases, whereas almost all countries of Latin America showed a decrease in cases

during 2021. The exception to this was Ecuador showed which showed an increase in Dengue cases in 2021. [30]

Considering that both diseases are known to have large pool of asymptomatic cases with a diverse clinical course, diagnostic strategies and preparedness is required. The healthcare system needs to continue the vector control measure amidst the ongoing Covid-19 pandemic. The silver lining of the pandemic was the prompt establishment of protocols for early diagnosis and management of the diseases at a large scale. These monitoring and control protocols maybe reviewed for their applicability towards vector-borne disease and may aid in better management.

**5.Conclusion**

Covid 19 pandemic was a challenge and imposed a tremendous pressure on health care systems globally and across the country with limited capacity to perform testing and provide patient care in resource poor setting countries. This study indicates that the diversion of healthcare system towards the pandemic caused a reduction in testing of Dengue which could be a probable reason for a higher surge observed after 2020. The situation thus created should be considered as a learning experience that will motive the establishment of protocols and arrangements to segregate healthcare facilities for different diseases. Steps should be taken to ensure adequate management in wake of future pandemics/ epidemics so that other disease/ healthcare facilities do not get neglected.

**Ethical approval:** Approval was not required as only data entered on public domain portal was utilized.

**Consent:** It was not required as no personal information of any patient was taken for the study.

**References**

**1.** Schafer TJ, Panda PK, Wolford RW. Dengue Fever [updated 2022 Nov 14]. In:Stat Pearls (Internet) Treasure Island (FL):Stat Pearls Publishing;2022 Jan

**2.** Gupta N, Srivastava S, Jain A, Chaturvedi UC. Dengue in India. Indian J Med Res. 2012;136(3):373-90

3. NVBDCP. (2020). National Vector Borne Disease Control Programme, Ministry of Health and Family Welfare, GoI . Retrieved from http://nvbdcp.gov.in/den-cd.htm

4. Gupta E, Dar L, Kapoor G, Broor S. The changing epidemiology of dengue in Delhi, India. Virol J 2006; 3 : 92-6.

5. Dash PK, Sharma S, Srivastava A, Santhosh SR, Parida MM, Neeraja M, et al. Emergence of dengue virus type 4 (genotype I) in India. Epidemiol Infect 2011; 139 : 857-61.

6. Sharma S, Dash PK, Agarwal S, Shukla J, Parida MM, Rao PV. Comparative complete genome analysis of dengue virus type 3 circulating in India between 2003 and 2008. J Gen Virol 2011; 92 : 1595-600.

7. Kaur M, Singh K, Sidhu SK, Devi P, Kaur M, Soneja S, et al. Coinfection of chikungunya and dengue viruses: A serological study from North Western region of Punjab, India. J Lab Physicians 2018;10:443-7.

8. Gupta S, Agrawal S, Shastri J. Dengue and Chikungunya Mono and Co-infections among Patients with Acute Febrile Illness. Journal of Clinical and Diagnostic Research. 2020 Oct, Vol-14(10): DC17-DC21.

9. Estofoletea BCF, Terziana ACB, Colombob TE, Guimarãesa GDF, Ferraz Jr. HC, Silvaa RAD. et al. Co-infection between Zika and different Dengue serotypes during DENV outbreak in Brazil. J of Infection and Public Health. 2019;12:178-81

10. Mercado-Reyes M, Acosta-Reyes J, Navarro-Lechuga E, Corchuelo S, Rico A, Parra E. et al. Dengue, chikungunya and zika virus coinfection: results of the national surveillance during the zika epidemic in Colombia. Epidemiology and Infection 147, e77, 1–7.

11. Sonkar L, Prakash V, Verma D, Agarwal S. Evaluation of dengue and malaria coinfection in Rohilkhand region of northern India. International Journal of Contemporary Medical Research 2019;6(9):I6-I9.

12. Mohapatra MK, Patra P, Agrawal R. Manifestation and outcome of concurrent malaria and dengue infection. J Vector Borne Dis 2012;49:262–265

13. Schulte HL, Brito-Sousa JD, Lacerda MVG, Naves LA, de Gois ET, MS Fernandes. et al. SARS-CoV-2/DENV co-infection: a series of cases from the Federal District, Midwestern Brazil. BMC Infectious Diseases 2021;21:727-34.
14. Tangsathapornpong A, Thisyakorn U (2023) Dengue amid COVID-19 pandemic. PLOS Glob Public Health 3(2): e0001558.https://doi.org/ 10.1371/journal.pgph.0001558
15. Sosa-Hernandez O. Covid-19 and dengue co-circulation: a challenge for the health system. GACETTA MEDICA DE MEXICO 2021;157:213
16. Rana MS, Alam MM, Ikram A, Zaidi SSZ, Mohd. Salman, Khurshid A. Cocirculation of COVID- 19 and dengue: A perspective from Pakistan. J Med Virol 2021;93:1217–1218.
17. Mutheneni1 SR, Morse AP, Caminade C, Upadhyayula SM. Dengue burden in India: recent trends and importance of climatic parameters. Emerging Microbes & Infections 2017; e70 (6):57-67.
18. Paulson W, Kodali NK, Balasubramani K, Dixit R, Chellappan S, Behera SK. et al. Social and housing indicators of dengue and chikungunya in Indian adults aged 45 and above: Analysis of a nationally representative survey (2017-18) Archives of Public Health (2022) 80:125-3
19. Mondal N. The resurgence of dengue epidemic and climate change in India. 2023;The Lancet;401:727-28.
20. Lu X, Bambrick H, Pongsumpun P, Dhewantara PW, Toan DTT, Hu W. Dengue outbreaks in the COVID-19 era: Alarm raised for Asia. PLoS Negl Trop Dis 2021; 15(10): e0009778.
21. Kumar M, Verma RK, Mishra B. The prevalence of dengue fever in Western Uttar Pradesh, India: A gender‐based study. Int J App Basic Med Res 2020;10:8-11.
22. Wiyono L, Rocha ICN, Cedeño TDD, Miranda AV, Lucero-Prisno III DE. Dengue and COVID-19 infections in the ASEAN region: a concurrent outbreak of viral diseases. Epidemiol Health 2021;43
23. Mahmood R, Benzadid MS, Weston S, Hossain A, Ahmed T, Mitra DK. et al. Dengue outbreak 2019: clinical and laboratory profiles of dengue virus infection in Dhaka city. 2021. Heliyon 7; e07183

24. Saita S, Maeakhian S, Silawan T. Temporal Variations and Spatial Clusters of Dengue in Thailand: Longitudinal Study before and during the Coronavirus Disease (COVID-19) Pandemic. 2022. Trop. Med. Infect. Dis.;7(8):171-185.
25. Surendran SN ,Nagulan R, Sivabalakrishnan K, Arthiyan S, Tharsan A, Jayadas TTP. et al. Reduced dengue incidence during the COVID‑19 movement restrictions in Sri Lanka from March 2020 to April 2021. BMC Public Health (2022) 22:388-98
26. Plasencia-Duenas R, Failoc-Rajas VE, Rodriguez-Morales AJ. Impact of the Covid-19 pandemic on the incidence of dengue fever in Peru. J Med Virol 2022;94:393-98.
27. Leon-Figuerosa DA, Abanto-Urbano S, Olarte-Durand M, Nunez-Lupaca JN, Barboza JJ, Bonilla-Aldane DK. et al. COVID-19 and Dengue infection in Latin America : A systematic review. 2022. New Microbe and New Infect; 49-50.
28. Dutta D, Ghosh A, Dutta C, Sukla S, Biswas S. Cross-reactivity of SARS-CoV-2 with other pathogens, especially dengue virus: A historical perspective. 2023. J Med Virol;95(2)
29. Lustig Y, Keler S, Kolodny R, Ben-Tal N, Atias-Varon D, Shlush E. et al. Potential antigenic cross-reactivity between SARS-CoV-2 and Dengue viruses. 2021. Clin Infect Dis;73(7): e2444–e2449.
30. Khan S, Akbar SMF, Yahiro T, Mahtab MA, Kimitsuki K, Hashimoto T. et al. Dengue Infections during COVID-19 Period: Reflection of Reality or Elusive Data Due to Effect of Pandemic. Int. J. Environ. Res. Public Health 2022, 19, 10768.

## LIST OF TABLES

**Table 1:** Total number of samples tested and positive dengue cases over three years

| | 2019 | | | 2020 | | | 2021 | | |
|---|---|---|---|---|---|---|---|---|---|
| **Months** | **No. of samples tested** | **Total no. of positives** | **Positivity Rate (%)** | **No. of samples tested** | **Total no. of positives** | **Positivity Rate (%)** | **No. of samples tested** | **Total no. of positives** | **Positivity Rate (%)** |
| January | 152 | 30 | 19.7 | 34 | 0 | 0 | 11 | 2 | 18.1 |
| February | 35 | 1 | 2.8 | 38 | 0 | 0 | 66 | 0 | 0 |
| March | 18 | 0 | 0 | 64 | 0 | 0 | 0 | 0 | 0 |
| April | 36 | 0 | 0 | 22 | 0 | 0 | 0 | 0 | 0 |
| May | 40 | 0 | 0 | 18 | 0 | 0 | 0 | 0 | 0 |
| June | 55 | 1 | 1.8 | 4 | 0 | 0 | 6 | 3 | 50 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| July | 103 | 24 | 23.3 | 7 | 0 | 0 | 23 | 8 | 34.7 |
| August | 137 | 26 | 18.9 | 18 | 0 | 0 | 84 | 4 | 4.7 |
| September | 254 | 106 | 41.7 | 24 | 0 | 0 | 172 | 40 | 23.2 |
| October | 291 | 141 | 48.4 | 27 | 5 | 18.5 | 709 | 309 | 43.5 |
| November | 256 | 128 | 50 | 29 | 2 | 6.8 | 891 | 386 | 43.3 |
| December | 72 | 10 | 13.8 | 14 | 0 | 0 | 211 | 39 | 18.4 |
| **Total** | **1449** | **467** | | **299** | **7** | | **2173** | **791** | |

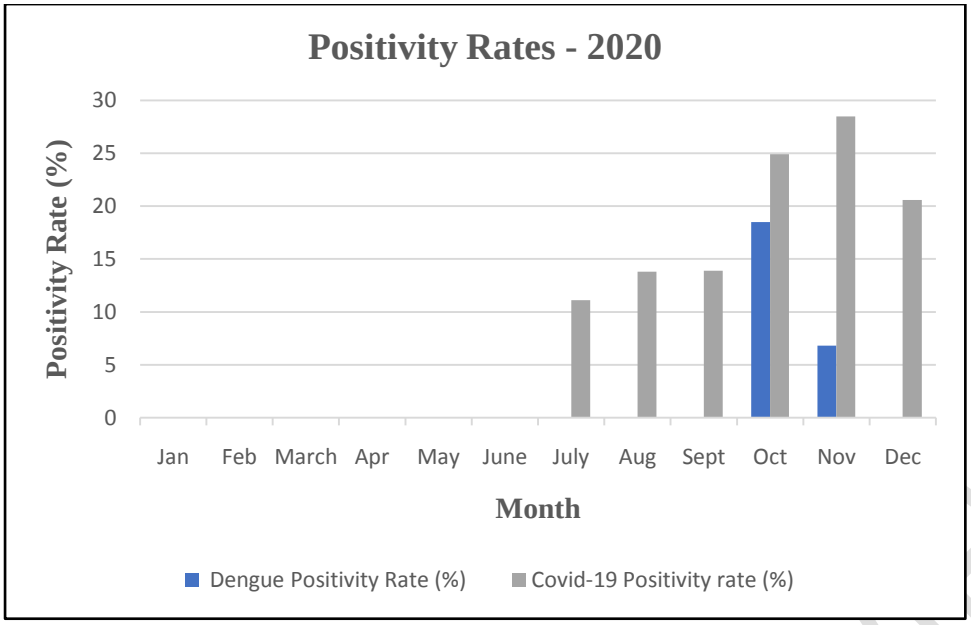
**Table 2:** Total number of samples tested for Covid-19

| | **2020** | | | **2021** | | |
|---|---|---|---|---|---|---|
| **Months** | **No. of samples tested** | **Total no. of positives** | **Positivity rate (%)** | **No. of samples tested** | **Total no. of positives** | **Positivity rate (%)** |
| January | - | - | - | 1744 | 71 | 4 |
| February | - | - | - | 1986 | 7 | 0.3 |
| March | - | - | - | 3580 | 31 | 0.8 |
| April | - | - | - | 2644 | 746 | 28.2 |
| May | - | - | - | 2754 | 470 | 17 |
| June | - | - | - | 2009 | 22 | 1 |
| July | 3455 | 385 | 11.1 | 2752 | 7 | 0.2 |
| August | 4109 | 571 | 13.8 | 3287 | 0 | 0 |
| September | 8751 | 1222 | 13.9 | 2693 | 0 | 0 |
| October | 2536 | 632 | 24.9 | 1923 | 1 | 0 |
| November | 2846 | 813 | 28.5 | 1151 | 1 | 0 |
| December | 2736 | 565 | 20.6 | 3339 | 10 | 0.2 |
| **Total** | **24,433** | **4,188** | | **29,862** | **1,366** | |



## GRAPHS

**Graph 1:** Month-wise positivity rates of Dengue and Covid-19 (2020)




**Graph 2:** Month-wise positivity rates of Dengue and Covid-19 (2021)