Asian Journal of Research in Infectious Diseases

Volume 14, Issue 2, Page 36-43, 2023; Article no.AJRID.101544
ISSN: 2582-3221

Dengue in Times of Covid-19: A Pre and Post Pandemic Evaluation in East Delhi Population

Anshdha Shah [a++], Swati Sinha [a++], Charu Jain [a#*], Shukla Das [a†], Nikita [a‡] and N. P. Singh [a†]

[a] Virus Research and Diagnostic Laboratory, Department of Microbiology, University College of Medical Sciences and GTB Hospital, India.

Authors' contributions

This work was carried out in collaboration among all authors. Author AS did conceptualization, data curation and wrote the manuscript. Author SS wrote the first draft of the manuscript. Authors NPS and Nikita reviewed the manuscript. Author SD reviewed the manuscript and did critical correction. Author CJ reviewed and edited the manuscript. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJRID/2023/v14i2286

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/101544

Original Research Article

Received: 08/05/2023
Accepted: 10/07/2023
Published: 29/07/2023

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.
Materials and Methods: A retrospective observational study was performed. The laboratory-based study retrieved data for the tests 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 incidence was studied.

[++] *Scientist B;*
[#] *Assistant Professor;*
[†] *Director-Professor;*
[‡] *Research Assistant;*
**Corresponding author: E-mail: cjain@ucms.ac.in;*

Observations: It was observed that dengue infection peaked during the monsoon and post-monsoon period. The testing for dengue infection declined by 79.3% when the Covid-19 pandemic struck in 2020. The testing for dengue in 2021 showed an increase of 49.9% when compared to 2019 with a higher positivity rate of 36.4%.

Conclusion: In the wake of Covid-19 pandemic, as the healthcare system became focused on managing the emergency-like situation and routine diagnostic protocols thus, the control measures for vector borne diseases were disrupted. The surge of dengue cases in 2021 indicates that onset of Covid-19 created a smokescreen which gave rise to increased spread of dengue in the following year. Therefore, it is prudent to incorporate measures to ensure that 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 Hemorrhagic 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 . 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 etiology without laboratory confirmation, as overlapping symptoms may result in misdiagnosis especially in dengue endemic regions. Simultaneous surges in both diseases may over burden the healthcare system, which poses 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 was directed towards Covid-19 crisis, 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 and executed in a tertiary care hospital in East Delhi. The records of diagnostic testing performed for dengue were retrieved for the years 2019 (pre-pandemic), 2020 (onset of pandemic) and 2021 (post-pandemic) to observe disease pattern during this period. The data retrieved utilized serum samples of patients suspected with DENV infection tested for dengue specific Immunoglobulin M (IgM) antibodies and virus expressed soluble non-structural protein 1 (NS1) antigen by using indirect enzyme-linked immunosorbent assay [8].

The records of covid diagnostics performed in year 2020 and 2021 were retrieved to observe the peaks of Covid-19 disease and if they co-incided with peaks presented by dengue infection. 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) in nasopharyngeal swab samples [13]. The data was obtained from the Covid lab set up for detection of Covid-19 during the pandemic. The information retrieved and used had been uploaded on public domain portal as a part of national surveillance programs and did not contain any personal information, hence, ethical approval was not required. The Statistical Software for Excel 2017, were used for all statistical data analysis.

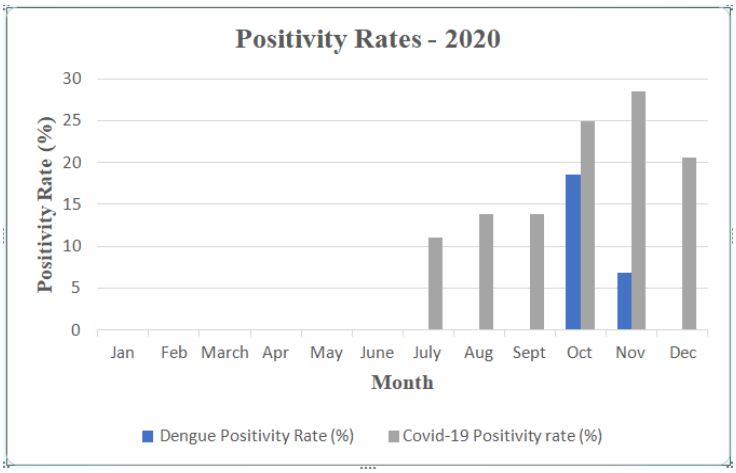
3. RESULTS

A total of 3921 samples were tested for Dengue during the year 2019-2021. The total samples tested during 2019 were 1449 with a positivity of 32.22%. A 79.3% decrease was seen in testing for dengue infection during 2020 with a positivity rate of 2.34%. A surge in testing for dengue was seen in 2021 when compare to 2019 with an increase of 49.9%. The positivity rate for 2021 was 36.4 % which was slightly higher than 2019.

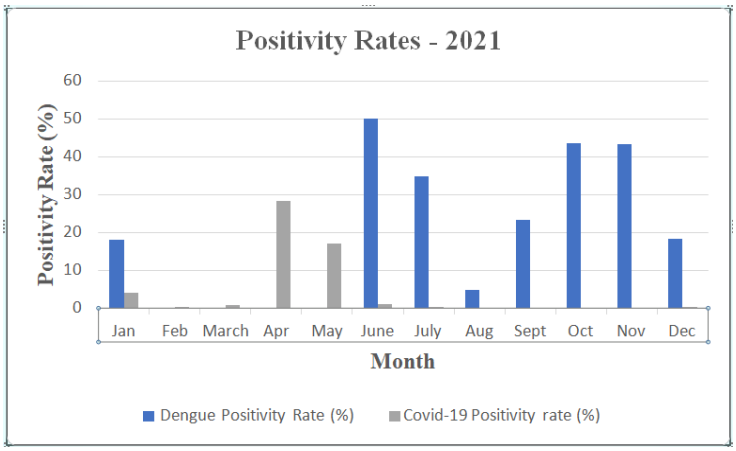
The months showing highest positivity rate remained constant for all 3 years i.e., October and November (Table 1) which constitutes the post-monsoon period in India.

The total samples tested for Covid-19 via RT-PCR in 2020 and 2021 were 24,433 and 29,862 respectively. The maximum samples were tested in the month of September in 2020 and in the month of March in 2021. The highest positivity rate was observed in November in 2020 and in April for the year 2021 (Table 2). The annual positivity rates for 2020 (17.14%) and 2021 (4.57%) were lower when compared to dengue indicating a higher testing for Covid-19.

The peak of infection for both viral illnesses did not coincide at any point of time.



Graph 1. Month-wise positivity rates of Dengue and Covid-19 in year 2020



Graph 2. Month-wise positivity rates of Dengue and Covid-19 in year 2021

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	32.22	299	7	2.34	2173	791	36.40

Source: UCMS and GTBH

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	17.14	29,862	1,366	4.57

Source: UCMS & GTBH

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, with 82,237 reported cases 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 with an evident decrease in dengue cases in 2020 of approximately 79% when compared to 2019. 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 [19,20].

The considerably lower positivity rate of Covid-19 when compared to dengue, even during the peak of the pandemic indicates a lack of diagnostic testing for Dengue infection even though India is highly endemic to the disease. During the pandemic diagnostic testing was pro-actively done for the asymptomatic family members of Covid-19 positive individuals, a similar diagnostic regimen if applied to Dengue positive patients will make diagnosis of asymptomatic cases possible. This will help identify the silent carriers of the virus.

Based on the National data, a surge in Dengue cases is usually expected from August onwards reaching peak during October-November and gradually declining in December. India observes monsoon from June to September, this is when a progressive rise in dengue cases maybe observed and the maximum number of cases is usually seen during post-monsoon (i.e., from October to September) season indicating high vertical transmission of dengue virus [21]. Studies have reported a higher positivity for Dengue infection in 2019 compared to previous years [22,23]. This indicates that despite preventive measures the disease is on the rise.

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 Arbovirus. A decrease in Dengue cases was seen in all states of India as well as all over the World [23-25]. During this period, the laboratory observed a high positivity rate for COVID cases which started rising from July and continued to increase till November followed by a decline. However, a study by Plasencia-Duenas et al (2022) [26] 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 also suggests 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 showed a 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. Delhi contributed 3.22% of the cases in 2019, 2.84% and 6.77% in 2020 and 2021 respectively [3].

A study by Khan et al. [30] 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.

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 healthcare programs 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 motivate 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.

CONSENT

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

ETHICAL APPROVAL

Approval was not required as only data entered on public domain portal was utilized.

ACKNOWLEDGEMENT

Authors are thankful to Virology Staff and VRDL Project Staff (Mr. Narendra Mogha, Mr. Jai Bhagwan, Ms. Poonam, Mr. Mahabir, Ms. Divya, Mr. Adesh, Mr. Rinkesh).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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):373-390

3. NVBDCP. National Vector Borne Disease Control Programme, Ministry of Health and Family Welfare, GoI . Retrieved: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;3:929-6.
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: 857-861.
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: 1595-1600.
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;10:443-447.
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;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; 12:178-181
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. 2019;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;21:727-734.
14. Tangsathapornpong A, Thisyakorn U. Dengue amid COVID-19 pandemic. PLOS Glob Public Health. 2023;3(2): e0001558. Available: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) 80:125-133
19. Mondal N. The resurgence of dengue epidemic and climate change in India. The Lancet. 2023;401:727-728.
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. Trop. Med. Infect. Dis. 2022;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; 22:388-398.
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; 94:393-398.
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. New Microbe and New Infect. 2022;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. J Med Virol. 2023;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. Clin Infect Dis. 2021;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.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/101544