

# Epidemiological study to assess the impact of COVID-19 pandemic on the occurrence of monsoon-related diseases in the city of Mumbai

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## ABSTRACT

**Background:** The onset of monsoons in Mumbai poses an additional health disease burden in the form of rising vector-borne and water-borne diseases such as dengue, malaria, leptospirosis, hepatitis, typhoid, chikungunya, and acute gastroenteritis. These monsoon-related illnesses are preventable with hygienic and sanitation measures that are likely to have been adopted during COVID-19 pandemic. **Aim:** To assess the impact of COVID-19 pandemic on the occurrence of monsoon-related diseases in the city of Mumbai and find out determinants of variations if any. **Material and Methods:** This was a retrospective descriptive study. Universal sampling was done using secondary data collected from the Epidemiological Cell of Municipal Corporation of Greater Mumbai (MCGM). Data mining was performed to obtain the trends of the monsoon-related diseases in Mumbai. **Results:** COVID-19 pandemic has remarkably affected the city of Mumbai with approximately 3 lakh cases till December 2020. MCGM has taken a lot of efforts resulting in a recovery rate of close to 95% with less than 3% mortality. With the effective use of social behavior change communication, which focused on masks, frequent hand washing, and social distancing, there seems to be a decline in monsoon-related illnesses in the year 2020 as compared to the previous two years of 2018 and 2019. **Conclusion:** Monsoon-related illnesses are impacted by behavior and lifestyle modifications like hygiene and environmental sanitation practiced during the COVID-19 pandemic. This study highlights the importance of these universal hygienic practices and their utility in the long-term reduction of monsoon-related illnesses.

**Keywords:** COVID-19, MCGM, monsoon-related diseases

## Introduction

Mumbai city is located on western coast towards Arabian sea and is known to have heavy monsoons. It is the financial hub of the country and is also among the most populated metropolitan cities, thereby having potential for major disease outbreaks.<sup>[1]</sup> Mumbai was severely affected by COVID-19 pandemic. The coronavirus

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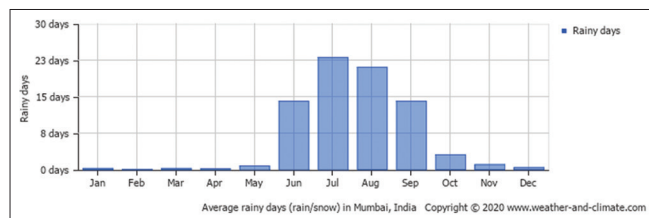
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disease 2019 (COVID-19) (WHO, 2020) is a rapidly spreading novel respiratory infection caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Person-to-person transmission is a common route for spreading the infection via direct contact or through droplets spread by coughing or sneezing by an infected individual.<sup>[1]</sup> Various other transmission routes have been proposed since the diagnosis of the novel virus for the first time in China including airborne transmission, dual ocular route, fecal–oral route, eye to nose route, perinatal transmission, transmission due to environmental factors, and venereal transmission.<sup>[2,3]</sup> The onset of annual monsoon season in Mumbai poses an additional health disease burden in the form of rising vector-borne and water-borne diseases, such as dengue, malaria, leptospirosis, influenza (H1N1), hepatitis, typhoid, and acute gastroenteritis (AGE). The rainfall during the period has profound effects on the epidemiology of these diseases. Previous experiences show that these infectious diseases pose severe problems of various dimensions for the city. The effective strategies recommended to control the spread of the COVID-19 infection by use of face masks, social distancing, and frequent hand washing are not easy to follow, practice, and implement for the millions of people who live in highly dense communities with insecure housing, poor sanitation, and limited access to clean water. In this study, we try to find out the current trends of monsoon-related diseases in Mumbai during the COVID-19 pandemic in comparison to recent past years.

#### Trend of Rainfall in Mumbai in 2020<sup>[4]</sup>



#### Rationale

We are in the midst of an ongoing pandemic, which keeps the outpatient departments, especially the fever clinics, running round-the-clock. This, on one hand, presented a chance to gauge the real load of other diseases including monsoon-related diseases. On other hand, this pandemic apparently may have led to hesitancy among patients in seeking appropriate health care. Furthermore, it seems to have exacerbated social and other nonmedical hassles such as transportation facilities and lack of availability and access to personal protective types of equipment like masks, sanitizers, hand washing facilities, etc., Hence, this study was planned to assess the impact of COVID-19 pandemic on the occurrence of monsoon-related diseases in Mumbai to know the current change of trends.

#### Objectives

This study was carried out to assess the prevalence of monsoon-related diseases in Mumbai in the last 3 years and to determine disparity (if any) in trends of these diseases.

## Material and Methods

This was a retrospective observational study using secondary data available from the Epidemiological Cell of Municipal Corporation of Greater Mumbai (MCGM). Ethical and administrative permissions were obtained in month of Dec 2020 and then data mining was carried out. Diseases included are malaria, dengue, leptospirosis, AGE, chikungunya, typhoid, viral hepatitis, and H1N1. Based on the available data, a trend analysis was conducted to plot the trends of diseases from January 2018 to December 2020.

The data includes cases from all OPD and IPD sources in Mumbai, which were reported to the epidemiology cell from the period of January 2018 to December 2020. Data analysis in form of proportions, change in proportions, and plotting of month-wise trends was done to provide insights regarding the current situation of monsoon-related diseases in the city of Mumbai.

## Results

Coronavirus cases have been increasing in Mumbai, and the administration has been working hard to ensure that the spread is controlled. Preventing monsoon-related diseases poses many challenges for the health department. Furthermore, in the year 2020, be an added responsibility to the already overburdened health system trying to contain the ongoing COVID-19 pandemic. The cases of malaria, dengue, leptospirosis, AGE, chikungunya, typhoid and viral hepatitis, H1N1 in 2018, 2019, and 2020 have been compared. Trends for almost all diseases in the year 2020 are lower than the previous 2 years [Figure 1].

#### Malaria

The disease is caused by a plasmodium parasite, transmitted by the bite of infected mosquitoes. The major concern was the identification of the breeding places in the vacant homes and locked construction sites during lockdown. In 2018, the number of cases was 5036, which decreased to 4357 in 2019 (decrease of 6.80%) and then increased to 5007 in 2020 (increase of 6.50%) [Table 1]. Furthermore, a peak was observed in cases of malaria in the month of July-August in 2020 [Figure 2a].

#### Dengue

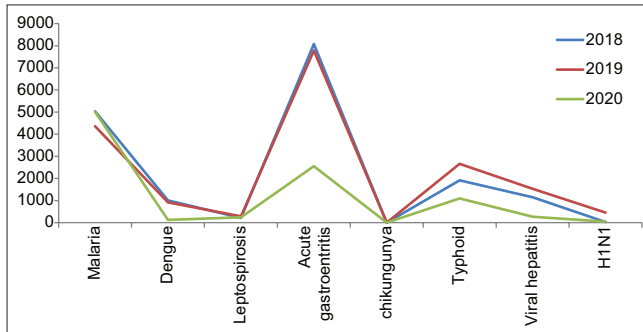
Dengue cases rise from August or September when *Aedes aegypti* mosquito starts breeding. In 2018, the number of cases was 1003, which decreased to 920 in 2019 (decrease of 0.83%) and to 129 in 2020 (decrease of 7.91%) [Table 1, Figure 2b].

#### Leptospirosis

Leptospirosis, which spreads through the urine of animals infected with the bacteria leptospira, can take from 2 days to 4 weeks to manifest into an ailment. In 2018, the number of cases was 218, which increased to 281 in 2019 (increase of 0.63%)

**Table 1: Total number of cases of monsoon-related illnesses in 2018, 2019, and 2020**

Diseases	Cases in 2018	Cases in 2019	% Change (per 10000 population) 2019 compared to 2018	Cases in 2020	% Change (per 10000 population) 2020 compared to 2019
Malaria	5036	4357	6.80%↓	5007	6.50%↑
Dengue	1003	920	0.83%↓	129	7.91%↓
Leptospirosis	218	281	0.63%↑	240	0.40%↓
Acute Gastroenteritis	8076	7785	3.18%↓	2549	52.36%↓
Chikungunya	0	0	0	0	0
Typhoid	1911	2658	7.47%↑	1092	15.66%↓
Viral hepatitis	1147	1534	3.87%↑	263	12.71%↓
H1N1	25	451	4.26%↑	44	4.07%↓

**Figure 1:** Graphical view of the comparison of cases among 2018, 2019, and 2020

and decreased to 240 in 2020 (decrease of 0.40%) [Table 1]. The reduced number of reported leptospirosis cases can be attributed to the three survey rounds carried out in slums and slum-like areas [Figure 2c].

### Acute gastroenteritis

People eating outside food are affected more by acute gastroenteritis (AGE). In 2018, the number of cases was 8076, which decreased to 7785 in 2019 (decrease of 3.18%) and decreased to 2549 in 2020 (decrease of 52.36%). In comparison to the summer, more cases are found in monsoon season. The unavailability of roadside food during the lockdown in COVID-19 pandemic may have contributed to a decrease in the number of cases of AGE [Figure 2d].

### Typhoid

Typhoid fever generally spreads through contaminated food and water. In 2018, the number of cases was 1911, which increased to 2658 in 2019 (an increase of 7.47%) and then there is a fall in the number of cases to 1092 in 2020 (decrease of 15.66%) [Table 1, Figure 2e].

### Viral hepatitis

Acute viral hepatitis is a common problem in India. Hepatitis A and Hepatitis E typically spread through contaminated food or water. Roadside food stalls are presumed to be a primary source of infection and their absence during pandemic may have helped to a reduction in the cases in year 2020 [Figure 2f].

### H1N1 Influenza

A human respiratory infection caused by an influenza strain that started in pigs. In 2018, the number of cases was 25, which increased to 451 in 2019 (an increase of 4.26%) and decreased to 44 in 2020 (decrease of 4.07%) [Figure 2g].

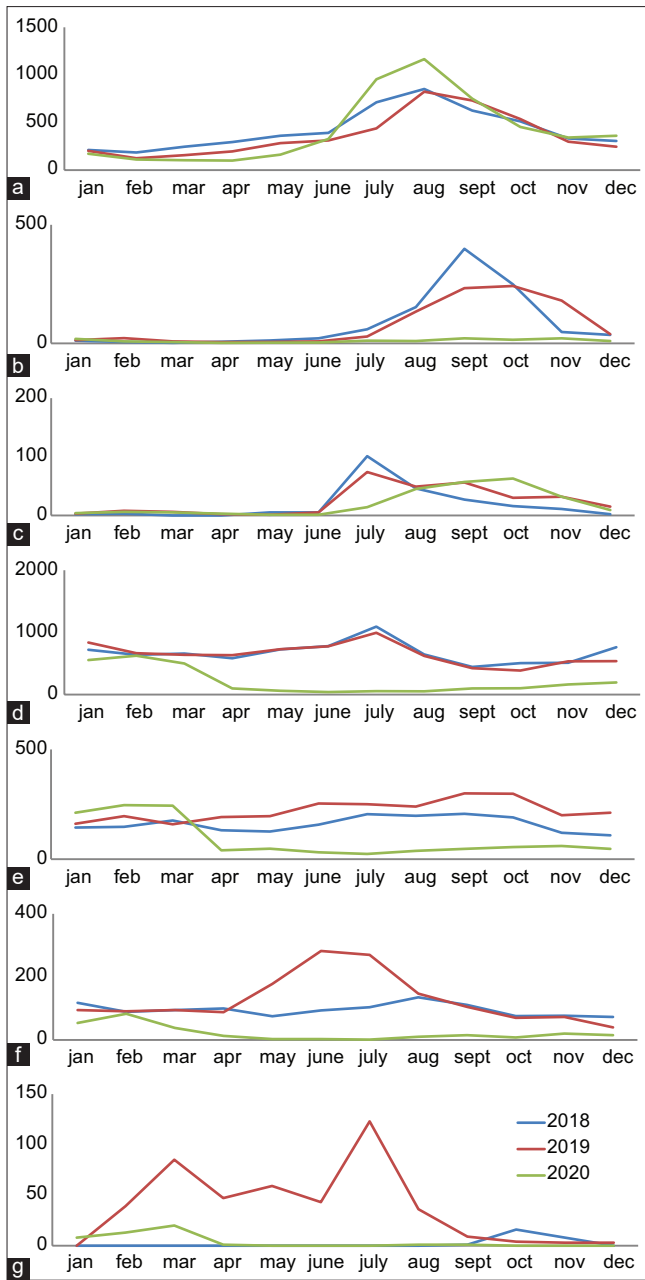
### Discussion

The onset of the annual monsoon season in Mumbai poses an additional health disease burden in the form of rising vector-borne and water-borne diseases, such as dengue, malaria, leptospirosis, influenza (H1N1), hepatitis, typhoid, and AGE. The major issues of patients and their families in the pandemic might have been fear of COVID-19, anxiety and stress, busy Covid hospitals, and lack of transportation across places.<sup>[2]</sup>

Many previously published research studies have summarized seasonal fluctuations of malaria, dengue, and leptospirosis. In this study also, seasonal trends were noticed for these diseases. Special drive at construction sites carried out for the screening of malaria may have led to a comparable number of cases in 2020 as compared to previous years. The trends of dengue in years 2018 and 2019 show a classical late monsoon period peak in September and October.<sup>[5-7]</sup>

However, the number of cases of dengue in year 2020 was far less than the last two years and there was no classical obvious peak in monsoon months. This may be due to reduced mobility leading to lesser Aedes-human contact. In addition, as per lay press reports in spite of lockdown, the pesticide control department with the support of NGO staff continued their various vector control activities, which may have yielded gains and transformed into lower dengue cases in the year 2020.<sup>[8]</sup> Previously published literature has concluded that there was a mixed impact of lockdown on dengue cases, whereas, in this study, it was pretty clear that cases of dengue were less than the previous 2 years.<sup>[9]</sup>

The trends of leptospirosis show that cases in 2020 are lesser than in 2019 but more than in 2018. Further, the month-wise graphs show that the peak came in September and October 2020. This may have occurred due to brief episodes of flooding along with the fact that due to lack of public transport people may have been forced to walk through flooded waters, which



**Figure 2:** Month-wise trends of monsoon-related diseases over 3 years. (a) Malaria, (b) dengue, (c) leptospirosis, (d) acute gastroenteritis, (e) typhoid, (f) viral hepatitis, and (g) H1N1

may have increased their chances of contracting leptospirosis. Another factor could have been that cases of COVID-19 with persistent fever were investigated for other concomitant causes by conducting a complete fever profile and due to this investigation, the trends of leptospirosis and also malaria and H1N1 may be showing numbers that are comparable to the previous two years.

For the first time in seven years, the number of AGE cases recorded in the city decreased. The absence of street vendors during the lockdown and focus on hygiene of fruits and vegetables seem to be the contributors for this fall in cases. With

everyone taking precautions to curb the spread of COVID-19, the risk of contaminated water had also diminished due to the use of boiled water and regular hand washing practices, which collaterally might have impacted the feco-oral transmission leading to reduced number of AGE and typhoid.<sup>[8]</sup>

Lack of public transportation, primarily closure and then limitation of travel in suburban train networks and closure of places of mass gatherings like temples, malls, cinema halls, etc., definitely might have impacted the exposure among citizens and thereby lowered the number of cases of diseases like H1N1. Overall the numbers of cases of almost all diseases were lesser than in previous years, whereas most of these diseases are expected to have higher peaks in every new monsoon season.<sup>[10]</sup>

To summarize it can be said that full-scale operations of a robust infrastructure of MCGM, especially its health department, and enforcement of strict lockdown measures by law and order authorities seem to have ensured relatively prompt management of the numerous COVID-19 cases. And furthermore, this study has shown that the efforts put in to contain the COVID-19 pandemic have led to collateral gains in form of reduced cases of many monsoon-related illnesses. This has been possible apparently due to the information education communication (IEC) activities carried out by all levels of government, but mostly the urban local bodies, which in this case is the MCGM. Unprecedented amount of health-related messages were transmitted through all available forms of communication channels, viz., outreach activities, door-to-door screening activities, pamphlets, radio, television, recorded caller tunes, and social media. The availability of 24 × 7 helpline numbers might have given an extra edge to the health education campaigns.

The above mentioned IEC activities were able to timely convey and spread messages about the importance of healthy and hygienic practices to the people. Thus, this study has also been able to emphasize the fact that investing in health education campaigns and in community participation for disease control has the potential to give multifold returns in reducing the disease burdens of society.

Notification of monsoon-related diseases was affected as most of the available human resources were deputed and diverted toward pandemic-related activities. This could have possibly resulted in the under-reporting of patients under the Integrated Disease Surveillance Program (IDSP), which may have resulted in a lower reported number of cases in year 2020.

### Conclusion

Monsoon has shaped history and survival of the inhabitants of the Indian sub-continent. During the turbulent times of the COVID-19 pandemic, the monsoon season offered various challenges and possibilities in the region. But in this study,

it was found that the burden of almost all monsoon-related illnesses was lesser as compared to previous years. This epidemiological change has to be summarized to be a collateral benefit of the commitments of the urban local body: MCGM and other governing systems against the pandemic. The results of this study also vouch for the efforts put in by the citizens in shouldering their responsibilities in this war against the COVID-19 pandemic.

Therefore, it may be recommended that all important pillars of our democracy, viz., the democrats, bureaucrats, technocrats, and the people themselves need to understand the importance of continuing these hygiene and preventive activities in this second year of the pandemic and even beyond. Further, there is a need to brainstorm possibilities of mainstreaming these infection prevention activities. One possible way of fulfilling this objective is by conducting refresher training for primary care physicians, paramedics, and even medical students about how simple health practices like hand hygiene (both soap and alcohol-based rub), wearing of masks, and food and water hygiene may bring about large impact in the control of communicable diseases. In addition, social and behavior change communication using all forms of contemporary media must be continued to actively involve citizens as well as their primary care physicians in control and elimination programs of communicable diseases, which are routinely run by health governing systems.

It is also suggested that the human resources used during the COVID-19 pandemic can be trained and be used in the control and prevention of monsoon-related illnesses in the post pandemic era. To conclude, this study has thrown light on the collateral benefits of pandemic containment activities, which resulted in lowering the trends of almost all monsoon-related illnesses.

### Limitations of this study

Some mildly symptomatic cases of monsoon-related illnesses may have been missed due to lockdown rules, lack of transportation, and limited non-Covid healthcare services. Such cases may not be a part of the official data, especially for year 2020, and hence were not included in this study.

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### Conflicts of interest

There are no conflicts of interest.

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