

## Original Research Article

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# A study of trend of incidence of dengue cases attending a tertiary care hospital in urban Maharashtra

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## ABSTRACT

**Background:** Presently, dengue is one of the most important mosquito-borne viral diseases in the world. The burden of the disease has drastically risen over the years with over 70% contributed by the Asia region. India is endemic to the disease and all four serotypes of the virus have been isolated from the country. This study aimed to describe the trends of incidence of dengue cases at a tertiary care hospital in urban Maharashtra.

**Methods:** Retrospective data analysis with respect to admitted dengue cases in the preceding five years was carried out from the records available at the hospital. Year-wise trend as well as correlation with average monthly rainfall were also analysed.

**Results:** The number of admitted cases of dengue showed a rising trend which was statistically significant. The study brought forth a change in the seasonality of occurrence of cases. The number of cases also showed a positive and statistically significant correlation with the monthly average rainfall in the Madhya Maharashtra region.

**Conclusions:** There is evidence for an increase in the burden of dengue. With the overall number, there is also change in seasonality of the disease, indicating a requirement of control measures to be instituted earlier than the usual pre-monsoon period. The rising burden will pose a public health challenge and requires tailor-made remedial activities taking into consideration various factors associated.

**Keywords:** Dengue, Maharashtra, Trend analysis

## INTRODUCTION

Dengue is a mosquito-borne disease that is caused by the dengue virus (DENV), a member of the *Flaviviridae* family. There are four distinct serotypes of the virus (DENV-1 to 4), with no cross immunity after infection with a particular serotype. However, it has been seen that an infection of a particular serotype confers lifelong immunity against that particular serotype. Subsequent infection with a different serotype increases the severity of the symptoms.<sup>1</sup> Dengue can have a wide range of presentation. It can range from asymptomatic/subclinical disease to severe dengue (associated with haemorrhagic manifestations and/or multi-organ damage, and even death).<sup>2,3</sup> The disease is found in tropical and

sub-tropical climatic zones worldwide, primarily in the urban and semi-urban areas.<sup>2</sup>

The burden of the disease has risen drastically globally over the years. WHO estimates there to be around 390 million (95% credible interval 284-528 million) dengue virus infections per year, with clinically manifesting illness in around 25%. A significant proportion of the disease is not reported due to being often misdiagnosed. The number of reported cases has increased from just over 5 lakh cases in 2000 to over 3.3 million currently. 3.9 billion people worldwide are at risk of the infection.<sup>2</sup>

At the moment, Asia accounts for approximately 70% of the global disease burden.<sup>2</sup> India has also been

contributing to this in a prominent capacity over the years. All four serotypes of DENV have been isolated in the country.<sup>4,5</sup> Dengue-like illness was first reported in India as early as 1780 from Chennai and several outbreaks have been documented in the 20<sup>th</sup> century.<sup>6</sup> The disease has been increasingly reported in the country from early 2000s. From being endemic in a few southern and northern states, Dengue has become endemic to all the states and UTs in the country.<sup>5</sup> In 2019, the maximum cases were reported from the states of Karnataka, Gujarat, Rajasthan, Maharashtra and Telangana.<sup>7</sup>

Currently, dengue ranks as the most important mosquito-borne viral disease in the world, with few coherent and coordinated efforts, at national or international levels, undertaken to hold dengue at bay and reverse these alarming trends. The Global strategy for dengue prevention and control, 2012-2020, aims to correct this situation. Rise in the number of cases of dengue on a large scale can affect the health status, public health machinery and the economy of a country.<sup>8</sup> Alongside the increase in the burden of the disease, it is pertinent to understand the change in trend of the infection in the recent years.

With this background, this study was conducted to describe and assess the trend of Dengue in an urban setting over the preceding five years (2015-2019).

## METHODS

This record-based study was carried out in a tertiary care hospital situated in Western Maharashtra. The study population included all the cases of Dengue that were admitted to the hospital from 01 Jan 2015 to 31 Dec 2019.

### Inclusion criteria

All cases (including secondary dengue infections) confirmed to have dengue infection using NS1Ag test and in-patients admitted to the hospital.

### Exclusion criterion

Incomplete data/non-availability of data in hospital records

A retrospective analysis of the data of these five years was carried out. Data was collected with respect to number of cases of dengue per month admitted to the hospital, age and gender of the admitted cases and test used for diagnosis of dengue. Data was also collected from the Indian Meteorological Department regarding the average rainfall in the state during the same period.<sup>9</sup> Trend analysis of the cases of dengue was carried out using Chi-square for trend by Epi-Info version 7 statistical software. Correlation of the number of cases with average rainfall was done using Spearman

Correlation Coefficient by SPSS version 20.0 statistical software.

Prior permission of competent authority was obtained for the use of the data and ethical clearance from Institutional Ethics Committee was also obtained prior to conduct of the study.

## RESULTS

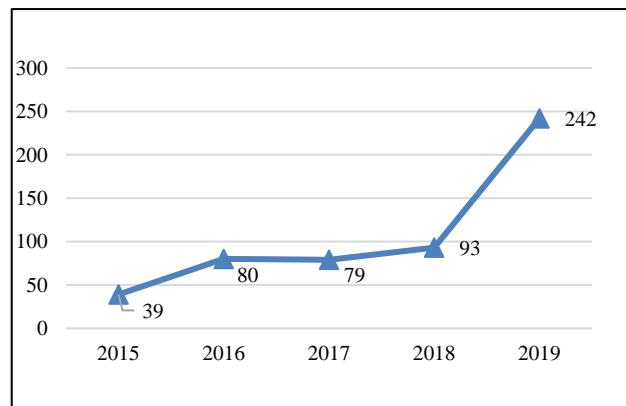
A total of 540 cases of dengue infection were admitted in the tertiary care hospital between 01 January 2015 and 31 December 2019.

### Characteristics of the study population

The mean age of the dengue patients did not show much change over the years. The mean age ranged from 25.97 to 31.15 years. The male to female ratio of the admitted cases was 3.1: 1. Majority of the cases were in the age group 15 to 60 years, with the youngest case of the age 5 months and the oldest at 65 years.

### Year-wise trend of the admitted dengue cases

The year wise trend shows a statistically significant increase ( $\chi^2$  value of 165.39 and p value<0.0001) in cases of dengue over the years, with 2019 recording more than double of the previous year (Figure 1).

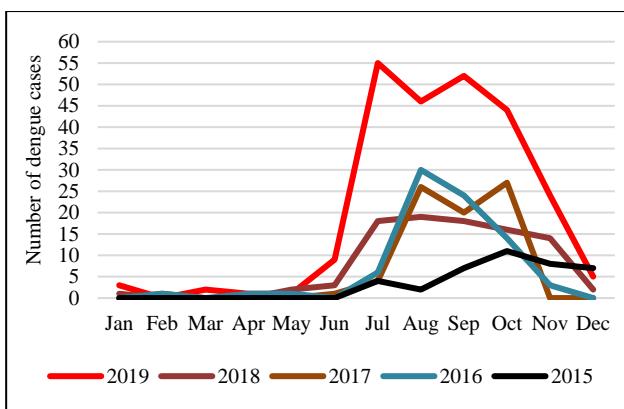


$\chi^2=165.39$ , df=4, p value<0.0001.

**Figure 1: Year wise trend of dengue cases.**

### Seasonal variation of the admitted dengue cases

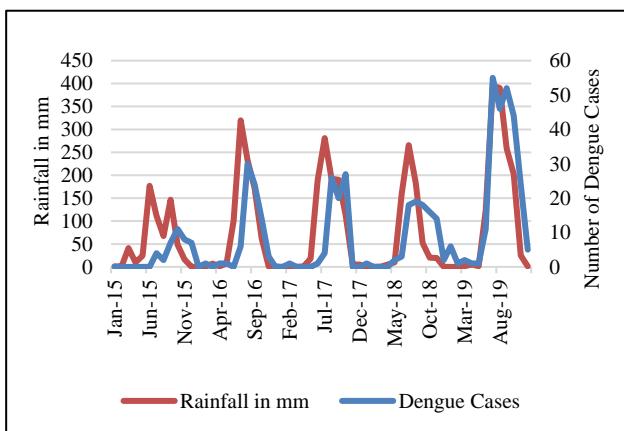
In 2015, cases were reported only from July to December, with no peak in the trend. In 2016, the cases increasing from the month of June with the peak in August and subsequent fall in the number of cases. A bimodal peak was observed in 2017, with peaks in August and October. There was no observable peak in 2018, with cases increasing from June and subsequent plateauing till November. Unlike previous years, cases were reported from all months of 2019, except February, with peaks in July and September (Figure 2).



**Figure 2: Trend of dengue cases admitted in the hospital.**

#### **Correlation with average monthly rainfall in Maharashtra**

Figure 3 depicts the trend of the monthly average rainfall with the number of cases of dengue admitted in the tertiary care hospital in the corresponding time. A significant correlation was observed between the number of dengue cases per month and the average rainfall (in mm) for the corresponding month (correlation coefficient- 0.622).



Spearman correlation coefficient= 0.622, p value<0.001.

**Figure 3: Correlation of dengue cases with average rainfall.**

#### **DISCUSSION**

Dengue infection has been a growing public health problem in India. With the other already existing challenges to the public health of the country, dengue can pose a significant threat. The number of cases of dengue has been found to be increasing during the study period, with the highest number in 2019. This finding is in sync with the reports of NVBDCP.<sup>7</sup> The number of cases of Dengue in India has increased from over 99,000 in 2015 to 1.36 lakhs in 2019. During the same period, the magnitude of cases has been correspondingly rising in Maharashtra as well, from just under 5,000 in 2015 to

over 12,000 in 2019. These findings are in line with that of Sujata et al, with respect to the trend of dengue cases in a tertiary care hospital in Mumbai.<sup>10</sup>

The demographic characteristics of the admitted cases did not show any statistically significant difference during this period with respect to mean age, gender and the age groups affected. In this study, the mean age of the cases ranged from 25 years to 31 years through the study period. In comparison, a Systematic Review and Meta-Analysis published by Kumar et al showed a pooled mean age of 22 years.<sup>11</sup> Majority of the cases occurred in males, similar to the findings of Sujata et al.<sup>10</sup>

It is not just the number of cases, but the patterns/seasonality of occurrence of cases which is of significance. The study has shown that over the years, the cases have started increasing from an earlier part of the year as compared to the previous years. There is also a change that has been observed with respect to the seasonality of the infection. In 2015, there were no cases reported from the months of January to July. However, in 2019 dengue cases were admitted in the hospital in all months except February. This indicates a shift from the usual trend of dengue cases post monsoon to a perennial nature of the infection. It would warrant dengue control activities to be initiated early or even to be carried out throughout the year, integrating into the routine preventive health service machinery.

Considering the average rainfall in Madhya Maharashtra region for the time period, a statistically significant correlation was observed between the average monthly rainfall in mm and the number of dengue cases admitted to the hospital in the corresponding months. The peaks of dengue cases coincided with the peaks in monthly rainfall. Therefore, a close monitoring of climatic parameters is necessary to predict the burden of the disease and to prevent it/ prepare the system accordingly.

The reasons for the increasing trend of dengue infections need a closer look. Globally, there are several factors that have contributed to this.<sup>12</sup> First and foremost, the dynamics of climate change have been implicated, with the rise in average temperatures, humidity and precipitation patterns found to be associated. Globalization and ease of travel have also contributed to the disease being spread across countries and continents, with more countries being endemic to the disease. Trade relations that span the globe are also important in this context. Other factors that contribute to this issue also include various socio-demographic and economic factors like the rapid pace of population explosion, population density, socio-economic status, type of housing, occupation, settlements, construction activities etc.

There are also various factors associated with the Public Health system that have been contributing to the increasing burden of the disease. Globally, the poor disease surveillance setups, misdiagnosis, lack of testing

facilities etc. are common challenges faced by several of the low-to-middle income countries, which cause the true burden of the disease to be underestimated and efforts to control it being inadequate.<sup>13</sup>

Vector control measures if inadequate can also be a major contributing factor. Insecticide resistance may be found among the vector species, which can cause uncontrolled growth in their populations. The policies and guidelines on insecticide use for a particular area has to be made taking this into consideration and has to be tailor-made for the region. In Maharashtra, the guidelines for vector control measures were modified in 2018, with Malathion as an anti-adult measure phased out and replaced with synthetic pyrethroids, after resistance to malathion was observed.<sup>14</sup> However, it is not necessary that the information has percolated to the lowest level and adequate modifications made accordingly. This may also be responsible for the significant jump in the number of cases between 2018 and 2019 in the study population. All these factors need to be identified in advance before making any recommendation/ action plan to limit the growth of the disease.

### **Limitations**

The data collected for the study was record based and limited to only the admitted patients of the hospital. It is just the tip of the iceberg and therefore, this study cannot portray the situation in the community at large, as several patients could have been treated on OPD basis as well those with mild illness, who did not seek medical attention would have been missed out. There was also paucity of data with respect to the clinical profile, duration of hospitalisation as well as outcome with respect to the study population. Under-reporting can also be due to the issue of misdiagnosis of cases, especially the mild ones.

This study has focussed on only rainfall as environmental factor associated with magnitude of dengue cases. Other parameters like temperature, humidity, population density etc. also need to be considered for reaching more impactful conclusions.

Another important parameter for which data was not available was the use of insecticides for anti-*Aedes* measures in the community. Inadequate/ incorrect use of chemicals and use of inappropriate chemicals for the region can have serious implications in terms of increasing burden due to both inabilities to control vector population as well as more probability of developing insecticide resistance.

### **CONCLUSION**

This study depicts a growing healthcare challenge for the Public Health system of the country. The burden of the disease has been consistently rising over the years, since early 2000s. There is not just an increase in the number of

the cases, but also significant changes with respect to the seasonality of occurrence of cases. It is clear that if left uncontrolled, this disease can overwhelm an already over-worked system. The index of suspicion for the disease has to be high, even in the seasons not traditionally associated with the disease.

Several factors contribute to the rising burden of the disease. Some are universal where as some factors can be unique to a particular area, for example insecticide resistance. Unless the underlying factors are correctly identified, remedial measures cannot be suitably instituted, resulting in further growth of the disease. Therefore, further studies may be warranted to corroborate the findings with respect to the community at large as well as the parameters that were not considered in the study.

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*Ethical approval: The study was approved by the Institutional Ethics Committee*

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