

## Trend and Epidemiological Profile of Dengue Fever/Dengue Haemorrhagic Fever in Ahmedabad City, Gujarat, India

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### Abstract:

**Introduction:** Dengue fever is an acute viral disease of public health importance having the potential of causing large scale outbreaks. Recently Dengue cases are increasing alarmingly in various parts of the country and Gujarat is one of them. **Objective:** The study was conducted to know the trend and epidemiological profile of Dengue cases and deaths. **Method:** In this record based study, month and year wise data including a number of suspected cases, confirmed dengue cases admitted or treated at various government and corporation run health facilities and reported number of deaths for the period of 2010-2016 for the Ahmedabad Municipal Corporation was collected. A descriptive analysis was done. **Results:** Incidence of Dengue were 16.3 per 1,00,000 population and maximum rate (26.2) was seen in children up to the age of 14 years followed by 15-44 years (17.3). There was no significant difference in the rate of Dengue among males and females ( $p>0.05$ ). A substantial increase in the incidence was seen in the year 2015 and 2016. Case fatality rate was less than 1% and proportion of deaths was maximum (57.89%) in children up to the age of 14 years. Seropositivity showed a declining trend. **Conclusion:** Dengue is showing increasing trend and found to be high in pediatric age group and males. The peak number of cases was found in mid-September. Overall case fatality was less but the proportion of deaths was high in the pediatric age group. Although cases showed an increasing trend, the seropositivity showed a declining trend. Active participation of the community by sensitization for integrated vector control programmes is required to tackle the challenges of vector control in fast developing urban area.

**Key Words:** Deaths, Dengue, Incidence, Seropositivity, Trend

### Introduction:

Dengue fever is a disease of public health importance caused by arbovirus and transmitted by *Aedes* mosquitoes both in urban and rural areas.<sup>[1]</sup> Dengue Fever/Dengue Haemorrhagic Fever is an acute viral disease having the potential of causing, large scale outbreaks. The risk of dengue has shown an increase in recent years due to rapid urbanization, life style changes and deficient water management including improper water storage practices in urban, peri-urban and rural areas, leading to a proliferation of mosquito breeding sites. In recent years Dengue cases are increasing alarmingly in various parts of the country including rural areas.<sup>[2]</sup> Dengue is endemic in 35 states/UTs of India. After 1996

outbreak upsurge of cases were recorded in 2003, 2005, 2008, 2010, 2012 and 2013. Gujarat is one of the most affected regions. In Gujarat State, there has been an increase in the number of dengue reporting units during the past few years due to the improved surveillance system including private hospitals and availability of serodiagnostic facilities at different centres in the state. The number of cases reported is increasing, probably because of the availability of IgM detection kits produced and distributed by National Institute of Virology through NVBDCP and better reporting.<sup>[3]</sup> Epidemiological studies carried out in rural and urban areas of Gujarat and in Ahmedabad district, in particular, have shown the predominance of Dengue Virus-2 serotype.<sup>[4]</sup>

Reported cases from Ahmedabad Municipal Corporation Area are also showing increase with passing years. The current study was carried out with the objectives (i) To study the trend of Dengue cases and death (ii) To study the epidemiological profile of Dengue cases and deaths.

#### **Method:**

**Study area:** Ahmedabad city is located in the Gujarat state of India. This city is the largest city and former capital of Indian state of Gujarat and is spread over an area of 466 sq.kms covering the population of 55,77,940. The city is having a density of 11,948/sq.km. Ahmedabad Municipal Corporation (AMC) is divided into six zones (East, West, South, North, Central and New-West) and has 64wards.<sup>[5]</sup> Ahmedabad has a hot, semi-arid climate (Koppen climate classification: BSh),<sup>[6]</sup> having marginally less rain than required for a tropical savanna climate. There are mainly three seasons. The summer season is from March to June. The rainy season starts from June end or July and ends in September. The winter season follows from November to February.

**Study design:** It was a record based cross-sectional study.

**Data Collection:** Dengue is a notifiable disease under (Integrated Disease Surveillance Programme) IDSP. This was a record based study. Secondary data was collected from the Malaria Office, NVBDCP Programme, AMC.

Ahmedabad Corporation Area has Government of India identified one Apex Referral Laboratory and two Sentinel Surveillance Hospitals for Dengue and Chikungunya. Three hospitals are also there which are run by Corporation catering to the population of Ahmedabad City. The information related to the confirmed cases of dengue from the two sentinel surveillance hospitals and other three hospitals goes to the health department of the Municipal Corporation through e-mail. Data were validated as the health inspector of Ahmedabad Municipal Corporation personally visits the household of the confirmed case of Dengue through the details

provided in the line-listing of cases. Confirmed cases of Dengue reporting to these hospitals from outside Ahmedabad were excluded. All the suspected cases reporting to these hospitals are tested by either IgM Elisa test or NS1 antigen test for confirmation.

**Data analysis:** Data was entered, processed and analyzed using MS Excel 2010. Descriptive analysis was done to know the average incidence of Dengue in various age groups and gender. Denominator for the calculation of rates was calculated by using census data of Ahmedabad Municipal Corporation<sup>[7]</sup> and applying arithmetic progression method. The population for the year 2010 was calculated using growth rate of the census data of the year 1991 and 2001. The population for the period of 2011 to the year 2016 was calculated using the growth rate of the census data of the year 2001 and 2011. Standard age groups were used for carrying out person analysis. Analysis was done by collecting the information related to the number of cases in each age group and denominator for each age group was calculated by using proportion of population of each age group. We calculated the average incidence for different age groups, Case fatality rate and seropositivity rate. Seropositivity rate was calculated by division of the laboratory confirmed cases by clinically suspected cases.

**Ethical Permission:** The permission of administrative authorities of Malaria department of Ahmedabad Municipal Corporation office was obtained for data collection and publication of information.

#### **Results:**

The overall incidence of dengue was 16.3 per 1,00,000 population. Maximum incidence was seen in children up to 14 years of age group (26.2 per 1,00,000 population) followed by 15-44 years age-group (17.3 per 1,00,000 population). The proportion of deaths was maximum (57.9%) in children up to the age of 14 years followed by 15 to 44 years age group in which the proportion of deaths was 36.84%. The incidence of dengue among males was higher than females however the difference was

**Table 1: Age and Gender wise distribution of Cases of Dengue and Deaths due to Dengue from 2010 to 2016**

Age group (in years)*	Number of cases	Population**	Incidence(per 1,00,000 population)	Deaths No. (%)
0-4	546	457369	17.1	10 (26.32)
5-14	1779	971204	26.2	12 (31.58)
15-44	3589	2964431	17.3	14 (36.84)
45-60	384	807455	6.79	01 (02.63)
≥60	136	451723	4.30	01 (02.63)
Gender	Number of cases	Population	Incidence (per 1,00,000 population)	Death No. (%)
Male	3725	3002827	17.7	25(65.79)
Female	2709	2643708	14.6	13(34.21)
Total	6,434	56,46,535	16.3	38 (100.00)

Figures in parenthesis shows percentage

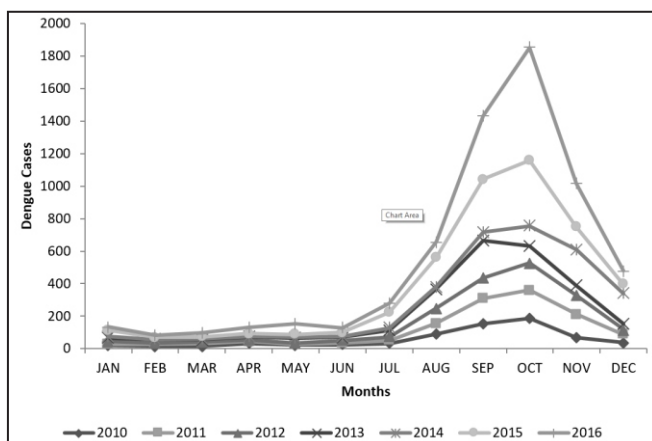
\* As Dengue affects both gender and all ages, we have used the standard age groups

\*\* Age group proportion was taken from the report published on Health Statistics, 2013-14 by Comissionerate of Health, Medical Services, Medical Education and Research Gujarat State Gandhinagar on August 2014.

not statistically significant ( $p>0.05$ ). Proportion of death was higher among males (65.79%) then females. (Table1)

The median age of dengue cases was 18 years and it was almost same from 2010 to 2016. Month wise distribution of dengue cases shows that the number of cases started increasing from July and peak was observed in the mid-September. (Figure 1)

**Figure 1: Month-wise distribution of dengue cases from 2010 to 2016**



Cases of Dengue were almost same till the year 2014 but the substantial increase was seen in the year 2015 and 2016. The number of cases in the year 2015 and 2016 was more than 2 SD of the average number of cases  $\{>751.1 (668 + 2x (41.55))\}$  in the previous five years (2010 to 2014). Case fatality rate was below 1% in all the years except for the year 2012. Even though the incidence of Dengue was high in the year 2015 & 2016 but CFR was less. (Table 2)

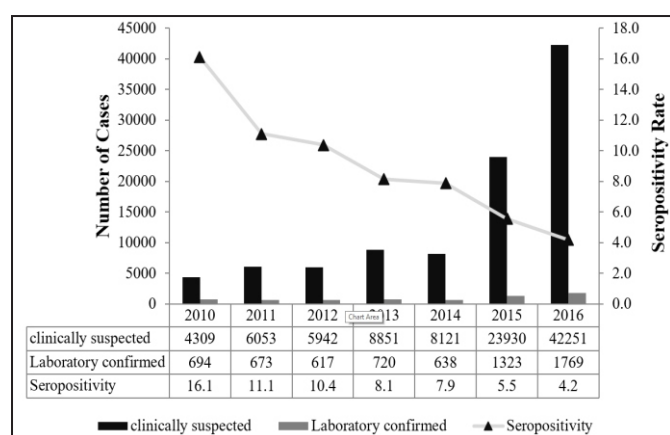
There was a substantial increase in the clinically suspected dengue cases across 2010 to 2016 but seropositivity is showing a declining trend. (Figure 2)

**Discussion:**

Dengue is currently the most important mosquito-borne, a human viral disease in terms of both the number of cases and number of deaths. The public health importance of dengue in India has been acknowledged.<sup>[8]</sup> In India, dengue is widespread and endemic in most major cities.<sup>[9]</sup> Since the mid-1990s, epidemics of dengue in India have become more

**Table 2: Number of DF/DHF cases and deaths reported from 2010 to 2016**

Year	No. of cases	Cases/1,00,000 population	No. of deaths	Deaths/1,00,000 population	CFR %
2010	694	16.84	5	0.12	0.72
2011	673	11.92	5	0.09	0.74
2012	617	10.54	7	0.12	1.13
2013	720	11.88	3	0.05	0.41
2014	638	10.19	0	0.00	0
Average of 2010-2014	668	12.27	4	0.08	0.60
2015	1323	20.45	6	0.09	0.45
2016	1769	26.50	12	0.18	0.68

**Figure 2 : Seropositivity Rate of Dengue cases from 2010 to 2016**

frequent, especially in urban zones and have quickly spread to new regions where it was historically non-existent.<sup>[10]</sup> During the last two decades, India experienced sustained, high levels of dengue transmission, with large epidemics every 2-3 years.<sup>[8]</sup> It is now estimated that India has become hyper-endemic.<sup>[1]</sup>

The risk of dengue has shown an increase in recent years due to rapid urbanization, lifestyle changes and deficient water management including improper water storage practices in urban, peri-urban and rural areas, leading to proliferation of mosquito breeding sites.<sup>[2]</sup> Dengue in Ahmedabad continues to increase in magnitude and poses a challenge. Ahmedabad being a fast developing city is expanding rapidly. As a result of development, the

conditions favourable for dengue transmission are generated. *Ae.aegypti* breeds almost entirely in domestic man-made water receptacles found in and around households, construction sites and factories. Vector control measures in such a scenario become a challenge. Dengue affects all races and both sexes. Dengue affects people of all ages. In South East Asia, where dengue is hyperendemic, DHF usually affects children younger than 15 years.<sup>[11]</sup> Although the age distribution of dengue has changed from predominantly paediatric disease to one that affects all age groups but patient age is a risk factor for severe dengue disease. In the present study, the cases was high in less than 15 years age group. In a study conducted by Gupta et al<sup>[12]</sup> and Dar et al<sup>[13]</sup> on outbreak of Dengue Haemorrhagic fever in Delhi, maximum number of seropositive cases was in the 5-20 years age group.

Cases among males were higher than females. This may be explained by the difference in the health seeking behaviour and outdoor activities. More males as compared to females may be reporting to the hospital for illness. In the majority of reports of dengue outbreaks in India, the male to female ratio was found to be high. Studies conducted in Delhi<sup>[13,14]</sup> showed high male to female ratio.

Dengue being a vector borne disease, the growth and development of dengue vector is climate

dependent. The ecological and climatic factors influence the seasonal prevalence of both the vector and the dengue virus.<sup>[15]</sup> The seasonality of transmission of dengue with increased severity has been observed in the post monsoon season.<sup>[12]</sup> The cases peak after monsoon and it is not uniformly distributed throughout the year. However, in the southern states and Gujarat, the dengue transmission is perennial.<sup>[3]</sup> In this study, cases started increasing from July and peak was seen in mid-September confirming the active transmission period is during monsoon and post monsoon period every year suggesting that preventive measures should be in full swing at the very onset of monsoon.

Throughout the country, the occurrence of widespread epidemics has been found followed by the endemic/hyper-endemic prevalence of all the four serotypes of dengue virus. The epidemiology of dengue virus and its prevalent serotypes has been ever changing.<sup>[8]</sup> High incidence of dengue in the year 2015 and 2016 is attributed to the occurrence of the outbreak in the Ahmedabad Corporation Area and due to changing serotypes. DEN-2, DEN-3 and DENV-4 have been isolated from the cases in Ahmedabad City. Dengue has a wide spectrum of clinical presentations often with unpredictable clinical evolution and outcome. While most patients recover following a self-limiting non-severe clinical course, a small proportion progress to severe disease, mostly characterized by plasma leakage with or without haemorrhage. Children are at higher risk of severe dengue. Young children, in particular, may be less able than adults to compensate for capillary leakage and are consequently at greater risk of dengue shock.<sup>[16]</sup> Although the number of dengue cases has shown a steady rise with every passing year, the mortality has reduced.<sup>[9]</sup> The present study shows that CFR remained below 1% throughout a span of seven years which could be probably the result of cumulative effects of better patient management, increased diagnostic capabilities and better reporting. The proportion of deaths was high in the children up to the age of 14 years as DHF is considered to affect

primarily children under 15 years of age and is an important cause of hospitalization.

For an alert system to trigger actions, the surveillance system needs to be: (a) sensitive in predicting or detecting an outbreak in a timely manner; and (b) specific to avoid unnecessary false alerts. When the sensitivity of an alarm signal increases, the specificity decreases and vice versa, but the optimal level of sensitivity/specificity is unclear.<sup>[17]</sup> Although clinically suspected cases showed an enormous increase during the year 2015 and 2016 but the seropositivity showed a declining trend. Over the period of seven years that is from 2010 to 2016, clinically suspected cases showed an increase and corresponding increase was also seen in the laboratory confirmed cases. The explanation for declining seropositivity rate could be attributed to the higher sensitivity of the surveillance system due to increased awareness among healthcare professionals of the need to report clinically suspected dengue cases. But at the same time standard case definitions should also be used to increase the specificity of the surveillance system.

#### **Conclusion:**

The present study shows that the trend of Dengue Fever is increasing. Incidence of dengue is high in pediatric age group and males. The peak of cases was found in mid-September. Incidence was high in the years when an epidemic occurred. Overall case fatality was less but the proportion of deaths was high in the pediatric age group. Although case showed an increasing trend but seropositivity showed a declining trend. Until the community actively participates in vector control measures the control is difficult. However it is important to observe the trend further to confirm the upsurge in Dengue cases by doing further studies.

#### **Limitations of the Study:**

As the source of information of Dengue is Passive Surveillance system it is likely to underestimate the extent of Dengue virus transmission due in large part to the often mild, non-specific presentation of the

disease and also because of cases going to the private health care providers.

#### Declaration:

Funding: Nil

Conflict of Interest: Nil

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