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**Ayesha Anam Irshad Siddiqui**  
Government College of Forensic  
Sciences, Aurangabad,  
Maharashtra, India

**Dr. Charansing Kayte**  
Government College of Forensic  
Sciences, Aurangabad,  
Maharashtra, India

## A systematic study to identify the awareness, severity and burden of mosquito-borne diseases in Maharashtra, India

**Ayesha Anam Irshad Siddiqui and Dr. Charansing Kayte**

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### Abstract

**Background:** Mosquito-borne diseases are a rising concern. There are six mosquito-borne diseases in Maharashtra, the Indian state, which include Malaria, Dengue, Chikungunya, Japanese Encephalitis, West Nile Virus, and Lymphatic Filariasis. The status and trends of the five malaria, dengue, chikungunya, yellow fever and Zika diseases was reviewed in this study. The world's mosquito species and India's mosquito species were studied. The goal of this review is to identify awareness, seriousness and to find burden of mosquito-borne diseases in Maharashtra from 2016 to 2020.

**Materials and Methods:** The present study was conducted in Maharashtra's urban cities. We carried out a survey using a questionnaire to assess the real burden of mosquito-borne diseases, and we also collected data to validate our findings from the National Vector Borne Diseases Control Program Directorate (NVBDCP) in Delhi.

**Results:** We have got the 38% respondent suffered from Malaria, 18% suffered from Dengue, 31% suffered from Chikungunya, 4.1% suffered from Yellow Fever. It was also found that 60% of respondent were not suffered from any mosquito-borne disease in Maharashtra, India. We found that 64% people need hospitalization to cure mosquito borne diseases.

**Conclusion:** To promote better awareness and to be conscious of mosquito-borne diseases, steps must be taken. The burden of malaria is higher than all other diseases transmitted by mosquitoes. Dengue patients are also found to be less than Chikungunya. There are records of death in Malaria and Dengue, but there are no recorded cases of death in Chikungunya.

**Keywords:** mosquito-borne diseases, mosquitoes, malaria

### Introduction

#### Mosquito

Mosquitoes belong to the group of insects known as *Diptera*, or flies. Mosquito means, "little fly" in Spanish. *Diptera* means, "Two wings" – the characteristic that distinguishes flies from other types of insects. Proboscis – long tubular mouthpart for sucking up fluids and the hair-like scale on its body distinguishes mosquito is different from types of flies.

#### Mosquito the dangerous insect

Mosquitoes and the viruses they spread have been responsible for killing more individuals in history than all the wars. Still now, malaria-borne mosquitoes kill 2 million to 3 million people and infect another 200 million or more annually. A range of other mosquito-borne diseases kill and weaken millions more [3].

#### Mosquito species

The *Culicidae* family is a large and abundant group scattered far outside the Arctic Pole, from tropical latitudes to temperate regions. It covers about 4,000 species, divided into two subfamilies and 112 genera [5]. There are three genera in the subfamily *Anophelinae* and 109 genera in *Culicinae*, divided into 11 tribes. Almost 4000 species of mosquitoes are found in the world. Up to 404 species live in India. 404 species and subspecies 3541, belonging to 50 genera and 2 subfamilies, are available in the catalogue (12 tribes) [6]

**Corresponding Author:**  
**Ayesha Anam Irshad Siddiqui**  
Government College of Forensic  
Sciences, Aurangabad,  
Maharashtra, India

### Vector - Parasites, Pathogens, Virus

Any of the most significant diseases in humans, agriculture and nature are commonly described as 'vector-borne' by many parasites and pathogens. Throughout the tropical world, these include emerging parasites and pathogens including dengue virus. One of the widest possible meanings describes a vector as any organism that acts as an infectious agent carrier between organisms of a different species (vertebrate or invertebrate) [4]. Parasites are species that live in or on another organism that obtain shelter and food from the host and damage it [9]. Viruses are small unavoidable intracellular parasites which, by definition, contain the chromosome of either RNA or DNA, surrounded by a protective protein coat controlled by a virus. Viruses can be used as mobile genetic components, most likely of cellular origin and distinguished by a long co-evolution between the virus and the host [10].

### Mosquito-borne diseases

Infected mosquitoes with bacteria, viruses or parasites may spread diseases to humans and livestock [11]. The mosquito vectors mainly belong to three genera, Anopheles, Aedes and Culex[7]. The vector of *Aedes* mosquito is responsible for Chikungunya, Dengue, Lymphatic filariasis, Yellow Fever, and Zika. The vector of *Anopheles* is responsible for malaria and Lymphatic filariasis and *Culex* is responsible for Japanese, Ecephalitis, Lymphatic filariasis, West Nile fever. Each year, more than one billion people are infected and more than one million die from a mosquito-borne disease. Vector-borne diseases (VBD) have arisen as a significant public health issue in South-East Asian countries, including India, in recent years. In order to reduce these burdens, WHO draws attention to a group of diseases transmitted by insects and other vectors, the heavy health and economic burdens they impose and what needs to be done. Every year, vector-borne diseases cause more than one million deaths. However, although alarming, death counts significantly neglect the human suffering and hardship caused by these diseases, as many individuals who survive infection remain severely disabled, disfigured, maimed or blind [1].

According to data from Directorate of National Vector Borne Diseases Control Programme, from 2016-2020 in India 23983 cases are reported for Malaria, 26 Deaths, 6792 cases of Dengue found and 33 deaths, and 7570 cases of Chikungunya found [2].

### Materials and Methods

The present study was carried out in urban cities of Maharashtra. Maharashtra is a large state which can be found in west-central India, in the northwestern part of the Indian Subcontinent. It has the area of about 120 thousand square miles and is the state where the large cities of Mumbai, Nashik and Pune are located. Maharashtra is an Indian state lying between 19° 39' 47.8080" N and 75° 18' 1.0548" E [8]. The review of mosquito-borne diseases was done for a period of five years from 2016 to 2020 of Maharashtra. Total of 75 houses was selected for study by systematic random sampling.

### Data collected using a semi-structured questionnaire

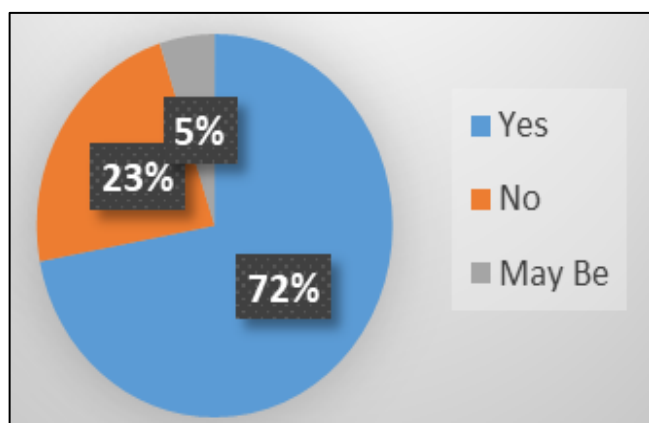
Data was collected using a semi-structured questionnaire during the transmission season of vector-borne diseases. The questionnaire included questions related to knowledge of people on mosquitoes borne diseases, the diseases spread by them, respondent's experience of mosquito-borne diseases and experiences of family members suffering from mosquito-borne diseases. Data is also collected about the hospitalization needed for mosquito-borne diseases.

**Table 1:** Socio-demographic distribution of study population

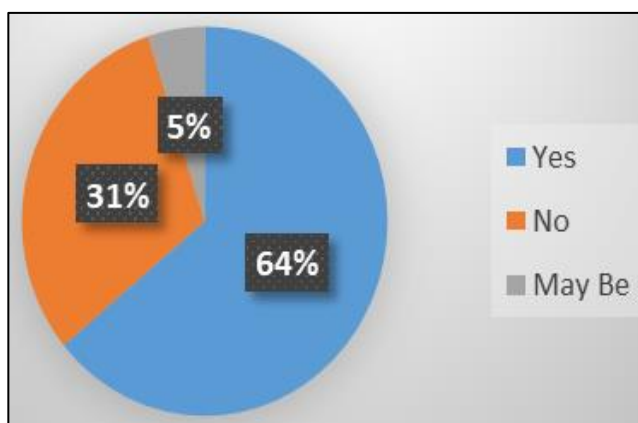
Social demographic Variables	variables	percentage
Age group	20-30	36%
	31-40	44%
	41-50	17%
	51-60	3%
Gender	Male	42%
	Female	58%
	Prefer not to say	0
Qualification	Doctorate	18%
	Post Graduate	38%
	Graduate	26%
	Undergraduate	19%

**Table 2:** Awareness and severity of mosquito borne diseases

Awareness of mosquito borne diseases	Yes	72%
	No	23%
	May Be	5%
Need of Hospitalization	Yes	64
	No	31%
	May be	5%



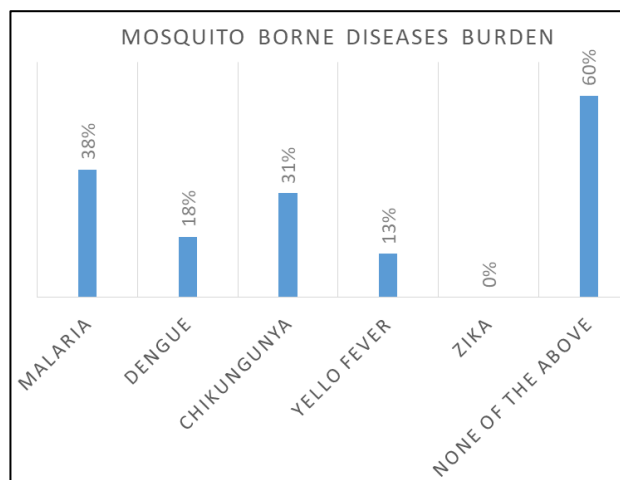
Awareness of mosquito borne diseases



Need of Hospitalization

**Table 3: Mosquito Borne Diseases Burden**

Diseases	Burden %
Malaria	38%
Dengue	18%
Chikungunya	31%
Yello Fever	13%
Zika	0%
None of the above	60%



**Fig 1: Mosquito Borne Diseases Burden**

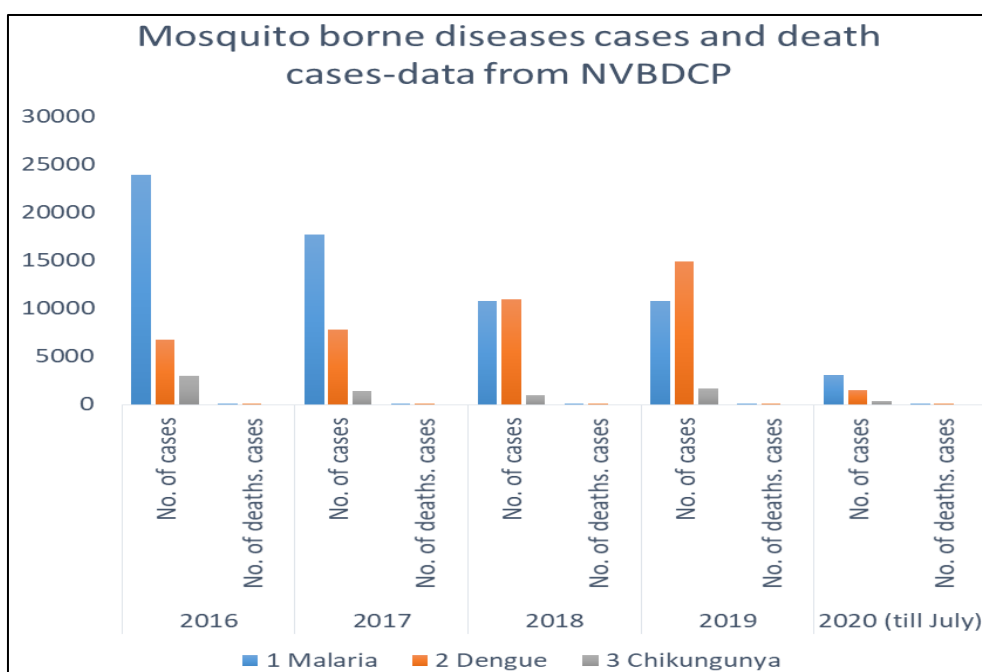
**Data from Directorate of National Vector Borne Diseases Control Programme(NVBDCP)**

We had collected data of the number of confirmed cases and death cases of mosquito-borne diseases from Directorate of

National Vector Borne Diseases Control Programme, 22 Sham Nath Marg, Delhi-110054. We have verified our survey data with this data collected from NVBDCP.

**Table 3: Mosquito Borne Diseases Burden from 2016-2020: Malaria, Dengue and Chikungunya**

Sl. No.	Diseases	2016		2017		2018		2019		2020 (till July)	
		No. of cases	No. of deaths. cases	No. of cases	No. of deaths. cases	No. of cases	No. of deaths. cases	No. of cases	No. of deaths. cases	No. of cases	No. of deaths. cases
1	Malaria	23983	26	17710	20	10757	13	10757	7	3090	3
2	Dengue	6792	33	7829	65	11011	55	14907	29	1499	2
3	Chikungunya	2949	0	1438	0	1009	0	1646	0	343	0



**Fig 2: Mosquito Borne Diseases Burden from 2016-2020 - NVBDCP**

### Survey Results

1. The participants of this sample were males (42%) and females (58 percent).
2. In the different age groups, the population was split. 36% of the population was found to be 20-30 years old, 44% were 31-40 years old, 17% were 41-50 years old, and 3% were 51-60 years old.
3. In this study subjects were divided in the different qualification group of doctorate (18%) postgraduate (38%), graduate (26%) and under graduate (19%).
4. The research acquired knowledge and mindset towards the disease borne by mosquitoes. We find that 71% of people are conscious about mosquito borne diseases, while 23% of the population know little about it, while 5% know nothing about mosquito borne diseases.
5. We reviewed a need for hospital treatment for mosquito-borne diseases to understand the seriousness of the diseases. It also came to know that 64% of respondents needed hospitalization for mosquito-borne diseases, 31% did not need hospital admission for the same diseases.
6. The study shows that 38% of respondents suffered from Malaria, 18% of respondents suffered from Dengue, 31% of respondents suffered from Chikungunya, and 4.1% of respondents suffered from Yellow fever. The present

study also indicate that 60% of the respondents did not have any mosquito-borne illness.

### Data from Directorate of National Vector Borne Diseases Control Programme

1. The data is also obtained from NVBDCP, and the burden of malaria is observed to be higher than all other mosquito-borne diseases.
2. It has also been found that there are cases of death in Malaria and Dengue, but in Chikungunya there are no cases of death.
3. It was also noted that more patients of Dengue than patients of Chikungunya.
4. From 2016 to 2020, the mortality rate for all mosquito-borne diseases has dropped.

### Comparison of survey data and data collected from NVBDCP

Data from Directorate of National Vector Borne Diseases Control Programme, collected and verified with survey data. It was found that the percentage of Malaria patients is more than all other mosquito-borne diseases. It was also found that Dengue patients were less than Chikungunya in survey but in NVBDCP data Chikungunya patients were less than Dengue.

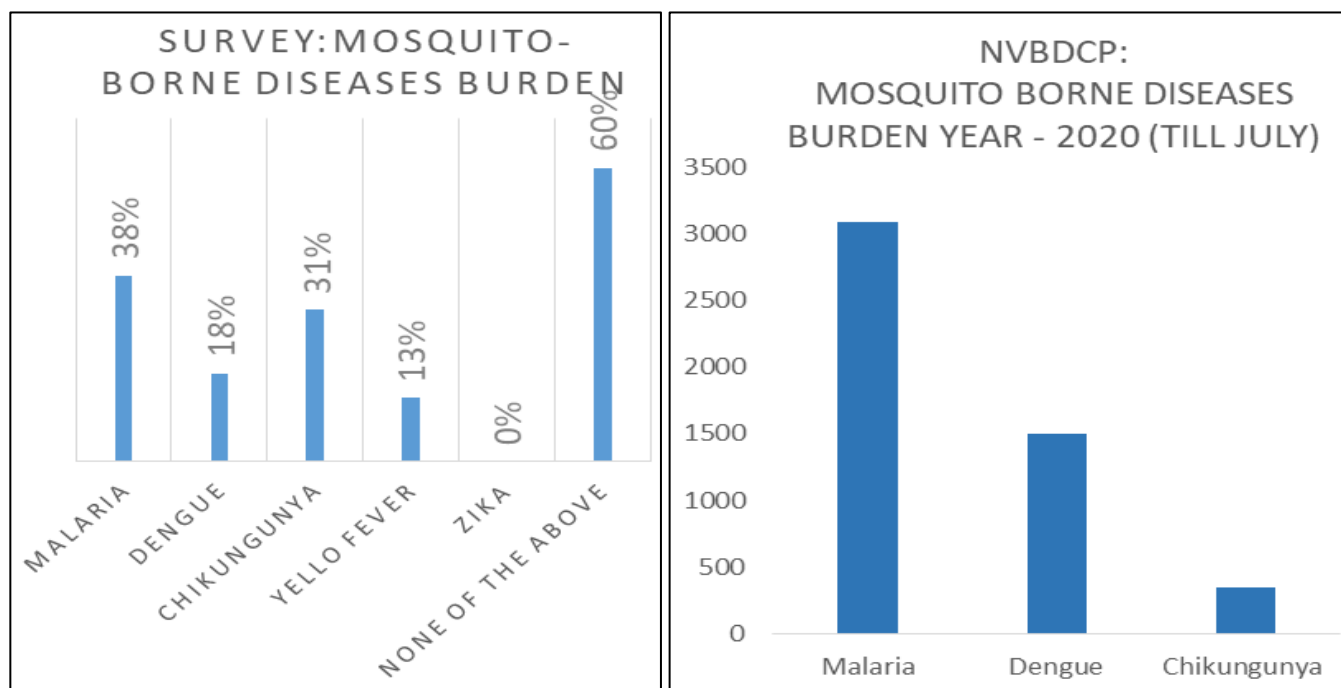


Fig 3: Comparison of mosquito borne disease burden

### Discussion

In the study, patients with malaria were found to be more susceptible than all other mosquito-borne diseases. It was also noticed that there are more Chikungunya cases than Dengue. Data from the National Vector Borne Diseases Control Program Directorate indicates that more than all other mosquito borne diseases are people suffering from malaria. It was also found that there were deaths in Malaria and Dengue, but in Chikungunya there were no reported deaths. It was also found that there were more Dengue patients than Chikungunya patients. According to the National Vector Transmitted Diseases Control Programme survey, the rate of death for all mosquito-borne diseases has declined from 2016

to 2020. Survey data is verified, with data from the Directorate of the National Vector Borne Diseases Control Programme

### Conclusion

The study gained insight and attitude towards the disease borne by mosquitoes. In order to understand the intensity of the diseases, we reviewed the need for hospitalisation for mosquito-borne diseases. It can be suggested that there is a need for enhanced initiatives to create public awareness and activate the community with regard to the preventive steps that can be taken. There are more malaria patients in Maharashtra than any mosquito-borne disease. Dengue

patients have also been shown to be lower in survey reports than Chikungunya. But there were fewer patients with Chikungunya than Dengue in the NVBDCP results. There were cases of death in Malaria and Dengue, but in Chikungunya there were no confirmed cases of death. As of 2016, the mortality rate for all mosquito-borne diseases has reduced.

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