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TRENDS OF VECTOR BORNE DISEASES IN DISTRICT PANCHKULA, HARYANA FROM 2011 TO 2021–A RETROSPECTIVE STUDY

Epidemology

Aprajita Singla Consultant Training (IDSP)
Neeraj Arora Additional Senior Medical Officer, Haryana.
Diksha Walia Senior Research Fellow, AIIMS, Bhopal

ABSTRACT

Background Vector-borne diseases are infections transmitted by the bite of infected arthropods, such as mosquitoes, ticks, triatomine bugs, and fleas. They account for more than 17% of all infectious diseases. Vector-borne illnesses worldwide include Malaria(Anopheles mosquitoes); Dengue, Chikungunya, Yellow Fever, Rift Valley fever and Zika (Aedes mosquitoes); Japanese encephalitis, Lymphatic Filariasis and West Nile fever (Culex mosquitoes). Many of these diseases are preventable by limiting exposures to the irrespective vectors. With the time due to climate and geo demographic changes the trends of various diseases are changing and this study was to identify the various changes in trends of vector borne diseases in relation to age, gender, demography and seasons. **Methodology** Study was conducted on Vector Borne Diseases data of District Health Lab of General Hospital, Panchkula from 2011 to 2021. It is a retrospective study. **Results** The study shows that in last eleven years a total of 1651 confirmed malaria cases were recorded in Panchkula with the highest number of cases n = 418 in the year 2011. The district showed high prevalence of P.vivax(98·24%) as compared to P.falciparum (1.76%). For dengue, a total of 1899 dengue cases were recorded in Panchkula during the year 2011-2021 and 2021 to be the highest contributor and cases of chikungunya were recorded mainly in two years 2011 and 2016 during the last eleven years. **Conclusion** The results show the declining trend of malaria prevalence in Panchkula which indicates the existence of significant malaria control and well developed prevention measures but a great challenge is to achieve success in ongoing malaria elimination programme. Dengue remains as a public health problem with increasing incidence rate every year.

KEYWORDS

Vector Borne Diseases, Malaria, Dengue, Chikungunya

1. INTRODUCTION

Vectors are blood-feeding insects and ticks capable of transmitting pathogens between hosts.[1] Vector-borne diseases are infections transmitted by the bite of infected arthropods, such as mosquitoes, ticks, triatomine bugs, and fleas.[2] They account for more than 17% of all infectious diseases causing more than 700,000 deaths annually and more than 3.9 billion people are at risk of infection.[3]

Vector-borne illnesses worldwide include malaria (*Anopheles* mosquitoes); dengue, chikungunya, yellow fever, Rift Valley fever and Zika (*Aedes* mosquitoes); Japanese encephalitis, lymphatic filariasis, and West Nile fever (*Culex* mosquitoes).These diseases are preventable by limiting exposures to their respective vectors.

Malaria and dengue are the most deadly and rapidly spreading diseases in the world, although malaria statistics have been seen in the last five years worldwide by 20% and mortality rates by 30%.[2]

The burden of these diseases is highest in tropical and sub tropical areas, and they disproportionately affect the poorest populations. Many of vector-borne diseases are preventable, through protective measures, and community mobilisation.[3]

Chikungunya is also a major public health problem in India. By 1973, the virus had almost disappeared from India and no case had been reported until the end of 2005[4]. The virus reappeared in 2005 after a 32-year gap and an outbreak was reported in 13 regions of India[5]. The number of reported cases has increased in recent years, especially between the periods of 2016-2017. Evidences show that Vector Borne Diseases have intensified their severity due to climate and environmental change, increasing population and globalization.

Around 95% of the Indian population lives in areas at risk of Malaria. Annually, more than 100 million blood slides are examined for malaria, with around one million cases of malaria reported in the country.[6] India has demonstrated significant achievements in malaria control with a progressive decline in total cases and deaths[7]

Dengue is mostly an urban public health problem; however, outbreaks are being increasingly documented in rural areas also. Based on global modeled data, an estimated 33 million clinically apparent dengue cases occur in India each year, contributing to a third of the total global dengue burden[8].In a community-based survey, the overall sero-prevalence of dengue infection in India was 48·7% (95% CI 43·5–54·0) found in this survey.[9]

In a country like India, which is an endemic area for chikungunya, dengue, and malaria, the seasonality of these infections overlaps. Chikungunya and Dengue have a common vector and shows similar clinical presentation.[10,11]

The National Vector Borne Disease Control Program (NVBDCP) is a program to prevent and control.. Malaria, Dengue, Chikungunya, Japanese Encephalitis (JE), Kala-azar and Lymphatic filariasis are the main diseases of this program. The epidemiology of these animal-borne diseases varies greatly due to ecology, vector bionomics, economic, social, and behavioral factors.[12]

Vector Borne Diseases prevalent in Haryana are Malaria, Dengue, Chikungunya and Japanese Encephalitis (JE). In Panchkula District, Malaria, Dengue and Chikungunya are covered under NVBDCP.

As there were no published studies from Haryana found during review of literature, the present study was therefore planned with the objective to evaluate the exact disease burden of malaria, dengue and chikungunya in Panchkula district of Haryana State, India. The purpose of this study was to find out the changes in the trends of various diseases with the time and due to climate and geo demographic changes. This study was to identify the various changes in trends of vector borne diseases in relation to age, gender, demography and seasons. It will assess the trends shown by vector borne diseases in last decade and any changes with time period.

2. MATERIALS AND METHODS

2.1 Study Area:

Our study area was Panchkula District, Haryana, India. (Fig. 1). In 2011 Census, Panchkula had a population of 561,293 of which male and female were 299,679 and 261,614 respectively. Panchkula district has total area of 898 Sq Km. It is smallest and least populous district of 22 districts of Haryana. [13] Panchkula has a sub-tropical continental monsoon climate having, hot summers, cool winters, good monsoon rainfall. It has great variation in temperature (0 °C to 43 °C). [14]

Fig.1 Map of Panchkula

2.2 Study Design And Methods

This is retrospective review study carried out to determine trend of 10-year (2011-2021) malaria, dengue and chikungunya lab confirmed cases of District Panchkula. Data of District Health Lab of General Hospital, Panchkula from 2011 to 2021 was utilized.Data was statistically analyzed with MS Excel and SPSS20.Permission from District Health Authorities was taken for usage of data.

3. Results And Interptetions

3.1 Annual Prevalence Of Cases Of Malaria, Dengue And Chikungunya

Lab of Civil Hospital of Panchkula confirmed 3683 cases of Vector Borne Diseases during 2011 to 2021. Malaria cases constituted 1651(44.8%) cases from total 3683 vector borne diseases cases. Highest number of Malaria cases were reported in 2011(n=418). Declining trend was observed in following years. Dengue consisted 51.6 % (1899 cases) . Outbreak of dengue in 2021 consisted 906 cases out of 1899 dengue cases. Chikungunya consisted only 3.6% cases i.e 133 cases. Highest cases of Chikungunya were reported in 2016 outbreak(n=79 cases)**(Table 1)**

Table 1. Lab Confirmed Cases of Vector Borne Diseases during 2011 to 2021in District Panchkula

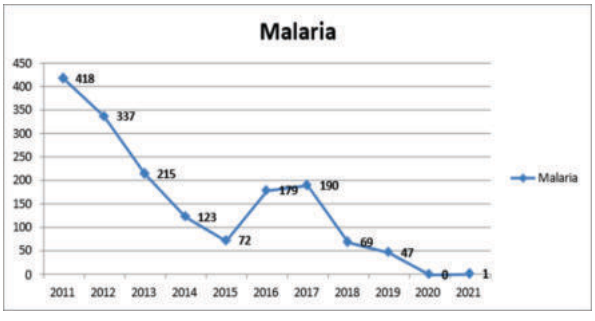
Disease	Year											
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Malaria	418	337	215	123	72	179	190	69	47	0	1	1651
Dengue	2	115	49	1	193	186	193	143	33	78	906	1899
Chikungunya	50				1	79					3	133
Total VBD Cases	470	452	264	124	266	444	383	212	80	78	910	3683

In 2011, 2012, 2013 and 2014, major proportion of cases of vector borne diseases were of malaria. But since 2015 major proportion of vector borne diseases constituted Dengue cases. This may be due to better diagnostic facilities of dengue and change in vector mosquito breeding topographic factors like increase in urbanization and climate change which favor breeding of Aedes Ageypti more than Anopheles mosquito. Entomological Surveillance and vector control strategies for malaria seems to be effective for Malaria elimination in the district with time.

Malaria

Graph 1(a) shows the year-wise trend of Malaria cases in District Panchkula from year 2011 to 2021. Trend shows decline in cases with time.

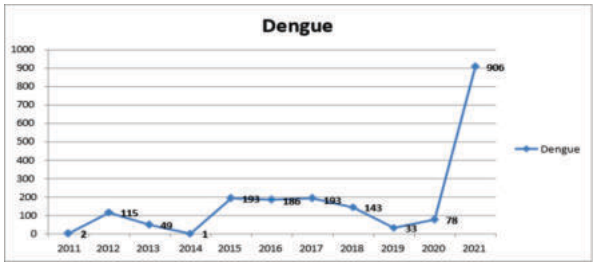
Cases declined from 418 to 72 from year 2011 to 2015, there was a surge of cases again in 2016 and 2017 then there was a rapid decline of cases. In 2020 no case was reported and in 2021 only one case was reported, low reporting in 2020 and 2021 may be a result of engagement of staff in COVID19 pandemic management.



Graph 1(a). Year Wise Trend of Malaria in District Panchkula from 2011 to 2021

With regard to Plasmodium species, most malaria cases 98·24% (1622) were P.vivax while 1.76%(29) were P.falciparum .

Dengue



Graph 1(b). Year Wise Trend of Dengue in District Panchkula from 2011 to 2021

1899 dengue cases were recorded in Panchkula during the years 2011-2021. The number of dengue cases significantly decreased in 2014, and then increased from 2015 to 2018. The number of dengue cases in 2021 was found to be highest in the last eleven years in Panchkula (Graph 1(b)). A total of 2 deaths were reported in last eleven years one in 2015 and one in 2021 with case fatality rate of 0.1%.

Chikungunya

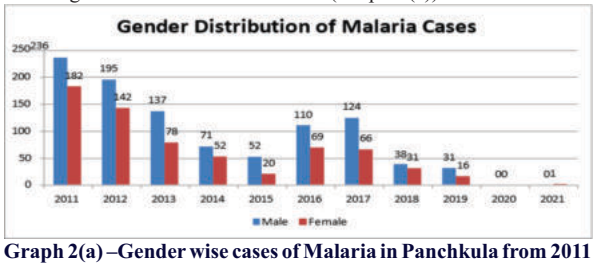
From 2011-2021, 133 cases of chikungunya has been recorded in Panchkula. The cases were observed in 2011, 2015, 2016 and 2021only,with maximum number in year 2016 (79) (Graph1(c)).

Graph 1(c).Year Wise Trend of Chikungunya in District Panchkula

3.2 Gender Wise Distribution Of Cases Of Malaria, Dengue And Chikungunya

Malaria

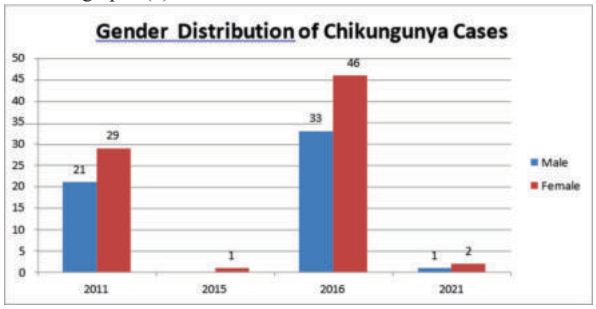
Prevalence of malaria was higher in males 994(60.21%) than females 657 (39.79%). Malaria prevalence among male individuals was 1·5 times higher than in female individuals (Graph-2(a))



Graph 2(a) –Gender wise cases of Malaria in Panchkula from 2011 to 2021

Chikungunya

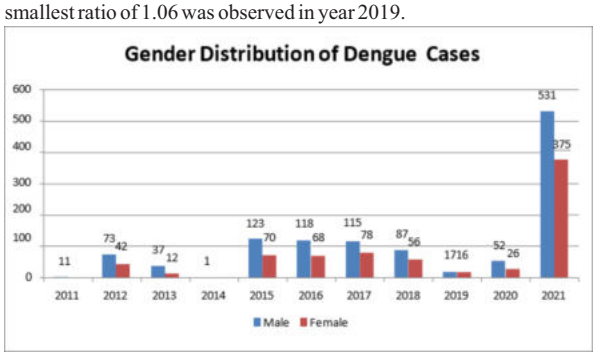
Prevalence of chikungunya infections was higher in females 78 (58.65%) than males 55 (41.35%). Chikungunya prevalence among female individuals was 1·42 times higher than in male individuals as shown in graph 2(b)



Graph 2(b) –Gender wise cases of Chikungunya in Panchkula from 2011 to 2021

Dengue

Out of 1899 dengue cases, 1155 were male and 744 were female. Numbers of male cases were higher than females overall. (Graph 2 c). The largest ratio of 3.08 was observed in year 2013 while as the smallest ratio of 1.06 was observed in year 2019.

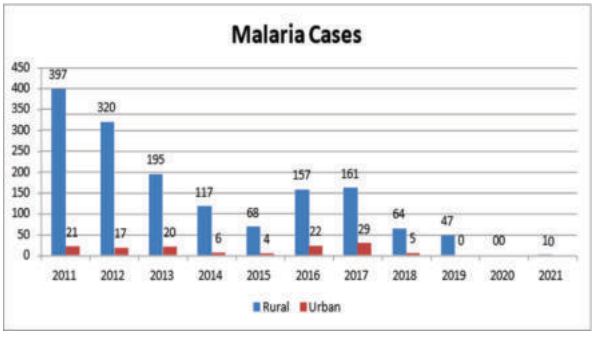


Graph 2 c –Gender wise cases of Dengue in Panchkula from 2011to 2021

3.3 Area Wise Distribution Of Cases Of Malaria, Dengue And Chikungunya

Malaria

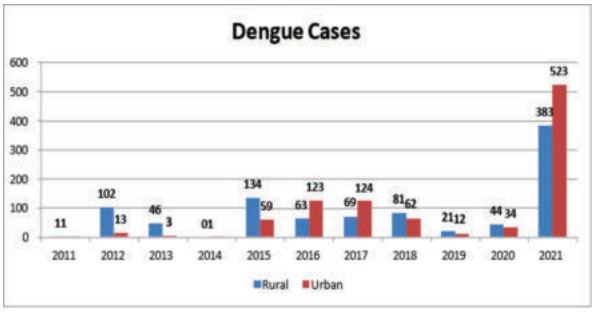
Out of 1651 total cases in the 11-year study period in Panchkula, 1622 cases were of P.vivax. With regard to block, the mean malaria cases were significantly high in Raipur Rani (82.7 ± 62.2) in 11year trend which indicates it to be endemic block for malaria whereas the lowest mean malaria cases were reported from Urban Panchkula (13.8±8.9) although total number of cases reported were more from block Kalka (781).With regard to areas, more cases of malaria were reported from rural areas (1527) as compared to urban areas (124) .(Graph-3.a)



Graph 3.a -Area wise cases of Malaria in Panchkula from 2011 to 2021

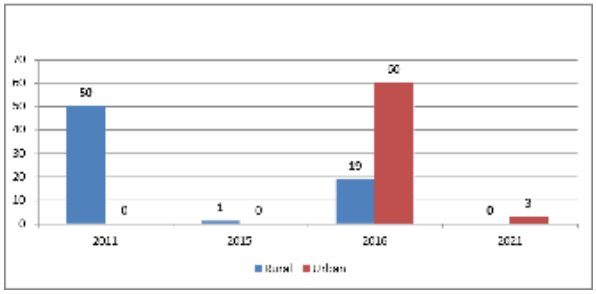
Dengue

The maximum number of dengue has been recorded in Urban Panchkula for the 2016, 2017, 2020 and 2021.With regard to blocks, Urban Panchkula hold the highest (86.82±92.64) dengue prevalence in last eleven years followed by Kalka (76.2±53.04) and Raipur Rani(19.72±18.2) reported the lowest dengue cases. Graph 3 b shows with respect to areas, more cases of dengue were found in urban areas as compared to rural areas.



Graph 3.b -Areawise cases of Dengue in Panchkula from 2011 to 2021Chikungunya

In year 2011, chikungunya cases were found in Kalka Block while in 2016 most of the cases were in Urban Panchkula. In 2011 more cases were in rural whereas in 2016, more cases were found in Urban Panchkula . (Graph 3.c)

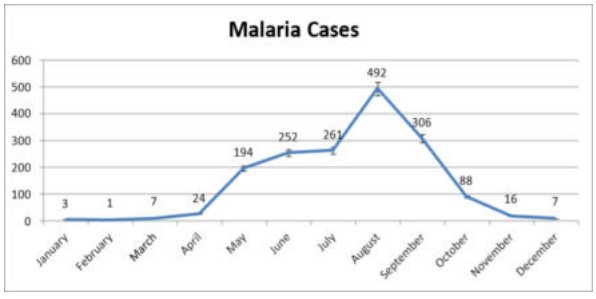


Graph 3.c –Area wise cases of Chikungunya in Panchkula from 2011 to 2021

3.4 Seasonal Trend Of Cases Of Malaria, Dengue, Chikungunya

Malaria

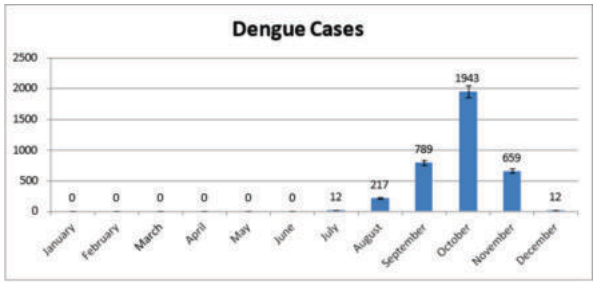
The prevalence of malaria cases have increased from May to August with Mean ± S.D. varying from 0.17±0. 16 to 82± 40.6(Graph 4(a)). This period is considered as the peak malaria transmission period in Panchkula after rain in June and July with highest cases in month of August.



Graph 4(a) –Seasonal prevalence of Malaria in Panchkula

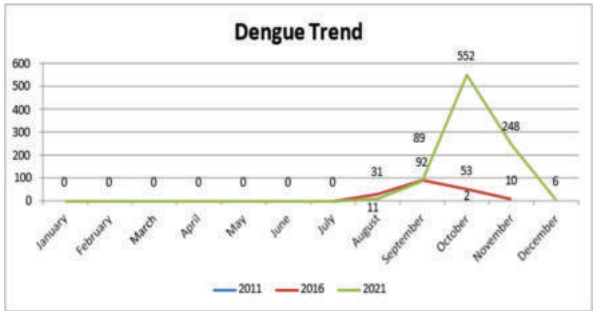
Dengue

No cases were reported during the first 6 months of a year (January to June) followed by a significant increase from July to October and starts decreasing during November(Graph 4(b)). Therefore, most dengue cases were reported between August and November, especially in September (789) and October (1943) showing significant difference with first six months of year.



Graph 4(b) –Seasonal prevalence of Dengue in Panchkula

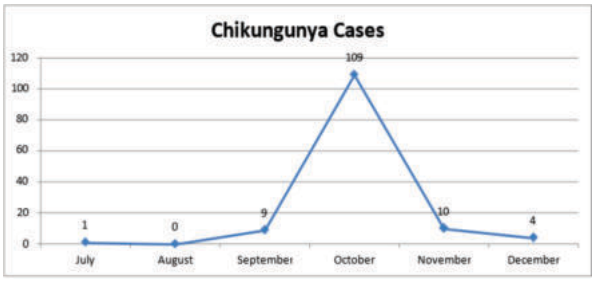
Graph 4c shows comparative seasonal trends of Dengue in Panchkula. Most of the cases were in September in 2016 but in 2021 most of the cases were reported in October.The trend deviation may be due to climate change and its impact onvectorbreeding.



Graph 4 c – Comparative Seasonal prevalence of Dengue in Panchkula in 2011, 2016 and 2021

Chikungunya

The prevalence of chikungunya increase from September to October showing highest number of cases in October. Cases show declining trend with fall in temperature during November and December (Graph4 d).



Graph 4 d –Seasonal prevalence of Chikungunya in Panchkula

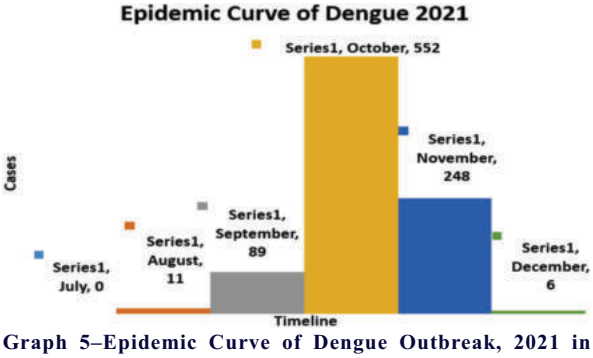
3.5 LARGE OUTBREAK OF DENGUE IN 2021

Graph 5 shows epidemic curve of Dengue Outbreak in Panchkula during 2021.Epidemic started in August and peak cases were reported in October and then epidemic curve declined with decline in temperature.

Table 2 Sociodemographic indicators of Dengue outbreak in 2021

Indicator	N	%
Male	531	58.6
Female	375	41.4
Rural	383	42.3
Urban	523	57.7
Age group		
Below 15	149	16.4
15-45	584	64.5
Above 45	173	19.1

In children of 0-5 age only 10 cases were reported. Old age group of age more than 60 years had only 68 cases.1death was also reported in this outbreak.



Graph 5–Epidemic Curve of Dengue Outbreak, 2021 in Panchkula

4. DISCUSSION

In Panchkula, Malaria, Dengue and Chikungunya are prevalent . Our study describes the distribution of these diseases throughout the district and their burden for the past eleven years. To our knowledge, this is first ever study from Haryana, India to explain the variation in the burden of the malaria, dengue and chikungunya. From the analysis of quantitative data, the present study showed that in last eleven years a total of 1651 confirmed malaria cases were recorded in Panchkula with the highest number of cases n = 418 in the year 2011. The district showed high prevalence of P.vivax(98·24%) as compared to P.falciparum(1.76%). For dengue, a total of 1899 dengue cases were recorded in Panchkula during the year 2011-2021 and 2021 to be the highest contributor and cases ofchikungunya were recorded mainly in two years 2011 and 2016 during the last eleven years.

In similar study in Punjab[15] , data of seven years of State of Punjab, three major mosquito borne diseases viz. Malaria, Dengue and Chikungunya was analysed. There paper described the distribution of vector borne diseases throughout the state and their burden for the seven years which was one of the pioneer study from Northern India to explain the variation in the burden of the malaria, dengue and chikungunya. From the analysis of quantitative data, their study showed that in last seven years a total of 7193 confirmed malaria cases were recorded in Punjab with the highest number ofcases n = 1760 in the year 2013. The state showed high prevalence of P. vivax(98·15%) as compared to P. falciparum (1.8%). For dengue, a total of 58,729 dengue cases were recorded in Punjab during the year 2012-2018 and 2017 to be the highest contributor and cases of chikungunya were recorded only two years 2017 and 2018 during the last seven years. There findings are similar to present study as Panchkula is neighboring district of Punjab and shows similar trends.

India has launched the malaria elimination drive and set the goal of malaria elimination by 2030 and the district Panchkula which is reporting <1annual parasite incidence (API) for the last five years has qualified for malaria elimination under category-1as per National Framework of Malaria Elimination 2016-30. Therefore, this trend analysis will be helpful for planning and execution of vector control strategies on priority in endemic district of Panchkula. Very few studies are published regarding epidemiology of malaria in Haryana, India.

Dengue is emerging as the most prevalent mosquito borne viral infection among tropical and subtropical countries and being top most contributor among the three major mosquito borne diseases in Panchkula. In a study[17] done on Dengue patients treated in a tertiary care hospital in the district Jalandhar of North India. Out of total 376 dengue cases, 206 (54.8%) were male and 170 (45.2%) female. 74.7% patients were urban and 25.3% rural. In the present eleven year trend analysis in district of Panchkula, males were more affected as compared to females and more cases were from urban areas.

The results clearly show the declining trend of malaria prevalence in Panchkula which indicates the existence of significant malaria control but a great challenge is to achieve success in malaria elimination programme. Therefore, concerned bodies have to act aggressively in order to control the prevalence of P. vivax.

Dengue remains as a public health problem with increasing incidence rate every year. The results suggest that urban areas of Panchkula need more attention and emphasis should be on education of the public. Therefore, in coordination with these findings it also necessitates further in-depth evaluation of all other factors which effect epidemiological trend of mosquito borne diseases like geographical, climatic and other demographic factors in the endemic districts of Panchkula which were not included in the present study. It will boost the active entomological surveillance in order to control these three major mosquito borne diseases.

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Conflict of Interest

No known conflict of Interest.

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