

# Seasonality of malaria in and around Aurangabad district, Marathwada region of Maharashtra, India

Pankaj R Gangwal<sup>1\*</sup>, N A Razvi<sup>2</sup>

<sup>1</sup>Lecturer cum Statistician, Department of Community Medicine, Indian Institute of Medical Science and Research Medical College, Badnapur, Jalna, Maharashtra, INDIA.

<sup>2</sup>Associate Professor (Statistics), Preventive and Social Medicine, Government Medical College, Aurangabad, Maharashtra, INDIA.

Email: [pankaj.gangwal@rediffmail.com](mailto:pankaj.gangwal@rediffmail.com)

## Abstract

**Background:** Malaria is a serious public health issue in developing countries. The present study was aimed to observe seasonal variation of malaria in our region. **Methods:** A retrospective record base study was carried out in Aurangabad District of Marathwada region of Maharashtra during the period of January 2010- December 2014. All positive cases were taken from the register maintained at the District Malaria Office. Data was analyzed in the form of percentage, t-test & ANOVA. **Results:** Incidence of malaria occurs throughout year. The highest number of cases were reported in July and the difference in monthly incidence of malaria was significant ( $p=0.0000$ ). The incidence of malaria was higher in Rainy season than Summer and Winter season ( $p=0.0000$ ). In the year 2010 and 2014 positive case of malaria were found respectively 296 and 92. From five year data analysis, the Present Study Concludes that as year progresses there is gradual decrease in number of positive patients. **Conclusion:** A seasonal pattern of Malaria was observed, which provide basis for future Malaria monitoring & control strategies in the study area.

**Keywords:** Malaria, Seasonality, Month wise, Aurangabad.

## \*Address for Correspondence:

Dr. Pankaj R. Gangwal, Lecturer cum Statistician, Department of Community Medicine, Indian Institute of Medical Science and Research Medical College, Badnapur, Jalna, Maharashtra, INDIA.

Email: [pankaj.gangwal@rediffmail.com](mailto:pankaj.gangwal@rediffmail.com)

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## INTRODUCTION

Malaria is one of the most important tropical diseases which remain one of the major public health with other diseases like, HIV/AIDS, tuberculosis. As per WHO, there were 214 million new cases of malaria and an estimated 438 000 malaria deaths worldwide in 2015. The South-East Asia Region accounted for most global cases of malaria (10%) and deaths occurred in the Asia Region (7%)<sup>1</sup>. In India about 91% of malaria cases and 99% of deaths due to malaria are reported from high disease burden states namely North-eastern (NE) States, Andhra

Pradesh, Chhattisgarh, Gujarat, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Rajasthan and West Bengal. In India up to November 2014, the malaria cases was around 1851372 and 316 deaths were noted, where as Maharashtra state malaria cases were 32071 and 35 deaths occurred<sup>2</sup>. Malaria is a mosquito-borne infectious disease of humans and other animals caused by parasitic protozoan's belonging to the Plasmodium type. The causative agents in humans are Plasmodium Falciparum, Plasmodium Vivax, Plasmodium Ovale and Plasmodium Malariae. From these four protozoa P. Falciparum and P. Vivax contributes most of cases of malaria in India. Malaria is a major public health problem in India though it is both a preventable and treatable disease. Different statistical time series model like ARIMA and SARIMA were used for forecasting Seasonality and malaria incidence cases using climatic factors as predictors in Delhi and Kolkata Municipal Corporation<sup>3,4</sup>. Artificial Neural Network and Support Vector Machine was play roll in Malaria prediction using a large dataset of Maharashtra state<sup>5</sup>. Incidence of malaria cases is influenced by Meteorological factors like climate, season and temperature plays key role. In many places

transmission is seasonal with the peak just after rainy season<sup>6,7</sup>. Malaria infections are often more common during rainy seasons because of increase in number of breeding sites. In India the problem is present not only in rural population but also in urban population. Malaria is a major contributor to human morbidity, mortality, and economic adversity and significant public health problem in India<sup>8</sup>. Therefore, the present study was designed with objectives to find out trend and seasonal variation of malarial cases in Aurangabad city.

**MATERIAL AND METHOD**

**Study area**

Aurangabad District is one of the 36 districts of Maharashtra state in western India. The Aurangabad district's North Longitude (Degree) is 19 and 20 and East Longitude (Degree) is 74 to 76. In the district rainy season starts from the month of June to September- and October to February-Winter Season and March to May Summer Season. The Average rain fall of Aurangabad District is 734 mm and the Minimum Temperature is 5.6 D.C. Maximum Temperature is 45.9 D.C. Aurangabad district is a major tourism region in

Marathwada. In Aurangabad district as per the Census 2001 total population is 3,701,282<sup>9</sup>. Aurangabad is the headquarters and principal city of Marathwada region.

**Data Collection**

The total number of monthly cases of malaria positive cases from January 2010- December 2014 was taken from the register maintained at the District Malaria Office located at Aurangabad city and it captures almost all the cases registered in Government Health Care Centres of a district. Since the data collected from official register ethical clearance was not sought.

**Statistical Analysis**

The data is entered into a SPSS 17 spread sheet and analysed to compare the means of the monthly reported cases. The descriptive statistics give information about the mean monthly reported cases of each year, the minimum and maximum number of reported cases each year. One sample t-test is used to test that the mean monthly cases of malaria of the years 2010-2014 are significantly different or not. The Kruskal-Wallis test also known as the H-test was used to investigate whether there was seasonality in the recorded figures from 2010-2014.

**RESULTS**

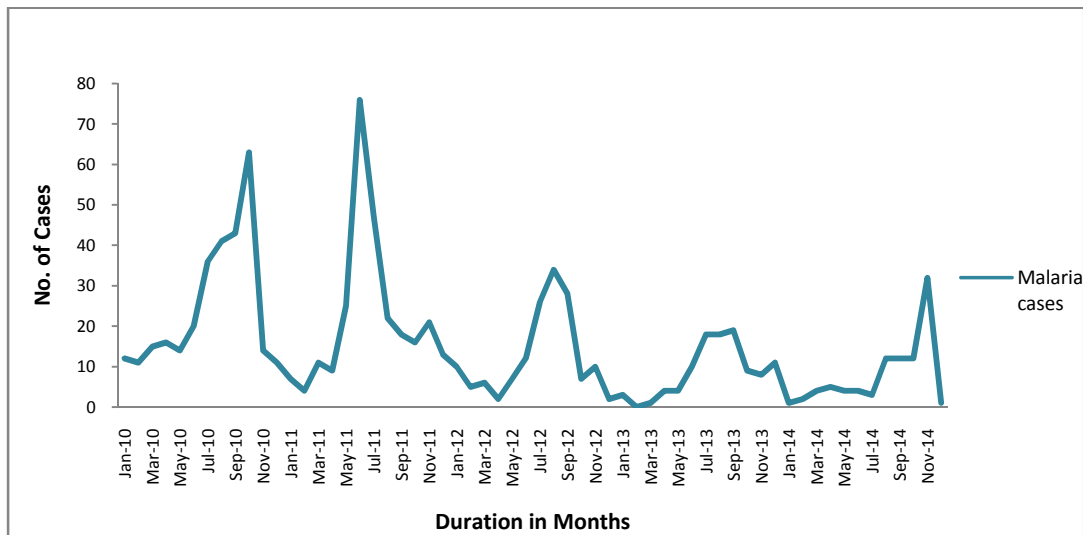


Figure 1: Graph Showing Month wise variation of Malaria cases

The descriptive statistics of reported cases is shown in Table 1. 296 and 92 positive cases of malaria were found during the year 2010 and 2014. The least number of maximum Monthly cases was recorded as 19 in 2013 and the highest number maximum Monthly cases was

recorded 2011 as 76. From compile data of five years we can say that there is gradual decrease in Annual cases of malaria. From fig.1 in 2011, the highest number was recorded in June as 76 and then, highest reported cases were 63 (in October 2010) and 34 (in August 2012).

**Table 1:** Descriptive Statistics of Reported Cases

Year	No. of Cases per Year	Minimum cases reported in Month During Year	Maximum cases reported in Month During Year
2010	296	11.00	63.00
2011	269	4.00	76.00
2012	149	2.00	34.00
2013	105	0.00	19.00
2014	92	1.00	32.00

**Table 2:** Reported cases are Differential by Month (Period)

Malaria Cases Reported by Month	t-Value	p-Value	Mean Difference	95% Confidence Interval of the Difference	
				Lower	Upper
	7.845 with 59 d.f.	<b>0.000</b>	15.18333	11.3105	19.0562

It is revealed from below Table 2 that the mean malaria cases are significantly different with a probability value of 0.000 which is less than 0.05. This implies that if 100 similar studies were carried out under the same conditions, all of them would show that there is a

significant difference in the malaria cases. This leads to the rejection of the null hypothesis and a conclusion is made that on average the malaria cases considered are significantly different.

**Table 3:** Reported cases are differential by Seasons

Seasons	No. of Months During Study Periods	Mean No. of Cases (Mean±SD)	F-Value	p-value
Summer (February-May)	20	7.45±6.24	9.015 with 59 df	0.0000
Rainy (June-September)	20	24.95±17.40		
Winter (October-January)	20	13.74±3.07		

From table 3, it is established that the maximum cases were recorded in June to September and followed by October to January. The null hypothesis is thus rejected and it is concluded that the series exhibited seasonality for the periods recorded. As observed in figure 1, most cases were recorded in June, July, August & September of which each accounted for 13.39%, 14.27%, 13.94% and 13.17% of the total cases respectively.

## DISCUSSION

India's geographic position and climatic condition had been, for long, favourable to the transmission of malaria. India is predominately characterised by unstable malaria transmission. In our study the maximum numbers of cases were found in the months of June to October with a peak in July. The high prevalence of malaria in this period could be due to collection of water in rainy season and mosquito breeding which continues till November. In most parts of India; the maximal prevalence is from July to October. Good rainfall, relative humidity of 60% and temperature between 20 and 30°C favour the spread of malaria similar results were observed in study carried out by B Prajapati, et.al<sup>6</sup> and Kevadiya SM et.al<sup>7</sup>. The minimum malaria incidence was observed during January, which was less than the mean annual incidence, our study correlates with study done by Ashirbad Pradhan et.al<sup>10</sup>. Our present study follows the decrease trend of

malaria as it occurs in all years of the study period. The same may be due to increase in awareness of malaria; increase in proper precautionary steps conducted by government against malaria or may be due to seasonal change similar result was observed by B Prajapati, et.al<sup>6</sup>. Malaria is strongly weather dependent i.e. it is depend on average amount of rainfall, humidity and mean temperature. Malaria transmission was found to occur between the months of June to September with a peak in month of July. Rainy season in Aurangabad starts in June and last till September. This shows that the incidence of malaria in Aurangabad has strong correlation with rainfall. Maximum cases were recorded in rainy season (54.77%). Transmission is seasonal with increased intensity related to rain. Varunkumar et. al. has also found similar results in Delhi<sup>3</sup> and B Prajapati, et.al<sup>6</sup>. which Conclude that malaria is seasonal disease. The correlation coefficient for the association between monthly rainfall and monthly incidence of malaria was found greater than the association between temperature and malaria incidence<sup>11</sup>. This indicates that rainfall seems to play a more important role in the transmission of the disease than temperature. Based on the results of the present study, the malaria cases show high peak of incidence in rainy season and the trend will continue to occur in the near future if appropriate actions are not taken on time.

## CONCLUSION

In the present study, there is gradual decrease in number of positive malarial cases annually from 2010 to 2014. There is high prevalence of Malaria in monsoon as compared to other seasons. Most of the cases were recorded during July and August; it indicates that malaria is a seasonal disease. Our study result will be helpful to government agencies for planning of preventive measures to control malaria.

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