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**ABSTRACT** Study is a record based retrospective study to determine the prevalence and seasonal variation of malaria with correlation to plasmodium species in 2014 & 2015. Patients presenting with clinical suspicion of malaria were tested for malaria by rapid malaria antigen detection test. The data was statistically analysed.

The prevalence of malaria was 820/14637(5.6%) in 2014 and 561/18112(3.1%) in 2015. Maximum number of cases, 538/820(65.6%) in 2014 and 332/561(59.2%) in 2015 were seen from August to November with a peak in September. Males were predominantly affected. .Plasmodium vivax(76.2% in 2014 &80.4% in 2015) was the predominant species, followed by Plasmodium falciparum(18.8% in 2014 & 10.2% in 2015). Mixed infection cases accounted for 41/820(5%) in and 53/561(9.4%) cases in 2014 & 2015 respectively.

A continual analysis of records of the demographics and prevalence of malaria will help in instituting prompt control measures as well plan future preventive control strategies.

### Introduction

The World Health Organization estimates 300–500 million malaria cases annually and the annual mortality attributed to malaria ranges from 700,000 to 2.7 million globally. Southeast Asia contributes 2.5 million cases to the global burden of malaria, of this India alone contributes 76% of the total cases (1,2,3).

The transmission of malaria through mosquitoes was discovered by Sir Ronald Ross in India more than a century back in 1897.Yet, despite so many advances in the therapeutics, malaria continues to be a major public health problem in India due to its high prevalence and drug resistance (1).

Environmental factors like excessive rainfall and flood increase malaria transmission as they increase breeding of mosquitoes which act as vector in its transmission. There are four species of human malaria parasites *Plasmodium vivax, falciparum,malariae*and *ovale.* In India 60 to 65 % of the infections are due to *P.vivax*and 35 to 40% due to *P. falciparum.* Only few cases of *P. malariae*have been reported from Orissa and Karnataka (3).

The WHO recommends that all cases of suspected malaria be confirmed using either light microscopy or Rapid Diagnostic Tests (RDTs) before administering treatment (4,5).

In developing countries, especially in remote areas where good microscopy facilities may not be available, RDTs become the backbone for diagnosis of malaria. RDTs also become very handy in situations like outbreaks, and at remote places where microscopy facilities may not available due to shortage of trained staff (6).

API (Annual Parasite Prevalence) was reported to be <2 in many parts of India as well as in Maharashtra. However

in Mumbai, it is 2-5, thus warranting tremendous control measures(2).A constant surveillance of the prevalence will help in taking preventive measures to control the spread of this disease.

Hence, the study was conducted to determine the trends in prevalence and seasonal variation of malaria in 2014 & 2015 in relation to plasmodium species. Demographics like age and sex in the case studies were also analysed.

### Materials and methods:

This is a record based, retrospective study of two years; 2014 & 2015, conducted at the Department of Microbiology, of a tertiary care hospital in Mumbai. All patients presenting with fever and with clinical suspicion of malaria were tested for malaria by rapid malaria antigen detection testbased on the principle of lateral flow immunochromatography (Accucare, procured from Labcare diagnostics Private Limited, Mumbai). Addresses of patients who tested positive for malaria were noted and sent to public health department for preventive antimalarial control measures via disease control centre of the Preventive and Social Medicine department. SPSS 20 was used to analyse the data.

### Results:

The total numbers of blood samples tested for malaria by malaria antigen detection test were 14,637 in 2014 and 18,112 in 2015. Of these 820 (5.6%) were positive in 2014 and 561 (3.1%) positive in 2015 (Graph 1).

Men were affected more than women in both the years, 651/820(79.4%) and 469/561(83.6%) in 2014 & 2015 respectively. Thus, male to female ratio was3.9:1 in 2014 and 5.1:1 in 2015.Cases in age group 20-30 years were the most affected in both years (Table 2).

Majority of the cases were seen in the period from August

to November, contributing to 538 out of 820 (65.6%) & 332 out of 561 (59.2%) of the annual burden in the years 2014 & 2015respectively. The peak prevalenceof malaria was seen in the month of September, 167 out of 820 (19.14%) in 2014 and 112 out of 561 (18.18%) in 2015 (Graph 2).

The most predominant *Plasmodium* species was *P. Vivax* in both the years, 625/820 (76.2%) in 2014&451/561 (80.3%) in 2015.*P. falciparum contributed* 154/820 (18.78%) in 2014 and 57/561 (10.1%) in 2015.There were also a few cases that had mixed infection with both *P.falciparum* and *P.Vivax*. Mixed infections accounted for 41/820 (5%) and 53/561 (9.4%) cases in the years 2014 & 2015 respectively (Graph 3).

### Discussion:

Malaria is a major public health problem in India. Hence, a constant monitoring of the prevalence is necessary to prevent spread of infection. The prevalence of malaria in this study was 5.6% in the year 2014 and decreased to 3.1% in the year 2015. The department of microbiology would send the number of total and positive tests with address of cases who tested positive serologically to Public health department via the disease surveillance unit (DSU) at the department of Preventive and Social Medicine. The data was sent daily in the monsoon period and weekly during the rest of the year. Probably continual attention to malaria control and preventive activities by different civic bodies and increasing awareness of people to malaria could be the reasons for the subsequent decrease of prevalence in 2015. Studies by Kerlekaret al (7) and Hadiyaet al (8) from Gujarathad showed prevalence 4.28% and 2.1% respectively which is closer to present study. A study from Éthopia (9) had got prevalence 17.1 which was quite high. The variation of reports of prevalence of malaria may not only be due to differences in the geographical and climatic conditions which affect mosquito breeding but also socioeconomic conditions of patients and awareness of people about health care.

In present study, men were affected more than the women. 79.4% and 83.6% of men were affected in the years 2014 &2015 respectively. Studies by Kembhavi *et al* (10) and Gurjeet *et al* (11) showed 85% and 64% of men affected. However the study by Mohammad Idris *et al* (12) and Balkrishana *et al* (13) had reported that 56% and 58.75% males affected. The higher prevalencerate in males may be due to the fact that compared to females;males are more often engaged in outdoor activitieswhich make themmore prone to infective mosquito bites.

Maximum number of cases of malaria occurred in the age group 21-30 years (31.52%) followed by the age group 30-40 years (25.95%). Findings of present study correlate with S.R. Gurjeet *et al* (11) from Mumbai who also reported similar finding. The study by Balkrishana (13) *et al* and Kembhavi *et al* (10) reported maximum prevalence in age group 20-40 years and 18-38 respectively. Possible explanation for higher prevalence in this age groupcould bethe increased mobility to earn their livelihood observed in people of this age group which makes themmore susceptible to acquire infection due to increased exposure to infective mosquito bite.

In this study, predominantspecies causing malaria was *Plasmodium vivax* (76.2% in 2014 & 80.4% in 2015) in both the years followed by Plasmodium *falciparum* (18.8% in 2014 & 10.2%% in 2015). Infection with mixed species i.e. with

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both Plasmodium vivaxand Plasmodium falciparum was observed to be 5% in 2014 & 9.4% in 2015. The cases with mixed infection were seen throughout the year. Many other studies from India have also reported higher prevalence of infection with Plasmodium vivax species. Studies from India by Hadiva et al (8) and Gurieet et al (11) reported prevalence of Plasmodium vivax as 61.41% & 54.8%, Plasmodium falciparum 38.56% & 17.8% and mixed infection as 0% & 27.4% respectively. Mdldriset al (12)from Pakistan reported prevalence of 72.47% for Plasmodium vivax, 24.1% Plasmodium falciparum and 3.44% mixed infection with Plasmodium vivax and Plasmodium falciparum both the species, which is similar to present study. The higher prevalence of Plasmodium vivax compared to Plasmodium falciparummay be because relapses are seen in P.vivax but not in *P* falciparum. Besides, drug resistance also may be a contributory factor as uncomplicated cases of P. vivax are treated with chloroquin. As per note from Centers for disease control and prevention (CDC); Chloroquine-resistant P. vivax malaria was first identified in 1989 among Australians living in or traveling to Papua New Guinea. P. vivax resistance to chloroquine has also now been identified in Southeast Asia, on the Indian subcontinent, and in South America.

Higher prevalence of malaria was seen between August to November, 538 out of 820 (65.6%) & 332 out of 561 (59.2%)of the annual burden in the 2014 & 2015 respectively. Study byGurjeetet al (11) showed maximum prevalence from July to November with peak in October. Study from Ethopia (9) showed maximum prevalence from September to November. Primarily, stagnation of water during the monsoon period leads to increase in breeding activities of mosquitoes and hence an increased burden of mosquitoes and corresponding cases of malaria. Taking into consideration the increased burden of mosquitoes during monsoons, increased public awareness on simple preventive measures like protective clothing, antimalarial repellents and mosquito nets will prevent transmission of malaria.Considering the heavy burden of malaria observed in Mumbai, continual preventive measures are required.

Coordination between the different departments in a tertiary care hospital will also control magnitude of infection as seen in the present institution where the departments of Microbiology, Preventive and Social Medicine and Public health department collaborated to control and prevent the transmission of malaria.

### Conclusion:

Present study shows that there is an annual seasonal variation in the prevalence of malaria infection. An increased prevalence of malaria was observed in monsoon and late monsoon seasons. The infection wasseen more in the active age group of 20 to 30 years. Men were predominantly affected. There was decrease in the prevalence of malaria in 2015 as compared to 2014, possibly as a result of continual control measures by the public health department. Thus, a continual analysis of records of the demographics and prevalence of malaria can help not onlytoinstitute prompt control measures but alsoto formulate future planning strategies as per the data available of previous months and years. Awareness of the epidemiology and the distribution as per the gender, age group, habitat and plasmodia species can help in targeted control measures and prevention of transmission of malaria.

Graph 1: Prevalence of Malaria in Mumbai in 2014 and 2015.



# Table 2: Age wise distribution in malaria positive cases (2014 & 2015).

	2014		2015	
	Total Posi- tive	Percent- age	Total Posi- tive	Percent- age
1 to 10	95	11.55%	59	10.50%
11 to 20	110	13.40%	65	11.60%
21 to 30	255	31.10%	188	33.50%
31 to 40	156	18.50%	121	21.50%
41 to 50	100	12.05%	59	1050%
51 to 60	62	07.05%	38	06.80%
61 to 70	33	05.25%	31	05.60%
71 to 80	09	01.10%	00	00%
81 to 90	00	00%	00	00%
91 to 100	00	00%	00	00%
Total	820	100%	561	100%

### Graph 2: Monthly distribution of malaria positive cases.



## Graph 3: Distribution of Plasmodium species in malaria positive cases.



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