

# Trends and Patterns of Malaria in India

## Abstract

In India Vector-borne diseases pose a serious challenge. Diseases like Malaria, has been a major public health problem in India. It has shows the pan Indian nature in terms of their spread and incidence. This paper is based on the data, available from the National Vector Borne Diseases Control Programme (NVBDCP). The major objective of the paper is to locate the spatio-temporal distribution of malaria and discuss the trends and patterns of their spread. Data is tabulated and represented through required figures and diagrams. Cartographic technique is used to map the incidence of diseases. The cases per 10000 populations are mentioned as prevalence. These diseases are spread due to many reasons like over urbanization, population movement, water disposal problems, lack of awareness among people and community etc. These problems can be addressed with proper drainage system, storm water disposal, awareness programmes and clinical management etc.

**Keywords:** Vector Borne Diseases, Incidence, Awareness, Prevalence, Urbanization.

## Introduction

The world including India celebrates World Health Day, on 7 April, every year. The main aim is to raise awareness on different health topics and motivate governments and communities to take action to improve the health of populations. Like this, World Malaria Day is observed every year on 25 April and recognizes global efforts to control malaria. The theme for World Malaria Day 2019 is 'Zero Malaria Starts with Me'. It gives people the chance to promote or learn about the efforts made to prevent and reduce Malaria around the world. Malaria has been a major public health issue in India. It is a potentially life threatening parasitic disease caused by parasites. It is transmitted by the infective bite of Anopheles mosquito. Plasmodium vivax, P. falciparum, are two types of parasites of human malaria, which are commonly reported from India. P. falciparum is the most deadly form of malaria. Good healthcare is important to prevent and treat diseases such as Malaria. Therefore the study of trends and patterns of malaria is required and in this paper same has been emphasized.

## Objectives of the Study

The objectives of the study are to,

1. Locate the incidence and distribution of malaria in India and
2. Analyze the spatio-temporal analysis of malaria across the country.

## Review of Literature

Disease or illness is as old as human civilization (Choudhary, 2006). With the study of the 'agent-host-environment' triad, disease is understood as a consequence of the interaction between the pathogens, the host, and the environment. In medical geography, health and disease are viewed from the ecological and the social standpoints i.e; disease ecology, human ecology and cultural ecology in a spatio-temporal perspective (Learmonth, 1988). While human ecology is concerned with "the patterns of human interaction with the physical environment", cultural ecology relates more specifically to "behaviour and belief system within a particular culture" (Meade and Earickson, 2006).

Impact of urban development can be seen in both developed and the developing world, though the rapid and unplanned urban growth has been particularly accompanied by massive urban poverty leading to widespread health implication in the underdeveloped and developing countries (Akhtar, 2002). Malaria is a complex disease and various factors influenced by human activities and natural calamity like excessive rainfall, flood, drought and other disasters have great bearing on mosquitogenic conditions leading to increased potential for malaria transmission (Lal et al., 2000). Rapid urbanization, environmental deterioration and their impact on health, have attracted attention of a large

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number of medical geographers. Akhtar, Dutt and Wadha focus on the health planning and the resurgence of malaria in urban India (Akhtar and Izhar, 2010).

Every year the news items relating to mosquito-borne diseases find a place in the newspaper and it becomes breaking news or headlines in every part of India. This is indicative of the fact that our country is not only endemic to these diseases, but also they often assume epidemic proportion here. Health and disease which are both a dynamic concept is found to have significant variation among population over space and time (Bagchi, 2010).

Though India is one of the known endemic countries, incidence of malaria is commonly influenced by environmental factors like climate, season, temperature and socioeconomic status. Also, and nowadays it is a problem of both rural and urban areas (Panchal et al. 2016). A diversity of factors influences the prevalence and incidence of malaria within the malaria-endemic regions of India depending on the presence of vectors, parasite species, drug resistance, socio-economic factors, geographical areas and the types of interventions used (Krishna et al. 2017).

Understanding the multifaceted determinants of tribal malaria is important as many factors play a role in malaria transmission directly or indirectly. The tribal villages are intersected by numerous hill streams and their tributaries which support mosquito breeding throughout the year. The rainfall, water logging and rise in the pooling are major problems of the tribal areas (Sharma et al; 2015). Malaria, a mosquito-borne infectious disease that inflicts devastating health and economic costs on society (Hanandita and Tampubolon, 2016). The substantial growth in the reach and rates of human travel, in particular the air traffic network, in recent decades, has had a major effect on global disease epidemiology, including malaria (Tatem, 2017).

The purpose of WHD 2014 which was celebrated with a theme to control VBDs, had been to make various stakeholders aware about the threat of VBDs and make good effort for sustainable control, and eradication (WHO, 2014). VBDs are among the most complex of all infectious diseases to predict, prevent or control. In India VBDs pose a serious challenge as the geographic distribution of these diseases has potential to affect more than 90 percent of the population, (WHO, 2014).

According to WHO World Malaria Report 2018, India has turned out as the only country among the 11 highest-burden countries to mark progress in reducing its disease burden. The country registered a 24 per cent decrease in 2017 compared to 2016 (WHO, 2018). According to the World Malaria Report 2018 (WHO), India reported almost 3 million fewer malaria cases in 2017, a 24% decrease over the previous year, while cases increased worldwide to 219 million from 217 million, after registering a steady decline since 2010. Around 70% of the world's malaria cases are found in India and 10 countries in sub-Saharan Africa. "There were 3.5 million more

malaria cases reported in these 10 African countries in 2017 compared to the previous year, while India showed progress in reducing its disease burden.

Malaria, one of the oldest and deadliest diseases, has had a long and chequered history. In November 2015, the Prime Minister of India joined 17 Asia Pacific leaders in endorsing a plan and roadmap to eliminate malaria throughout the region by 2030. India further pledged to achieve this goal by 2027, three years ahead of the regional and global target. This, however, may appear a rather daunting task given the complex and dynamic nature of the health problem and the state of public health preparedness in the country (Narain and Nath 2018).

#### **Data and Method**

The present study is based on the secondary data available mainly from the National Vector Borne Disease Control Programme, Government of India. Here the data is tabulated and represented through figures and diagrams. Cartographic techniques were used to map the incidence of disease. The incidence maps for four major outbreak years of Malaria during 2010 to 2017 were prepared and further classified into different categories by using mean and standard deviation. The reported cases per 10000 populations are calculated and mentioned as prevalence.

#### **Malaria in India**

India is mainly endemic to the six mosquito-borne diseases, viz. Malaria, Japanese Encephalitis and Lymphatic Filariasis, Dengue and Chikungunya. In this study the emphasis has been given to the trends and patterns of Malaria in India. In India, The Directorate of National Vector Borne Diseases Control Programme is the central agency for the prevention and control of VBDs. The World Health Organisation's 2017 World Malaria Report revealed that India is one of 15 countries in the world to have the highest cases and deaths of malaria (WHO).

According to NVBDCP, malaria is a public health problem in several parts of the country. About 95% population in the country resides in malaria endemic areas and 80% of malaria reported in the country is confined to areas consisting 20% of population residing in tribal, hilly, difficult and inaccessible areas.

A rapid fall in morbidity and mortality was achieved and by 1965, eradication seemed to be almost within grasp, for there were estimated to be only 1,00,000 active cases and no deaths in that year. However, the resurgence began in 1966 and number of cases rose, fairly, rapidly and steadily, to over five million recorded in 1975 and 1976. The resurgence is due to faltering of campaign. From 1965 onwards, there was a period of interruption of severe delays in the flow of imports of the vital residual insecticides, DDT, dieldrin and later compounds (Reddy, 2001).

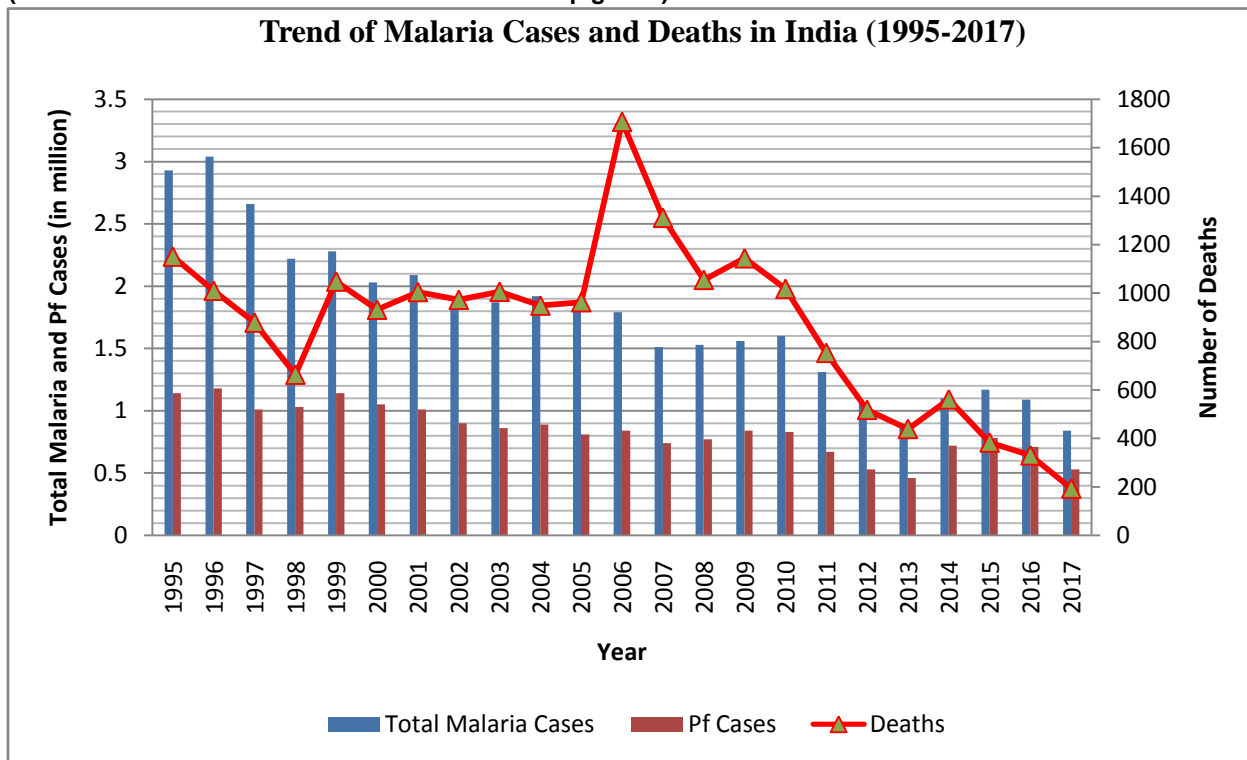
#### **Findings and Discussion**

Malaria is a public health problem in several parts of the country. About 95% population in the country resides in malaria endemic areas and 80% of malaria reported in the country is confined to areas consisting 20% of population residing in tribal, hilly, difficult and inaccessible areas (nvbdcp). Cases have consistently declined from 3.04 million to 2.08 million

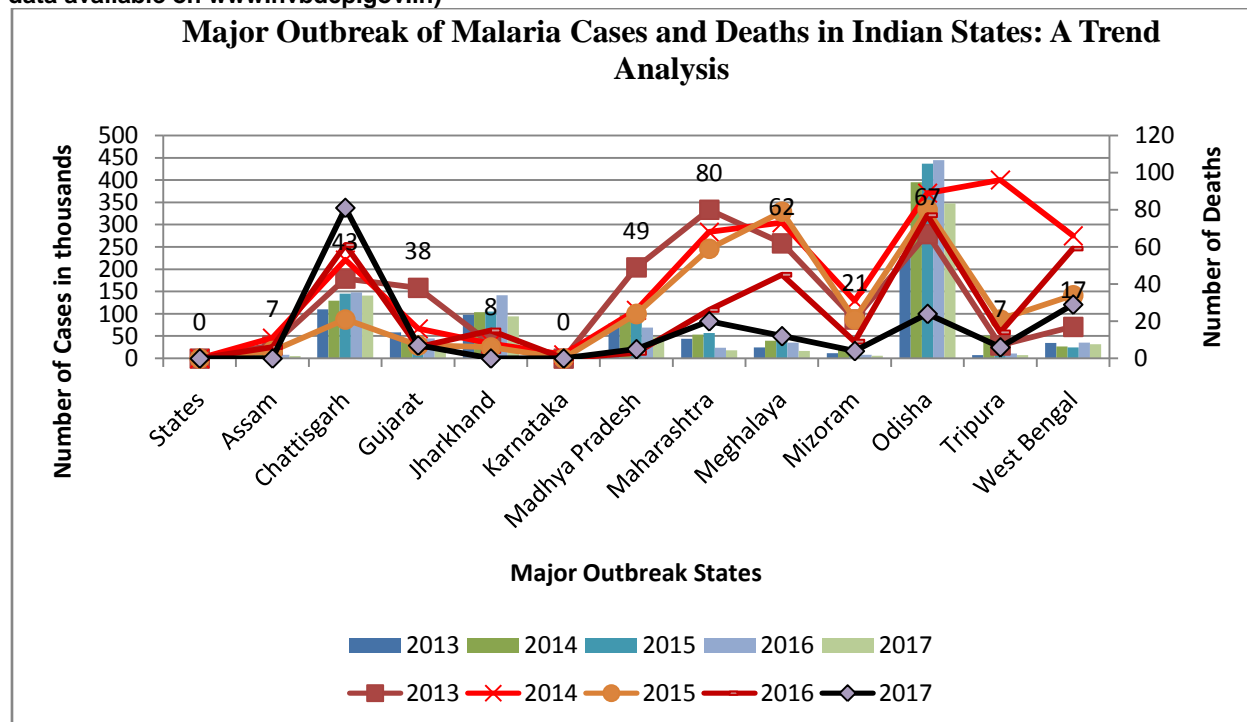
and from 2.08 million to 1.08 million during 1996 to 2001 and 2001 to 2016. Similarly Pf cases have declined from 1.18 million to 1.0 and from 1.0 to 0.71 million cases during the same period. The number of reported deaths has been levelling around 1000 per

year were reported during all the years, with a peak in 2006 when an epidemic was reported in NE States affecting Assam caused by population movements (figure 1).

**Figure 1: Total Malaria Cases and PF Cases in India (left axis) and deaths (right axis) in India, 1996-2017 (based on NVBDCP data available on www.nvbdc.gov.in)**



**Figure 2: Trend of Malaria Cases and Deaths in Major Outbreak Indian States 2013-2017 (based on NVBDCP data available on www.nvbdc.gov.in)**



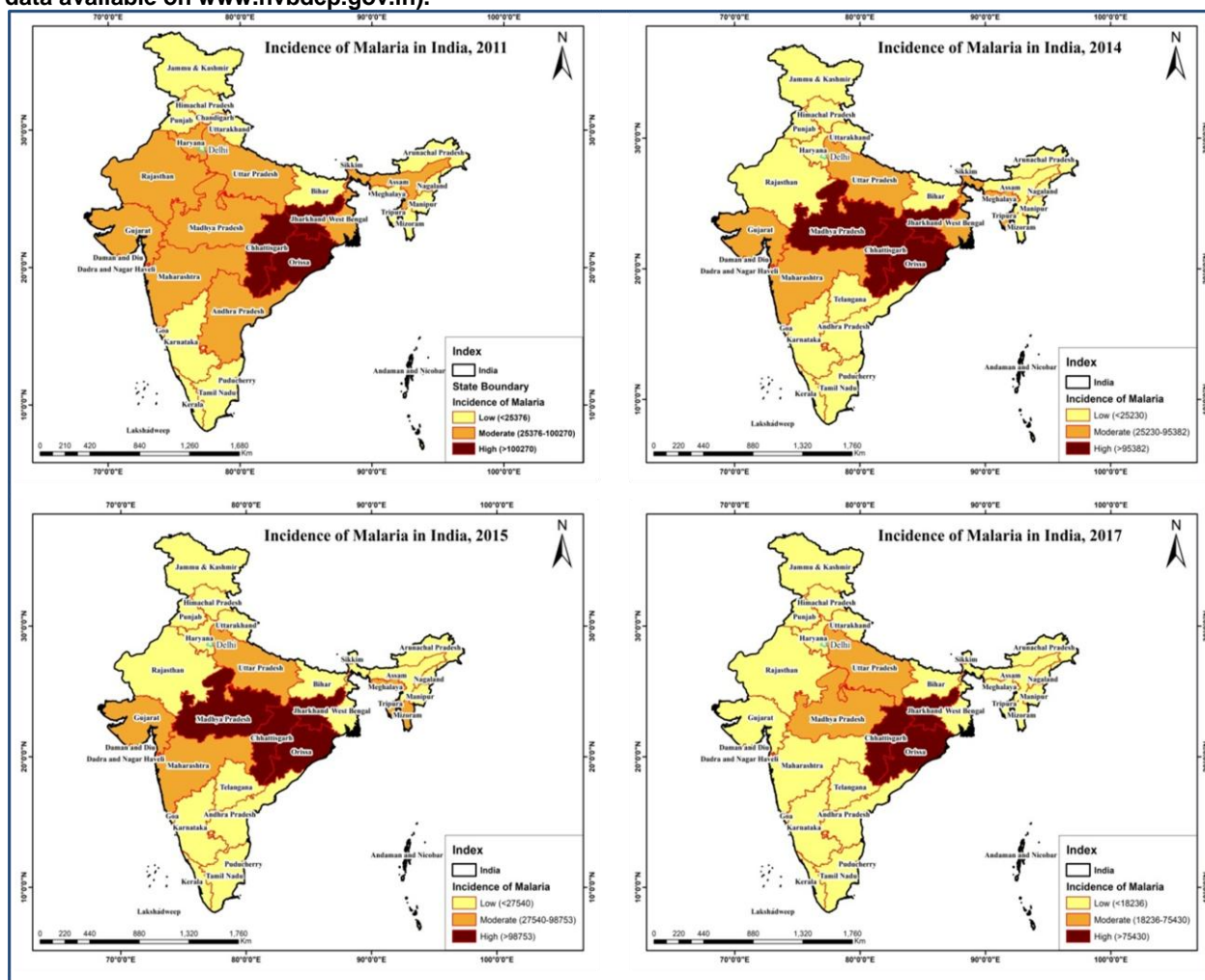
From the above discussion, it is clear that the malaria is occurring frequently in Indian states. The percentages of cases were high mainly in Odisha, Chhattisgarh, Jharkhand, Madhya Pradesh, Maharashtra West Bengal, Karnataka, and Andhra Pradesh. Some of the north eastern sates mainly Tripura, Mizoram, Meghalaya contribute to the large number of malaria cases and deaths. These states contribute more than 80 percent of the cases and more than 90 percent of the deaths caused by malaria every year (Figure 2). When we take the prevalence rate it show the distribution of disease cases per 10000 populations. The average prevalence of **Figure 3 a, b, c, d : Incidence of Malaria Cases in India in the year 2011, 2014, 2015, 2017 (based on NVBNDPC data available on www.nvbndcp.gov.in).**

malaria in the major outbreak years are mentioned in Table1.

**Table 1: The Average Prevalence of Malaria in India (Major Outbreak Years).**

Year	Prevalance (per 10000 popn.)
2011	23.10
2014	22.48
2015	23.37
2017	10.29

It has been observed that the prevalence of Malaria cases were high in the year 2011, 2015 and 2015 however there was decline in the year 2017.



The maps in figure 3 show the incidence of malaria or the distribution of cases over spaces and time. This also shows the geographical distribution of Malaria. It is evident from these maps that though the Malaria cases are found to be concentrated in some states every year but there is also variation in distribution. The figure makes it clear that every year Odisha, Jharkhand, Madhya Pradesh were having many cases of malaria and are under high incidence category compared to other states, most of them are under moderately incidence category.

Although Orissa has a population of 36.7 million (3.5%), it contributed 25% of a total of 1.5–2

million reported annual malaria cases, 39.5% of *P. falciparum* malaria, and 30% of deaths caused by malaria in India (NVBDCP, India). Similarly, in the other states inhabited by ethnic tribes mainly in the forest ecosystems, meso to hyper endemic conditions of malaria exist with the preponderance of *P. falciparum* to the extent of 90% or even more (Kumar et al., 2007) .

**Major Causative Factors**

Incidence of malaria has been attributed to increased haphazard and unplanned growth of towns resulted in creation of 'urban slums' with poor civic amenities,agro base belt, restricted water supply or

water scarcity, migration, fall in the health infrastructure, changing climatic condition, rapid increase in human population, lack of awareness and increased breeding of vector mosquitoes. The control activities are restricted to chemical control. The focus was not on the integrated source reduction measure to control breeding. The hot and humid climate in conjunction with heavy rainfall during summers favours the growth of shrubs and vegetation. These factors are conducive for the breeding and proliferation of mosquitoes, which is the vector of this disease. The situation in this respect is no less significant in the case of India.

#### Major Suggestions

On the basis of above discussion major suggestions for prevention of vector borne diseases are Reduction/elimination of vector breeding sites near domestic and peri domestic areas, regular emptying and drying of containers used for water storage, use of larvicides, assessment of community's perception regarding the disease transmission and breeding sites, providing better water facilities, drainage system, public awareness about control of Malaria to people in all areas. The PPP model can be used with various stakeholders like educational institute etc. Financial support is necessary to promote measures to curb VBDs along with skilled staffs and better sanitary support system.

#### Conclusion

Every year Malaria is occurring in various parts of India. Though there is spatio-temporal variation in the distribution but some states like Odisha, Chattisgarh, Jharknad, Madhya Pradesh, Maharashtra, West Bengal, Karnataka, showed the maximum concentration of cases every year. Especially Chattisgarh, Jharkhand and Madhya Pradesh had maximum Malaria cases while other states showed fluctuating cases. Many documents released by WHO on VBDs also provides various recommendations and focuses on the engagement of various stake holders. Timely diagnosis, proper clinical management, symptomatic treatment and the control of mosquito (vector) can reduce both morbidity and mortality to a large extent. The *Global vector control response (GVCR) 2017–2030* approved by the World Health Assembly (2017) provides strategic guidance to countries and development partners for urgent strengthening of vector control as a fundamental approach to preventing disease and responding to outbreaks.

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