RESEARCH ARTICLE

Transmission of malaria- in diverse geo-ecological paradigms: A case study of Thane district in Maharashtra- India.

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Manuscript details:

Received: 10 July, 2014
Revised : 11 August, 2014
Revised received: 27 August, 2014
Accepted: 07 September, 2014
Published: 30 September, 2014.

Editor: Dr. Arvind Chavhan

Citation this article as:
Oak Deepali and Deore Sachin (2014) Transmission of malaria- in diverse geo-ecological paradigms: A case study of Thane district in Maharashtra- India. *Int. J. of Life Sciences*, 2(3):229-234.

Acknowledgement:
The author gratefully acknowledges NVBDCP and the District Malaria Department for providing data through their website and published material.

ABSTRACT

Malaria is persistent in India. Maharashtra was not affected badly since the beginning of the 21th century. But in last few years the situation has changed. Thane district in Maharashtra faced the problem of outbreak of malaria in 2010.The present study is a retrospective analysis of malaria situation in Thane district from 2003 to 2012. Epidemiological data of malaria indicators is obtained from District Malaria Department and NVBDCP is considered, and a regression is formulated. Correlation R square and trend values are quantified. GIS technique based maps are prepared to identify hot spots. API of India, Maharashtra and Thane are compared by graphical representation. The results show that the trend of malaria of Thane is in contrast to the scenario of India. Hot spots are located in the north east tribal area. Ground realities reveal that urban API is unbelievably low as people prefer private medical services. API (Annual Parasitic Index) of tribal areas was 13.03to 47.51 in 2010, which was far more than the national and state average. Though it reduced in next few years, holistic approach at administrative and social level would dilute the problem. Political will power, governance over the health environment, public participation, and creating health awareness can control the resurgence of malaria in Thane district.

Key words: Epidemiology, Health Care, Malaria Indicators. API, Urbanization.

INTRODUCTION

As the world develops keeping sustainability in mind, various diseases do tend to crop up, not only in developing world but also in the developed countries (Seth, 2011). Malaria is such is disease that has kept a challenge of eradication of Malaria before the field of medicine and administration. Therefore 'Small Bite: Big Threat' is the slogan of WHO for the year 2014. The root sources or reasons responsible for diseases, other than malaria, are comparatively less and to some extent they are controllable. But the diseases like Malaria and Dengue are beyond control due to high adoptability and immunity of vectors.

Malaria is more prevalent in South East Asia and similarly in India. Malaria has remained persistent in India since centuries. In India the epidemiology of malaria is complex because of geo-ecological diversity, multi ethnicity (Kumar, 2007). In 2003, about 1.87 million cases of malaria were reported in the country. Since then the reported cases were < 2 million (NVBDCP). Most of the malarial attributable mortality is reported from areas occupied by ethnic tribes in India.

There has been a decline in malaria incidence in most of the district of Maharashtra except a few districts. (Dhiman, 2005). The year 2010 happened to be a hectic year for the people as well as for the local administration. Malaria gained epidemic proportion across the state, but Mumbai and Thane appeared to be the victim of the disease. Thousands of people were affected on pervasive scale. Since then the situation is receding, despite of efforts implemented at war front by local government. It is necessary to note that in the year 2013, probably due to prolonged rainy season the diseases have popped up their head. Vector of malaria has high adoptability, and develops immunity against the insecticides. The Present nature of urban settlements provides n number of breeding sites for mosquitoes. Control of malaria is logistically difficult and outbreaks are frequently recorded (Srivastava, 2009). Sustainable control requires that, the twin problems of poverty and environment be addressed in a holistic manner (Sharma, 2003). Chagala (2011) has integrated malaria situation in Rajasthan in comparison to national scenario, which provided guidelines for better control of malaria. On the same lines the present study is the retrospective analysis of malaria situation in Thane district in Maharashtra, in comparison to national and state scenario.

Thane, the study area, is the northern district of Konkan division of Maharashtra. It lies adjoining the Arabian Sea in the north west of Maharashtra State. It extends between 18° 42' and 20° 20' north latitude and 72° 45' and 73° 45' east longitude. It is adjacent to the city of Mumbai metropolitan city, the capital city of Maharashtra. It is a part of north Konkan and connected to Gujrath in the north. Konkan is a narrow strip of land between Arabian Sea and Western Ghats. The region is marked by western slopes of Sahyandri ranges, with plateaus, peaks, pockets of river valleys and estuarine swamps. The climate in the coastal area is hot and very humid whereas the climate of eastern mountainous areas is comparatively dry. The rainfall is very heavy and concentrated (94%) from June to August. The region covers area is 9558 sq.km and is one of the largest districts and most populous district (1018872, census 2011) of the country. Thane occupies a unique position as Mumbai is connected to rest part through Thane.

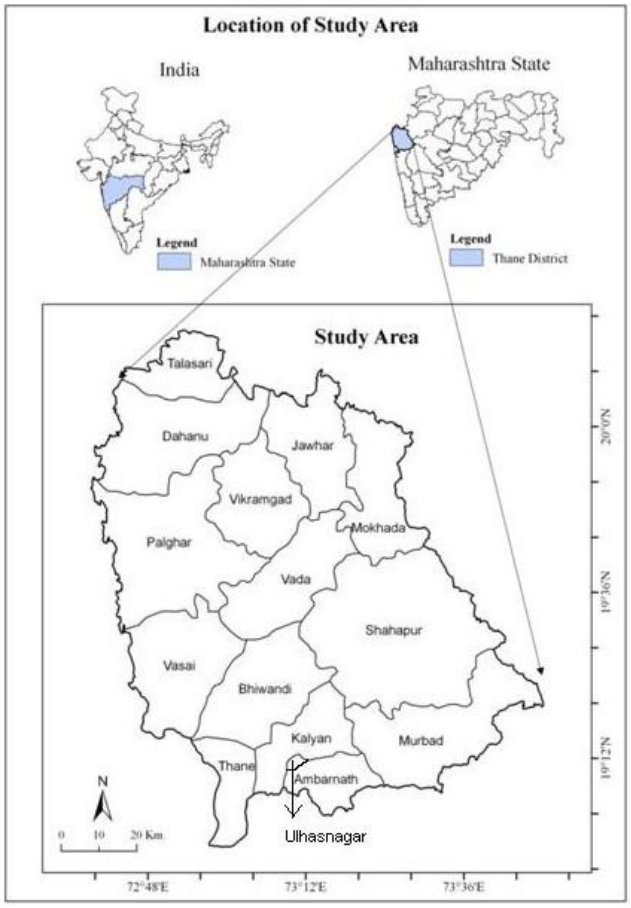

Fig. 1: Location map:

MATERIALS AND METHODS

For the retrospective study of malaria, ten years malaria data for all states of India as well as Maharashtra are collected from published reports and articles. To study the present situation of Malaria in Thane district, data of malaria cases, in Thane are collected from District Malaria office.API values are collected for India, Maharashtra, and for each taluka of Thane district. Taking malaria API from 2003 to 2012 for India Maharashtra and Thane a regression equation is formulated. For the equation slope and intercept, the data (Table 1) is calculated. Correlation R Square and trend are also calculated. The regression line with malaria API is then plotted in a graph for India Maharashtra and Thane (fig 5) API is plotted on

line graph for comparison. The spatial distribution of malaria for Thane is presented with the help of GIS technology, with Arc GIS 9.3. API values, taluka wise are averaged into seven groups with the difference of 5. The symbology has helped in identifying high risk areas. Interviews clarified the facts about the practical problems of tribal people.

RESULTS AND DISCUSSION

The situation of prevalence of malaria API in India Maharashtra and Thane (fig. 5) indicate that the API of India was highest in 2003 and 2004 which was 1.75 and 1.76. Thereafter it declined and reduced up to 1.01 in 2012. This means that the schemes that were implemented for control on malaria occurrence were successful overall in India. But these average values do not represent all the states as malaria incidences were high in states of Assam, Orissa, Zarkhand whereas low in snow covered areas.

Table 1: Analysis of malaria data for India, Maharashtra and Thane.

	INDIA	MAHARASHTRA	THANE
Year	API	API	API
2003	1.75	0.49	0.2
2004	1.76	0.47	0.8
2005	1.64	0.5	0.66
2006	1.65	0.53	0.7
2007	1.3	0.66	0.9
2008	1.3	0.62	0.1
2009	1.3	0.62	1.56
2010	1.18	1.2	2
2011	1.1	0.76	1.69
2012	1.o1	0.42	1.42
variance	0.076966	0.051001	0.443317
slope	-0.08867	0.031091	0.155697
Intercept	179.3973	-61.788	-311.599
R Square	0.936345	0.17374	0.5447
Trend	1.798	0.487091	0.302364

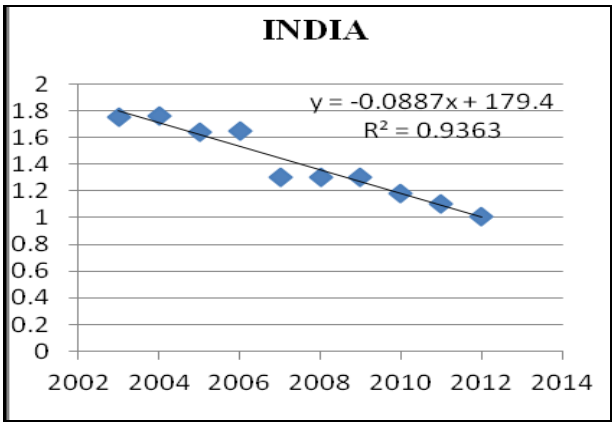

Fig. 2: API for India

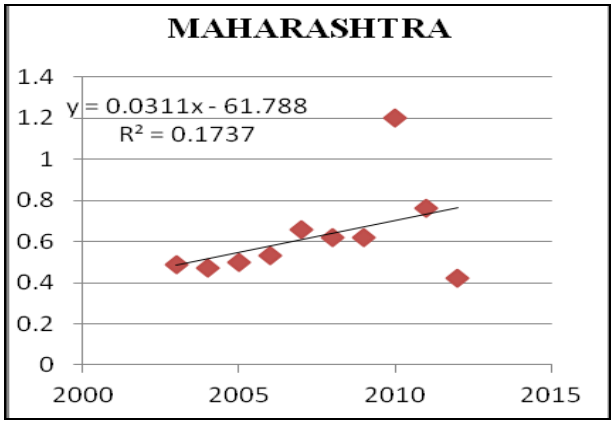

Fig. 3: API for Maharashtra

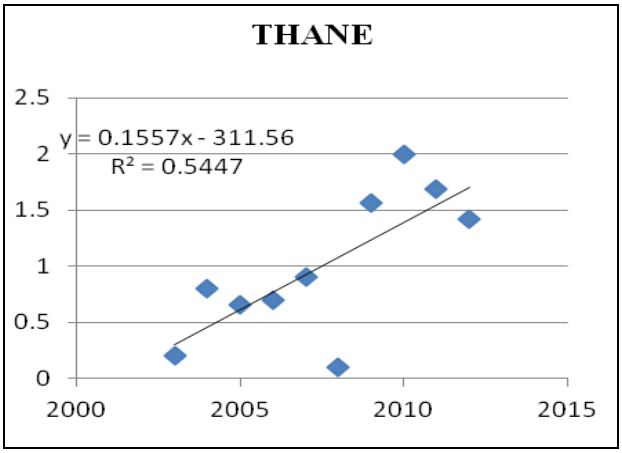

Fig. 4 : API for Thane

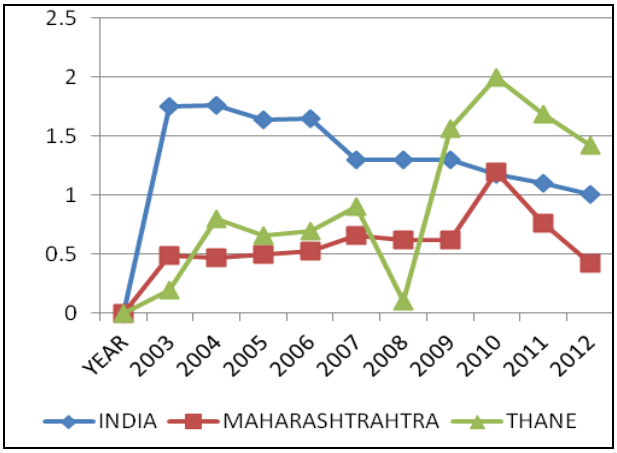

Fig. 5: API for India, Maharashtra and Thane

Fig. 6 : API Thane 2003 -2007

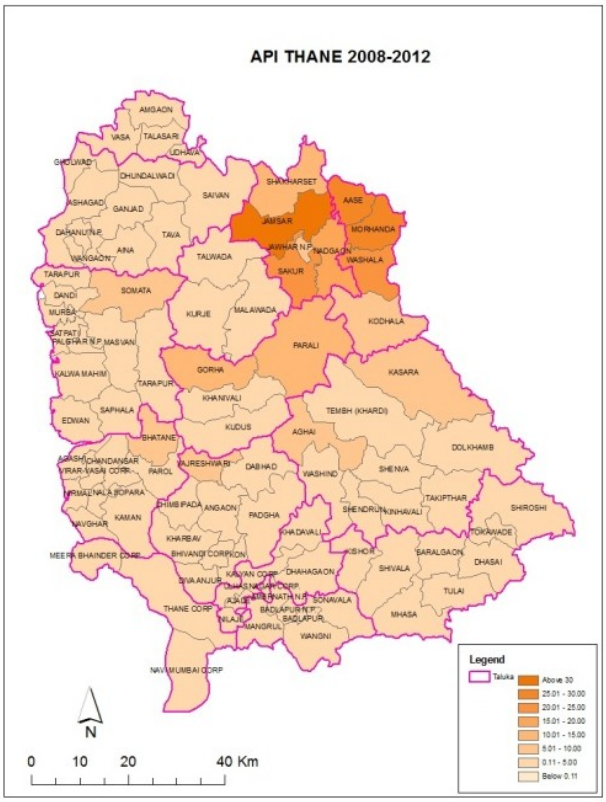

Fig. 7 : API Thane 2008-2012

The situation of Maharashtra was opposite till 2009, as API was up to .5. Thereafter it has suddenly increased to 1.3 which was nearly triple fold. After 2010 is reduced to .8 and .4 in next two years. API is a ratio between total population and disease incidence or cases in a year.

The situation of Thane appears to be somewhat fluctuating. From below 0.0 increased up to.7 and in 2010 is touched the figure of 2.0. Though the average API is not much striking the micro level observations underline the deteriorating situation of tribal areas in the district and identify high risk areas or 'hot spots. It was found so, as the situation of Mumbai, Navi Mumbai and Thane was critical. Malaria attacked these areas to great extent and people were affected on pervasive scale. Government authorities and medical staff implemented malaria control schemes at war front and it resulted into decline in API.

To compare the scenario of malaria in India, Maharashtra and Thane the regression of the average API (fig 2, 3, 4) are calculated. The results (table 1) show that the slope of the line of regression for Thane it is 0.1556 with intercept -311 , for Maharashtra it is 0.031 with intercept -61.68 and for India is -0.08 with intercept + 179.30.Thus there is fall of malaria in India whereas and rise in Maharashtra much more in Thane. If we look into R square values we observe that R square calculated for Thane it is 0.56, for Maharashtra it is 0.17 and for India is 0.93. The trend value for Thane it is 0.30 for Maharashtra it is 0.48 and for India 1.79. In figure 5 showing the API trend data of India, it may be observed that the points are close to the line of regression where as for Maharashtra points are close to the line up to 2010 and points are not close to the line of regression for Thane. Variance value for malaria API for Thane is 0.44, for Maharashtra 0.05 and for India 0.076.

These observations show that malaria in Thane appeared to be active after 2005 and abrupt increase showing API up to 2.0 after 2009. There after it declined to 1.4. In Maharashtra also it was active from 2003 and there was steady increase. At national level it persistent showing API up to 1.8 but steady down fall up to 1.0.

GIS based maps for the study area help to visualize the situation of malaria. API of different PHCs in all talukas depicts (fig. 6, 7) the spatial spread of malaria from 2003- 2007 and from 2008- 2012. It is observed that

though malaria is persistent in the district due to hot and humid climate throughout the year. API was quite restricted and was evenly distributed with API average values from 0.1 to 1.5, except a few places in Vikramgad and Jawhar in the north east which are forested areas dominated by tribal ethnic groups.

The situation changed after 2007. Though the average values at district level were low taluka wise values give entirely different picture. The API of Sakarshet, Sakur, Mokhada and Jawhar was 10.08, 12.15, 12.45 and 28.42 respectively in 2009. It was very high compared to the average national and state scenario. Wasala recorded highest API 49.33 in 2009. This situation became more serious in all PHCs, but reached to worst conditions in 2010. The API of Khodala, Sakarshet, Wasala, Nandgoan Mokhada, Jamsar, Aase, Jawhar reached up to 13.03, 21.50, 29.57, 32.89, 34.64, 35.41, 43.43 and 47.51 respectively. These were the major hot spots or high risk areas in Thane rural areas. In the agricultural areas in Shahaprur, Vasai, Murbad API is comparatively less, but increases in rainy season due to water logging, and working in farms.

The field study observations brought out the fact that, the geo-ecological conditions that prevail in rural, forest dominated tribal areas are typical and cannot be compared with urban areas. Both urban and rural areas have their own specific problems hence be treated with different perspectives. Geographical and cultural environment together create circumstances favorable for disease attack.

The study revealed that small ponds along the river and pits prepared for brick making provided breeding sites. It is observed that tribal people have less awareness about the health and sanitation process. Malnutrition is a common issue among children and women. Tribal communities believe that any physical illness can be caused by evil spirits, unfulfilled ancestor communities (Sundarajan, 2013). The people here are less educated, very poor so they approach to local medical advisers, called as 'Vaidus'. These traditional solutions are not much effective. Sharma (1996) He has stated that the population in forest areas is also the most neglected segment of our society because of their life style, settlements in inaccessible areas, sociological structures and beliefs.

The huts covered with vegetation roofs, scanty cloths, resting outside the huts increase the biting chances of mosquitoes. In the opinion of local MPWs' due to very hard physical work and starvation people become liquor addict and do not realise mosquito biting as they are fast asleep. The areas become inaccessible in rainy season (which is more than 2500 mm). Construction of new highway from Mumbai to Nasik via tribal area attracted local labours, which were affected by malaria. In spite of all these negative cultural aspects there is space to say that the negligence, lack of staff were also responsible for this outbreak. After the outbreak in 2009 the local administrative units implemented malaria control schemes effectively and that resulted into decline in the API. At present the staff at different level is working in rural areas, electronic surveillance is effective. API has come down to less than 10.0. Only at Durves and Gorha it is 20.17 and 30.65. It means that the risk areas are shifting towards the west.

In urban areas the situation appears not to be very serious, probably due large number of medical services available over here. But the fact is that the people having sound economic condition do not turn towards government medical services. They prefer private services. Surveillance through private sector is not systemized, and only sever cases are recorded at hospital level. The magnitude of vector borne diseases is increasing with enormous population growth, rapid industrialization, indiscriminate urbanization and gross neglect of the environment (Rudra, 2012). It is true that ceaseless migration towards the cities in the study areas puts pressure on civic amenities. Present infrastructure has created problems of vector borne diseases like malaria and dengue. Malaria and dengue transmission mainly takes place from June to October, which is characterised by hot and humid climate. Certain facts are observed from ground realities. Thane urban area comprises of seven municipal corporations with population, Thane, 1780576, Navi Mumbai 1152868, Kalyan-Dombivli 1401536, Bhiwandi 1265524, Ulhasnagar 560623, Meera-Bhayandar 116814, Vasai- Virar 1221233. The result is that the settlements are compact, congested, with small land area. Slums and large number of mushrooming constructions, industrial estate's scrap generates breeding sites for mosquitoes.

In addition, in and after the rainy season due to low quality and damaged roads uncountable roadside pits filled with stagnant water provide breeding sites. Empty containers, tyres, and even coconut shells and

garbage becomes a nuisance. House roofs, in rainy season are covered with plastic sheets to avoid leakage, create tiny bowls as breeding sites. Moisture in the soil and green vegetation and such other reasons cannot be under mined. Development projects such as roads, highways, bridges, dams are introduced with increasing urbanization. They attract labour from outside. In case of Thane the incoming workers are from malaria endemic states also.

CONCLUSION

The spread of malaria is, common as well as consistent in all parts of India. The retrospective analysis from 2003 -2012 reveals that the situation of malaria in India is inclined towards decline of malaria API. Maharashtra shows increase in API till 2010 and then there is decline. The situation of Thane district of Maharashtra shows contrast conditions and shows steady increase in API after 2008. The year 2010 created serious conditions with disease disaster in the tribal areas. This situation diverted the attention of government authorities and malaria control schemes were implemented at war front. This resulted into not only decline in API, but improvement in surveillance and sufficient staff supply. It is necessary to provide work to poor tribal people to reframe them from seasonal migration for survival. There is need for overall improvement in health environment, and provide clean environment. In addition, health awareness and public participation would help in diluting the problem of malaria spread. There is need to study the reasons responsible for the situation at micro level. Integrated and holistic approach, collaborative planning, supplies of sufficient staff, and advanced technology in GIS can guide the authorities in solving the problem.

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