Epidemiological Determinants for Malaria in Rajkot Municipal Corporation, Gujarat

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Abstract :

Introduction: : In recent years, Vector-Borne Diseases (VBDs) have emerged as a serious public health problem. Many of these, particularly Malaria, now occur in epidemic form almost on an annual basis causing considerable morbidity and mortality. About 95% population in India resides in Malaria endemic areas. The Malaria situation remains a major problem in certain states and geographical pockets of India. **Objectives :** To study epidemiological determinants for occurrence of Malaria in Rajkot city. **Method:** Study was done in Rajkot Municipal Corporation (RMC), Rajkot, Gujarat state in the year 2015 by using pre-formed, semi structured proforma. Data were collected from records available at Malaria department, RMC office. In the year 2015, total 105 malaria cases were recorded. Analysis was done by using Microsoft office Excel 2007. **Results and Conclusion:** This study demonstrates Malaria distribution in Rajkot Municipal Corporation with higher prevalence of P. vivax than P. falciparum. Malaria was seen relatively higher in males and most affecting age group was 15-30 years. Peak of malaria cases were found after major rainfall. West Zone having major Risk factors like irrigation canal, construction/development projects and industrial area reported highest malaria cases.

Key words : Epidemiological determinants, Malaria

Introduction:

In recent years, Vector-Borne Diseases (VBDs) have emerged as a serious public health problem in countries of the South-East Asia Region, including India. Many of these, particularly Malaria now occur in epidemic form almost on an annual basis causing considerable morbidity and mortality. [1]

Malaria is a life-threatening disease caused by Plasmodium parasites that are transmitted to people through the bites of infected mosquitoes. There are four parasite species that cause Malaria in humans: Plasmodium Falciparum, Plasmodium Vivax, Plasmodium Malariae and Plasmodium Ovale. Plasmodium Falciparum and Plasmodium Vivax are the most common. Plasmodium falciparum is the most deadly. [2] Transmission depends on climatic conditions that may affect the number and survival of mosquitoes, such as rainfall patterns, temperature and humidity. In many places, transmission is seasonal, with the peak during and just after the rainy season. [2]

Malaria has been a major public health problem in India. Intermittent fever, with high incidence during the rainy season, coinciding with agriculture, sowing and harvesting, was first recognized by Romans and Greeks who associated it with swampy areas. They postulated that intermittent fevers were due to the 'bad odor' coming from the marshy areas and thus gave the name 'Malaria' ('mal'=bad + 'air') to intermittent fevers. In spite of the fact that today the causative organism is known, the name has stuck to this disease. [3] About 95% population in the country resides in Malaria endemic areas.[4] India contributes 70% of malaria cases and 69% of malaria deaths in the South-East Asia Region. Overall, malaria cases have consistently declined from 2 million in 2001 to 0.88 million in 2013, although an increase to 1.13 million cases occurred in 2014 due to focal outbreaks.

The incidence of malaria in the country therefore was 0.08% in a population of nearly 1.25 billion. [5]

In India, screening of fever cases for Malaria is presently done under the National Vector Borne Diseases Control Programme (NVBDCP) covering about 10% of the population annually, of which about 1.5 million are positive for the Malaria parasite; around 45-50% of these cases are due to Plasmodium Falciparum. Though the Annual Parasite Incidence (API) has come down in the country, it varies greatly from one state to another. The Malaria situation remains a major problem in certain states and geographical pockets. [6] Malaria is showing rising trend in recent past in Gujarat. This is the reason to conduct this study.

Objective:

The objective of the present study is to study epidemiological determinants for occurrence of Malaria in Rajkot city.

Method:

Study Area:

Current study was conducted in Rajkot Municipal corporation (RMC) area, Rajkot, Gujarat state. Total population of Rajkot Municipal Corporation was 14,75,138 in year 2015. Rajkot city is divided in three zones; namely East zone, West zone and Central zone. Population of East zone was 4,50,549; west zone 6,06,597 and central zone 4,17,992 in the year 2015. There are 7 wards in East zone, 8 wards in West zone and 8 wards in Central zone. So there are total 23 wards. There are 19 Urban Health Center (UHC) in Rajkot Municipal corporation area.

Data collection tool:

Pre-formed, semi structured proforma was used for data collection. Details regarding cases and death of Malaria, blood smear collected, age and sex wise distribution of cases, details of rain fall and rainy days in year 2015 and details of risk factors for occurrence of Malaria cases during year 2015 were collected.

Data Collection:

The study was carried out based on the secondary data generated as a part of National Vector Borne Disease Control Program (NVBDCP) through active surveillance and routine health care at UHCs as passive surveillance. For active case detection of Malaria, field volunteers and USHA searched for cases of fever in their field areas. For passive case detection, fever cases reported at UHC were studied for Malaria. All Data were collected from records available at Malaria department, Rajkot Municipal Corporation Office.

Data analysis:

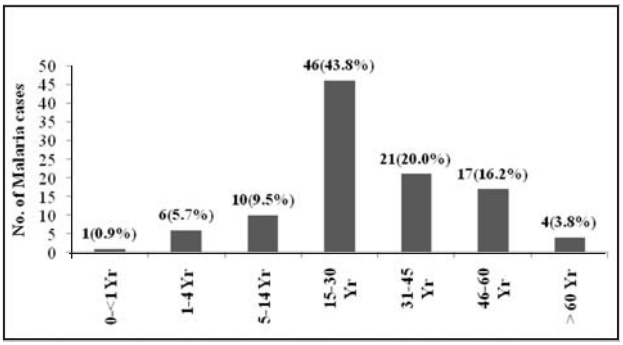
Secondary data regarding Malaria were collected and analyzed using Microsoft Office Excel 2007. Charts were prepared for showing trend of situation in Corporation/UHC.

Results:

In the year 2015, in Rajkot Municipal Corporation, total 105 Malaria cases were reported and no any deaths were reported due to Malaria. Cases included all Malaria cases reported from Urban Health Centres, P.D.U. Government Medical College and Hospital (Tertiary Care Center), P.K. Hospital (District Hospital, Rajkot). Out of them, 78.6% cases were due to P. vivax while 21.4% cases were due to P. falciparum.

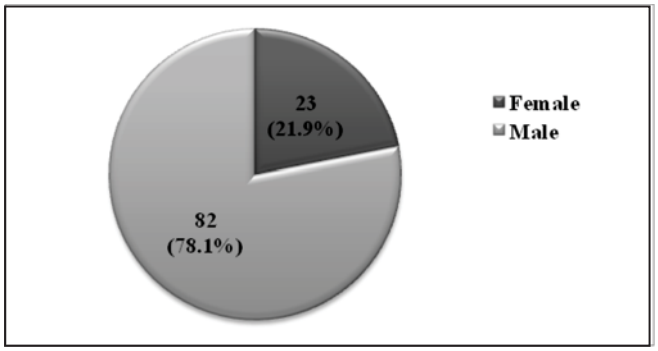
In our study, highest Malaria cases i.e. 46(43.8%) were observed in 15-30 years of age group followed by 21(20%) cases in 31-45 years of age. Overall, majority of malaria cases were reported in 15-60 years of age group. (Figure-1)

Figure 1: Age wise distribution of malaria cases during year 2015 in RMC



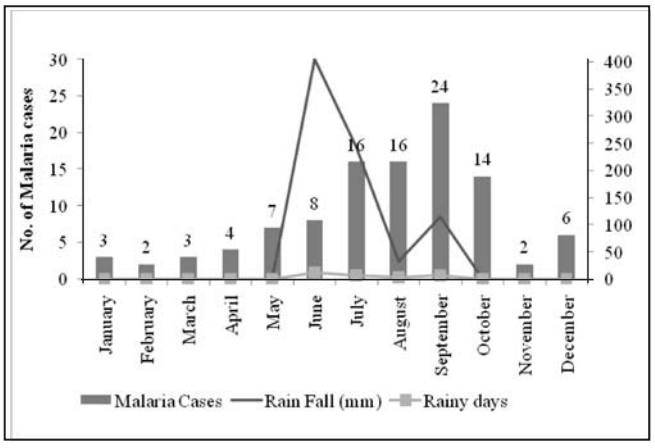
Malaria cases were found four times more common in males as compared to females in the year 2015. (Figure-2)

Figure 2: Sex wise distribution of Malaria cases in RMC during year 2015



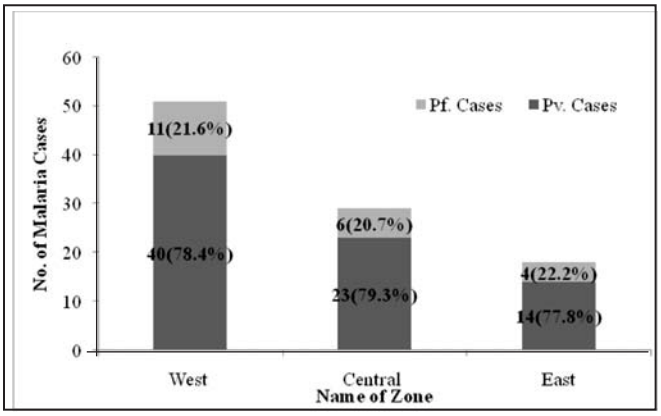
It was seen that in year 2015, total number of Malaria cases were ranged from 2-24 cases per month. Overall majority of Malaria cases were seen during July to October months. Highest Malaria cases were noted in September month (24 cases). Maximum rain fall as well as rainy days was seen during June months in the year 2015. After first major rain fall, more number of cases of Malaria were seen in next 2-3 months. (Figure-3)

Figure 3: Month wise Distribution of Malaria cases and rain fall & rainy days in year 2015 in RMC



Our findings show that maximum Malaria cases were seen in west zone followed by central zone in year 2015. Overall Plasmodium vivax cases were more observed as compared to Plasmodium falciparum cases. Lowest Malaria cases were found in East zone. (Figure-4)

Figure 4: Zone wise distribution of Malaria cases during 2015



All zones have one or more risk factors. Irrigation canal, more constructions and development projects and also more industries were also seen in west zones. This is the reason that most of the Malaria cases were reported from west zone. (Table-1)

Discussion:

This study was done in Rajkot Municipal Corporation area during year 2015. In this year 105 Malaria cases were reported.

In our study, 21.4% cases were due to P. falciparum while 78.6% cases were due to P. vivax. The dominance of P. vivax cases over P. falciparum cases may be due to several factors like parasitic load, vector density, vectorial capacity, host parasite interaction or fresh introduction of P. vivax from nearby areas by means of migratory population to this area. Our findings were supported by other studies done by Upadhyayula et al. [7], Chery et al. [8], Rashmi Sharma [9] and Sharma et al.[10] in which also majority of cases were due to P. vivax. But in some other studies done by Rabha et al. [11] and Singh et al.[12] P. falciparum cases detected were higher than P. vivax.

We observed highest Malaria cases i.e. 46(43.8%) in 15-30 years of age group. In study done by Rashmi Sharma [9], highest cases were seen among 5-15 years of age group. Farnert et al.[13] reported Malaria incidence highest among the youngest children and decreased with increasing age. In study done by Singh et al.[12], 50% of the cases were reported in children less than 8 year of age group.

Table 1: Zone wise risk estimation of Malaria in 2015

Name of Zone	Risk factors					Malaria cases n (%)
	Major Dam/ Lake (Yes/No)	Major irrigation canal passing in area (Yes/No)	No. of Major water logging present	No. of construction or development projects	No. of Industries	
West	No	Yes	1	130	1125	51 (52.0)
Central	No	No	4	129	613	29 (29.6)
East	Yes	No	4	53	1168	18 (18.4)
Total	**-**	**-**	**9**	**312**	**2906**	**98 (100.0)**

In this study, males were more affected as compared to females. Similar findings were found in a study done by Kumar et al.[14], Karlekar et al.[15] and Pathak et al.[16]

It is observed from the study, that the disease transmission occurred throughout the year but, average to higher number of case were recorded in rainy season i.e. in July to October month and highest cases were reported in September month. Maximum rainfall was seen during July month and rainfall occurred from July to September month. According to WHO report, moderate rainfall, instead of high volume, was found to be more congenial for malaria incidence.[17] The factor of rainfall influences the transmission of malaria by creating the breeding sites and also increases the relative humidity, which is favorable for mosquito, parasite development and disease transmission. On the other hand, abundant rainfall wash out the breeding sources which may lead to decrease in the mosquito population and reflects on decrease in number of malaria incidences.[7] In other than rainy season, malaria cases were also occurred. This is due to the availability of vector habitation, existence of permanent water bodies, such as slow-flowing rivers and lakes which provide suitable breeding sites for malaria vectors.

Rainfall and number of rainy days also showed positive correlation with the number of malaria cases in a study done by Upadhyayula et al.[7] and Qayum et al.[18]. R Sharma et al.[10] also found June-July month is the peak season for malaria. Goswami et al.[19] found peak of malaria cases in the monsoon months (June-September). But Bhattacharya et al.[20] found that not only rainfall directly correlates with malaria but temperature and humidity conditions also affect mosquito development during this period.

Rajkot Municipal Corporation is divided in 3 zones (west zone, central zone and east zone). Out of them more than 50% of malaria cases were occurred in West zone. This may be due to more number of major industries, construction/development projects, presence of water logging and also due to passing of irrigation canal in that area. Migrant laborers are working in majority of industries and developmental projects.

One potentially important factor in the spread of malaria in India, particularly P. falciparum, is human migration. For South Asian malaria control experts, the link between human migration and the importation of malaria into urban settings is of enormous interest. Migrants may not have access to government health services and may therefore be exposed to preventive and treatment strategies different than national malaria control recommendations (e.g., use of ITNs and correct choice of anti-malarial drug/drug regimens).[21] The construction and infrastructure development projects also attract migrants from other areas. Enhanced malaria risk has also been related to

construction activities, such as the local production of bricks and road works that create vectors' habitats.[22]

Conclusion:

Our study demonstrates Malaria distribution in Rajkot Municipal Corporation with substantially higher prevalence of P. vivax than P. falciparum. Malaria was seen relatively higher in males and affecting 15-30 years of age group more. Peak of malaria cases were found after major rainfall. West zone having more risk factors like irrigation canal, construction/development projects and industrial area has high risk of malaria.

Recommendations:

Morbidity and mortality burden of malaria could be reduced by strengthening Malaria Surveillance. Risk factor assessment during pre-monsoon period and there after required. Pre-monsoon preventive actions need strengthening. More focus requires in industries and developmental projects. Large water bodies needs to be treated with suitable methods recommended under National Vector-Borne Disease Control Programme.

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Declaration:

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Conflict of Interest: Nil

References:

1. Boratne AV, Datta SS, Singh Z, Purty A, Jayanthi V, Senthilvel V. Attitude and practices regarding mosquito borne diseases and socio demographic determinants for use of personal protection methods among adults in coastal Pondicherry. Indian Journal of Medical specialities. 2010 Jul 1;1(2):91-6.
2. Malaria-Fact sheet, WHO. Updated April 2016. Available from: http://www.who.int/mediacentre/factsheets/fs094/en/. [Last accessed on: 2017 May 02].
3. Malaria, Historical Perspective, National Vector Borne Disease Control Programme, Directorate General of Health Services, Ministry of Health and Family Welfare. Available from: http://www.nvbdcp.gov.in/malaria2.html. [Last accessed on: 2017 May 09].
4. Malaria, Magnitude of the Problem, National Vector Borne Disease Control Programme, Directorate General of Health Services, Ministry of Health and Family Welfare. Available from: http://www.nvbdcp.gov.in/malaria3.html. [Last accessed on: 2017 April 10].
5. National Framework for Malaria Elimination in India: 2016-2030, Directorate of National Vector Borne Disease Control Programme, DGHS, Ministry of Health and Family Welfare, Government of India.
6. Operational Manual for Implementation of Malaria Programme 2009. Directorate of National Vector Borne Disease Control Programme, Directorate General of Health Services, Ministry of Health and Family Welfare, Government of India. Available from:http://www.nvbdcp.gov.in/malaria3.html. [Last accessed on 2017 May 09].
7. Upadhyayula SM, Mutheneni SR, Chenna S, Parasaram V, Kadiri MR (2015) Climate Drivers on Malaria Transmission in Arunachal Pradesh, India.PLoS ONE 10(3): e0119514. doi:10.1371/journal.pone.0119514.
8. Laura Chery, Jenifer N. Maki, Anjali Mascarenhas, Jayashri T. Walke, Pooja Gawas,Anvily Almeida et al. Demographic and clinical profiles of Plasmodium falciparum andPlasmodium vivax patients at a tertiary care centre in southwestern India. Malar J. 2016; 15:569.
9. Rashmi Sharma. Epidemiological Investigation of Malaria Outbreak in Village Santej, District Gandhinagar (Gujarat), Indian J. Prev. Soc. Med. Vol. 37 No. 3& 4 , 2006.
10. Sharma R, Ahmed S, Gupta S. Comparative evaluation of seasonal fevers in last 2 years at a tertiary care hospital in North India. Int. J. Curr. Microbiol. App. Sci. 2014;3(7):631-4.
11. Rabha B, Goswami D, Dhiman S, Das NG, Talukdar PK, Nath MJ, Baruah I, Bhola RK, Singh L: A cross sectional investigation of malaria epidemiology among seven tea estates in Assam, India. J Parasit Dis. 2011, 36: 1-6.
12. Singh N, Chand SK, Bharti PK, Singh MP, Chand G, et al. (2013) Dynamics of Forest Malaria Transmission in Balaghat District, Madhya Pradesh, India. PLoS ONE 8(9): e73730. doi:10.1371/journal.pone.0073730.
13. Farnert et al. Epidemiology of malaria in a village in the Rufiji River Delta, Tanzania: declining transmission over 25 years revealed by different parasitological metrics. Malar J. 2014 13:459.
14. Kumar A, Valecha N, Jain T, Dash AP. Burden of malaria in India: retrospective and prospective view. Am. J. Trop. Med. Hyg. 2007 Dec 1;77(6 Suppl):69-78.
15. Karlekar SR, Deshpande MM, Andrew RJ. Prevalence of Asymptomatic Plasmodium vivax and Plasmodium falciparum Infections in Tribal Population of a Village in Gadchiroli District of Maharashtra State, India. An Int J. 2012;4(1):42–4.

16. Pathak S, Rege M, Gogtay NJ, Aigal U, Sharma SK, et al. (2012) Age-Dependent Sex Bias in Clinical Malarial Disease in Hypoendemic Regions. PLoS ONE 7(4): e35592. doi:10.1371/journal. pone.0035592.

17. WHO. (1998). WHO Expert Committee on Malaria. Twentieth Report. WHO 1998, Geneva.

18. Qayum A, Arya R, Kumar P, Lynn AM. Socio-economic, epidemiological and geographic features based on GIS-integrated mapping to identify malarial hotspots. Malar J. 2015 May 7;14(1):192.

19. Goswami P, Murty US, Mutheneni SR, Kukkuthady A, Krishnan ST (2012) A Model of Malaria Epidemiology Involving Weather, Exposure and Transmission Applied to North East India. PLoS ONE 7(11): e49713. doi:10.1371/ journal.pone.0049713.

20. Bhattacharya S, Sharma C, Dhiman RC, Mitra AP. Climate change and malaria in India. CURRENT SCIENCE-BANGALORE-. 2006 Feb 10;90(3):369.

21. McDade TW, Adair LS, 2001. Defining the "urban" in urbanization and health: a factor analysis approach. Soc Sci Med 53:55–70. Available at:http://www.ncbi.nlm.nih.gov /pubmed/11380161. [Last accessed on: 2017 June 10].

22. Baeza A, Bouma MJ, Dhiman RC, Baskerville EB, Ceccato P, Yadav RS, Pascual M. Long-lasting transition toward sustainable elimination of desert malaria under irrigation development. Proc Natl Acad Sci USA. 2013; 110 (37):15157–15162.