Trend Assessment of Different Malariometric Parameters of Surat City: A Retrospective Study

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Abstract: *Malaria is a life threatening disease caused by parasites of the genus Plasmodium that is transmitted to people through the bites of infected mosquitoes. It is the leading cause of death in children under the age of 5 years and pregnant women, in developing countries. The present study was carried out with secondary data to assess the trend of malaria in terms of various malariometric parameters such as Annual Blood Examination Rate (ABER), Annual Parasite Incidence (API), Slide Positivity Rate (SPR) and Slide Falcifuram Rate (SFR) of Surat City. The analysis has shown that there is an overall declining trend in malaria in the city. The annual blood examination rate has increased from 2001 to 2014. The various malariometric indicators such as API, SPR and SFR have reduced drastically in the last decade This could imply that although there are different malaria control activities each year such as insecticide spraying, elimination of mosquito breeding sites, distribution of Insecticide Treated Nets and malaria drugs to decrease mortality and morbidity of malaria, prevalence is sustained by the continuous vigilance of local governing body that is Surat Municipal Corporation.*

Keywords: Malaria, trend, Slide positivity rat

INTRODUCTION

Despite decades of sustained control efforts, Malaria continues to pose a worldwide public health problem. According to the estimates of World Health Organization in December 2013, there were about 207 million cases of malaria in 2012 and estimated 627000 deaths. (1). Out of the 11 countries of South-East Asia Region, 10 are endemic to malaria. Maldives is malaria free country since 1984. In the Democratic People's Republic of Korea and Sri Lanka the malaria incidence is low and in pre-elimination stage. In rest eight countries, Bangladesh, Bhutan, Timor Leste, India, Indonesia, Myanmar, Nepal and Thailand, malaria is in control phase(2). Out of about 1.4 billion people living in the eleven countries of South East Asia Region, 1.2 billion (85.7%) are exposed to the risk of malaria and most of whom live in India (3).

Epidemiological profile of India demonstrates that 89% of the population is at danger of malaria infection (1). Abundance of writing is accessible about the trend and characteristics of malaria for developed and developing urban areas (4-6) yet there is generally sparse information accessible for Indian coastal urban areas. Comprehensive studies regarding the prevalence of malaria over a period of time are scarce in India in spite of having a significant burden.

Coastal cities of India behave differently from heavy precipitation and other climatic factors and Surat is one of them. Surat City is profoundly inclined to vector borne ailments particularly malaria because of its geographic location, socio demographic structure, urbanization and climatic variables (precipitation, temperature, humidity)

Therefore the objective of the study was to analyze the prevalence of malaria in Surat city from 2001 to 2014.

MATERIALS AND METHODS:
Study area

The retrospective secondary data analysis was conducted at Surat City which is India's ninth most populated city having population of 4.5 million with 88% literacy rate. City's geographical coordinates are 21.112° North latitude and 2.814° East longitude (Census 2011) (7). It is the commercial capital of Gujarat State and rests on the bank of the Tapi River, which flows into the Arabian Sea (8). The city has a diverse demographic profile and witnessed exponential urbanization rates over the past several decades. Due to proximity to sea, it is predominately humid and hot and represents as sub-humid of tropical climate. The seasons of Surat city are broadly divided into summer, winter and monsoon. Annual rainfall ranges from 1250 mm to 1300 mm and the relative humidity varies from 50%-80%. Maximum precipitation occurs from Mid June to Mid September. Surat Municipal Corporation (SMC) is considered as one of the progressive Municipal Corporations with several award winning innovations and achievements also in the field of climate resilience. Vector Borne Disease Control (VBDC) Department of SMC has a robust house-to-house surveillance system (active and passive) to control mosquitoes and parasite for prevention of vector borne diseases especially malaria.

Study Design: Retrospective study was conducted to assess the trends of malariometric parameters from 2001 to 2014 such as SPR, ABER and API

Definitions:
Annual Parasite Incidence (API): is a measure of malaria incidence which in turn based on both active and passive surveillance. It is defined as (confirmed cases during one year per population under surveillance) X 1000.

Annual Blood Examination Rate (ABER): Calculated as (number of slides examined / population) X 100. It shows the operational efficiency. WHO recommendation for malarious areas is that the number of slides examined per month should equal at least 1% of the population.

Slide Positivity Rate (SPR): Defined as the number of laboratory-confirmed malaria cases per 100 suspected cases examined. SPR has been used as a surrogate to measure the incidence of malaria (6, 9, 10, 11).

Malaria data collection and analysis:
Retrospective study was done to determine the prevalence of Malaria by reviewing the Vector Borne Disease annual report compiled by the Vector Borne Disease Control department of Surat Municipal Corporation. Data collected from various records was entered in MS- Excel 2007 spreadsheet and processed and analyzed manually. The data was described and presented to assess and draw the trend of difference malaria parameters

RESULTS AND DISCUSSION

Total population of Surat City has doubled from 2876374 in 2001 to 44 66,826 in 2011. With the rising population the blood slide collection has increased three times from 2001 to 2014(Table 1). According to the National level data in 2001 the blood smear examined was 90.3 million and has increased to 108.9 million in 2012 (12).

Table 1- Year wise distribution of malaria cases

Year	Blood Slide Collection	Total Positive cases	Total PF cases
2001	510592	11363	4781
2002	530650	8274	2926
2003	573635	6984	2739
2004	625460	8227	2793
2005	606281	8292	2669
2006	737308	12617	4895
2007	769569	9765	4387
2008	908425	10141	4649
2009	974756	10250	3609
2010	1114752	13593	4147
2011	1131175	12369	3545
2012	1273932	11641	2345
2013	1342046	9209	1834
2014	1402139	7737	1304

ABER is used to determine the surveillance activities for case detection. The study shows that with the increase in population, ABER is showing an increasing trend in the last decade except in the year 2007 (ABER -16.99 %.). This aligns with the objectives of the Eleventh five year plan for NVBDCP in which the minimum target for ABER is 10%. (13)

Table 2- Year wise distribution of various malariometric parameters in Surat city

Year	ABER	API	SPR	SFR	Pf%
2001	20.98	4.67	2.23	0.94	42.0
2002	20.77	3.24	1.56	0.55	35.3
2003	21.39	2.6	1.22	0.48	39.2
2004	22.22	2.92	1.32	0.45	33.9
2005	19.74	2.7	1.37	0.44	32.1
2006	21.49	3.97	1.71	0.66	38.8
2007	19.05	2.42	1.27	0.57	44.9
2008	21.25	2.37	1.12	0.51	45.8
2009	22.10	2.56	1.16	0.36	31.0
2010	25.25	3.08	1.22	0.37	30.5
2011	24.67	2.7	1.09	0.31	28.6
2012	27.07	2.47	0.91	0.18	20.1
2013	27.43	1.88	0.69	0.14	19.9
2014	27.58	1.52	0.55	0.09	16.8

API is showing the highest peak in the year 2001 (4.67%) and a decline post 2001 with an exception for the year 2006 (3.89%) which was the flood year (Table 2). API has been brought down from 2013. Efforts are undertaken by the local governing body to meet the objectives of 11th five year plan for NVBDCP to achieve API less than 1.3 or less and to halt and reverse the incidence of Malaria by 2015 as per Millennium Development Goals (6, 13).

Total malaria cases from the year 2001 to 2014 show fluctuating trend with two peaks observed in the year 2006 (12617 cases) and 2010 (13593 cases) respectively. In the base year 2001, total malaria cases were 11363 that have declined to 7737 in 2014. (Figure1).
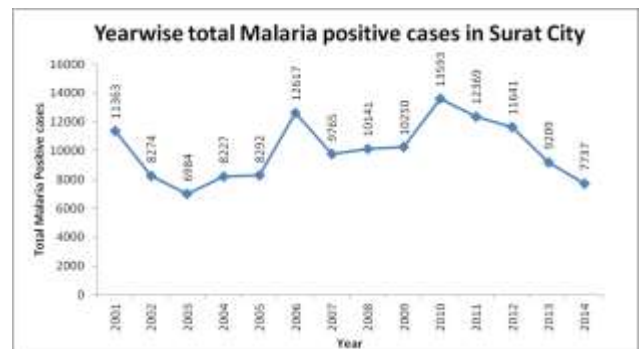

Figure 1: Year wise (2001-2014) total malaria cases in Surat City

National level data shows that the Malaria positive cases have declined from 2.08 million in 2001 to 1.06 million in 2012. (12)

ABER and Pf% show a fluctuating trend on yearly basis. ABER has increased from 20.98% in 2001 to 27.58% in 2014 respectively. Pf% is showing declining trend from 2001, yet there is steep increase in the cases from 2006 to 2008(Figure 2)
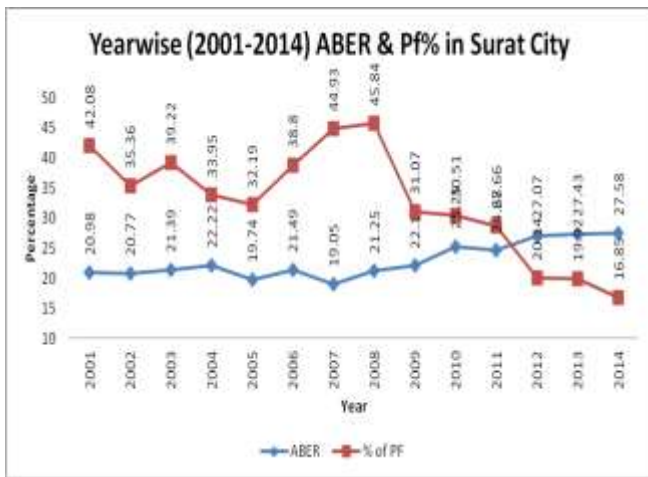
Figure 2: Year wise (2001-2014) trend of ABER and Pf% in Surat City

At national level the reported PF cases have declined 1.01 million in 2001 to 0.53 million in 2012; however the PF% has gradually increased from 48.20% to 50.01% in 2012. (12)

The analysis shows that all the three parameters API, SPR and SFR show a declining trend from 2001. Yet there is a peak observed in the year 2006. Between 2000- 2013 the city was flooded five times out of which the floods of 2006 has been the most devastating so far. (Figure 3)
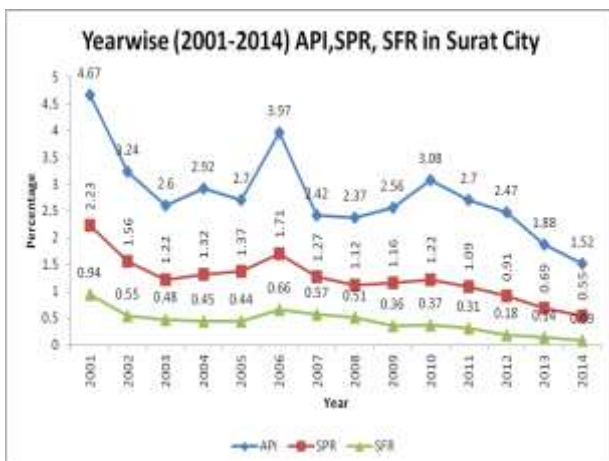

Figure 3: Year wise (2001-2014) trend of API, SPR and SFR in Surat City

National data highlights that the API has consistently lowered from 2.12 per thousand in 2001 to 1.1 in 2011 but the confirmed deaths due to malaria have been fluctuating during this period from 1707 and 753. SPR and SFR both have reduced over the years of 2001-2011. (13). While interpreting API at low levels of surveillance as interpreted by ABER, the alternative good indicator is SPR. The SPR has showed decline in India from 3.32 in 1995 to 1.20 in 2011 (13)

Pf cases have shown a fluctuating trend from 2001 to 2014. The base year (2001) had 4781 cases registered and the year 2014 had 1304 cases. There are two Pf peaks observed one in year 2006 (4895) and other in 2008(4649)

Figure 4: Year wise (2001-2014) trend of total PF (P.Falcifuram) cases in Surat city

Various studies have shown that malaria morbidity occurs due to both the species of Plasmodium that is Plasmodium Vivax and Plasmodium Falciparum, yet the contribution towards malaria morbidity is more due to P. Falciparum. (4,5) P. Falcifuram cases have decreases from 1.14 million in 1995 to 0.67 million in 2011. However the proportion of P.Falcifuram cases among total malaria cases have gradually increased from 39% in 1995 to 50.7% in 2011. (13) This could imply that there is increasing resistance of P.Falcifuram to Chloroquine.

Early diagnosis and prompt treatment are vital steps in malaria elimination strategy. Along with these steps community perception about diseases and treatment seeking behavior are also essential components for control of malaria. Coordination between community, primary health workers, health providers and policy makers can contribute to rapid control followed by elimination of malaria. (14)

This study can be further strengthened by exploring the underlying cause of the decline in malaria cases in Surat since this is a descriptive secondary data based study. If the study is carried out on a large scale with primary data inputs from various stakeholders it can give results which can be validated and replicable.

CONCLUSION

The study has shown that Surat has performed well as far as malaria control is concerned. The Annual Blood Examination Rate has increased in the last decade. The malariometric parameters such as API, SPR and SFR have reduced from 2001 to 2014. Yet during the floods of 2006 the Malaria prevalence was high .Post flood period is the most vulnerable period for epidemic outbreak of malaria, but in case of Surat city regular house to house disease surveillance, early detection and effective and prompt treatment, vector management, intersectoral convergence by dissemination of information about fever cases and clustering of cases to various departments of SMC, management of fever cases along with vector control measures are couple of strategies for malaria control adapted by Surat Municipal Corporation.

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Author Profile

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