Original Research Article

Epidemiological trends of malaria in an endemic district Tumkur, Karnataka

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ABSTRACT

Background: Efforts to control and eliminate malaria are high-impact strategic investments that generate significant returns for public health. In this regard, Government of India, launched NVBDCP in 2002, to control the disease. Since then, India has demonstrated significant achievements in malaria control with a progressive decline in total cases and deaths. Overall, malaria cases have consistently declined from 2 million in 2001 to 1.1 million cases in 2015. The decline in number of cases varied from region to region. In this background, the present study was conducted to know the trend of malaria in one of the endemic district Tumkur of Karnataka state.
Methods: A case record analysis was done for the past 15 years (2001-2015) from the available data at district malaria office of Tumkur district and the data was analysed.
Results: The present study showed that there is a gradual decline in the malaria cases from 27,553 in 2001 to 68 in 2015 and no deaths have been reported. The number of outbreaks is also declining with no outbreaks in the last 3 years. The present study also showed a seasonal trend in occurrence of malaria with increased incidence during June-October months.
Conclusions: The trend in malaria cases is gradually declining, indicating that it is progressing towards malaria control and with sustained efforts, malaria can be reduced substantially and elimination can be achieved by 2030.

Keywords: Malaria, Control, Trends, Tumkur

INTRODUCTION

Malaria is a vector borne disease transmitted by female anopheles mosquitoes, which is a common and life-threatening disease in many tropical and subtropical countries. Nearly half of the world's population is at risk of the disease. In 2015, there were about 212 million malaria cases and an estimated 4,29,000 malaria deaths with 91 countries had on-going malaria transmission.[1] India is also a malaria endemic and contributes to 70% of malaria cases and 69% of malaria deaths in the South-East Asia Region.[2]

Increased public health efforts are dramatically reducing the malaria burden in many places/ countries. Between 2010 and 2015, trends in malaria incidence among populations is decreasing and it fell by 21% globally. Similarly, India has demonstrated significant achievements in malaria control with a progressive decline in total cases and deaths. Overall, malaria cases have consistently declined from 2 million in 2001 to 0.88 million in 2013. Karnataka state has also showed a decline of malaria cases from 1,09,118 in 2001 to 14,794 in 2015.[3] Undoubtedly, such reduction of malaria morbidity and mortality reflects tangible success in the control of the disease.

These achievements in reducing the malaria burden in the country were due to new tools such as rapid diagnostic tests, artemisinin-based combination therapy (ACT) and long-lasting insecticidal nets (LLINs). Also playing a part are major initiatives and interventions including additional human resources, capacity building, community level awareness and mobilization, partnerships, strengthened monitoring and evaluation, investments from domestic and external sources such as the Global Fund and the World Bank. Therefore, under the umbrella of the National Health Mission, overall health systems strengthening has contributed to the reduction in the disease burden.[4]

In India, generally 80% of malaria occurs among 20% of people classified as "high risk", and are found in some 200 districts of Andhra Pradesh, Chhattisgarh, Gujarat, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Odisha, West Bengal and seven north-eastern states. Similarly, nearly 50% of malaria cases in Karnataka were reported from the districts of Tumkur, Hassan, Chickmagalur and Chitradurga. In Tumkur, malaria is mainly a rural problem with >25% of P. falciparum cases. The main vector of malaria is An. culicifacies.[5] The recent reports shows a drastic decline in the number of cases making into a low endemic area; but, as malaria is characterized by focal occurrences and achievements made with reduction in mortality and morbidity are fragile without constant attention to the existing malaria challenges, the sustaining of gains is critical as there is a risk of turning low endemic areas back into high risk areas.

In this background, the present study was conducted to know the trend of malaria in the endemic district of Tumkur, Karnataka, as one of the key indicators to measure progress towards malaria elimination.

Objective

To determine the trends of malaria cases in Tumkur district.

METHODS

A case record analysis was done for the past 15 years (2001-2015) from the available data, at district malaria office of Tumkur district. All the records pertaining to malaria were studied in detail mainly focussing on the total number of cases reported in the corresponding year & different species involved, annual parasite index and mortality reported. The intra-annual trend for the previous 3 years was also studies in detail. Similarly, the trends in the epidemiological indices with respect to malaria control was also recorded i.e., number of peripheral blood smear examined, number of species specific positive cases among the smears examined, ABER, API, SPR & SFR were also recorded. The outbreaks of malaria, if any, were also recorded. All the studied data was analysed using trend analysis, means & percentages, to know the trend of malaria cases in the district of Tumkur.

RESULTS

The study showed an overall decrease in the malaria cases from past 15 years (2001-2015). There was a significant (99.0%) decline in the number of malaria cases from 27,553 in 2001 to only 68 malaria cases in 2015. The cases of Plasmodium Vivax were more than Plasmodium falciparum throughout the study period. The Pf: Pv ratio varied from 35.98% in 2001 to 8.2% in 2015. The Pf percentage has shown a fluctuating trend that is around 20% during 2001-06 which reduced to 4.23% in 2009, but rose to 26.54% in 2012 and once again reduced to 7.35% in 2015.

**Table 1: Epidemiological trends of malaria in Tumkur (2001-15).**

Year	Population	Blood smear examined	Positive cases	Pf Cases	ABER	API	SPR	SFR
2001	2584711	750123	27553	7290	29.02	10.66	3.67	0.97
2002	2599948	666028	21960	3610	25.62	8.45	3.30	0.54
2003	2616875	729756	12004	1541	27.89	4.59	1.64	0.21
2004	2632112	656556	7990	1837	24.94	3.04	1.22	0.28
2005	2645758	733891	6577	1635	27.74	2.49	0.90	0.22
2006	2798210	674389	4297	879	24.10	1.54	0.64	0.13
2007	2798210	597154	1514	176	21.34	0.54	0.25	0.03
2008	2804947	597609	743	76	21.31	0.26	0.12	0.01
2009	2827387	624313	2318	98	22.08	0.82	0.37	0.02
2010	2821647	601703	1973	193	21.32	0.69	0.33	0.03
2011	2913304	541912	566	86	18.60	0.19	0.11	0.02
2012	2775661	534797	162	43	19.27	0.06	0.03	0.01
2013	2771713	586350	82	10	21.15	0.03	0.01	0.01
2014	2777059	588360	44	4	21.19	0.02	0.01	0.01
2015	2797542	638864	68	5	22.84	0.02	0.01	0.01

The annual parasite incidence (API) is a malariometric index to express malaria cases per thousand populations. The present study showed a decreasing trend in API from 10.66 in 2001 to 0.024 in 2015. Similarly, the present study also showed that, the average ABER was 23.23% and is consistently above 20%, indicating a good surveillance system. The Slide Positivity Rate (SPR) has shown gradual decline from 3.67 in 2001 to 0.011 in 2015. The Slide Falciparum Rate (SFR) has also shown gradual decline from 0.97 in 2001 to 0.001 in 2015 (Table 1).

The present study showed that, there were no deaths reported due to malaria during the entire study period of 2001-15.

Seasonal trends of malaria cases in the study area

The previous 3 years (2014-2016) study showed a seasonal trend in occurrence of malaria with increased incidence during June to October months associated with rainy season and increased vector breeding in rainy season (Figure 1).
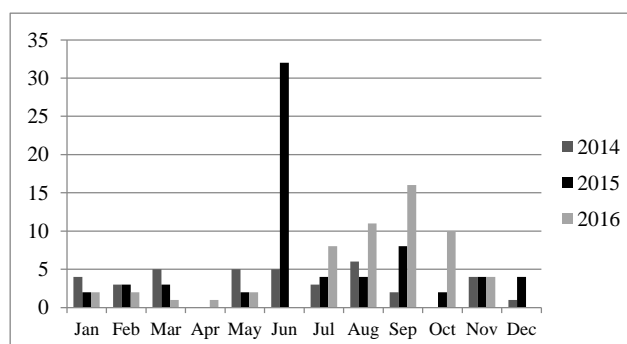
Figure 1: Seasonal trends of malaria in Tumkur district 2014-16.

Table 2: Outbreaks of Malaria in Tumkur (2001-15).

No.	Year	No. of outbreaks	No.	Year	No. of outbreaks
1	2001	14	9	2009	5
2	2002	11	10	2010	8
3	2003	7	11	2011	2
4	2004	10	12	2012	Nil
5	2005	11	13	2013	Nil
6	2006	7	14	2014	Nil
7	2007	1	15	2015	Nil
8	2008	1			

Number of outbreaks

The present study also showed a declining trend in the number of outbreaks of malaria in the district of Tumkur i.e., from 14 outbreaks in 2001 to no outbreaks in the last 4 years (2012-15) (Table 2).

DISCUSSION

Malaria has been the focus of multiple declarations, and a range of targets have been set since the beginning of the millennium. Malaria control has been a central element of the Millennium Development Goals (MDGs) and has been highlighted in World Health Assembly. In 2005, the World Health Assembly set a target to reduce malaria cases and deaths by 75% by 2015. In 2011, the Roll Back Malaria Partnership updated the objectives and targets that had been set out in the Global Malaria Action Plan.[6]

Similarly, in India we have various programmes from the independence, now merged under one umbrella of national vector borne disease control programme (NVBDCP), but still, malaria is a public health problem in several parts of the country and about 95% population in the country resides in malaria endemic areas.[7] Tumkur is one of the 13 endemic districts of Karnataka. The district has 10 administrative units (Talukas). The health infrastructure in the district comprises of 93 primary health centres, 38 primary health units, 2 general hospitals (400 bed and 100 bed), 7 taluka hospitals (50 bed each), 28 Ayurvedic hospitals, 376 subcentres, 646 drug distribution centres and 4 fever treatment depots. Malaria in the district is mainly a rural problem. On an average, > 15,000 malaria cases were reported annually with >25% of P. falciparum cases. The main vector of malaria is An. culicifacies. The anti-vector measures were insecticide indoor residual sprays against adult vectors in rural areas and antilarval measures in urban areas. DDT, malathion and synthetic pyrethroids are used for indoor residual sprays and fenthion and temephos for antilarval treatments.[6]

According to WHO malaria report, globally, there were large reductions in the number of malaria cases and deaths between 2000 and 2015 (from 262 million cases & 839000 deaths in 2000 to 214 million cases & 438000 deaths in 2015 i.e., 18% decline in malaria cases and a 48% decline in the number of deaths).[2] At the national level, the malaria incidence and deaths due to malaria have reduced significantly in recent years. During the period 2000 to 2015, cases declined by 44% from 2.03 million to 1.13 million and deaths declined by 69% from 932 to 287.[3]

The present study showed that, there is a gradual decline in the number of malaria cases from 27,553 in 2001 to 68 in 2015 (99.0%) in the endemic district of Tumkur. The cases of Plasmodium vivax (Pv) was more than the cases of Plasmodium falciparum (Pf) throughout the period (2001-15). Similarly, at the national level, the Pf percentage remained around 50% from 2000 to 2013, but rose to 65.6% in 2014 and 67.1% in 2015, contributed by increased Pf detection by widespread use of bivalent RDTs by trained ASHAs.[4] Similar results were seen at state level, i.e., 25.93% in 2001 to 8.98% in 2014.[2] But the actual mortality rate and the malaria incidence are

always greater than reported. The reason for under reporting is mainly due to low annual blood smear examination rate (ABER), Other reasons include lack of awareness, misdiagnosis by the use of light microscopy and people relying on private practitioners or hospitals through which the government does not collect the data.[8]

The annual parasite incidence (API) is a malariometric index to express malaria cases per thousand populations. The present study showed a decreasing trend in API from 10.66 in 2001 to 0.024 in 2015. As per the NVBDCP incidence records, in most of India, the API was <2, whereas 2–5 API was in scattered regions, and regions with >5 API were scattered in the states of Rajasthan, Gujarat, Karnataka, Goa, Southern Madhya Pradesh, Chhattisgarh, Jharkhand and Orissa and in north-eastern states.[8] Karnataka's API showed a decline of 89.3% from 3.74 in 2001 to 0.27 in 2014.[9]

As per national vector borne disease control program, the annual blood examination rate (ABER) for malaria should be at least 10% on the presumption that, 10% of the population in a year will have fever at one point in time. It is assumed that if all or most of the fever cases are examined for malaria, most of the incidence of malaria could be captured during fortnightly active surveillance. The present study shows that the average ABER was 23.23% and is constantly more than 20% indicating a good surveillance system. At the national level, average ABER from 2001-15 is 9.29%.[4] In 14 of 29 states, however, it ranged from 1% to 8%, and in the remaining 15 states and union territories, ABER ranged from 10% to 40%.[10]

The Slide Positivity Rate (SPR) has shown gradual decline from 3.67 in 2001 to 0.011 in 2015. The slide falciparum rate (SFR) has also shown gradual decline from 0.97 in 2001 to 0.001 in 2015. At national level, SPR showed a decline from 2.31 in 2001 to 0.89 in 2014. SPR of Karnataka during 2014 was found to be 0.15.[9]

The present study showed a seasonal trend in occurrence of malaria with increased incidence during June-October months because of increased vector breeding in rainy seasons. India is characterized predominantly by unstable malaria transmission, the seasonal transmission being related to rains.[11] A study showed that, like all other states of India, the malaria incidence in Karnataka correlates with the onset of monsoon, with increased malaria incidence from the month of June onwards.[9]

Malaria outbreaks are associated with two major environmental and climatic factors that have an impact on vectors and parasites and this can be made worse with population movement. A malaria epidemic or outbreak is defined as the occurrence of malaria cases highly in excess of the number expected in a given place and time. The present study showed a declining trend in number of outbreaks from 14 outbreaks in 2001 to no outbreaks in the last 4 years (2012-15). This might be possible because

of prompt disease surveillance and integrated vector control measures which have been taken up in the entire district of Tumkur by the health care delivery system. Integrated interventions against malaria are needed which will be highly cost-effective and has demonstrated as one of the highest returns on investment in public health.

CONCLUSION

The trends in malaria cases in the study area is gradually declining, indicating that it is progressing towards malaria control & with sustained efforts, malaria can be reduced substantially and elimination can be achieved by 2030.

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