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## Malaria Trends in Dakshin Kannada, Karnataka: An Epidemiological Review

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### Abstract

**Introduction:** Malaria is a global health problem. Nearly 2 billion of world's population is at risk of malaria. In 2016, there were 216 million cases of malaria and 4,45,000 of deaths. India is the poorest performer in the South East Asia. Though there has been a decline in malaria cases during last decade, India's numbers remain a problem due to alarmingly low surveillance. India had 649 million population at risk in 2010 and reported 1018 deaths. Now, it has 698 million population at risk with 331 reported deaths. Dakshin Kannada, a city in Karnataka, has been relatively free from malaria until early 1990 but, since 1990, it has made a dramatic comeback accounting for highest number of cases in entire Karnataka during the recent years. **Methods and Material:** This is a record based retrospective study of last five years i.e. 2012 to 2016. The data was collected from the records of district malaria office to analyze the trend of malaria using indicators like API, ABER, SPR, PF%. **Results:** The data reveals that highest number of cases in Dakshin Kannada were in the 2014 (.7708) while the lowest cases were in 2013, (5314). Mangaluru was single largest contributor of malaria (94.76% of all cases) to Dakshin Kannada. **Conclusion:** The study reveals a significant decline in all Talukas in Dakshin Kannada since 2012, except in Mangalore where Malaria burden continues to be still a major health issue and a cause of concern and needs urgent remedial measures.

**Keywords:** Annual Parasite Index (API); Annual Blood Examination Rate (ABER); Slide Positivity Rate (SPR); Plasmodium Falciparum % (Pf %).

### Introduction

Nearly half of the world's population is at risk of malaria. In 2016, an estimated 216 million cases of malaria occurred worldwide as compared to 237 million cases in 2010 and 212 million cases in 2015 [1]. Besides, number of deaths reached 4,45,000 in 2016, a similar number (4,46,000) to 2015. Most malaria cases in 2016 were in African Region (90%), followed by South-East Asia Region (7%) and the Eastern Mediterranean Region (2%). The incidence rate of malaria is estimated to have decreased by 18% globally, from 76 to 63 cases per 1000 population between 2010 and 2016 [2]. The South-East Asia Region has recorded the largest decline (48%) followed by the Americas (22%) and the African Region (20%). Plasmodium falciparum has been the most prevalent malaria parasite in sub-Saharan Africa, accounting for 99% of estimated malaria cases in 2016. P. vivax has been the dominant parasite in most countries outside of sub-Saharan Africa [3].

India is the poorest performer in the South East Asian region (SEAR). The number of cases in its highest endemic state, Odisha, shot up in 2016, doubling the number from 2013 [4]. Meanwhile, neighboring Sri Lanka was declared malaria free in 2016 by the WHO, as was Kyrgyzstan. Though there has been a decline in the rate of incidences from 2010 to 2016, from 76 down to 63 cases per 1000 population at risk, India's numbers remain a problem due to alarmingly low surveillance [5]. India had 649 million population at risk in 2010 and reported 1018 deaths. Now, it has 698 million population at risk with 331 reported deaths. Far from being good news, this

number further indicates that cases were simply not being reported in the country. A report published in "The Lancet", brings out that malaria killed close to 2,05,000 people annually in India, 13 times higher than the WHO estimate of 15000 [6].

In 2016, an estimated US\$ 2.7 billion was invested in malaria control and elimination efforts globally by governments of malaria endemic countries and international partners, but India had the lowest funding average per person at risk in the region. While India is on track to reduce malaria cases by 20 to 40 percent by 2020, most other SEAR countries will hit over 40 percent reduction [7].

Dakshin Kannada, a picturesque city in Karnataka, has been relatively free from malaria until early 1990. However, since 1990, due to a sudden spurt in industrialization and construction activities, malaria has made a dramatic comeback here and has also spread, not only to all the villages of this district, but also to the neighboring districts of Udupi and Kasaragod (Kerala) as well [8].

In the backdrop of above, this study was undertaken to analyze the malarial trends in Dakshin Kannada during last 05 years.

## Material & Methods

Dakshin Kannada district consists of five talukas. A retrospective, record based study for a period of 05 years i.e. from 01 January 2012 to 31 December 2016, was carried out. The data on malaria pertaining these five Talukas; was collected from the records of district

malaria office with an aim to analyze malaria trends in the district during these 5 years with the help of epidemiological indicators like API, ABER, SPR and Pf%. The study included only confirmed cases of malaria. Institutional ethical clearance as well as clearance from the district malaria officer was taken for the study.

## Results

Table 1 shows over all distribution of malaria cases in Dakshin Kannada district from 2012-2016 in all its Talukas. The analysis of the data reveals that the total confirmed cases of malaria in Dakshin Kannada were highest in the year 2014 i.e.7708 while lowest in 2013, i.e. 5314; with a gradual decline in successive years. Mangaluru was single largest contributor of malaria cases in Dakshin Kannada district, contributing 94.76% of all cases that occurred in Dakshin Kannada, while during 2016, Mangaluru contributed 96.43% of cases.

The trends in annual blood examination rate (ABER), throughout the years under study were good, ranging from 14.44 % to 15.48 %, which also meet the requirement of NVBDCP which is 10% and (Figure 1).

The slide positivity rate (SPR) which gives information on the parasitic load in the region, has been in the range of 1.75-2.4% during the last 05 years (Figure 2). The study reveals a declining trend of SPR, during the period of study in the Mangaluru as well as Dakshin Kannada (DK),

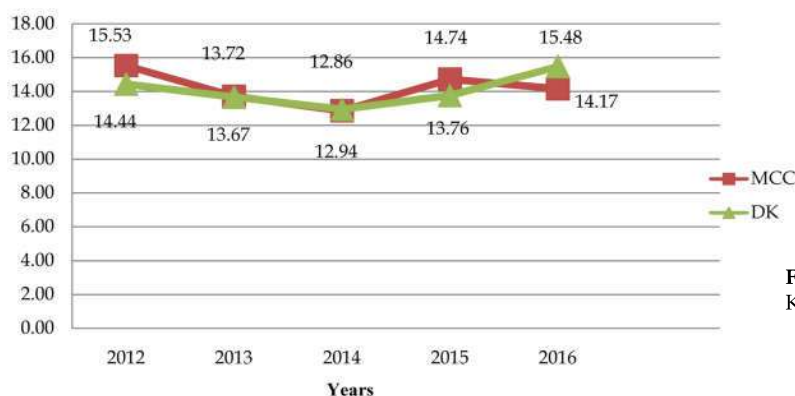


Fig. 1: Trend showing ABER in Dakshin Kannada and Mangaluru

Table 1: Distribution of Malaria cases according to Talukas in Dakshin Kannada

Years	Mangaluru	Bantwal	Beltangady	Puttur	Sullia	Total (DK)
2012	5327	143	125	32	50	5677
2013	4714	158	160	45	57	5134
2014	7313	194	82	105	14	7708
2015	5763	128	36	39	0	5966
2016	5004	95	19	59	12	5189

though it was higher than the national average (0.89 in 2014) [4].

Figure 3 shows Annual Parasite Incidence (API) in Dakshin Kannada during the period of study, which had been found to be more than 2 cases per 1000 population ranging from 2.35 to 3.71 throughout the period of study; which were much higher than the national average (0.89 in 2014).

Further, Mangaluru had even higher API; ranging from 9.41 to 14.69 per 1000 population during this period. The incidence of Plasmodium falciparum Pf % ranged from 10.14% to 6.79% during the period of study, though it showed a declining trend over the years. (Figure 4). However, the incidence of Pf% of malaria cases was much less than the national average of 65.66%.

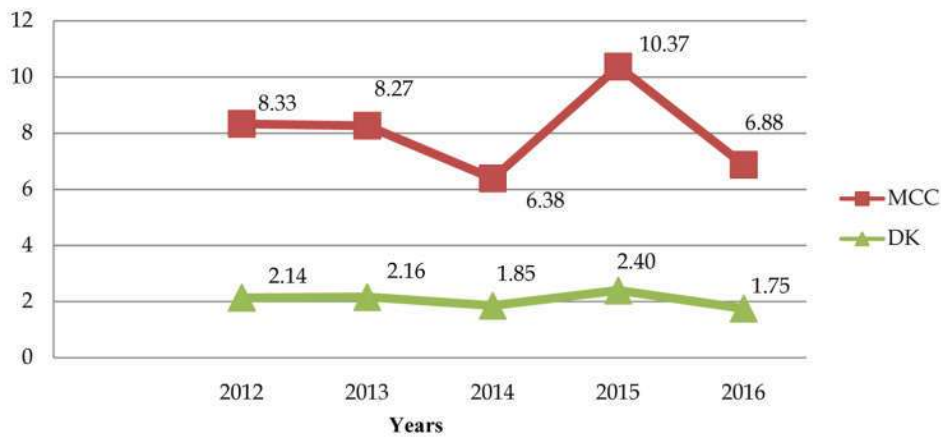


Fig. 2: Trend showing SPR in Dakshin Kannada and Magaluru

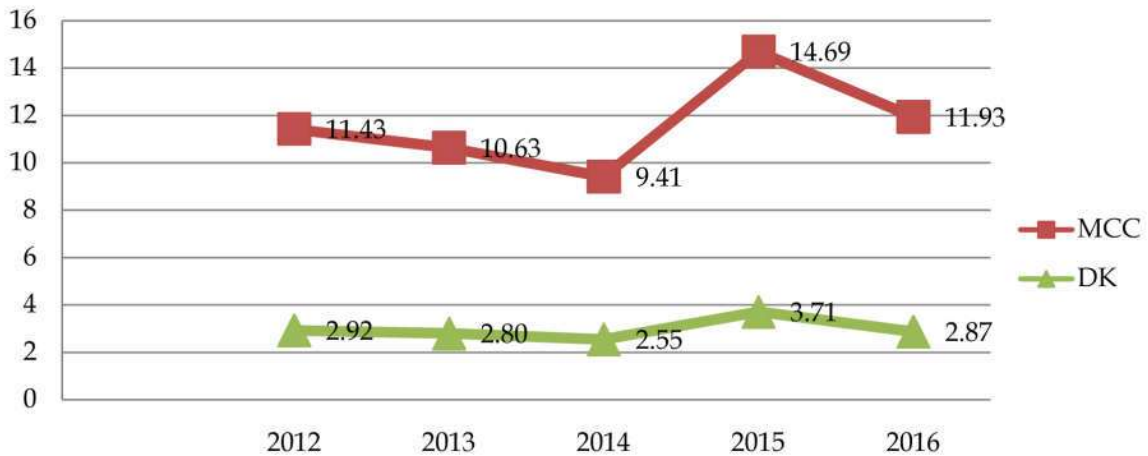


Fig. 3: Trend showing API in Dakshin Kannada and Mangaluru

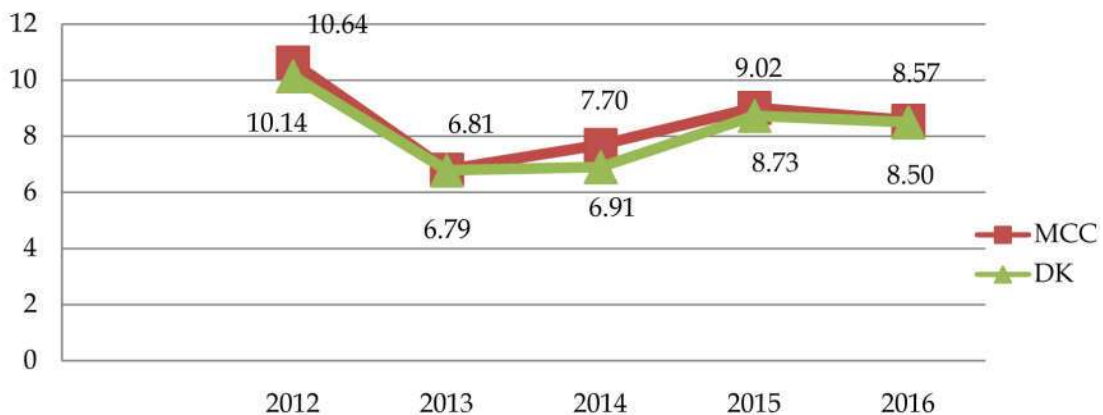


Fig. 4: Trend showing PF% in Dakshin Kannada and Mangaluru

## Discussion

Malaria is a major global public health problem leading to 300-500 million cases and 1.1-12.7 millions death every year. However, between 2010 and 2015, malaria incidence has decreased by 37% while mortality has fallen by 60%. India contributes 6% to the global burden of malaria and 89% to South-East Asia Region. Karnataka is one of the malaria endemic states in the country. However, the state has recorded an overall reduction of 89% since the year 2000; while the API of the state has fallen below 1; except in two districts viz., Dakshin Kannada and Udupi, which are still having API of more than 1. The surveillance in the state has been consistently good and has recorded an ABER of 15% and above, which is very good. Now, the state is looking at achieving a zero malaria status by 2022 [9].

Around 64% of the malaria burden in Dakshin Kannada is mainly localized in urban agglomerations. Unplanned construction, poor reporting by private sector, problems of low detection of malaria cases in migrant population, lack of usage of personal protective measures, lack of legislative measures to enforce screening among construction workers, lack of compliance to the recommended "National Treatment Guidelines" have been some of the major challenges in malaria control in Dakshin Kannada [10].

However, despite all these barriers and challenges, the incidence of malaria has shown a consistent decline in Dakshin Kannada during last decade; which can be attributed to good interventional measures, consistent surveillance, bed net distribution and indoor residual spray by special groups constituted by District Malaria team of Dakshin Kannada. Present study reveals a reduction in incidence of malaria from 27.98% in 2012 to 9.8% in 2016 in Dakshin Kannada. However, reduction in the incidence of malaria in Mangaluru revealed a slow progress. Similar decreasing trends in incidence of malaria were observed in a study by Shivakumar et al. (2015) [11] in Karnataka where incidence of malaria decreased from 85.5% to 26% over a period of ten years while Hellen OP et al (2014) [12] in their study in Malaita, Solomon Islands also observed a reduction by 86.5% over a period of five years.

The present study reveals that 91.5% of the cases reported in 2016 in Dakshin Kannada were due to Pv, whereas only 8.5% of cases were due to Pf, showing a decline in Pf incidence by 1.5% over a period of last five years. It is well established that Pf species can be controlled more easily than the Pv

species, though it is much deadlier than Pv. Yang CY et al (2013) [13] in their study in Henan Province of China, also reported Pf cases as dominant species accounting for 78.2% of all cases of malaria, followed by Pv (9.1%) while other strains constituted 12.7% of the cases. Similarly Hellen OP et al (2014) [12] in their study at in Malaita over a period of five years observed a decline in the incidence of Pf cases from 96.7% to 65.3; mainly due to strict surveillance and vector control measures. Sharma et al (2016) [14] in their study in North Eastern states also reported a very high incidence of Pf (84.44%) among malaria cases. However, in India, Orissa is a state which contributes a significant proportion of malaria cases and accounted for 41.22% of all malaria cases and 54.35 of all Pf cases in during 2016 [15].

The API in Dakshin Kannada, was observed to be more than 2/1000 population during the past five years, while in Mangaluru it reached the figure of 14.69 during 2015. This figure implies that malaria had been a vital, un-resolved health issue since long in Dakshin Kannada. Similar fluctuating trends of API were also observed by Das R et al (2004) [16] in their study in Aligarh district of Uttar Pradesh during 1990-99, where the mean API was found to be 11.02/1000 population which was much higher than the national average of 2.75/1000 population (1990-95).

Present study revealed SPR of <5% during the period of study i.e. 2012 to 2016 in Dakshin Kannada, which indicates that the control measures to contain the malaria have been effective. However, Mahapatra et al (2012) [17] in their study, in Balsore district of Orissa, in a door to door survey in three blocks; aimed at identifying the fever cases due to malaria, over a span of 18 days, found 172 cases of fever with SPR of 24.4% and Pf% of 81%, even though Malaria was considered to be nonendemic there. Das R et al (2004) in their study (1990-1999); also reported the mean SPR of 32.1% which was also much higher than the all India figure of 2.93% for the first half of the decade.

During the period of study, the ABER ranged from 12.94% to 14.44% which was more than recommended national guidelines of 10% and above as well as the National average of 11.04 (2016) [15]. During the period of study there were only 02 deaths in Dakshin Kannada during 2014, while there were no cases of death during the year 2012, 2013, 2015 and 2016.

### Limitations

Present study has the limitations that are inherent to any record-based study. The actual burden of

Malaria in Dakshin Kannada could even be much more; as likelihood of non reporting of many cases of malaria by private sector in Dakshin Kannada cannot be ruled .

### Conclusion

Karnataka contributes only a small proportion i.e. 1.01% (2016) to the national burden of malaria, while most of these cases are only from two districts i.e. Dakshin Kannada and Udupi. The study reveals a significant decline in all Talukas in Dakshin Kannada, except in Mangalore where Malaria burden continues to be still a major health issue and a cause of concern. Integrated management of vectors in Mangaluru remains an underdeveloped component of malaria control policy. A multidisciplinary approach with sound public health policies that provide a favourable setting for community participation are crucial for malaria control. Importantly, the research will continue to play a key role in further improving the methods of surveillance, prevention and control. Needless to say, that with existing understanding of vector bionomics and availability of its multiple control options; the goal to eliminate malaria fever as a public health problem from Dakshin Kannada is achievable.

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*Conflicts of Interest:* There are no conflicts of interest.

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