



Research Article

An Epidemiological Study to Assess the Environmental and Socio-Cultural Determinants of Malaria in Coastal Karnataka

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A B S T R A C T

Background: India has grappled with the problem of malaria since many decades. Moreover, Udupi district contributes 13% of malaria cases to Karnataka making it a significant public health concern.

Objectives: To explore the socio-cultural and environmental factors that affect malaria incidence in Udupi.

Methods: Areas with high annual incidence of malaria in Udupi city were selected for the study. A validated structured questionnaire was used for data collection. Study findings were expressed in frequencies and percentages.

Results: Out of 315 households, 79.7% belonged to urban areas with 30.1% being graduates and above. In 14% of households, there was a malaria case in the past one year. The respondents were assessed for belief surrounding malaria and most of the respondents (80.3%) agreed that malaria is a severe disease that needs treatment. On assessing for treatment seeking behaviour, the majority of the respondents preferred private clinics (58.7%). On probing for prevention practices, most respondents (89.8%) preferred indoor residuals spraying. Only 31% of the respondents were found to be using bed nets at night. Almost 8.9% of the houses had completely uncovered windows thus facilitating the entry of mosquito indoors. Majority of the respondents were found to have open wells in close proximity to their homes (71.4%).

Conclusion: It was found that despite having adequate knowledge regarding, malaria people do not adhere to the prevention strategies. The socio-cultural, housing and environmental factors were found to favour mosquito breeding and biting with potentiality of malaria transmission.

Keywords: Behaviour, Environmental, Housing, India, Malaria, Socio-Cultural



Introduction

Malaria is a disease of major health concern in most parts of India today.¹ Mangalore district in coastal Karnataka has been a hotspot of malaria since the last decade.² About 2 million confirmed malaria cases and 1,000 deaths are reported annually. India contributes 77% of the total malaria in Southeast Asia.³ In the year 2014, there were 3.8 Lakh confirmed cases of malaria according to National vector borne disease control program records.⁴ Out of total 12,464 cases reported during 2015, 52% of the cases are from Dakshina Kannada and 12% is from Udupi. At present only 2 districts viz., Dakshina Kannada and Udupi are showing more than 1 API. During 2015, contribution of these two urban areas is 64%.⁵ According to the 2016 annual report of World Health Organization, there were 2.14 million confirmed cases of Plasmodium vivax globally, 18% of which had occurred in India.³

Karnataka records over 70% Plasmodium vivax malaria among its annual malaria burden whereas, in Udupi, P. vivax solely contributes about 90% to its annual malaria burden.⁶ The proximity of Udupi to such a high endemic area makes it vulnerable for malaria transmission. Moreover, the presence of favourable environmental factors aggravates the growth of parasite as well as mosquito. Environmental factors such as temperature, relative humidity and their daily variation influence a range of mosquito life history traits and hence, malaria transmission.⁷ While temperature can influence the vector competence of mosquitoes directly, for example by affecting the longevity of the mosquito and the development of the malaria parasite, it may also have an indirect impact on the parasite's transmission. By influencing larval development, they may affect the adult traits that are important for the parasite's development and transmission.⁷

According to District Vector Borne Disease Control Officer (DVBDCO), Udupi district, there were 561 cases of malaria diagnosed across Udupi district in the year 2014 which is an alarming number. Despite many preventive activities carried out by the DVBDCO at Udupi, the trend of malaria incidence has been on the rise.

There have been many studies done on risk factors of malaria in the past but there is not much research available on housing and socio-cultural factors associated with Malaria. Understanding the social, cultural, behavioural and environmental characteristics of malaria in Udupi thus becomes important. There has been a substantial increase in the population of cities owing to urbanization. Inadequate living spaces within the cities make the environment conducive for mosquito growth. Poor waste water management within cities also leads to mosquito growth.⁸⁻¹¹ Increase in use of Insecticide treated bed nets (ITNs) has always been the focus of the government in

India. But this must be coupled with emphasizing on the need of better housing structures to reduce the entry of mosquitoes inside the households as well.⁸ In addition to this, administering proper timely awareness about the disease to bring about behavioural change in the population is also important.¹²

The Annual Parasite Index (API) in India has reduced from 3.29 in 1990 to 0.89 in 2014 as a result of constant efforts of NVBDCP.¹³ Passive surveillance has been carried out in PHC's, CHCs, Malaria clinics etc. Activities carried out by ASHAs at village level include diagnostic and treatment services such as Rapid Diagnostic tests and usage of Artemisinin Combination Therapy (ACT) for the treatment of P. falciparum cases¹⁴ and chloroquine (CQ) for the treatment of P. vivax cases.¹⁵ According to the World Malaria Report 2014, 22% of India's population lives in high transmission (>1 case per 1000 population) areas, 67% live in low transmission (0–1 cases per 1000 population) areas and 11% live in malaria-free (0 case) areas.¹⁴ Recent trends of malaria in India, available at NVBDCP indicate 0.7-1.6 million confirmed cases and 400-1,000 deaths on a yearly basis.¹⁵⁻¹⁷ Studies in other parts of the globe emphasize the importance of understanding socio-cultural determinants of malaria. The present study was undertaken to explore the relationship of socio cultural, environmental and preventive characteristics of the local community with the risk of malaria. The results of this work may be useful for health departments to frame their policies and plans in the future.

Materials and Methods

A community based cross sectional study was conducted between January to July 2016 in Udupi city. Prior approval was obtained from institutional ethics committee constituted by Kasturba Medical College, Manipal. Udupi is characterised by a tropical climate with significant rainfall in most months of the year. Average annual precipitation is about 4360 mm with annual average temperature being 27.2 degrees. Relative humidity here is conducive for mosquito growth, survival and longevity. The major factor that favoured increased incidence of malaria in the year 2014 may be attributed to scanty and discontinuous rains thereby leading to more breeding sites.¹⁸ Rainfall plays a crucial role in malaria epidemiology because it provides the medium for the aquatic stages of the mosquito life cycle. Studies report that moderate rainfall favoured malaria incidence. Rain may prove beneficial to mosquito breeding if moderate, but if excessive it may flush out the mosquito larvae. Rainfall creates breeding sites. The relative humidity augments parasitic development and disease propagation. A higher level of rainfall conversely washes away breeding sites, thus, decreasing incidence of the disease.^{19,20}

Data Collection

Complete line listing of malaria cases of the year 2014 was

obtained on request from the Department of Health, Udupi District. Based on this list, nine most prominent areas of high malaria incidence were selected. The nine selected areas were Nittur, Doddanagudde, Ambagilu, Ajjarkadu, Ambalpady, KM Marg, Beedinagudde, Rathabeedi and Kallianpura communities.

The study population included people residing in these communities. The study tool included a validated structured questionnaire that covered questions on the socio demographic, socio cultural, environmental and housing determinants of malaria. Ethical clearance was obtained from the institutional ethics committee of a tertiary health center and informed consent was obtained from each of the respondents.

Sample Size Calculation

The sample size was calculated to be 384. In each of the nine high risk areas, households were selected using the stratified random sampling technique. Households were included keeping in view that equal representation is obtained from slums, individual houses and flats. People of all education levels, socio economic status and age are thus represented in the study.

Result

Table 1. Socio-demographic characteristics

Variables	Frequency (n=315)	Percentage (%)
Area of residence		
Urban	251	79.7
Peri urban	64	20.3
Educational status		
Upto primary school	120	38.1
Middle to high school	100	31.7
Graduate and above	95	30.1
Occupation		
Unemployed	42	13.3
Skilled	72	22.8
Shopkeeper/owner/clerical	91	28.9
Profession	110	34.9
Resident of this area		
Less than 15 years	190	60.3
16-29 years	55	17.5
30 and more years	70	22.2

Table 1, shows the socio demographic characteristics of study sample. Majority of respondents lived in urban areas (79.7%) as compared to those in peri urban areas (20.3%). Less than one third of the respondents had completed

graduation and higher studies (30.1%). There were comparatively lesser respondents who were unemployed (13.3%) as compared to skilled (22.8%), self-employed (28.9%) and professional respondents (34.9%).

Table 2, shows the socio-cultural characteristics of the study sample. A vast majority of the respondents (80.3%) believed that malaria is a severe disease which demands prompt treatment. On assessing for treatment-seeking behaviour, there were more respondents who preferred to visit private clinics for malaria (58.7%) as compared to those respondents who preferred government health facilities (41.3%). Almost every respondent (97.2%) denied having used any form of home remedy as treatment for malaria whereas a small proportion of them (4.1%) stated that they had used indigenous/ traditional forms of malaria treatment. Use of indoor residual spraying for malaria control was found to be significantly high (89.8%) in the community.

Table 2. Socio-cultural characteristics of the participants

Variables	Frequency (n=315)	Percentage (%)
Malaria diagnosed since past one year		
Yes	44	14
No	271	86
Malaria is a severe disease that needs treatment		
Yes	253	80.3
No	62	19.7
Usage of home remedies for treating malaria		
Yes	7	2.2
No	308	97.8
Preference for malaria checkup		
Government	130	41.3
Private	185	58.7
Indigenous form of medicine/ traditional healer		
Yes	13	4.1
No	302	95.9
Indoor residual spraying		
Yes	283	89.8
No	32	10.2

Table 3, shows the environmental and housing characteristics of the study sample. Almost half of the respondents lived in concrete houses (45.7%) while one tenth of the respondents lived in thatched huts (10.1%). Among the respondents, most of the houses had fully screened windows (64.1%)

while a few households had completely uncovered windows (8.9%). Very few respondents had uncontrolled vegetation within 2-5 metres from their housing premises (3.8%). A vast majority of the households had open wells which were uncovered (71.4%).

Table 3. Environmental and housing characteristics of the participants

Variable	Frequency (n=315)	Percentage (%)
Roof type		
Concrete	144	45.7
Asbestos	138	43.8
Thatched	33	10.5
Windows		
Complete uncovered	28	8.9
Partially screened	85	27
Fully screened	202	64.1
Do you have a well?		
Yes	129	41
No	186	59
Do you cover the well?		
Yes	90	28.6
No	225	71.4
Do you have uncontrolled vegetation in your house?		
Yes	12	3.8
No	303	94.7

Table 4. Preventive methods practiced by participants

Variables	Frequency (n=315)	Percentage (%)
Usage of mosquito control measures		
Yes	210	66.7
No	105	33.3
Usage of bed nets during sleep		
Yes	99	31.4
No	216	68.6

Table 4, shows the preventive measures adopted by the study sample. Only 31.4% of the respondents were using bed nets during sleep. However, a significant percentage (66.7%) of the respondents agreed to have used some form of mosquito control measure such as mosquito repellent creams or mosquito repellent coils during sleep.

Discussion

The present study was conducted to assess the environmental and socio-cultural determinants of malaria

in urban and peri urban parts of Udupi city, Karnataka. It was found in the study that the educational status of respondents was not significantly associated with the occurrence of Malaria. Fungladda W et al.²¹ and Butraporn P et al.²² also reported similar findings in their respective studies from South East Asia.

A majority of respondents (80.3%) agreed that malaria is a severe disease that needs treatment. Yadav SP et al.²³ reported in his study that 54.2% of the respondents agreed that malaria can be a fatal disease if left untreated. In the present study, 89.8% of the study participants allowed indoor residual spray in their homes. A study conducted by Oghalu et al.²⁴ in Nigeria stated that 59.9% of the study respondents used insecticides for indoor residual spraying. The rest of the respondents did not prefer the use of insecticides due to the bad smell and fear of poisoning.

Among the study sample, 64.1% of the respondents had fully screened windows as they believed that keeping windows screened reduced malaria risk. Similar findings have been reported by Yadav SP et al.²³ in the study conducted in Rajasthan, India. From the present study, it was found that only 31.4% of the respondents used bed nets for sleeping at night. A study by Yadav SP et al.²³ conducted in Rajasthan, India also revealed that the bed net usage was 21.1% among the community. This indicated that though 66.7% of the respondents reported using some methods to prevent malaria, all were not found to use Insecticide Treated Nets (ITNs) during sleep. The use of some forms of preventive methods have been observed in a study in Dakshina Kannada by Salunkhe et al.²⁵ while the use of ITNs were less used as observed in studies conducted by other researchers.^{26,12} The problem in using ITNs can be attributed to their housing conditions. Most of the slums and houses with thatched roofs do not have a ceiling/ table fan without which it becomes difficult to sleep inside an (to deleted) ITN. Seidlein V et al.²⁷ in their study indicated that poor compliance and usage of bed nets in the tropical zones is attributed to poor airflow and heat discomfort which is caused by ITNs. Similar observations have been put forth in a study by Pulford J et al.²⁸

It was also noted during the study that 41% of the study participants had wells in the immediate vicinity of their homes out of which 28.6% were covered. This was again not according to the basic standards. The wells were used only during the summers and mostly covered with a thick iron mesh, and thus the purpose of covering the wells in such a way was not protection from mosquitoes. The study participants lacked knowledge in this regard.

In the present study, 2.2% of the study participants agreed that they use certain home remedies whereas 4.1% of the study participants agreed upon the usage of indigenous forms of medicine/ traditional healer for treating malaria.

Similar findings have been reported by Jombo GTA et al.²⁹ in a study conducted among residents of malaria endemic area in West Africa where 10.7% of their study participants preferred the use of traditional herbs for treating malaria.

Many patients resorted to private practitioners for diagnosing malaria, thereby leading to inadequacy and inaccuracy in government records. This may lead to under reporting.

The reason for an increased number of malaria hotspots within Udupi city may also be attributed to the construction of new buildings for residential complexes and commercial complexes. This is an observation as there is rapid urbanization in the study area. A study conducted by Kamath R et al.³⁰ found that factors such as rapid urbanisation, increased construction activities and influx of migratory workers are leading cause for the advent of malaria in Manipal which is an area abutting the present study setting. In 2010, out of 136 cases, 110 (80.88%) were reported from construction sites and only 26 (19.12%) cases reported from other sites. In 2011, out of 186 cases, 170 (91.4%) were reported from construction sites and only 16 (8.6%) cases reported from other sites.

Conclusion

There is a need of behavioural change among the community towards perceiving malaria as a major problem. Ignoring the risk of malaria despite adequate knowledge in this sample was observed that could have contributed to high incidence in the past years. Community participation is key in augmenting the efforts towards reducing the incidence of malaria. In order to gain an insight into sociocultural barriers toward uptake of prevention measures for malaria.

Recommendation

The disease must be understood in all its nuances in the local context. Awareness and reinforcement of preventive measures need to be emphasized in this setting. Enhancing health-worker and community members' engagement and ownership may help strengthen efforts towards this end. Future directions would include conducting in-depth interviews with local residents including susceptible populations such as migrant labourers on the barriers to prevention and designing interventions that are need-based and fit the local context.

Conflict of Interest: None

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