A household survey to assess prevalence of malaria and risk factors under urban field practice area, Dakshin Kannada

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Received: 26 September 2018
Accepted: 29 October 2018

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INTRODUCTION

Mosquitoes are insects of public health importance because it causes many deaths every year due to a wide range of parasitic diseases. These include malaria, chikungunya, dengue and Japanese encephalitis. Among these vector borne diseases, malaria contributes a significant chapter in the archives of biological parasitism.\textsuperscript{1} For the past 80 years, human malaria has been known to be caused by four plasmodium species-\textit{Plasmodium falciparum}, \textit{Plasmodium malariae}, \textit{Plasmodium ovale} and \textit{Plasmodium vivax}. Out of these, \textit{P.falciparum} being responsible for the most severe cases. Recently a fifth Plasmodium species has been recognized as the cause of malaria in humans. The newcomer is \textit{Plasmodium knowlesi}, which was formally known to cause malaria in macaques.\textsuperscript{2} Malaria is transmitted by...
female anopheline mosquitoes poses a diagnostic challenge to medical community worldwide.3

According to the World malaria report 2015, estimates 212 million cases of malaria occurred globally with about 4,29,000 deaths. Malaria was considered to be endemic in 91 countries and territories in 2016.4 In India, the burden and the risk of malaria is enormous and it is a major health concern. The country has the 3rd highest number of cases in the World and accounts for the highest malaria burden of 70% in WHO SEAR in 2015.5 According to the data source from the Directorate of NVBDCP the number of positive cases in Karnataka was reported 9356 cases till October 2016, out of which 70% are from Dakshina Kannada and Udupi Districts.6 Malaria mostly affects children under the age of 5 yrs and pregnant women in developing countries.7 Pregnant women are more vulnerable because they experience depressed immunity during pregnancy.8 Similar problem arises with children below the age of 5 yrs as their immunity system are not yet fully developed.9

Malaria transmission varies across climatic seasons, ecological zones, neighboring villages and even between neighboring households.10 Households in close proximity to breeding sites have higher mosquito densities and are at increased risk of transmission, usually following a seasonal pattern.11 Mangaluru is 22 meters above sea level and its climatic conditions favors vector borne diseases. The rapid rise in development work and stagnant water at construction sites in urban area have also led to the rise in incidence of malaria.6 Urban malaria control have become a challenge due to the lack of inter-sectoral coordination, poor planning, mosquito control is usually practiced rather than species sanitation, acute water storage and erratic water supply in highly dense areas, water storage in a variety of containers, inadequate man power to tackle vector control operation and parasite surveillance, empirical and incomplete treatment.12 Therefore the present study was aimed to assess the various socio-demographic and environmental factors associated with malaria prevalence among residents of urban field practice area.

METHODS

A base line survey was conducted to obtain demographic details among residents of Lingappayakadu, of urban field practice area under the Department of Community Medicine Srinivas Institute of Medical Sciences and Research Centre, Mangalore between July to September 2017. This peri-urban locality is 7 kilometers away from medical institute.

A community based survey was conducted with the help of health workers and Interns. All families were included under field practice area in the study sample. Total 1043 families were participated under study. The ethical clearance was obtained from the Medical Ethics Committee. The participants under survey were explained about purpose of study and informed written consents were taken. The survey was done similar to the fortnightly surveillance. Blood was collected for rapid diagnostic testing and a thin and thick blood smear was prepared for everyone who had fever during the survey or gave a history of fever in last 15 days. Results were confirmed within 24 hours from institutional laboratory and anti-malarial drugs including the Primiaquine (as per the guidelines of NVBCP) were given to all the positive cases.13 Malaria positive case confirmation was done by reports regarding smear positive malaria cases.

Study was further expanded by analysis of population residing at urban field practice area on a semi structured, self-designed, oral, interview based questionnaire to elicit the socio-demographic, environmental and health seeking behavior profile regarding prevalence of malaria. The questionnaire was interviewed in vernacular (Kannada, Tulu) language. The data was entered and tabulated in Microsoft excel. The statistical test was done by using SPSS, version 20 data analysis system.

RESULTS

Total 4954 people from 1043 households were included, out of which 41 (3.93%) households were reported to have malaria. Among participants total number of fever cases was 137 (2.76%) and out of which 70 cases were diagnosed as Malaria. The prevalence of malaria in the study was found to 1.41%. The slide positivity was 51.09%.There was significant effect on number of members present in the family (p=0.00001, X²=199.37), age group (p=0.0168, X²=8.17) type of working status (p=0.0293, X²=7.06). However it was observed that there was no significant difference between gender distribution (p=0.9203, X²=7.06) (Table 1).

The influence of particular characteristics of households was analyzed on the presence or absence of malaria cases in the households and risk was calculated. It was found that there was significant difference between number of members present in the family (p=0.00001, OR=19.2525), presence of ANC (p=0.0001, OR=0.0023)
and socioeconomic status (p=0.0001, OR=0.9939) residing in malarious or non malarious household. There was no statistical significant difference amongst children under 5 age group (p=0.0942, OR=0.05600) staying in particular type of household. Under environmental conditions, environmental factors like type of housing (p=0.3366, OR=1.3854), peri-domestic sanitation (P=0.1646, OR=0.554), Mosquito breeding (p=0.4504, OR=0.6757), indoor mosquitoes (p=1.000, OR=0.6173) and mosquito bite prevention methods were (p=0.1910, OR=1.7316) not shown any statistically significant difference. It was found that 48.8% of malarious households staying in katcha-pucca type house. About 80.5% malarious housing was having poor peri-domestic sanitation. Whereas 97.6% and 82.9% malarious households had mosquito breeding at near surroundings and Indoor mosquitoes respectively. There were 9.8% malarious and 15.7% non-malarious households not using any type of prevention methods.

Table 1: Distribution of demographic attributes of study population.

| Characteristics | Total number of surveyed population (n=4954) |
|-----------------|---------------------------------------------|
| Demographic features | Number of surveyed population positive for the attributes n=4954 | Number of malaria patients positive for the attributes n=70 | Number of non malaria patients positive for the attributes n=4884 | P(x²) |
| Members | N (%) | N (%) | N (%) |
| 1 to 3 members | 775 | 6 (0.77) | 769 (99.26) | 0.00001 (199.37)* |
| 4 to 7 members | 247 | 53 (21.45) | 194 (78.55) |
| >7 members | 21 | 11 (52) | 10 (48) |
| Under 5 | 0-5yrs | 357 | 9 (2.5) | 348 (97.5) | 0.01689 (8.17)* |
| 6-25yrs | 785 | 17 (2.2) | 768 (97.8) |
| >25 yrs | 3812 | 44 (1.2) | 3768 (98.8) |
| Gender | Male | 2750 | 39 (1.41%) | 2711 (98.58%) | 0.9203 (0.01) |
| Female | 2204 | 31 (1.40%) | 2173 (98.59%) |
| Working | Outdoor occupation | 3101 | 40 | 3061 |
| Indoor occupation | 883 | 8 | 875 | 0.0293 (7.06)* |
| Not working | 970 | 22 | 948 |

*P<0.05

Table 2: Distribution of demographic and environmental characteristics among surveyed households.

| Characteristics | Total number of surveyed house-holds (n=1043) | Number of malaria house-holds (n=41) | Number of non-malaria house-holds (n=1002) |
|-----------------|---------------------------------------------|--------------------------------------|---------------------------------------------|
| Demographic feauters | N % | N % | N % |
| Members | 1 to 3 | 775 | 74.3 | 6 | 0.77 | 769 | 99.25 | 0.00001* | 19.2525 (7.9987-46.3396) |
| >3 | 268 | 25.7 | 35 | 13.05 | 233 | 86.94 |
| Under 5 | Not present | 651 | 62.4 | 20 | 48.8 | 631 | 63 | 0.0942 | 0.5600 (0.29951.0468) |
| 0-5 yrs | 392 | 37.6 | 21 | 51.2 | 371 | 37 |
| Anc | No ANC | 1005 | 96.3 | 10 | 24.4 | 995 | 99.3 | 0.0001* | 0.0023 (0.0008-0.0064) |
| ANC | 38 | 3.7 | 31 | 75.6 | 7 | 0.7 |
| Socioeconomic status (modified BG Prasad’s classification) | Class I and II | 356 | 34.1 | 2 | 4.9 | 354 | 35.3 | 0.0001* | 0.0939 (0.0225-0.3911) |
| Class III, IV & V | 687 | 65.9 | 39 | 95.1 | 648 | 64.7 |
| Environment | Type housing | Pucca | 453 | 43.4 | 21 | 51.2 | 432 | 43.1 | 0.3366 | 1.3854 (0.7415-2.5883) |
| Kutcha –pucca | 590 | 56.6 | 20 | 48.8 | 570 | 56.9 |

Continued.
There were total 137 cases of fever were found during survey out of which 70 cases were diagnosed with malaria. Maximum number of malarial cases (62.9%) was found in >25 year age group. Distribution fever Cases (male=55.5%, females=44.5%) and malaria cases (males=55.7%, females=44.3%) found slightly more amongst males compared to females. Also it was found that number of malaria cases were more amongst illiterate and educated upto primary level (52.9%) compared to literate (47.1%). It was found that maximum number of
malaria cases were treated from government hospital (57.1%). Furthermore 12.9% and 27.1% malarious cases had taken treatment from private clinic and private hospital respectively. There were 95.71% malarial cases taken oral anti-malarial and injectable drugs whereas 46.7% fever cases taken treatment of oral anti-malarial drugs. Among malarial cases 94.3% completed treatment.

**DISCUSSION**

The study was conducted for analysis of prevalence of malaria and associated factors. Urban malaria is a major problem in Karnataka and the coastal city, Mangalore, accounted for 57% of malaria cases in 2014 compared with only 3% in 2002. Total number of members present in the family, age group, type of working status showed significant difference but there was no significant difference related with gender. A similar study conducted by Thomas et al. showed age group and gender was analyzed, it did not show any significant association with malaria. However, presence of malaria was found to be significantly associated with occupation/vocation. Malaria infection was found to be more with increase in number (>3) of household members. Similar results were also observed in studies from Madhya Pradesh, India.

Further demographic and environmental factors were analyzed to find influence of type of households and its significance. It was found that there was significant association with socioeconomic status and presence of ANC in malarious or non malarious type of household. Poverty was associated with malaria occurrence in the study population. Many studies have regarded malaria as a disease of the poor, which is substantiated by the fact that the malaria burden is often concentrated in the poorest continents and countries. Pregnant women are 3 times more likely to suffer from severe disease as a result of malarial infection compared with their non-pregnant counterparts, and have a mortality rate from severe disease that approaches 50%.

Environmental factors like type of housing, peri-domestic sanitation, mosquito breeding or presence of mosquitoes indoor not having statistically significant difference.

Improved housing as a malaria intervention may be complementary to the processes of urbanization and economic development ongoing in Sub Saharan Africa. However, this observation should not be universally generalized since urban slums can contain dense housing of poor quality, with poor drainage and environmental management, enabling malaria vectors to proliferate. The presence of any breeding habitat did not significantly associate with the malaria of a particular household as seen in Thomas et al study. The methods used for prevention of mosquito bites like repellants, coils, mosquito bed nets did not show any statistically significant result. In another study conducted in Ghana showed the application of mosquito coils did not reduce the incidence of malaria. Though maximum number of malaria cases was treated from government hospital still some of the malaria cases did not take anti-malarial treatment or completed the anti-malarial treatment course because of lack of knowledge. Poor public awareness about drug resistance and its prevention and also reported substantial proportion of self-medication. Improving general awareness about drug resistance and its prevention might lead to improved compliance to therapy. Thus, health education campaigns must be tailored to plug the gaps around causes and prevention of drug resistance in order to prevent the emergence and spread of resistance.

To conclude, the survey could provide data regarding socio-demographic characteristics under malaria prone urban endemic setup. Furthermore study did not show any significance of association with many environmental parameters may be because of other confounding factors like structural details of housing as well as knowledge regarding use of anti-vector measures. Knowledge regarding health seeking behavior could be improved with frequent surveillance to start correct and complete treatment with appropriate diagnostic methods as well as to prevent anti-malarial drug resistance.

Limitations of the study are that the proportion of malaria cases under urban study area did not represent the actual prevalence of malaria and represent the urban setup in Dakshin Kannada. Another limitation is the potential for recall bias, which is always a possibility when relying on self-report.

**ACKNOWLEDGEMENTS**

We thank the health care assistants for their assistance for collecting blood samples lab diagnostic methods. We acknowledge Health Inspector Mr. Mathen and interns (Dr. Kartik Chandra, Dr. Aishwarya H, Dr. Shwetha Ural, Dr. Srikala, Dr. Leo P, Dr. Steve R, Dr. Sivliya, Dr. Shilpa) posted under department of community medicine SIMS & RC for consenting the participants, conducting the interviews and distributing the malaria medication.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Salunkhe L, Gupta A, Hameed S. A household survey to assess prevalence of malaria and risk factors under urban field practice area, Dakshin Kannada. Int J Community Med Public Health 2019;6:223-8.