



SOCIOECONOMIC AND ENVIRONMENTAL DETERMINANTS OF MALARIA



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R. BHATTACHARYA¹, R. BANIK¹, P. BARMAN¹,
G. BISWAS¹, A. BHATTACHARYA²



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1. Department of Environmental Science, University of Kalyani, Kalyani.
2. M.G.M. Medical Collage, Kishanganj.

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Corresponding Author

Dr. R. Bhattacharya

Abstract

Malaria and other mosquito borne diseases impose health problem particularly in Tropics. Transmission of malaria depends on both climate and socioeconomic variables. Our study is a survey among the population of Chitpur and Bagbazar of Kolkata Municipal Corporation (KMC), West Bengal. Blood slide positive rate of the areas under investigation is found to be 26.75%. Whereas SPR of KMC area is about 27%. It is observed that 25.71% malaria infected patients belong to BPL. Males are found more prone to malaria infection in the survey region. Odd ratio (OR) ranges from 1.011 to 1.565 depending on the locality coverage. The study again reflects that 84.28% are infected by *P. vivax*. Hence socioeconomic factors play important role to malaria spread. Moreover rigorous researches on drug treatment are needed to control *P. vivax* transmission.

INTRODUCTION

Malaria is a growing public health problem in tropical countries as a result of enhanced transmission rate. Transmission of malaria is affected by regional climate because both parasites and vectors are sensitive to ambient temperature, relative humidity, diurnal temperature range, sunshine hours, precipitation and air flow. The probability of transmission of malaria in the regions having similar climate should be equal. But both positive and negative feedbacks were reported by different investigators¹⁻¹⁰. So it seems that in addition to climate, socioeconomic factors and environmental conditions of the residential areas are responsible for the spreading of malaria in a locality. Malaria is usually confined to tropical countries having humid climate. About 300-500 million populations are affected by malaria over globe each year. Most of the incidences are caused by *Plasmodium falciparum* and *Plasmodium vivax*¹¹⁻¹³.

India is a developing country with diversity of climate, culture and population. Approximately 30% of the population lives under BPL (Below Poverty Line). Fig 1 shows

the contribution of different states to malaria in India. Most of the districts of Eastern states are malaria prone. Proportion of *P. falciparum* and *P. vivax* incidences are equal over India but the proportion varies in different regions of India. It is also observed that highest contribution comes from Orissa. West Bengal ranked three in the list. According to WHO¹⁴, India has 1.5 million incidences with 19,500 mortality per year^{15, 16}. However, Govt. of India has reported lower number of incidences in comparison with WHO report^{17, 18}. In India mortality is higher in males than females with female: male ratio of 1:1.71. Total DAYS lost from malaria is about 1.86 million years and economic loss ~ 1 billion USD^{19, 20}.

Fig 2 shows the distribution of API (Annual Parasite Incidence *i.e.*, malaria cases/1000 population) over India (www.nvbdc.gov.in) for the year 2010 ranges from <0.1 to > 10 whereas in West Bengal API >10 in Kolkata as shown in Fig 3. In West Bengal Kolkata Municipal Corporation (KMC), Jalpaiguri, Murshidabad, Purulia and Midnapore (W) have about 74%, 4%, 3.5%, 3.5% and 2.7% of incidences per year respectively. It is

interesting to observe that the two adjacent districts of Kolkata Municipal Corporation (KMC) viz. North 24 Parganas and South 24 Parganas have only 1.5% incidences, indicating the role socioeconomic conditions to transmit malaria along with other factors.

Economic conditions may be one of the indirect causes of malaria. Metropolitan cities are always associated with slum areas. In KMC area, malaria is a real burden and control of the disease is very difficult. Our study is aimed to analyze the socioeconomic factors associated with malaria infection.

METHODOLOGY

KMC has 141 wards in fifteen boroughs. 5500 slums are situated in KMC area which accounts one third of residential population. The present study is carried out in Bagbazar and Chitpur area of KMC. Two hundred and sixty households are selected from the high dense localities of ward 2, 6 and 7 and mass survey is undertaken. Questionnaire is designed to reflect the objective of the study. The questionnaire is prepared in English but communicated in Hindi /Bengali. The head of the household who was present with the patient at the

time of survey are interviewed. The survey includes the demographic characteristics, socioeconomic structure and health practices of the subjects. The surrounding environment and sanitation of the living areas are also noted. The survey is usually carried from 09:00 hrs. to 16:00 hrs. during March 2010 to September 2012. Information regarding total blood examined, number of infected patients are obtained from health records of Chitpur and Bagbazar Health Clinics of KMC. Patients from ward 2, 6 and 7 are usually come to these clinics with fever for blood tests to diagnosis of malaria.

RESULTS AND DISCUSSION

Table 1 represents the demographic structure of the participants. 64.80% of the surveyed population belongs to working group i.e. age varying from 20 yrs to 60 yrs. 34.4% have primary education though only 4% are illiterate. Most of them are engaged in different types of work like hawkerring, pulling rickshaw, shoe repairing and polishing, labour etc. Socioeconomic conditions viz. income in rupees per month, house type, house hold size, number of rooms etc of the population of Chitpur (CHIT) and Bagbazar (BAGB) are reflected in

Table 2. They live in poor quality houses made with either mud or brick without any plan. 2% have no shelter except footpath. House hold size of the majority (70%) is more than three. 8% have children greater than three. 63.07% have monthly income in between Rs. 4000/- to Rs. 5000/-. 34% of surveyed population has ill health (Table 3). Slide positive rate among the subjects of Bagbazar and Chitpur are respectively 31.11% and 22.4%. Distribution of malaria among different age group and sex is shown in Table 4. Data clearly shows that among the infants, malaria cases are only 28.57%. Out of total 70 patients about 25.71% belonged to BPL (Below Poverty Line) are residents of Ghosh bagan basti and Rail coloney basti in Chitpur and Galif street basti, Kumortuli and 3 No. Bus stand basti in Bagbazar. These habitations are poorly built without toilet and surrounded by open drain. All most 80% population live near open drain and stagnant water logged and therefore have ample pockets of mosquito breeding as shown in Fig 4 and Fig 5.

Poor economic conditions are responsible for their ill health. Only 8% and 16.3% in Chitpur and Bagbazar slum areas use

mosquito nets. On account of poverty they cannot afford mosquito coils or liquids as a preventive measure. Table 5 gives the relative risk factor of malaria infection between males and females. Males are more prone to malaria infection. The relative risk factor varies from 1.343 to 1.565.

Fig 6 shows the scenario of SPR and *P.vivax* infected malaria cases in India, West Bengal, KMC, Bagbazar and Chitpur. It is noted that both Bagbazar and Chitpur are malaria prone area. All over India malaria infection by *P.falciparum* and *P.vivax* are nearly equal. But in West Bengal, *P.vivax* cases dominant malaria infection though *P.vivax* and *P.falciparum* are the most prevalent species that infected human. The clinical features of *P.vivax* and *P.falciparum* are depicted in Table 6²¹⁻²⁴. Control of *P.vivax* is different due to the fact that responses of *P.vivax* to antimalarials differ from *P.falciparum*. Fig 7 shows the antimalaria action to parasite life cycle. Moreover the behavior and biology of vectors and parasites is not crystal clear²⁵. Chloroquine is still in use to eliminate *P.vivax* blood stages²⁶.

CONCLUSIONS

From the survey, it may be concluded that socioeconomic factors play key role to malaria transmission in addition to climatic change. It is also reported earlier by several investigations²⁷⁻²⁹. Economic problems cannot be solved immediately but distribution of mosquito coils, habit of mosquito net use, improvement of sanitations, drainage pattern, spraying of insecticides, awareness of health practices and campaign by Government or NGO's may help to minimize the hazards³⁰. In

addition to control *P.vivax* transmission more researches on drug treatment and monitoring are needed.

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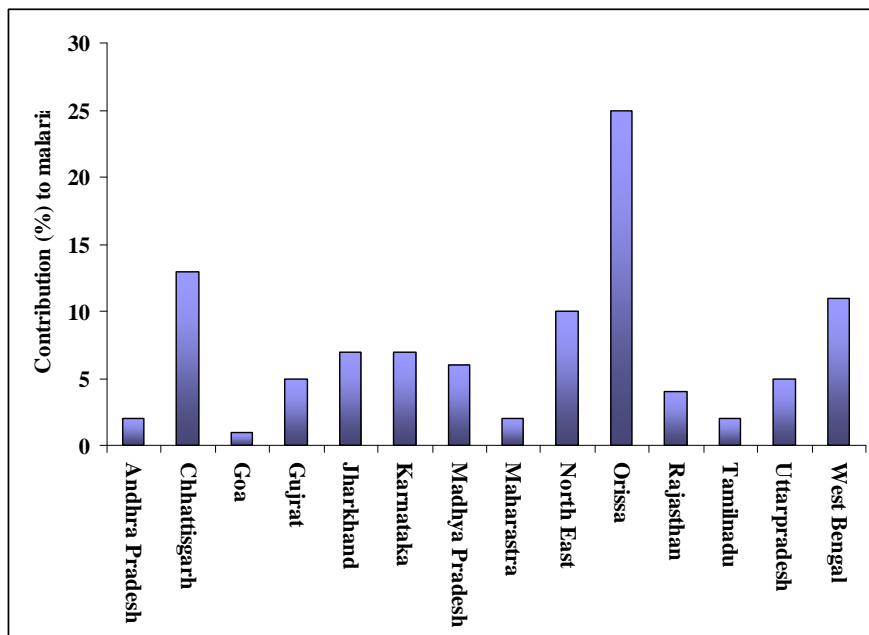


Figure 1 Contribution of different states in malaria

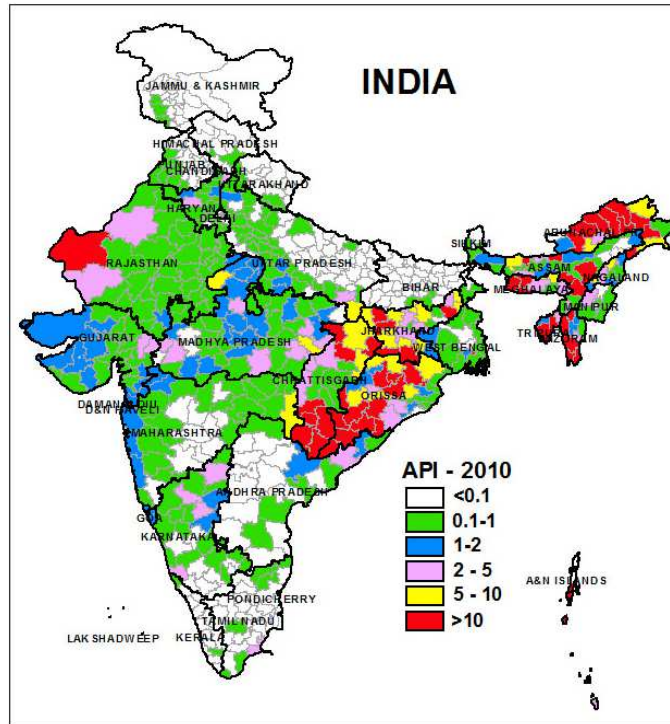


Figure 2 Distribution of API over India

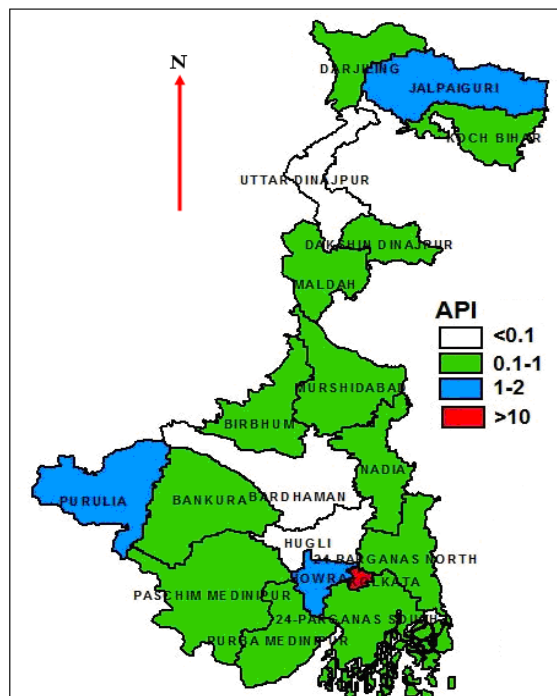


Figure 3 Distribution of API over West Bengal



Figure 4 Breeding place of mosquito, Bagbazar



Figure 5 Mosquito Larva at Ghosh Bagan, Chitpur

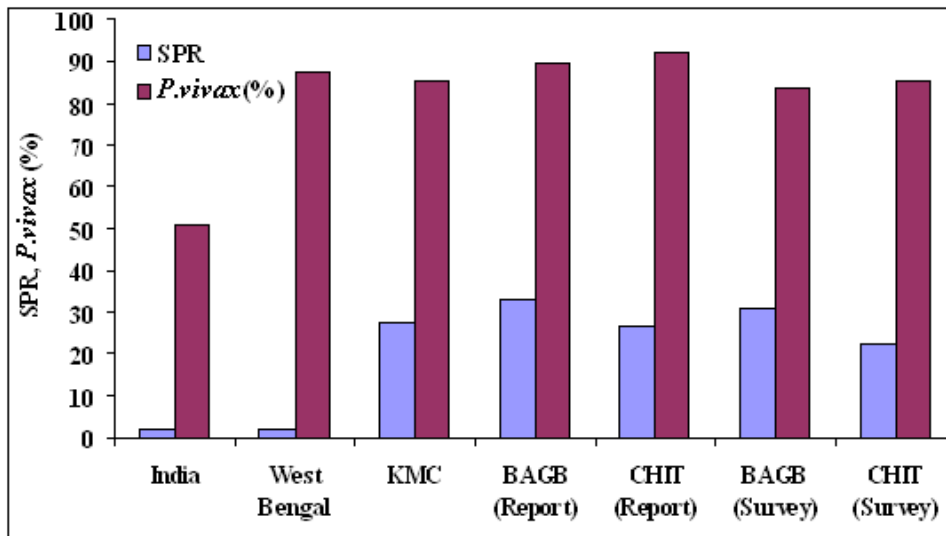


Figure 6 Comparison of malaria cases

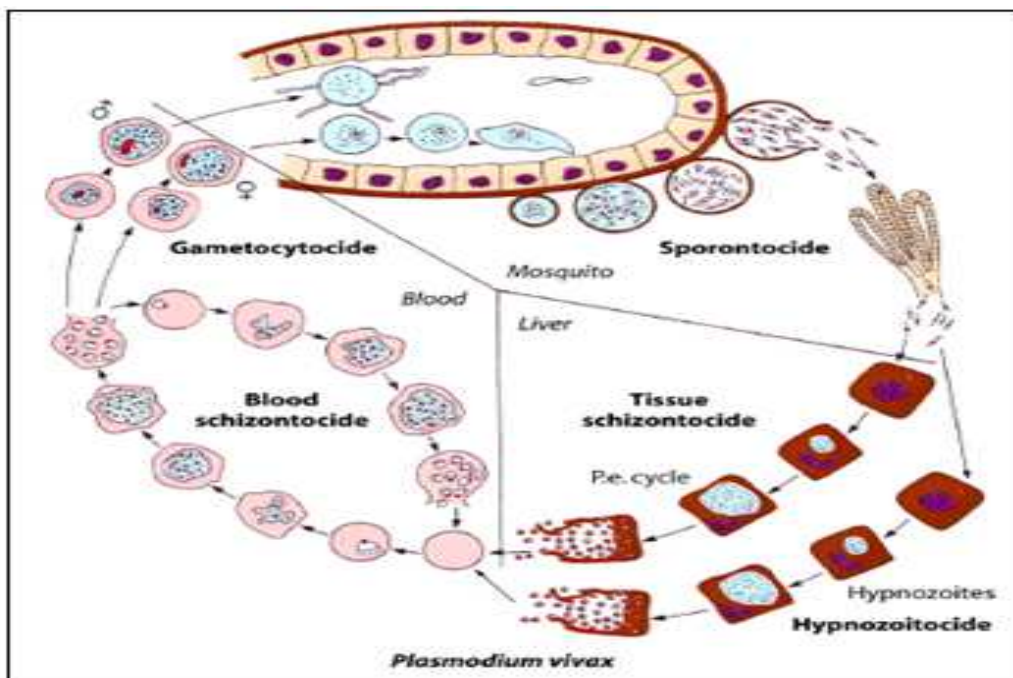


Figure 7 Action of antimalarial drugs (source: J. Kevin Baird)

Table 1
Demographic profile

Population size			Population size		
Parameters	CHIT	BAGB	Parameters	CHIT	BAGB
Age (year)			Education		
≤ 10	13(10.4%)	15(12%)	Illiterate	8(6.4%)	26(19.2%)
11 - 20	28(22.4%)	37(29.6%)	Primary	43(34.4%)	47(34.8%)
21 - 30	36(28.8%)	28(22.4%)	Secondary	30(24%)	16(11.85%)
31 - 40	26(20.8%)	21(16.8%)	above	41(32.8%)	37(27.40%)
41 –50	12(9.6%)	22(17.6%)	Not answered	-	9(6.67%)
51 - 60	7(5.6%)	7(5.6%)	Occupation		
> 60	3(2.4%)	5(4%)	Workers	27(21.6%)	34(25.18%)
Sex			Service	15(12%)	15(11.11%)
Male	93(74.4%)	93(74.4%)	Business	30(24%)	22(16.2%)
Female	32(25.6%)	42(33.6%)	Others	53(42.4%)	46(34.07%)
			Not answered	-	8(5.92%)

Table 2
Socioeconomic profile

Population size			Population size		
	CHIT	BAGB		CHIT	BAGB
Income per month(Rs)			House hold size		
< 3000		4(2.96%)	1		4(2.96%)
3000 – 3500	10(8%)	11(8.15%)	2	8(6.4%)	5(3.70%)
3501 – 4000	30(24%)	34(25.19%)	3	30(24%)	37(27.41%)
4001 – 4500	33(26.4%)	26(19.26%)	4	53(42.4%)	47(34.81%)
4501 – 5000	42(33.6%)	43(31.85%)	5	23(18.4%)	34(25.19%)
5001 – 5500	3(2.4%)	11(8.15%)	6	7(5.6%)	7(5.19%)
5501 – 6000	5(4%)	5(3.70%)	7	1(0.8%)	1(0.74%)
6001 – 6500	2(1.6%)	1(0.74%)	8	1(0.8%)	
House type			Number of rooms		
Kacha	23(18.4%)	20(14.81%)	1	94(75.2%)	68(50.37%)
Paca	37(29.6%)	44(32.59%)	2	27(21.6%)	61(45.19%)
Mixed	61(48.8%)	68(50.37%)	3	1(0.8%)	3(2.22%)
Footpath (FP)	3(2.4%)	3(2.22%)	FP	3(2.4%)	3(2.22%)

Table 3
Health practices profile

S			Population size		
Parameters	CHIT	BAGB	Parameters	CHIT	BAGB
Malaria			Drain		
Not infected	97 (77.6%)	93 (68.89%)	Open	108 (86.4%)	104 (77.04%)
<i>P. vivex</i>	24 (19.2%)	35 (25.92%)	Closed	17 (13.6%)	31 (22.96%)
<i>P.falciparum</i>	4 (3.2%)	7 (5.18%)	Use of mosquito nets		
Smoking habit			Yes	10(8%)	22(16.30%)
Yes	43 (34.4%)	42 (31.11%)	Occasionally	42 (33.6%)	62 (45.92%)
No	82 (65.6%)	93 (68.89%)	No	73 (58.4%)	51 (37.78%)

Table 4
Age and sex distribution of malaria infected respondents

Age group (years)	CHIT		BAGB	
	Male	Female	Male	Female
≤ 10	1(3.57%)	1(3.57%)	2(4.76%)	4(9.52%)
11 - 20	5(17.85%)	1(3.57%)	3(7.14%)	1(2.38%)

21 - 30	6 (21.42%)	2(7.14%)	10(23.81%)	0
31 - 40	5(17.85%)	1(3.57%)	3(7.14%)	3(7.14%)
41 - 50	1(3.57%)	-	10(23.81%)	3(7.14%)
51 - 60	2 (7.14%)	-	1(2.38%)	0
> 60	2 (7.14%)	1(3.57%)	-	-
	22(78.57%)	6(21.43%)	29(69.05%)	13(30.95%)

Table 5
Relative risk factor between male and female

Location	Odd Ratio (OR)	95% Confidence Interval
KMC	1.565	0.865 – 2.836
Chitpur	1.343	0.551 – 3.311
Bagbazar	1.011	0.429 – 2.396

Table 6
Clinical features of the malaria parasites

Features	<i>P.falciparum</i>	<i>P.vivax</i>
Incubation period	9 – 14 days	12 – 17 days
Periodicity of fever	24 hours, 36 hours	48 hours
Merozoites per schizont	8 -32	12- 24
Relapses	No	Yes
Drug resistance	Multiple drugs	Chloroquine

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