

Research Article

# Socio-Economic Status and Burden of Malaria in Kolkata Municipal Corporation (KMC) Area, West Bengal

Sajda Khatoon<sup>1</sup>, Mohd Mazhar Ali Khan<sup>2</sup>

<sup>1</sup>Research Student, <sup>2</sup>Professor, Department of Geography, Jamia Millia Islamia, New Delhi, India.

DOI: <https://doi.org/10.24321/0019.5138.202009>

## I N F O

### Corresponding Author:

Sajda Khatoon, Department of Geography, Jamia Millia Islamia, New Delhi, India.

### E-mail Id:

sajdakhatoon1990@gmail.com

### Orcid Id:

<https://orcid.org/0000-0002-5930-2332>

### How to cite this article:

Khatoon S, Khan MMA. Socio-Economic Status and Burden of Malaria in Kolkata Municipal Corporation (KMC) Area, West Bengal. *J Commun Dis* 2020; 52(1): 72-77.

Date of Submission: 2020-02-28

Date of Acceptance: 2020-03-21

## A B S T R A C T

**Background:** Among vector-borne diseases, malaria induces a significant socio-economic burden mainly on poor households directly or indirectly. So in a country like India where BPL population is about 21.9%, (Census of India, 2011), malaria continues to be a persistent public health concern. The present paper is a modest attempt towards the assessment of the effect of socio-economic status on disease burden in KMC Area which is a high burden area of West Bengal.

**Methods:** The data was collected from 396 randomly selected households across the randomly selected 12 wards of Kolkata Municipal Corporation (KMC) Area. The household expenditure incurred on preventive measures and total expenses on the treatment of malaria were calculated. Socio-economic status (SES) of the households is examined against the prevalence of the diseases as well as against the preventive and curative expenditure incurred due to malaria.

**Result:** Malaria is the most commonly found disease in the study area, having a prevalence rate of 5.02%. More males are affected than females and the working-age group is the worst affected category. The population had to spend about 0.06% to 1.79% of their annual income on the treatment of the disease.

**Conclusion:** The economic burden of the disease seems to be higher in those wards, which are having a larger population of low SES. The improvement in SES of the household's status and fruitful developments in the slums would help alleviate the disease prevalence and consequently would lessen the economic burden on the residents.

**Keywords:** Malaria, Burden, Cost, Socio-economic status, Kolkata

## Introduction

Malaria remains a significant public health concern, especially in tropical countries. There were 228 million malaria cases globally in 2018 and India is one of the 11

countries which has the highest burden of malaria in the world, reporting about 0.34 million malaria cases.<sup>1</sup> India currently accounts for about 4% of global malaria cases and 52% of malaria deaths, excluding the African countries. The National Strategic Plan for Malaria Elimination (NSPME) was

launched in 2017, which caused the focus against malaria to shift from its control to elimination in India. So 2030 is set as the target year to achieve the elimination of the disease. About 95% population of the country resides in malaria-endemic areas and 80% of the cases are reported from hilly, tribal and inaccessible areas of the country.<sup>2</sup>

The state of West Bengal, according to the National Framework for Malaria Elimination 2016-30, falls in category 2 i.e., Pre-elimination phase with Annual Parasite Incidence (API) less than 1 per 1000 population per year. However, Kolkata has the highest burden of the disease amongst all the districts of West Bengal, with a prevalence rate of 3.45/1000 population suffering from malaria (2016).

Analyzing malaria prevalence and expenditure on its treatment and prevention are essential to monitoring health inequalities and also the effectiveness of malaria control measures. The burden of malaria can be measured in terms of lives lost, absenteeism from work or school, time spent in caring for the sick as well as monetary losses incurred on prevention and treatment.<sup>3</sup> So malaria affects the individuals, households as well as the economy at large.<sup>4</sup> About INR 20 billion per year is estimated to be spent under the NSPME for malaria elimination in the country.<sup>5</sup>

The SES and economic impact of malaria have been looked into by various studies globally mainly pertaining to African countries like Kenya, Ethiopia, Tanzania, Ghana etc.<sup>6</sup> Several studies have focused on the economic burden on households.<sup>7,8</sup> Despite India having a persistent malaria prevalence, very few studies are attributed to economic impact of malaria at the household level, although for chikungunya and filariasis, such studies are conducted.<sup>9,10</sup> The present attempt, thus, focusses on the effect of Socio-Economic Status (SES) on malaria prevalence in KMC Area at the ward level in Kolkata district. It includes the objective to study the prevalence of malaria at ward level within the selected 12 wards and to study the relationship between the SES and the burden of malaria in the study area.

## Materials and Methods

### Study Area

The study was conducted in Kolkata Municipal Corporation (KMC) Area of Kolkata district, West Bengal, which is the only district that is entirely urban. With a geographical extent of 22°30' N to 22°37' N latitude and 88°18' E to 88°23' E longitude and an average elevation of 6.40 meters above the Mean Sea Level (MSL), the city extends north to south along the east bank of River Hooghly (Figure 1). It is the third-largest metropolitan city of India, which is administered under 144 wards spread over 205 sq. kms. The KMC Area has a Tropical wet-and-dry monsoon type climate. The annual mean temperature is 26.8°C. The yearly average rainfall is about 1600 mm most of which occurs in

the S-W monsoon period. The city has a population of 44,96,694 persons and population density of 24,306 persons/sq.kms which is the highest in the state.<sup>11</sup>

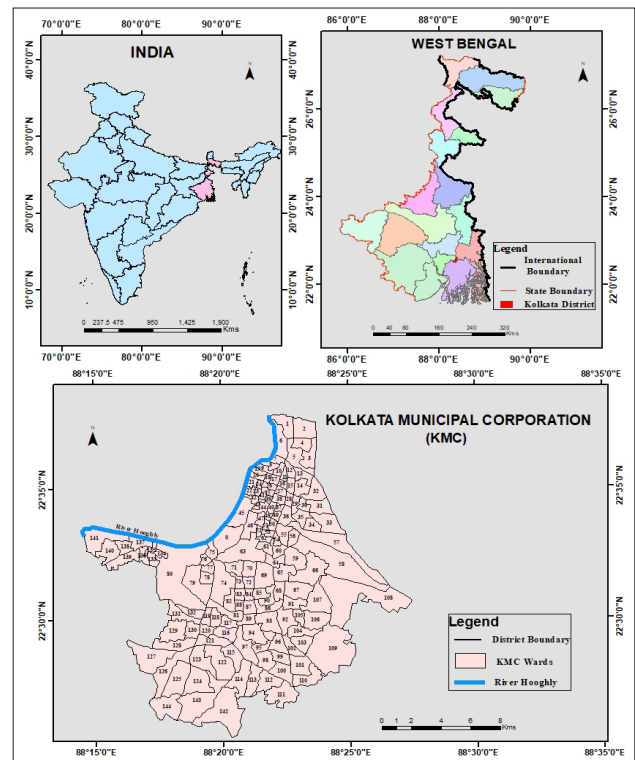


Figure 1. Location of the study area

### Database

Social and demographic data on age and sex, household size, educational attainment and religion as well as economic data on occupation and family income were collected. The data on disease prevalence, methods of prevention and treatment of malaria by the residents were also collected for the present study.

### Methodology

Based on a semi-structured interview schedule, a cross-sectional study was conducted through the interview schedule. The consenting adults of above 18 years or the head of the family were interviewed. The sample size of the households was 396, which was calculated with a 95% confidence level, 5% error margin and assumption of 50% population proportion. Thirty-three households were randomly selected out of 12 chosen wards out of 144 wards of KMC Area. The wards were categorized as high, moderately high, moderately low and low categories using nested means method on different aspects of the study and are depicted with the help of maps, diagrams and tables. The other attributes of the disease were calculated using the following techniques.

$$\text{Prevalence rate} = \frac{\text{Number of Malaria Cases}}{\text{Total Population}} \times 100$$

SES is calculated as a composite index of education, occupation and monthly family income. Formal Educational levels including primary, secondary, higher secondary, graduation and above as well as illiterates are considered. Homemakers, employed informally, self-employed (small and large income sources) and formally employed were selected as main occupation categories. School going juvenile dependents were also considered. Monthly family income has 4 sub-categories- Economically Weak Section (EWS), Low Income Group (LIG), Middle Income Group (MIG) and Upper Income Group (UIG). Each of these subcategories is multiplied by allocated ranks varying between 1 and 6. The illiterates and dependents were multiplied by -1 since these have a negative impact on household income. The values obtained for each sub-category are added up to get composite scores divided into 4 quartile categories i.e. lower, lower-middle, upper-middle and upper SES classes.

**Statistical Analysis**

All statistical analyses are carried out using SPSS 20. The data have been tested for normality using the Shapiro-Wilk test. Spearman’s rank correlation coefficient (p) was applied to find the correlation of SES with disease prevalence, prevention and treatment costs using the following formula:

$$\rho = 1 - \frac{6 \sum d^2}{n(n^2 - 1)}$$

Where: d=difference in ranks; n=number of pairs of data.

To deal with skewed expenditure data, the difference in the distribution of disease prevalence, expenditure incurred on prevention and treatment of malaria across the wards, Kruskal-Wallis test (H) (1952), was carried out using the following formula.

$$H = \frac{12}{N(N + 1)} \sum_{i=1}^k \frac{R_i^2}{n_i} - 3(N + 1)$$

Where, Ri=sum of ranks for each group, N=total sample size and ni is the sample size of a particular group.<sup>12</sup>

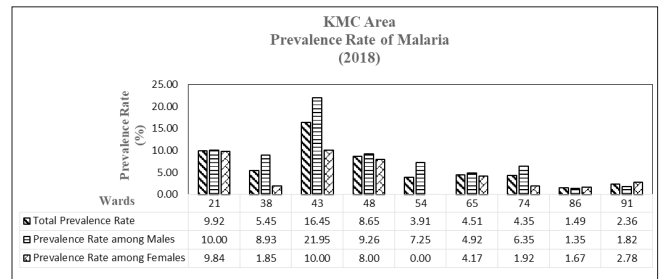
**Result**

**Characteristics of Study Participants**

Out of the total population of 1455 persons across 396 households, 51.40% were males and 48.59% were females. About 76.22% of the population comprised of the working-age group (15-59) and about 16.08% were young dependents (<15) and about 7.70% were the senile dependents (>59). The average household size was 3.67 in the study area. The majority of the population (76.52%) are Hindus which are followed by Muslims (23%) and other communities are comprising of only about 0.5% of the population. About 87% of the population is literate and educated and the rest about 14% are deprived of education.

**Prevalence of Malaria**

The prevalence rate of the disease in all of the surveyed wards was 5.02% (73 cases) in 2018. Out of total cases of malaria, (48 persons) about 65.8% of the malarial population were males as compared to 25 cases which represents approximately 34.2% of the females. The male: female ratio was 1.92:1. About 80.82% of the malaria cases were reported from the 15-59 age group.

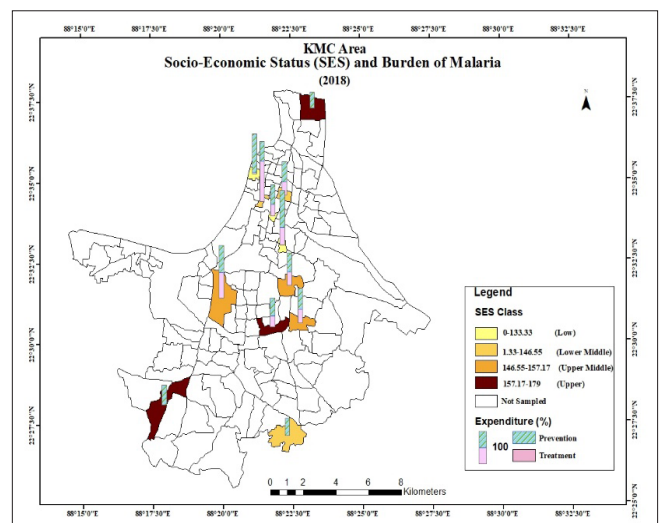


**Figure 2. Prevalence rate of malaria**

Ward 43 reported a maximum of 25 total malaria cases which are about 16.45% of the surveyed population. This ward was followed by ward numbers 21 and 48 with 12 and 9 absolute cases which are about 9.92% and 8.65% respectively. Wards 38 and 65 reported 6 cases each which are about 5.45% and 4.51% respectively and were followed by wards 74 and 54 with 5 cases representing about 4.35% and 3.91% of the surveyed population respectively. Ward 91 and 86 reported 3 and only 2 cases (2.36%, 1.49%) respectively (Figure 2). Wards 2, 111 and 126 did not report any case of malaria in 2018.

**Socio-Economic Status (SES) and Burden of Malaria**

It was found that about 25% of wards, i.e. 3 wards in each category represented the low, lower-middle, upper-middle and upper classes (Figure 3 and Table 1).



**Figure 3. Socio-economic Status (SES) and burden of malaria**

**Table 1. KMC area - SES class categories, malaria prevalence and expenditure on prevention and treatment of malaria (2018)**

SES Class	Wards	Malaria prevalence (%)	Expenditure	
			Prevention (%)	Treatment (%)
Upper	Ward 2	NA	0.71	NA
	Ward 86	1.49	0.81	0.49
	Ward 126	NA	0.87	NA
Upper Middle	Ward 65	4.51	0.85	0.58
	Ward 74	4.35	1.2	1.14
	Ward 91	2.36	0.91	0.63
Lower Middle	Ward 38	5.45	0.92	0.58
	Ward 43	16.45	0.88	1.79
	Ward 111	NA	0.77	NA
Low	Ward 21	9.92	1.73	0.06
	Ward 48	8.65	0.88	0.51
	Ward 54	3.91	1.64	0.78

**Table 2. KMC Area- SES and prevalence of malaria in KMC, 2018**

		Low SES	Lower-Middle SES	Upper-Middle SES	Upper SES
Malaria prevalence	Correlation coefficient (rho)	0.421	0.197	0.028	-0.646*
	Sig. (2-tailed)	0.173	0.540	0.931	0.023
	N	12	12	12	12
	Kruskal Wallis Test	$p=0.156$			

\*Correlation significant at 0.05 level of significance (2-tailed).

**Table 3. SES and expenditure on prevention and treatment of malaria in KMC Area, 2018**

Expenditure	Correlation Coefficient (p)	Low SES	Lower-Middle SES	Upper- Middle SES	Upper SES
Prevention	p	0.558	-0.112	0.140	-0.586*
	Sig. (2-tailed)	0.059	0.730	0.665	0.045
	N	12	12	12	12
Treatment	p	0.028	0.112	0.450	-0.591*
	Sig. (2-tailed)	0.931	0.728	0.142	0.043
	N	12	12	12	12
Kruskal Wallis Test	Prevention cost	$p=0.129$			
	Treatment cost	$p=0.199$			

\*Correlation significant at 0.05 level of significance (2-tailed).

The disease prevalence (Table 1 and 2) shows a moderately negative correlation with Upper SES ( $\rho=-0.646$ ;  $p=0.023$ ). All the other classes show a positive but moderately weak correlation with the disease. Though it is not statistically significant in the latter's case yet, it helps in supporting the statement that better living status reduces the chances of disease incidence (Table 2). Higher SES is translated by

better awareness about diseases and assured accessibility and affordability for prompt and proper treatment. The ward wise variation, however, could not be established as the Kruskal Wallis test result ( $p=0.156$ ) was greater than 0.05. However, by observation (Table 1), it is seen that wards in the upper SES (ward 2, 86 and 126) have low malaria prevalence in comparison to all the other wards in the rest

of the SES categories. The upper-middle group (wards 65, 74 and 91) has a prevalence rate lower than the ones in lower-middle SES (wards 38, 43 and 111) except for ward 43 which registered the maximum prevalence rate higher than the low SES wards (21, 48 and 54).

The expenses on preventive measures (Table 3) show a negative moderately strong correlation with Upper SES wards ( $p=-0.586$ ) which is significant at 95% confidence level with  $p$  being 0.045. It is to be noted that low SES showed a moderate positive correlation with prevention expenses. Though it was not statistically significant ( $p=.0059$ ), yet, it still reflects a greater burden on the poorer sections. The treatment expenses showed negative moderate relation with upper class ( $p=-0.591$ ;  $p=0.043$ ). No significant difference was revealed in the distribution for both prevention and treatment expenditure across SES by the Kruskal-Wallis test as the level of significance was ( $p=0.129$  and  $0.199$  respectively) greater than 0.05. By observation (Table 1), the low and lower-middle SES wards (21, 54 and 74) spent a considerable share of their income on preventive measures.

## Discussion

The higher male-female ratio in this study is in line with the findings of some other studies conducted in India.<sup>13,14</sup> The economically active group share a larger burden of these diseases as they are more exposed to the risk of being infected because of high mobility towards the endemic location and malaria-prone work environment. Moreover, the poor persons were found more burdened by the prevention expenses because of their limited income. It was similar to findings reported in some other studies.<sup>6</sup> The burden of treatment seemed to be more on the lower-middle and upper-middle class. This may be because they opted for private facilities in contrast to the low SES class, which chose free government services and did not incur out of pocket expenses. The expenditure on the treatment of malaria shows some fluctuations. It ranges from 0.06% of the annual income in ward 21 in low SES class to 1.79% in ward 43 in the lower-middle class. This is due to the highest prevalence of this disease is noted in ward 43. Moreover, people here work in local small manufacturing units of shoes and bags which are located in the cramped and unhygienic environment and are having little awareness about effective prevention measures. Also, they do not consider malaria as life-threatening, which resulted in a lax attitude to the disease.

The correlation between SES and the prevention and treatment expenditure of the households shows an insignificant difference in distribution across the study area. It may perhaps be because 49.32% of people are using free treatment facilities for malaria provided by the Kolkata Municipal Corporation (KMC) at urban primary

health centers (UPHCs), ward health units and malaria clinics in areas lying within its jurisdiction.

## Conclusion

Malaria is the most commonly noticed vector-borne disease in the city, affecting more males than females, and the working-age group is the worst affected segment of the surveyed population. About 80.82% of the malaria cases were found in this age group. The economic burden for the prevention of the disease is greater in low-income households compared to higher-income households. Treatment burden is greater in lower-middle (ward 43) and upper-middle wards (ward 74) mainly due to higher preference of the inhabitants for private treatment facilities. No significant differences are noticed in disease distribution, prevention and treatment expenses across the SES classes. However, the disease is having a moderate negative correlation with the Upper SES of the people which points towards the positive impact in reducing the disease incidence. So continued rigorous efforts are needed for the elimination of this disease with more focus on lower-middle and low SES dominant wards to mitigate economic losses of generally poor households and the economy at large. Equally important are the efforts to create awareness of malaria infection among the males and cleanliness of the workplaces.

## Acknowledgment

We would like to thank the people of KMC Area for kindly answering the interview schedule.

**Conflict of Interest:** None

## References

1. World Health Organization. World Malaria Report. Geneva: World Health Organization; 2019 p. 24. Available from: <https://www.who.int/publications-detail/world-malaria-report-2019>.
2. Magnitude of the problem: National Vector Borne Disease Control Programme (NVBDCP). Cited 4 December 2019. Available from: <https://nvbdcp.gov.in/index4.php?lang=1&level=0&linkid=420&lid=3699>.
3. Arrow K, Panosian C, Gelband H. Saving lives, buying time: economics of malaria drugs in an age of antimalarial drugs. 1st ed. Office of Health Economics, National Academic Press, Washington D.C. 2004. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK215634/>.
4. Shepard DS, Ettlign MB, Brinkmann U et al. The economic cost of malaria in Africa. *Tropical medicine and parasitology: official organ of Deutsche Tropenmedizinische Gesellschaft and of Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ)* 1991; 42(3): 199-203.
5. Narain J, Nath L. Eliminating malaria in India by 2027:

- The countdown begins!. *Indian Journal of Medical Research* 2018; 148(2): 123.
6. Worrall E, Basu S, Hanson K. Is malaria a disease of poverty? A review of the literature. *Tropical Medicine & International Health* 2005; 10(10): 1047-59.
  7. Ettling M, McFarland DA, Schultz LJ, et al. Economic impact of malaria in Malawian households. *Tropical medicine and parasitology: official organ of Deutsche Tropenmedizinische Gesellschaft and of Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ)* 1994; 45(1): 74-9.
  8. Hailu A, Lindtjørn B, Deressa W, et al. Economic burden of malaria and predictors of cost variability to rural households in south-central Ethiopia. *PloS One* 2017; 12(10).
  9. Gupta I, Chowdhury S. Economic burden of malaria in India: the need for effective spending. *WHO South-East Asia Journal of Public Health* 2014; 3(1): 95-102.
  10. Rajasekhar M, Nandakumar NV. Occupational malaria and health risk among select occupational health care employee groups in an urban hospital at Tirupati, AP. *Indian journal of Malariology* 2000; 37(3-4): 53-60.
  11. Census of India. District Census Handbook: Kolkata. Kolkata: Directorate Of Census Operations West Bengal; 2011 p.26. Available from: [http://censusindia.gov.in/2011census/dchb/1916\\_PART\\_B\\_DCHB\\_KOLKATA.pdf](http://censusindia.gov.in/2011census/dchb/1916_PART_B_DCHB_KOLKATA.pdf).
  12. Field A. *Discovering Statistics Using SPSS*. 3rd ed. Sage Publications, London. 2009.
  13. Sahu SS, Gunasekaran K, Vanamail P, et al. Persistent foci of falciparum malaria among tribes over two decades in Koraput district of Odisha State, India. *Malaria Journal* 2013; 12(1): 72.
  14. Yadav D, Chandra J, Aneja S, et al. Changing profile of severe malaria in north Indian children. *The Indian Journal of Pediatrics* 2012; 79(4): 483-487.