



Socioeconomic Determinants Of Malaria Morbidity And Mortality In Endemic Regions Of Bihar, India

Dr. Sudha Prabha^{1*}

*Research Scholar, Department of Zoology, B.N. Mandal University, Madhepura, Bihar, India

***Corresponding Author:** Dr. Sudha Prabha

*Research Scholar, Department of Zoology, B.N. Mandal University, Madhepura, Bihar, India

Received June 12,2020 Accepted July 10,2020 Published August 28,2020

Abstract

Malaria is a major public health issue in some of the flood prone and rural districts of Bihar, India, where socioeconomic vulnerability is a factor in perpetrating infections and avoidable deaths. The current research paper focuses on the association between malaria morbidity and mortality with socioeconomic factors in the selected endemic areas in the state of Bihar. It is a cross-sectional survey of a community-based survey, with 200 adult respondents sampled by 4 high-risk districts, namely, Purnia, Katihar, Araria and Kishanganj. The main data will be gathered using a structured questionnaire of education, income, occupation, housing condition, preventive habits and treatment seeking behaviour. Data analysis is done using descriptive statistics, chi-square tests and binary logistic regression analysis. The results indicate that low-income and illiterate respondents, daily wage laborers, and people living in kutcha houses with no mosquito nets will be more inclined to malaria. Higher morbidity and mortality are noted in those respondents who postpone treatment or through informal health providers, but prompt treatment in formal health care facilities lowers mortality. Logistic regression results in delayed treatment, lack of mosquito nets, illiteracy and distance to health facilities are the factors to predict malaria deaths ($p < 0.05$). The research finds malaria in Bihar to be directly related to poverty and the lack of access to healthcare pointing at the necessity of combined prevention and healthcare actions.

Keywords: Malaria, Socioeconomic Status, Morbidity, Mortality, Bihar, Public Health Inequality.

1. INTRODUCTION

Malaria is among the greatest infectious diseases that are transmitted by vectors and are prevalent in the tropical and subtropical areas of the world. Plasmodium parasites cause it and are spread to human beings when bitten by infected female Anopheles mosquitoes. Although the world has made significant inroads in malaria control, the disease still manifests itself as a significant public health problem in the developing world especially to the poor and rural populations. The malaria burden does not spread evenly but is concentrated in areas where the poor conditions of housing, sanitation, and healthcare services are observed.

India is a significant source of malaria in the South-East Asian region. In spite of the fact that national malaria control programs and better diagnostic and treatment facilities have led to the overall decrease in the number of cases, some states still face the problem of persistent transmission. Bihar is a region that is vulnerable because of the nature of its geographical and socioeconomic features. Seasonal flooding, waterlogging and stagnant water bodies are common phenomena in the state, which serve as good breeding grounds to the mosquitoes. Moreover, a huge percentage of the human population lives in the rural regions where poverty, congestion, and lack of sanitation amenities are prevalent.

Historically, malaria has been regarded as a biomedical and environmental illness, but there is a growing trend that it is heavily dependent on the social and economic status. Economic and social parameters like income, education, job, housing, and access to healthcare make a significant difference in the exposure of an individual to a mosquito bite, preventive practices, and access to timely treatment. Those people who stay in substandard houses or those who stay in places where the drainage systems are not well constructed are more exposed to the breeding grounds of the mosquitos. On the same note, individuals who are poorly educated might have limited information about malaria symptoms, transmission and prevention that could make the diagnosis late.

Delayed treatment-seeking behaviour is a significant issue in most of the rural societies. Before patients go to a medical institution, they are keen on using the self-medication or healers. These delays may cause serious complications such as anemia, organ failure or cerebral malaria and hence the risk of death. Moreover, the presence of few means of transport and distances to health institutions are known to exacerbate the lack of timely medical attention especially in flood-prone places.

Thus, malaria is not just a disease, which is caused by a parasite and a vector but a disease that is deeply connected with poverty and social inequality. To develop effective control of malaria, one needs to understand the socioeconomic

determinants of malaria. The use of medical treatment and control of vectors only would not result in a long-term success unless social and economic factors are managed.

1.1. Objectives of the Study

The following are the research objectives of the study:

- To assess the relationship between socioeconomic factors and malaria morbidity in endemic districts of Bihar.
- To identify major determinants of malaria mortality, including treatment-seeking behaviour and healthcare access.
- To suggest measures for reducing malaria incidence and deaths in the study area.

2. LITERATURE REVIEW

Past research has been done to investigate the association between malaria and socioeconomic status of various endemic areas, which has shown that the illness has a greater implication on social and environmental factors than on biological determinants.

Kumar et al. (2007) conducted a review of the malaria burden in India and had evaluated the retrospective and prospective trends of the disease. The authors indicated that malaria was still a chronic issue in the country concerning the overall level of public health in some of the rural and economically disadvantaged areas. Their evidence showed that living in impoverished conditions, not having proper sanitation and access to healthcare services was a major factor that led to the further spreading of malaria. They also noted that poorer and less educated population was more susceptible because of late diagnosis and treatment that resulted in more complications and death.

Mmbando et al. (2011) examined spatial variation and socioeconomic determinants of *Plasmodium falciparum* infection in northeastern Tanzania. The research discovered that the rates of infections between communities differed due to the household wealth, educational levels and the quality of the house. The people who lived in malaria-infested houses and those who had low-income earners showed a high prevalence of malaria. The authors have concluded that socioeconomic inequality was a major factor that contributed to exposure to mosquito vectors and highlighted the fact that living standards and community awareness should be enhanced to ensure that the spread of malaria is minimized.

Deressa, et al. (2007) studied the household and socioeconomic determinants of the febrile illness and treatment-seeking behaviour among rural Ethiopian communities. As their study revealed, families that had less socioeconomic status had lesser chances of seeking quick medical care and more relied on traditional medicine or homemade cures. This predisposed children to severe malaria and complications because of this delay in treatment. The authors pointed out that timely treatment and survival were greatly dependent on education and availability of healthcare services.

Cox, et al. (2010) talked about contextual determinants of malaria in sub-Saharan Africa and discussed environmental, economic and social factors that determine the transmission of the disease. The authors noted that malaria was more prevalent in the communities where there was poverty, high population density, poor housing and poor public health infrastructure. They highlighted that environmental factors were not sufficient to support persistence of malaria and stated that malaria control strategies required socioeconomic development as well as housing and empowerment of health systems.

3. RESEARCH METHODOLOGY

This part outlines the study design, the area of study, the sampling process, data collection and the analysis process that was used to examine the socioeconomic determinants of malaria morbidity and mortality in the endemic Bihar area in India.

3.1. Research Design

The research design used in the study is community-based cross-sectional research design, which aims at studying the relationship between malaria morbidity and mortality and socioeconomic factors in Bihar, an endemic area. The design enables exposure variables (socioeconomic conditions) to be collected simultaneously with the outcome variables (malaria occurrence and deaths).

3.2. Study Area

The study is carried out in four malaria endemic districts of Bihar namely Purnia, Katihar, Araria and Kishanganj. These areas have been chosen because they are prone to floods, stagnant water, rural communities and malaria cases recorded by the local health authorities.

3.3. Study Population and Sample Size

The target population of this research is adult people living in certain villages of the four districts. The survey is made up of 200 respondents. Interviewed are only those people between 18 years and above due to their ability to offer credible information concerning their socioeconomic status, preventive behavior, and malaria history.

3.4. Sampling Technique

Multistage sampling technique is embraced. Initially, a block with a high malaria burden is picked in every district. Two are then chosen randomly out of each block as villages. In the chosen village, there are eligible adult respondents that

will be selected through systematic random sampling, with the help of the ASHA workers and village health registers. Each household is selected to find out the number of respondents and therefore no duplication of information is allowed.

3.5. Data Collection

The main data is gathered in a form of a structured questionnaire, in the form of face-to-face interviewee. The questionnaire will contain data on:

- demographic characteristics,
- education, income, and occupation,
- housing and sanitation conditions,
- mosquito prevention practices,
- treatment-seeking behaviour, and
- malaria episodes during the past 12 months.

The questionnaire is tested in a local village and some minor changes are done to make it understandable.

3.6. Statistical Analysis

Data collected is code and analyzed in SPSS software. The data are summarized in terms of descriptive statistics (frequency and percentage). The Chi-square test is used to test the relationships between malaria incidence and the socioeconomic factors. The binary logistic regression analysis is employed to determine the predictors of malaria deaths. A p-value less than 0.05 is considered statistically significant.

4. RESULTS AND ANALYSIS

The section presents results of the research using the data gathered in the 200 respondents in the malaria-prone districts in Bihar. The findings are described in tables and analyzed to test the correlation that exists between socioeconomic variables and malaria morbidity and mortality.

Table 1 shows the socioeconomic profile of the sampled respondents in the sampled malaria-infested districts in Bihar.

Table 1: Socioeconomic Characteristics of Respondents

Variable	Category	Frequency	Percentage
Education	Illiterate	72	36%
	Primary	64	32%
	Secondary & above	64	32%
Monthly Income	< ₹5000	84	42%
	₹5000–₹10000	74	37%
	> ₹10000	42	21%
Housing Type	Kutchha	92	46%
	Semi-pucca	64	32%
	Pucca	44	22%
Occupation	Daily wage labour	86	43%
	Agriculture	66	33%
	Service/Business	48	24%

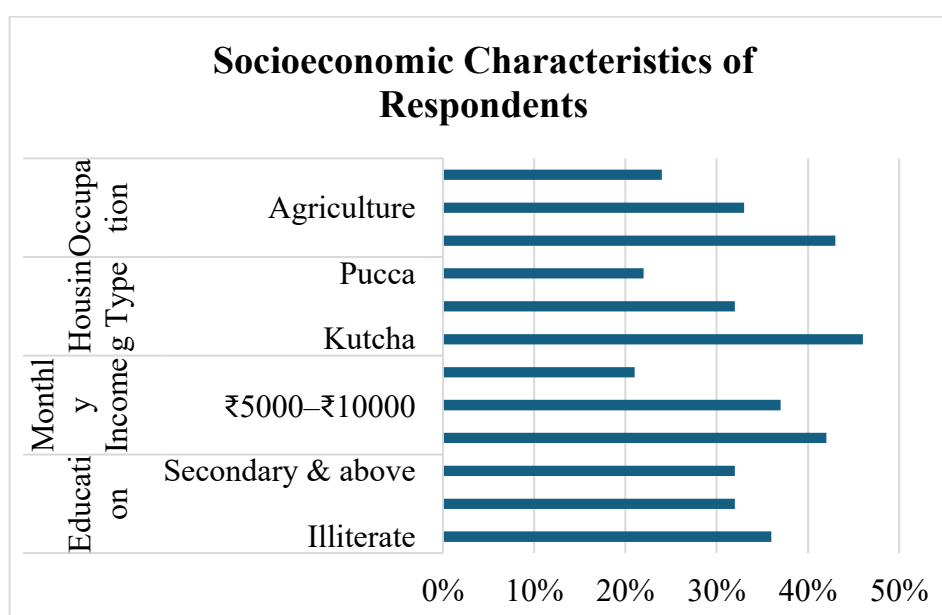


Figure 1: Socioeconomic Characteristics of Respondents

A significant number of the respondents are socioeconomically disadvantaged as indicated in Table 1. In terms of education, 36% are illiterate, 32% are only primary school education with 32% secondary school education or higher which implies a moderate level of education but high literacy gap. Considering the monthly income, the biggest proportion of the respondents (42 percent) has a low income below ₹5000 per month, 37 percent between ₹5000-₹10000 and only 21 percent has a high income above ₹10000 per month, which shows that low income is widespread among the respondents. The housing conditions also translate to vulnerability which is almost half of the respondents (46%) have kutcha houses, 32% have semi-pucca houses and only 22 have pucca houses. The occupation distribution indicates that 43 percent of the respondents are occupationally distributed as daily wage laborers, 33 percent are in agriculture sector and only 24 percent are occupationally distributed in service or business spheres. On the whole, the data in Table 1 indicate that most respondents are not only economically, but also socially vulnerable and it can predispose them to malaria and make them more susceptible.

Table 2 demonstrates how the various socioeconomic variables were related to the morbidity of malaria among the respondents surveyed.

Table 2: Malaria Morbidity by Socioeconomic Status

Factor	Malaria Cases	No Malaria	Incidence (%)
Low income	55	29	65.5%
Middle income	30	44	40.5%
High income	8	34	19.0%
Kutcha house	60	32	65.2%
Pucca house	10	34	22.7%
No mosquito net	71	37	65.7%
Using mosquito net	22	70	23.9%

Chi-square test showed statistically significant association ($p < 0.05$).

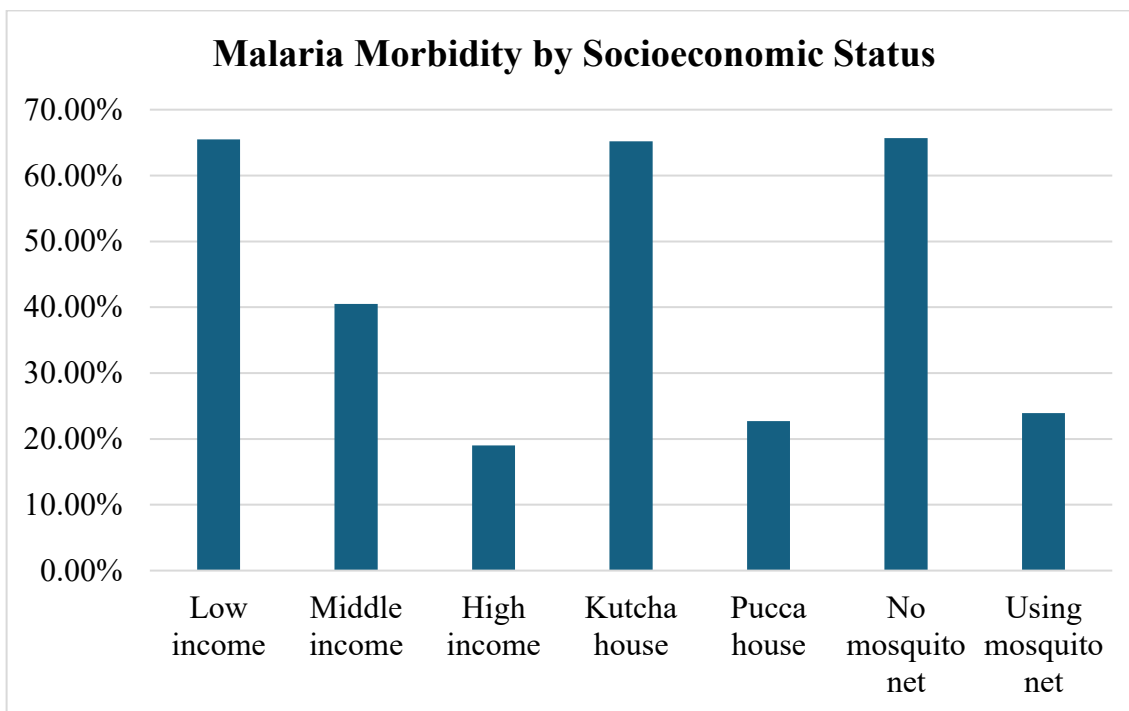


Figure 2: Graphical representation of Incidence (%) of Malaria by Socioeconomic Status

Table 2 shows that there is significant variation in malaria incidence when the socioeconomic conditions differ. The highest percentage of malaria cases is reported in low-income respondents (65.5%) as compared to middle income respondents (40.5%) and high-income respondents (19.0%), which is an indicator that economic status is a major factor that determines the occurrence of the disease. The housing condition is also significant factor because with 65.2 percent of the respondents living in kutcha houses exposed to malaria and with 22.7 percent living in pucca houses not exposed to the malaria infection. Prevention practices also have an impact on the morbidity trends; malaria incidence rate is high in non-mosquito net users 65.7% and low in mosquito net users at 23.9%. The chi-square test shows that socioeconomic factors have a statistically significant association with malaria ($p < 0.05$). In general, Table 2 results indicate that poverty, housing, and absence of protective measures are important contributors to malaria susceptibility.

The treatment-seeking behaviour of the respondents, as well as its relation to severe malaria cases and death, is given in Table 3.

Table 3: Treatment-Seeking Behaviour and Outcomes

Treatment Source	Respondents	Severe Malaria Cases	Deaths
Government hospital	74	9	1
Private clinic	50	7	2
Traditional healer	46	16	6
Self-medication	30	11	4

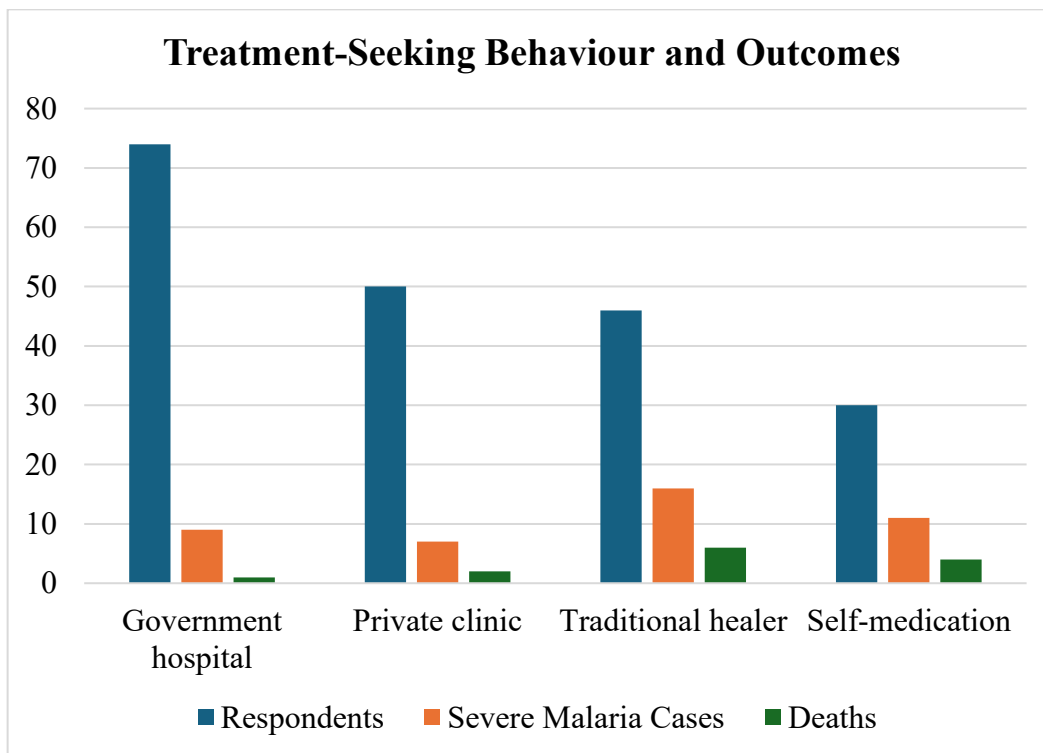


Figure 3: Graphical Representation of Treatment-Seeking Behaviour and Outcomes

Table 3 indicates that malaria is clearly affected by the source of treatment. When the respondents refer to government hospitals, only 9 serious cases and 1 death are found, which implies a relatively high treatment efficacy. Equally, respondents who attended private clinics give 7 serious cases and 2 fatalities. Conversely, the number of severe malaria cases (16) as well as deaths (6) is much higher in respondents who use traditional healers. Self-medication also leads to bad consequences; 11 serious cases and 4 deaths were noted. These results indicate that untimely or improper treatment has a great role in enhancing the severity of diseases and deaths. On balance, the findings of Table 3 show that people relying on traditional healers or self-treatment are the most likely to be afflicted with malaria with high mortality rate, but those receiving timely treatment in formal healthcare facilities are less likely to develop severe malaria and perish. The outcome of the logistic regression analysis that indicates the factors related to malaria mortality are provided in Table 4.

Table 4: Logistic Regression Predicting Malaria Mortality

Variable	Odds Ratio	p-value
Illiteracy	2.65	0.004
Kutch housing	2.18	0.009
No mosquito net	3.01	0.001
Delayed treatment (>48 hrs)	4.52	0.000
Distance to health facility (>5 km)	2.41	0.006

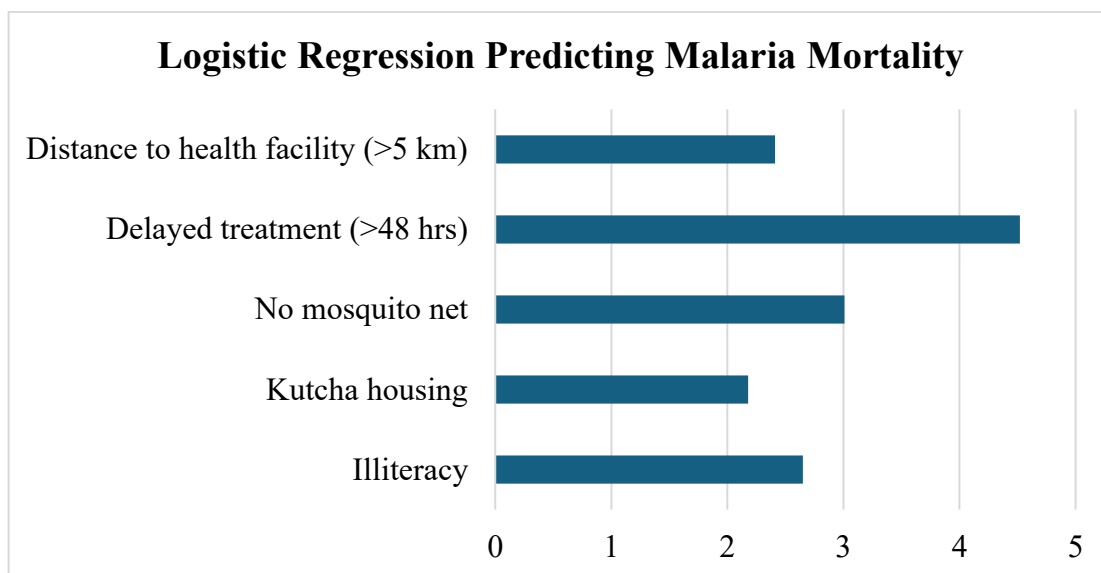


Figure 4: Graphical Representation of Odds Ratio from Logistic Regression Predicting Malaria Mortality

Some of the socioeconomic and access-related variables as shown in Table 4 to be significant in determining malaria-related death are the likelihood of having the disease. The increased mortality rate of 2.65 times ($p = 0.004$) implies that ignorance and slow identification of symptoms are some of the factors that cause death. Persons in kutcha houses are at a higher risk of death (2.18 times, $p = 0.009$), which may be attributed to being more exposed to breeding sites of mosquitos. There is also the increased risk due to the lack of mosquito nets, with odds ratio 3.01 ($p = 0.001$). Delayed treatment more than 48 hours is the most important factor and has the possibility of increasing the risk of death by 4.52 times ($p < 0.001$), the strongest predictor of death. Moreover, those households which are over 5 km distant to a health facility have increased mortality risk 2.41 times over ($p = 0.006$). These results in Table 4 clearly indicate that the socioeconomic disadvantage and lack of access to healthcare are both important contributors to malaria mortality.

5. DISCUSSION

The present research explores the effect of the socioeconomic status on malaria morbidity and mortality among the respondents who reside in endemic areas of Bihar. The results indicate that malaria is not an environmental or biological issue but it is highly influenced by social and economic disparities. The findings show that low income, illiteracy, poor housing, ineffective preventive measures, slow treatment, and access to the healthcare facilities are major contributors to the incidence of malaria and the risk of death will be high.

The connections between malaria incidence and poverty are one of the most significant ones. The low-income respondents recorded significantly more cases of malaria as compared to middle- and high-income respondents. Poverty exposes individuals to malaria in various ways. The poor people live in an environment that has stagnant water, poor drainage and lack of environmental sanitation that provide good breeding grounds to the mosquitoes. Also, less affluent respondents will not be able to afford preventive strategies like mosquito repellents or insecticide treated bed nets. There are also financial constraints that slow down treatment-seeking behaviour and this gives time to the infection to advance to severe levels. Thus, malaria causes and contributes to poverty since sickness decreases the labor ability and raises the cost of healthcare.

Another important factor that was also found to be a determinant of malaria outcomes is educational status. The illiterate respondents had been identified to be at greater risk of death as opposed to the literate respondents. Poor education will decrease awareness on the spread of malaria, early warning signs and the need to treat in time. The educated population will have a higher likelihood of noticing the presence of persistent fever as a possible symptom of malaria and early medical attention. Contrarily, low literacy respondents tended to use traditional healers or self-medication, and this factor led to late diagnosis and more complications. Therefore, education is a protective mechanism, as it enhances health-seeking behaviour and raises awareness.

Malaria was significantly caused by housing conditions. The malaria incidence was more in respondents who lived in kutcha houses as compared with those who lived in pucca houses. Housing structures are also in poor conditions with open spaces, cracks on the walls and inappropriate protective barriers that enable the mosquitoes to get into the house and sleep there. These conditions expose an individual to more and more bites by mosquitoes especially during the night when the malaria vectors are most active. Better housing having good walls, screened windows and enhanced ventilation can thus do a lot in preventing indoor mosquito exposure and serve as a viable preventive method.

Mosquito nets demonstrated a high protective relationship with malaria morbidity. The respondents who frequently used mosquito nets had significantly lower incidences of malaria in comparison to those who did not. This observation indicates that basic preventive strategies are effective in managing the spread of malaria. It implies that by increasing the distribution and decent use of insecticide-treated bed nets in the endemic areas, the disease burden can be significantly lowered.

The behaviour of seeking treatment became an important variable that explained the severity and mortality of malaria. The respondents who attended government hospitals and the private clinics had fewer incidences of severe cases and deaths as compared to respondents who used traditional healers or self-medication but this situation recorded higher mortalities. Treatment delayed more than 48 hours was reported to be the most powerful predictor of death. Unless treated early, malaria can easily develop to severe complications like cerebral malaria, severe anemia and dysfunction of the organ. Thus, timely diagnosis and fast medical intervention are the key to avoiding fatal consequences. Mortality was also influenced by accessibility of healthcare facilities. The respondents who were more distant to health centers had higher mortality rates, probably because they had troubles with transportation, were not aware of it, and took more time to reach medical attention. Physical access to health care is especially challenging to rural and prone to flooding regions of Bihar, especially during the monsoon seasons. This emphasizes the need to enhance primary healthcare facilities, rural transportation, and initiate mobile health facilities in rural locations.

6. CONCLUSION

The present research paper reveals that malaria morbidity and mortality in the Bihar endemic districts are greatly dependent on the socioeconomic status and not on the environment itself. The results indicate that low income, illiteracy, inadequate housing, absence of mosquito protection systems, late treatment and inadequate accessibility of healthcare centers play significant roles in increasing incidences of malaria as well as predisposing victims to death. Those who were in kutchha houses and those who were not using mosquito nets were at a high risk, although those who took late medical attention or had to use the traditional healers had more mortality. These findings show that malaria remains a disease being closely associated with poverty and social inequality. Hence, the application of an integrated method made up of medical care, early diagnosis, community education, better housing, increased supply of mosquito nets, and enhanced primary healthcare provision in rural and remote communities is required to ensure proper management of malaria. To achieve sustainable malaria burden reduction and to prevent malaria-related deaths in Bihar, it is important to address the socioeconomic disadvantages.

REFERENCES

1. Bhattacharya, S., Sharma, C., Dhiman, R. C., & Mitra, A. P. (2006). Climate change and malaria in India. *Current science*, 90(3), 369-375.
2. Chaturvedi, H. K., Mahanta, J., & Pandey, A. (2009). Treatment-seeking for febrile illness in north-east India: an epidemiological study in the malaria endemic zone. *Malaria journal*, 8(1), 301.
3. Cox, J. S. H., Mouchet, J., & Bradley, D. J. (2010). Determinants of malaria in sub-Saharan Africa. In *The contextual determinants of malaria* (pp. 167-186). Routledge.
4. Das, A., Anvikar, A. R., Cator, L. J., Dhiman, R. C., Eapen, A., Mishra, N., ... & Valecha, N. (2012). Malaria in India: the center for the study of complex malaria in India. *Acta tropica*, 121(3), 267-273.
5. de Castro, M. C., & Fisher, M. G. (2012). Is malaria illness among young children a cause or a consequence of low socioeconomic status? Evidence from the United Republic of Tanzania. *Malaria journal*, 11(1), 161.
6. Deressa, W., Ali, A., & Berhane, Y. (2007). Household and socioeconomic factors associated with childhood febrile illnesses and treatment seeking behaviour in an area of epidemic malaria in rural Ethiopia. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 101(9), 939-947.
7. Fürst, T., Raso, G., Acka, C. A., Tschannen, A. B., N'Goran, E. K., & Utzinger, J. (2009). Dynamics of socioeconomic risk factors for neglected tropical diseases and malaria in an armed conflict. *PLoS neglected tropical diseases*, 3(9), e513.
8. Kumar, A., Chery, L., Biswas, C., Dubhashi, N., Dutta, P., Dua, V. K., ... & Rathod, P. K. (2012). Malaria in South Asia: prevalence and control. *Acta tropica*, 121(3), 246-255.
9. Kumar, A., Valecha, N., Jain, T., & Dash, A. P. (2007). Burden of malaria in India: retrospective and prospective view. *Defining and Defeating the Intolerable Burden of Malaria III: Progress and Perspectives: Supplement to Volume 77 (6) of American Journal of Tropical Medicine and Hygiene*.
10. Mmbando, B. P., Kamugisha, M. L., Lusingu, J. P., Francis, F., Ishengoma, D. S., Theander, T. G., ... & Scheike, T. H. (2011). Spatial variation and socio-economic determinants of *Plasmodium falciparum* infection in northeastern Tanzania. *Malaria Journal*, 10(1), 145.
11. Onwujekwe, O., Uzochukwu, B., Dike, N., Okoli, C., Eze, S., & Chukwuogo, O. (2009). Are there geographic and socio-economic differences in incidence, burden and prevention of malaria? A study in southeast Nigeria. *International Journal for Equity in Health*, 8(1), 45.
12. Sarkar, J., Murhekar, M. V., Shah, N. K., & Van Hutin, Y. (2009). Risk factors for malaria deaths in Jalpaiguri district, West Bengal, India: evidence for further action. *Malaria Journal*, 8(1), 133.
13. Sharma, V. P. (2010). Determinants of malaria in South Asia. In *The contextual determinants of malaria* (pp. 110-136). Routledge.
14. Singh, V., Mishra, N., Awasthi, G., Dash, A. P., & Das, A. (2009). Why is it important to study malaria epidemiology in India?. *Trends in parasitology*, 25(10), 452-457.
15. Tripathy, R., Parida, S., Das, L., Mishra, D. P., Tripathy, D., Das, M. C., ... & Panigrahi, P. (2007). Clinical manifestations and predictors of severe malaria in Indian children. *Pediatrics*, 120(3), e454-e460.