ORIGINAL ARTICLE

https://doi.org/10.3329/jmcwh.v21i2.83586

COMMUNITY KNOWLEDGE AND PRACTICES FOR MALARIA PREVENTION: A CROSS-SECTIONAL STUDY ON TRIBAL ADULTS IN BANGLADESH

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ABSTRACT

Background: Malaria is a major public health concern in Bangladesh, with ethnic minorities in the Chittagong Hill Tracts (CHTs) being highly vulnerable due to forest-based occupations and poor housing. **Aim:** This study aims to find out the current state of knowledge and practices on the prevention of malaria among tribal adults in Bangladesh.**Materials and Method:** A community-based cross-sectional study was carried out from January to December 2022 in the Rangamati district, Bangladesh. Data were collected from 234 conveniently selected tribal adults through face-to-face interviews using a semi-structured questionnaire. **Results:** Knowledge of malaria transmission and prevention was generally high, with 96.6% identifying mosquito bites as the cause and 99.1% recognizing it as preventable. Most (97.9%) knew preventive measures, and long lasting insecticide treated Net (LLINs) were widely known (96.6%), though none were owned or used. Misconceptions persisted, with 30.8% attributing malaria to poor cleanliness. Symptom recognition was inconsistent, with fever and shivering (60.7%) most common, while awareness of intermittent fever, sweating, and convulsions were low. Vulnerable groups such as pregnant women (67.1%) and children (44.4%) were better recognized than the elderly (30.8%) or people with chronic disease (1.3%). Prevention practices relied mainly on environmental control: cleaning surroundings (98.7%), vegetation clearance (73.1%), and land levelling (54.7%); while personal protective measures (21.8%) were less used. The absence of LLIN access, despite high awareness, highlights the need for improved distribution and targeted health education. **Conclusion:** The study highlights strong general awareness of malaria transmission and prevention among the respondents, with widespread knowledge of LLINs despite none owning them. Environmental management practices are well adopted, but personal protective measures and recognition of less common symptoms and vulnerable groups remain limited.

Keywords: Community tribal population, Malaria prevention, Chittagong Hill Tracts, Bangladesh.

Cite this article: Chakma A, Niloy LT, Aktaruzzaman MM, Orchi K, Nurunnabi M, Gupta M, Hossain I. Community Knowledge and Practices for Malaria Prevention: A Cross-sectional Study on Tribal Adults in Bangladesh. J Med Coll Women Hosp.2025;21(2): 91-101.

INTRODUCTION

Malaria remains a substantial global health challenge, particularly in tropical and subtropical regions where climatic and environmental conditions favour its transmission[1-3]. It is a life-threatening disease caused by *Plasmodium* parasites, transmitted to humans through the bites of infected female *Anopheles* mosquitoes[4].

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In 2020, the World Health Organization (WHO) estimated approximately 241 million malaria cases and 627,000 deaths worldwide, with more than 95% of the burden occurring in sub-Saharan Africa[4,5]. Bangladesh, one of the nine malaria-endemic countries in the WHO Southeast Asia region, continues to grapple with the disease[5], particularly in the Chittagong Hill Tracts[5-8]. The country accounted for 2.6% of malaria cases and 5.6% of malaria-related deaths in the region in 2020[5,9-12]. A concerning 72% increase in malaria cases was reported in 2019 compared to 2018, with Bandarban (68%) and Rangamati (23%) being the most affected districts, reporting 6,130 cases and nine deaths in 2020[12,13].

Bangladesh's malaria burden is concentrated in 13 eastern and north-eastern border districts, with more than 80% of cases originating from three districts: Bandarban, Rangamati, and Khagrachari[13-18].The high prevalence in these areas is attributed to dense forests, favourable mosquito breeding conditions, and limited healthcare access[19-22].Tribal populations residing in remote hill areas are particularly vulnerable due to their traditional forest-based occupations, inadequate housing, and cultural practices that limit their engagement with healthcare services[16,17,22].

The National Malaria Elimination Program (NMEP) aims to eliminate malaria in Bangladesh by 2030 through universal access to preventive and curative services[23,24]. One of the key interventions has been the widespread distribution of long-lasting insecticide-treated nets (LLINs), with over 96% of at-risk populations now having access to LLINs[13,23,24].Environmental management strategies such as clearing vegetation, draining stagnant water, and using insecticides remain underutilized[25-29].Moreover, healthcare-seeking behaviour among tribal populations is often delayed due to cultural beliefs, financial constraints, and geographical barriers[30,31].Studies indicate that while 82% of respondents recognize the importance of seeking treatment within 24 hours of symptom onset, traditional healers and self-medication are still commonly preferred over formal healthcare facilities[23,28,32].

Malaria disproportionately affects marginalized communities, exacerbating poverty and limiting economic development[33,34]. The direct economic burden includes healthcare costs, loss of productivity, and expenses for preventive measures[31,35]. In Bangladesh, malaria-endemic districts experience significant economic losses due to reduced labour capacity, with seasonal outbreaks further straining the healthcare system[33,36]. A World Bank analysis highlighted that households affected by malaria spend an average of 10%-20% of their annual income on treatment and related costs, pushing many families into deeper poverty[29,31].

Despite national and global efforts to control malaria, the disease remains a persistent threat in Bangladesh, particularly among tribal populations in the CHTs. However, the purpose of this study was to evaluate the existing knowledge and practices of malaria prevention among tribal adults in Rangamati district, with the goal of guiding future intervention strategies.

MATERIALS AND METHOD

Study design and settings

This community-based descriptive cross-sectional study was conducted from January to December 2022 in three malaria-endemic Upazilla of Rangamati district, Bangladesh- Kawkhali, Naniarchar, and Rangamati Sadar. The study focused on tribal adults aged 18 years and above who had resided in these areas for at least one year.

Data collection and analysis

A total of 234 participants were selected through convenience sampling based on accessibility and feasibility. Individuals with serious illnesses or communication difficulties were excluded to ensure data accuracy. Data were collected via face-to-face interviews using a pre-tested semi-structured questionnaire that covered socio-demographic information, knowledge of malaria transmission and symptoms, awareness of preventive measures, and current prevention practices. Trained data collectors conducted interviews in the local language. The data were then reviewed, organized, and entered into IBM SPSS version 27 for analysis. The results aim to inform more effective malaria prevention strategies and guide targeted interventions among ethnic minorities in the Chittagong Hill Tracts.

Ethical approval

The study objectives and significance were clearly communicated to all participants prior to recruitment. Written informed consent was obtained from each individual, and confidentiality was rigorously upheld throughout the study. Ethical approval was granted by the Institutional Review Board (IRB) of the National Institute of Preventive and Social Medicine (NIPSOM), which also provided an ethical clearance waiver. The approval reference number is NIPSOM/IRB/2017/09.

RESULTS

Socio-demographic characteristics

The socio-demographic characteristics of the respondents are summarized in Table 1.The socio-demographic profile of the respondents (n=234) shows a male predominance (62.4%), with most participants aged between 31–45 years (45.3%), followed by 18–30 years (27.8%) and those above 45 years (26.9%). Educational attainment was generally low, with 29.5% having no formal education and 37.2% completing only primary school; just 8.5% attained higher education. Agriculture was the primary occupation for the majority (72.6%), while 14.5% were day labourers, and smaller proportions engaged in business (6.8%) or were unemployed/others (6.1%). Most households were made of bamboo/wood (63.7%) rather than brick/tin (36.3%). Nuclear families were slightly more common (59.8%) than joint families (40.2%), and in most cases, the household head was male (78.6%). In terms of economic status, the largest share of households earned between 5,000–10,000 Bangladeshi Taka (BDT) per month (42.7%), while 38.5% earned less than 5,000 BDT, and only 18.8% reported an income above 10,000 BDT. Overall, the data reflect a rural, agriculturally dependent population with low income levels and limited formal education.

Table 1: Socio-demographic characteristics of the respondents (n=234)

Characteristics		Frequency (n)	Percentage (%)
Gender	Male	146	62.4
	Female	88	37.6
Age groups (in years)	18-30	65	27.8
	31-45	106	45.3
	>45	63	26.9
Education level	No Formal Education	69	29.5
	Primary	87	37.2
	Secondary	58	24.8
	Higher Education	20	8.5
Occupation	Agriculture	170	72.6
	Day Labourer	34	14.5
	Business	16	6.8
	Others/Unemployed	14	6.1
House type	Bamboo/Wood	149	63.7
	Brick/Tin	85	36.3
Family type	Nuclear	140	59.8
	Joint	94	40.2
Family head	Male	184	78.6
	Female	50	21.4
Monthly income (Bangladeshi taka)	<5000	90	38.5
	5000-10000	100	42.7
	>10000	44	18.8

n= Number of respondents.

Knowledge on prevention of Malaria

Table 2 presents the distribution of knowledge regarding malaria prevention among the respondents. The study findings reveal that while general awareness of malaria transmission and prevention is high among respondents, gaps persist in knowledge of specific symptoms and less common preventive measures. A very high proportion (96.6%) correctly identified mosquito bites as the cause of malaria, and nearly all respondents (99.1%) understood that malaria is preventable. Most (97.9%) were aware of preventive measures, with long-lasting insecticide-treated nets (LLINs) being well-known (96.6%). However, misconceptions remain, as 30.8% attributed malaria to a lack of cleanliness and 1.7% cited carelessness as a cause. Knowledge of key symptoms was variable. Fever with shivering (60.7%) and high fever (37.6%) were relatively well recognized, but awareness of fever at intervals (9.8%), remission with sweating (7.3%), and convulsions (4.3%) was low. Non-specific symptoms like headache (19.7%), nausea/vomiting (20.1%), weakness (15.0%), and loss of appetite (12.0%) were under-recognized. Regarding vulnerable groups, two-thirds (67.1%) identified pregnant women, 44.4% recognized children, and 30.8% mentioned the elderly, but only 1.3% identified people with chronic disease as at higher risk. In terms of information sources, NGOs were the most common providers (53.4%), followed by neighbours/relatives (44.4%), media (26.9%), and government health workers (1.3%). For prevention, beyond LLINs, mosquito coils (42.3%) were relatively common, while environmental measures such as cleaning surroundings (30.3%), draining stagnant water (30.3%), and insecticide spraying (9.8%) were less frequently mentioned. Very few (3.4%) knew about personal protective measures beyond nets and coils.

Table 2: Knowledge on prevention of Malaria (n=234)

Questions	Frequency (n)	Percentage (%)
Past history of having malaria	86	36.8
Knows mosquito bites cause malaria	226	96.6
Thinks malaria is caused by lack of cleanliness	72	30.8
Knowledge regarding carelessness as a cause of malaria	4	1.7
Recognizes fever with shivering as a symptom	142	60.7
Identifies fever at intervals	23	9.8
Knows remission of fever with sweating	17	7.3
Knows high fever is a symptom	88	37.6
Identifies headache as a symptom	46	19.7
Recognizes nausea and vomiting as symptoms	47	20.1
Knowledge regarding weakness as a symptom of malaria	35	15.0
Recognizes convulsions as a symptom	10	4.3
Recognizes loss of appetite as a symptom	28	12.0
Identifies cold hands and feet as a symptom	96	41.0
Recognizes children as vulnerable	104	44.4
Knows pregnant women are most vulnerable	157	67.1
Knowledge regarding all adults are usually affected by malaria	22	9.4
Knows elderly are vulnerable	72	30.8
Knowledge regarding immuno-compromised person are usually affected by malaria	42	17.9
Knowledge regarding person with chronic disease are usually affected by malaria	3	1.3
Gets malaria information from government health workers	3	1.3
Gets malaria information from NGO health workers	125	53.4
Relies on media (radio, TV, newspapers) for information	63	26.9
Learns about malaria from neighbours or relatives	104	44.4
Knowledge regarding information of malaria is known by the respondent himself	81	34.6
Knowledge regarding understanding that malaria is preventable	232	99.1
Knowledge of preventive measure for malaria	229	97.9
Knows about long-lasting insecticide-treated nets	226	96.6
Believes in cleaning surroundings to prevent malaria	71	30.3
Draining of stagnant water for malaria prevention	71	30.3
Knows about insecticide spray as a preventive measure	23	9.8
Uses mosquito coils as a preventive measure	99	42.3
Knowledge of personal protective measures for malaria prevention	8	3.4

n=number of respondents.

Practices on prevention of Malaria

Table 3 highlights the distribution of malaria prevention practices. The findings indicate that although nearly all respondents practiced some form of environmental management to prevent mosquito breeding, ownership and use of proven protective tools such as long-lasting insecticide-treated nets was absent (0%). Almost all respondents (98.7%) reported cleaning their surroundings, and 73.1% cleaned vegetation around their homes.

More than half (54.7%) engaged in levelling or filling land slopes to prevent waterlogging. Use of personal protective measures was moderate (21.8%), with smoke or incense (18.4%) being more common than wearing long clothing (3.4%) or applying coconut oil (2.6%) to repel mosquitoes. These results suggest a strong reliance on environmental control methods over personal protection strategies, but also highlight a complete lack of access to LLINs, which remain one of the most effective malaria prevention tools.

Table 3: Practices on prevention of Malaria (n=234)

Questions	Frequency (n)	Percentage (%)
Having long lasting insecticide treated net	0	0.0
Their use of personal protective measures to prevent mosquito bite	51	21.8
Their use of full long clothing to prevent mosquito bite	8	3.4
Their use of massage of coconut oil to prevent mosquito bite	6	2.6
Their use of smoke/incense to prevent mosquito bite	43	18.4
Their practice of cleaning of surroundings	231	98.7
Their practice of cleaning of vegetation around home	171	73.1
Their practice of levelling and filling land slopes where water can log	128	54.7

n=number of respondents

DISCUSSION

This study finding highlights significant gaps in malaria knowledge and prevention practices among ethnic minority populations in Rangamati district. Although there is widespread awareness that mosquito bites cause malaria, misconceptions about the transmission pathways persist. This aligns with studies in Nigeria and Iran, where a substantial proportion of respondents mistakenly believed that malaria could be caused by poor hygiene rather than the bite of an infected mosquito[9,16].

The use of LLINs was universally reported in current study, consistent with findings from similar studies in India, Cameroon and Vietnam, where LLIN ownership and usage were high due to mass distribution programs[20,25,27]. However, the reliance on LLINs as the primary preventive measure raises concerns, as environmental management practices - such as draining stagnant water and clearing vegetation - were less commonly adopted. Many Studies have shown that a combination of LLINs, insecticide sprays, and personal protective measures significantly reduces malaria transmission, indicating the need for more integrated malaria prevention strategies in this study region[22,25].

Another key concern is healthcare-seeking behaviour. While hospital-based treatment was the preferred option, a notable proportion of respondents still relied on

village doctors or home remedies. Similar trends have been documented in remote areas of India, where trust in traditional healers and difficulty accessing formal healthcare facilities contributed to delays in seeking appropriate treatment[14]. These delays can lead to severe complications and higher malaria-related morbidity. Expanding community-based healthcare services and training village doctors in proper malaria management could help bridge this gap.

Moreover, this study found that Non-government organization (NGO) health workers were the most common source of malaria-related information, whereas government health workers played a minimal role in disseminating knowledge. This contrasts with a study in SriLanka, where government-led malaria programs were highly effective in reaching at-risk communities[21]. Strengthening the role of government health workers through improved outreach efforts and collaboration with NGOs could enhance public awareness and promote sustainable malaria control measures[37-40].

These findings suggest that while Bangladesh has made progress in malaria control, there is still a need for multi-faceted interventions that combine education, environmental management, and improved healthcare access. Addressing these gaps through culturally tailored strategies will be crucial in achieving the national malaria elimination goal by 2030.

CONCLUSION

The study shows good knowledge of malaria transmission and prevention among a predominantly low-income, agricultural population. While environmental control practices are common, none owned or used LLINs, and personal protection was limited. Gaps in symptom recognition and some misconceptions remain. Improve LLIN distribution and provide targeted health education to address knowledge gaps and promote personal protection for more effective malaria prevention.

RECOMMENDATIONS

To improve malaria prevention, communities must be educated about transmission, the role of Anopheles mosquitoes, and common symptoms. Key strategies include eliminating mosquito breeding sites, maintaining cleanliness, and focusing on high-risk groups such as pregnant women, children, and the elderly. Public campaigns should encourage seeking treatment from healthcare facilities, supported by better training for village doctors. Health workers need to actively share accurate prevention information. Continued LLIN distribution, proper usage education, and support for community-based environmental management like draining stagnant water will enhance prevention efforts.

LIMITATIONS

This study used convenience sampling in a rural community, limiting its generalizability to other endemic areas. Participant availability reduced the sample size, and recall bias may have affected response accuracy.

ACKNOWLEDGMENT

The authors express their gratitude to the study participants for their time and valuable insights. Special thanks are

extended to the field researchers, healthcare workers, and local authorities who facilitated data collection. Appreciation is also given to government and non-government organizations involved in malaria control efforts in Bangladesh.

CONFLICT OF INTEREST

There is no conflict of interest.

FUNDING

This study received no funding.

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