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Research Articles

Assessment of knowledge about malaria and LLIN ownership and its use in Bankura, West Bengal, India

Arpita Dey[1], Asit Kumar Biswas[2], Kingsuk Jana[3], Ardhendu Kumar Maji[3] & Pabitra Saha[3, 4]

[1]Institute of Public Health Kalyani, Kalyani, West Bengal, India; [2]Department of Health and Family Welfare, Government of West Bengal, Swasthya Bhavan, Salt Lake City, Kolkata, West Bengal, India; [3]Protozoology Unit, Dept. of Microbiology, Calcutta School of Tropical Medicine, Kolkata, West Bengal, India; [4]Department of Zoology, P. R. Thakur Govt. College, Ganti, Thakurnagar, West Bengal, India

ABSTRACT

Background & objectives: Community participation is one of the key factors for implementation and success of a public health programme which depends upon knowledge about that disease. Therefore, understanding the community knowledge about malaria is important for designing sustainable control programmes. This study was conducted to assess the knowledge about malaria, to evaluate long lasting insecticidal nets (LLINs) distribution and their use by LQAS method in endemic areas of Bankura district, West Bengal state, India

Methods: It was a community based cross-sectional survey conducted in Bankura during December 2019–March 2020. Structured questionnaire under four categories: socio-demographic variables, knowledge of malaria, owner ship of LLINs and its use were used for the interview. Ownership of LLINs and its use were analysed by LQAS method. Data were analysed by binary logistic regression model and chi-squared test.

Results: Out of 456 respondents, 88.59% had good knowledge, 97.37% had good ownership of LLIN and 78.95% used LLINs properly. The knowledge about malaria was significantly associated with education level (p-value<0.0001). Out of 24 lots studied, 3, 2, 4 lots were underperforming with respect to knowledge, ownership of LLIN and its use, respectively.

Interpretation & conclusion: The study population had a good knowledge about malaria. In spite of good coverage of LLIN distribution, the use of LLINs was not up to the mark. LQAS analysis showed underperformance in few lots about knowledge, ownership of LLIN and its use. The IEC and BCC activities about LLIN should be done to achieve the impact of this intervention at the community level.

Key words Malaria; knowledge; LLIN; LQAS; India

INTRODUCTION

Malaria is one of the most prevalent mosquito-borne protozoan disease and presently endemic in 85 countries[1]. The World Health Organization (WHO) recorded 241 million cases and 627,000 deaths due to malaria worldwide in 2020[1]. The WHO South-East Asia Region contributed about 2% of the global malaria burden and India alone accounted for about 83% of total malaria cases of this region[1]. So, malaria still remains as one of major public health problems in India with a total of 0.19 million malaria cases and 93 deaths in 2020[2]. A total of 14,049 malaria cases and 7 deaths were also reported from West Bengal state in 2020[2].

In 2015, WHO adopted the Global Technical Strategy for malaria 2016–2030 with the goal of reduction of global malaria incidence and mortality rates by at least 90% by 2030[3]. Accordingly, the National Vector Borne Disease Control Programme (NVBDCP) of Government of India developed the National Strategic Plan (NSP) 2017–2022 for eliminating malaria from the country within this period[4]. Four different strategic components were implemented by the NVBDCP, of which diagnosis and case management, and integrated vector control are the two main components for malaria control and prevention[4]. Vector control measures are primarily based on larval source management, indoor residual spray (IRS) with insecticides and use of long lasting insecticidal nets (LLINs). Use of LLINs is the most widely implemented and cost-effective public health intervention tool for control and prevention of malaria[5]. Since 2009, India

has scaled up LLIN interventions to control malaria in endemic states. In malaria endemic areas, universal coverage of LLIN with adequate usage may reduce the incidence of malaria by up to 50%[6]. LLINs provide up to 55% protective efficacy in preventing malaria-attributed mortality among children under 5 years of age[7]. Operational success can only be achieved when universal coverage is attained and at least 80% of bed nets are actually used by the community[8]. Various factors and determinants such as inadequate net availability, heat and discomfort due to sleeping under the net, absence of mosquito nuisance, seasonal variation, and sleeping pattern of household members were responsible for non-use of LLINs[9–10]. Some beliefs, customs, and practices of malaria are often associated with culture which affects the efficacy of malaria control strategies[11].

Community participation is one of the key factors for the implementation and success of any public health programme which depends on the level of knowledge about that disease. Community knowledge, attitude and practice about malaria are often overlooked in malaria control and prevention programmes and vary from country to country and among individual households[12]. Failure to consider community's knowledge, attitude, and practice (KAP) about malaria may contribute to the inability of the program to achieve sustainable control. Therefore, understanding the level of knowledge of the community about malaria and role of LLINs in preventing disease transmission would help in designing sustainable malaria control programmes that will lead to behavioural change and adoption of new ideas[13]. There are several reports on community-based studies about knowledge on malaria, role of LLINs and its use from various parts of India[14–19] but such reports from West Bengal state are scarce[15]. The present study was conducted to assess the knowledge about malaria and to evaluate LLIN mass distribution and their use by LQAS method in endemic areas of Bankura District, West Bengal, India.

MATERIAL & METHODS

Study areas

The present study was carried out in 22 villages under 7 different sub-centres of 4 blocks of Bankura district from December 2019 to March 2020. The study blocks were Indpur (6 villages of 2 subcentres), Onda (3 villages of 1 subcentres), Raipur (7 villages of 2 subcentres) and Ranibandh (6 villages of 2 subcentres) (Table 1). Bankura is one of the malaria endemic districts of West Bengal and malaria transmission is perineal with a peak in monsoon season during the month of July to September. In 2017, the annual parasite index (API) of the study blocks Indpur, Onda, Raipur and Ranibandh were 1.5, 1.0, 1.06 and 1.17, respectively. As per the national guidelines framed by the NVBDCP, the study blocks were saturated by the mass distribution of LLINs (Fig. 1). Bankura is situated between 22°38' to 23°38' north latitude and 86°36' to 87°46' east longitude. Bankura is the western part of West Bengal and is a part of Chota Nagpur plateau region. It has an elevation of 83 m of sea level. The area is mostly covered with seditious forest. Humidity varies from 71 to 90 %, temperature ranges from 29°C to 45°C and annual average rain fall rate is about 1,400mm. According to the 2011 census, Bankura district has a population of 3,596,674 and population density of 523 inhabitants per square km.

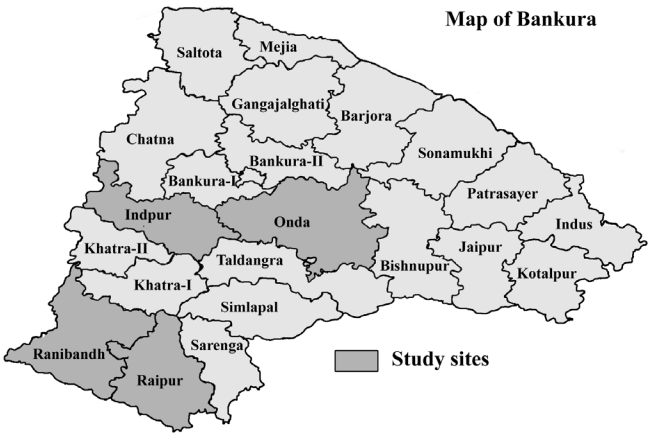

Fig. 1: Map showing the study blocks of Bankura district, West Bengal, India.

Sample size calculation

This study was a community-based cross-sectional survey, conducted to assess the knowledge about malaria and evaluation of LLIN mass distribution and its use by LQAS method. Assuming the last night usage of LLIN as 50% (as no information is available from the present study villages), confidence interval 95% and precision 5% (two tailed), the sample size was calculated as:

$$N = Z^2 \text{x } P \text{ x} \frac{(1\text{-}P)}{d^2}$$

where, Z = Z Score (value of Z score is 1.96 using 95% CI), P = Prevalence value (50%), d = precision (5%) and N = sample size.

The total calculated sample size is:
N = 3.84 X 50 X 50/25 = 384

Table 1. Study villages in West Bengal, India and sampling frame of PPS method

Blocks	Sub-centres	Villages[#]	Village population	No. of households	Sub-centre wise cumulative households	Total cumulative households	Randomly selected households	No. of selected households
Indpur (API = 1.5)	Gourabazar	Arabari	548	112	112	112		
		Danga	183	30	142	142		
		Dhuniyagarh	1227	212	354	354	297	288-306
		Dumurtore	539	109	463	463		
		Gora	490	90	553	553		
		Gourabazar	4188	783	1336	1336	648 999	639-657 990-1008
		Mohisdobra	520	105	1441	1441	1350	1341-1359
		Ramnagar	195	46	1487	1487		
		Shyampur	350	55	1542	1542		
	Khirpai	Dubraji	775	142	142	1684		
		Jhaktore	779	151	293	1835	1701	1692-1710
		Karkata	683	137	430	1972		
		Khapkata	219	44	474	2016		
		Khirpai	455	94	568	2110	2051	2042-2060
		Marageria	171	42	610	2152		
		Rampur	514	93	703	2245		
		Rowtara	918	187	890	2432	2402	2393-2411
		Sitapur	1042	207	1097	2639		
Onda (API =	Agaya 1.0)	Agaya	397	88	88	2727		
		Baruibandh	239	46	134	2773	2753	2744-2762
		Chandabila	717	138	272	2911		
		Chatra	77	21	293	2932		
		Chingra	60	8	301	2940		
		Daldali	150	36	337	2976		
		Goaltore	333	80	417	3056		
		Hunumanhir	204	44	461	3100		
		Kashidanga	455	91	552	3191	3104	3095-3113
		Madnapur	190	44	596	3235		
		Mandalbandh	80	16	612	3251		
		Nandanpur	354	98	710	3349		
		Patangpur	680	130	840	3479	3455	3446-3464
		Salukdoba	53	12	852	3491		
		Sareshkanali	767	186	1038	3677		
		Talbandhi	279	66	1104	3743		
Raipur (API	Chingra = 1.06)	Beldanga	99	16	16	3759		
		Chingani East	1295	324	340	4083	3806	3797-3815
		Chingani West	2507	568	908	4651	4157 4508	4148-66 4499-517

Blocks	Sub-centres	Villages[#]	Village population	No. of households	Sub-centre wise cumulative households	Total cumulative households	Randomly selected households	No. of selected households
		Geredha + Krishnanagar	302	68	976	4719		
		Jambadia	431	65	1041	4784		
		Kamarkata	721	138	1179	4922	4859	4850-4868
		Majherpara	148	35	1214	4957		
		Manjuria	578	115	1329	5072		
		Metyapara	314	72	1401	5144		
		Murgadanga	198	45	1446	5189		
		Ramaswaria	89	22	1468	5211	5210	5201-5219
		Seyalkonda	56	15	1483	5226		
		Shyamnagar	1012	210	1693	5436		
	Lowapara	Asharda	693	148	148	5584	5561	5552-5570
		Babuida	932	210	358	5794		
		Benasuli	354	80	438	5874		
		Chandpara	931	209	647	6083	5912	5903-5921
		Damdi	81	20	667	6103		
		Dolapara	432	100	767	6203		
		Fulberia	117	27	794	6230		
		Keduadungri	191	61	855	6291	6263	6254-6272
		Kukrajhore	194	50	905	6341		
		Lowapara	130	37	942	6378		
		Madanpur	122	29	971	6407		
		Nihila	230	58	1029	6465		
		Saltora	268	73	1102	6538		
Ranibandh (API = 1.17)	Chhendapathar	Bagdubi + Birkar	697	135	135	6673	6614	6608-6620
		Ctpani + Ghoraduba	987	184	319	6857		
		Chhendapathar	524	94	413	6951		
		Fuljhore + Orlo	583	115	528	7066	6965	6956-6974
		Murkum	472	85	613	7151		
		Satnala	1093	203	816	7354	7316	7307-7325
	Khejuria	Bansdiha	1498	225	225	7579		
		Gunpara	723	156	381	7735	7667	7658-7676
		Jabla + Karapara	953	205	586	7940		
		Khejuria	1300	214	800	8154	8018	8009-8027
		Raigarh	733	153	953	8307		
		Ramgarh	545	106	1059	8413	8369	8360-8378

Village name in underlined represents the study villages

Considering maximum non response rate 15% the final sample size will be:

$N = 384 + 57.6 = 441.6 \sim 442$

Probability Proportionate to Size (PPS) sampling technique was used to select the households as our sampling unit from 8413 households of 72 study villages of four study blocks. Village-wise list of households were prepared in each subcentre and households were assigned serial numbers. The blocks, subcentres and villages were sorted alphabetically and cumulative household numbers of the villages were calculated. A village was considered as a sampling unit (lot) and a total of 24 lots were taken for this study. So, the sampling interval was 8413/24 = 350.54 ~351. A random number was selected from the first village (lot) as first selected household. Subsequent villages (lots) were selected accordingly. If the selected village had the household number less than the required number we considered the remaining household(s) (to select randomly) from the adjacent village. In each study lots a total of 19 households were selected. So, the final sample size = 24 X 19 = 456 (Table 1).

Study variables

For operational clarity, a pilot-tested, pre-designed, structured questionnaire was prepared in local vernacular (Bengali language) for interview. The questionnaire was first prepared in English and then translated into Bengali by a linguistic expert keeping semantic equivalence. To verify the translation, it was again translated into English by two independent researchers who were unaware of the earlier English version. The structured questionnaire was prepared under four categories: socio-demographic variables, knowledge of malaria, owner ship of LLIN and use of LLIN.

Lot Quality Assurance Survey (LQAS) method

LQAS is an established analysis methodology adapted to health sciences in the mid-1980s to classify management units according to a performance target[20]. By the LQAS method, information about specific sample is collected in a study area. For each indicator, the number of correct responses is counted and compared with a predetermined cut off value. If the number of correct responses were fewer than the cut off value, then the area was classified as low performance; if it was more than the cut off value, then the area is classified as high performance.

In this study, three different indicators i.e., first: knowledge on malaria, second: ownership of LLIN, and third: usage of LLIN were taken to identify the underperforming areas. After filling up all the correct responses for each lots, the total correct responses for each indicator was calculated by summing up each of them. The average coverage score for each indicator was calculated by dividing total correct score with sample size and multiplying it with 100. The target coverage percentage of first, second and third indicators were 55%, 100% and 80%, respectively. The decision rule of each indicator was calculated from LQAS decision rule table after considering the sample size of each lot and target coverage percentage.

Data collection

Before the initiation of field survey, a sensitization meeting was organized in the study village in the presence of local health authorities. During the survey, a study team visited door-to-door with a pre-printed questionnaire. Then one-to-one interview was conducted with the head of the households/ adult member of the household where head of household was not present. Where a selected house was found locked, the next house was used as a replacement.

Data management and data analysis

To ensure the quality of data, all filled questionnaires were checked for completeness. Data thus collected was entered in MS Excel. Every question under the variables knowledge about malaria was scored by adding a value of 0 or 1. Each correct answer was scored a value of 1, whereas the 'wrong' and 'do not know' answer by zero. Each index was categorized into two groups - 'poor' and 'good'. The values below the median range of overall score were considered as 'poor', whereas the score above the median value as 'good'. There were 15 questions under the variable knowledge about malaria and scored 0–15. The scoring of 0–6 was considered as 'poor' and 7–15 as 'good'. Associations between dependent and independent variables were was determined by binary logistic regression model using SPSS software version 21 (IBM Corp., Armonk, NY).

Ethical statement

The protocol of the present study was approved by the Institutional Ethical Committee, Institute of Public Health Kalyani (IPHK). Informed consent was obtained from the head of the households and who were willing to participate in the study.

Table 2. Socio-demographic characteristics of study respondents (n=456)

Characteristics		n	%
Gender	Male	158	34.65
	Female	298	65.35
Age group (years)	18-30	153	33.55
	31-40	105	23.03
	41-50	98	21.49
	51-60	70	15.35
	>60	30	6.58
Marital status	Married	409	89.69
	Unmarried	25	5.48
	Married but single	22	4.82
Family Structure	Nuclear	238	52.19
	Joint	218	47.81
Number of family members	1	4	0.88
	2	28	6.14
	3	64	14.04
	>4	360	78.95
Under five years member (s)	Yes	140	30.7
	No	316	69.3
Pregnant woman	Yes	15	3.29
	No	441	96.71
Education	No primary	169	37.06
	Primary	81	17.76
	Secondary	152	33.33
	Higher secondary	32	7.02
	Graduate/ Post-graduate	22	4.82
Occupation	Home makers	237	51.97
	Cultivation	82	17.98
	Labour	83	18.2
	Service	7	1.54
	Business	23	5.04
	Others	24	5.26
House type	Pucca (permanent)	83	18.20
	Semi-pucca	58	12.72
	Kacha	315	69.08
Monthly income	INR 4000 & above	251	55.04
	< INR 4000	205	44.96

RESULTS

Sociodemographic characteristics of participants

A total of 456 individuals were interviewed during this study and all of them were aged between 18 years to 81 years with an average age of 39.9 years. The socio-demographic characteristics of the study respondents (n = 456) are represented in Table 2.

Out of 456 participants, 65.35% were male and 34.65% were female. Only 140 (30.7%) and 15 (3.29%) households had under 5 years age children and pregnant woman, respectively. A significant proportion of respondents were illiterate (37.06%), whereas 17.76% possessed primary education and 45.17% had higher education. Most of the study participants had Kacha house (69.08%) and 44.96% earned less than 4000 INR per month.

Knowledge about malaria

Among total study participants, 88.59% had good knowledge about malaria. It was found that 89.69% respondents had the knowledge that malaria is transmitted by insect (mosquito) bite but only 39.69% were aware about the exact timing of the mosquito bite that transmitted malaria. Fever as a common symptom of malaria was known to 85.31% respondents. Most of the respondents (89.69%) knew that blood sample is used for malaria diagnosis and 90.79% had the knowledge that malaria can be cured by treatment. Out of total respondents, only 61.62% had the knowledge that malaria affected severely among children and pregnant woman (Table 3).

Malaria can be prevented by avoiding water storing was known to only 41.23% respondents. The predominant Anopheles species of the study areas are *Anopheles culicifacies, An. subpictus,* and *An. annularis*, of which *An. annularis* is a tank breeder. Most of the study population (58.77%) had no proper knowledge about the breeding site of the malaria vectors. Only 19.96% of the study population believed that malaria can be prevented by early detection and prompt treatment. Most of the respondents knew that malaria can be prevented

Table 3. Knowledge about malaria among study respondents (n=456)

Variables		N	%
Malaria is transmitted through	Air	2	0.44
	Water	4	0.88
	Insect (mosquito)	409	89.69
	Others & don't know	41	8.99
Timing of bite of mosquitoes that transmitted malaria	Day	33	7.24
	Evening	86	18.86
	Night	181	39.69
	Anytime	156	34.21
Symptoms of malaria	Cough	7	1.54
	Fever	388	85.09
	Diarrhea	3	0.66
	Others & don't know	58	12.72
Sample used for malaria diagnosis	Blood	409	89.69
	Urine	5	1.09
	Sputum	1	0.22
	Others & don't know	41	8.99
Is malaria cured by treatment?	Yes	414	90.79
	No	42	9.21
Malaria affected severely among	Aged & adolescent	125	27.41
	Children & pregnant	281	61.62
	woman	50	10.96
	Don't know		
Malaria can be prevented by avoiding water storing	Yes	188	41.23
	No	268	58.77
Malaria can be prevented by early detection & prompt treatment	Yes	91	19.96
	No	365	80.04
Malaria can be prevented by spraying insecticides	Yes	63	13.82
	No	393	86.18

Malaria can be prevented by using LLINs	Yes	377	82.68
	No	79	17.32
LLIN can prevent malaria by acting as man-mosquito barrier	Yes	397	87.06
	No	59	12.94
LLIN can prevent malaria by acting as mosquito repellent	Yes	177	38.82
	No	279	61.18
LLIN can prevent malaria by acting as man-mosquito barrier and mosquito repellant	Yes	181	39.69
	No	275	60.31
What is the washing frequency of LLIN	Monthly	167	36.62
	Quarterly	76	16.67
	Half yearly	136	29.82
	Yearly	77	16.89
Knowledge on free distribution of LLIN by the government	Yes	456	100.0
	No	0	0
Overall knowledge of malaria	Good	404	88.59
	Poor	52	11.41

by using LLINs but only 13.82% thought that it can be prevented by insecticide spraying. Regarding the role of LLINs in malaria control, 87.06% respondents believed that LLINs prevent malaria by acting as a man-mosquito barrier whereas only 38.82% thought that LLINs can act as mosquito repellent and 39.69% believed that LLINs can prevent malaria by acting as man-mosquito barrier as well as a mosquito repellent. Only 29.82% study participants had the correct knowledge of LLINs washing frequency and all the participants had the knowledge on free distribution of LLINs by government (Table 3).

Ownership of LLINs

All the study participants received free LLINs and 15.35%, 35.31%, 31.36% and 17.98% respondents received 1, 2, 3, and more than 3 LLINs, respectively. A significant proportion of participants (97.37%) had LLINs during the study period. Only 2.63% participants were unable to show LLINs during house visit. About 35.75% respondents purchased bed nets other than LLINs from the local market (Table 4).

Usage of LLINs

Majority of respondents (78.95%) had used the LLIN last night and 70.39% of study participants used LLIN every day. Out of 456 houses, children below 5 years and pregnant woman were found in 140 and 15 households, respectively. About 87.14% children below 5 years and 80.0% of pregnant woman slept under LLINs the previous night. Only 17.93% of respondents used LLIN during daytime sleep. The major concepts behind the use of LLIN were to prevent mosquito bite, snake bite and other bites, prevent malaria, and the profit in using it were the main factors responsible for use of LLINs (Table 5).

Table 4. Ownership of LLINs among study respondents (n=456)

Variables		N	%
Received free LLIN or not	Yes	456	100.0
	No	0	0
Number of LLIN received	1	70	15.35
	2	161	35.31
	3	143	31.36
	>3	82	17.98
LLIN currently present at your house	Yes	444	97.37
	No	12	2.63
Number of LLIN currently present at your house	0	12	2.63
	1	91	19.96
	2	160	35.09
	3	127	27.85
	>3	67	14.69
Purchase other bed nets or not	Yes	163	35.75
	No	293	64.25

Table 5. Usage of LLIN among study respondents (n=456)

Variables		N	%
Whether slept under LLIN last night	Yes	360	78.95
	No	96	21.05
Whether under 5 years children slept under LLIN last night	Yes	122	26.75
	No	18	3.95
	Not applicable	316	69.29
Whether pregnant woman slept under LLIN last night	Yes	12	2.63
	No	3	0.66
	Not applicable	441	96.71
Frequency of LLIN use	Never	43	9.42
	Frequently	61	13.38
	Occasionally	31	6.79
	Everyday	321	70.39
Whether use LLIN at day time	Yes	82	17.98
	No	374	82.01

Association of knowledge about malaria, ownership of LLIN and usage of LLIN with sociodemographic variables

It was observed that knowledge about malaria depends on the level of education of the respondents, higher the education better is the knowledge. Persons with primary and higher education had 3.83 times (OR=3.83, 95% CI=1.44-10.19) and 3.74 times (OR=3.74, 95% CI=1.44-10.19) better knowledge respectively than the illiterate persons. Agricultural labours (OR=8.37, 95% CI=1.97-35.42) and daily-wage labours (OR=2.81, 95% CI=1.32-5.99) had better knowledge about malaria than house workers. No such association was noted in between ownership of LLIN and use of LLIN with any of the socio-demographical variables (Table 6).

The gender of the study respondents was not significantly associated with the knowledge about malaria, ownership of LLINs and usage of LLINs (chi-square>0.26, p-value>0.087). Same thing was also noticed for monthly income (chi-square<3.051, p-value>0.081). A significant association was recorded between level of education and knowledge of malaria (chi-square=20.19, p-value<0.0001) but the level of education was not significantly associated with ownership of LLIN (chi-square=0.25, p-value=0.884) and usage of LLIN (chi-square=0.58, p-value=0.747). The occupation of the respondents was significantly associated with knowledge of malaria (chi-square=18.16, p-value=0.0004) but not associated with ownership of LLIN (chi-square=3.97, p-value=0.264) and usage of LLIN (chi-square=0.68, p-value=0.87).

Evaluation of LLIN mass distribution by LQAS method

A total of 24 lots were selected and 19 households from each lot were included in this study. Three different indicators i.e., first: knowledge on malaria, second:

Table 6. Association between knowledge about malaria, malaria control and LLIN, ownership of LLIN and Use of LLIN with socio-demographical status

Socio-demographical variables		Knowledge about malaria		Ownership of LLIN		Use of LLIN	
		OR	95% CI	OR	95% CI	OR	95% CI
Gender	Male	0.53	0.27-1.04	1.15	0.74-1.77	1.37	0.89-2.09
	Female	-	-	-	-	-	-
Education	Illiterate	-	-	-	-	-	-
	Primary	3.83	1.44-10.19	1.04	0.56-1.92	1.12	0.66-2.22
	Higher	3.74	1.44-10.19	0.91	0.58-1.45	0.97	0.62-1.51
Occupation	House work	-	-	-	-	-	-
	Agriculture	8.37	1.98-35.42	1.68	0.9-3.16	0.79	0.46-1.38
	Daily Labour	2.81	1.32-5.99	0.92	0.57-1.45	0.97	0.59-1.56
	Service	-	-	-	-	-	-
Monthly income (INR)	< 4000	0.729	0.41-1.31	0.81	0.53-1.24	0.82	0.55-1.24
	> 4000	-	-	-	-	-	-

OR : Odds Ratio, CI: Confidence Interval

Table 7. Evaluation of LLIN mass distribution by LQAS method (n = 456)

Supervision area	Indicators		
	Knowledge about malaria	Ownership of LLIN	Usage of LLIN
Total no. of lots	24		
Sample size in each lot	19		
Total correct response	404	444	360
Total sample size	456	456	456
Average score, %	88.59	97.37	78.95
Target score, %	55	100	80
Decision rule	8	17	13
No. lots scored below decision rule (%)	3 (12.5)	2 (8.33)	4 (16.67)
No. lots scored above decision rule (%)	21 (87.5)	22 (91.67)	20 (83.33)

ownership of LLIN, and third: usage of LLIN were taken into consideration for the identification of the underperforming lots by LQAS method. It was observed that 88.59% respondents had good knowledge, 97.37% had good ownership of LLINs and 78.95% have used the LLINs properly. The average score of the first indicator was above the target score but average score of second and third indicators were just below the target score. The decision rule for first, second and third indicators were 8, 17, and 13 respectively. It was also recorded that 3, 2, 4 lots were below the decision rule for first, second and third indicators, respectively (Table 7).

DISCUSSION

Evaluation of knowledge, attitude and practices regarding malaria among the common people living in an endemic region is an important aspect for development of an effective malaria control strategy to reach the goal of elimination of malaria in India by 2030. Correct knowledge and practices in relation to malaria prevention at the community level is an indication of acceptance and assimilation of different malaria control measures. This is very important for improving the malaria situation at the national and sub-national level.

Present study revealed that the most of the study participants possessed very good knowledge about the disease malaria. About 89.59% knew malaria was transmitted through the bite of mosquitoes but only 39.69% had the correct knowledge about the timing of mosquito bite that transmitted malaria. Similar findings were recorded by Tyagi *et al*. 2005[12], Gupta *et al*. 2016[17], Gupta *et al*. 2019[18], Borkar *et al*. 2017[21], and Mahesh *et al*. 2014[22] in different parts of India, whereas a study conducted by Singh *et al*. 2013[23] showed that only about 66.7% of study participants were aware that malaria is transmitted by mosquitoes in Bihar and Jharkhand states. More than 85% of the respondents possessed correct knowledge about symptoms and diagnosis of malaria and it can be cured by treatment. Similar results were shown by Borkar *et al*. 2017[21] in which most respondents (92.2%) gave correct response about symptoms of malaria. But previous studies by Gupta *et al*. 2016[17], Gupta *et al*. 2019[18] and Singh *et al*. 2013[23] showed that about 66.2%, 52.4%, and 74.4% respectively know that fever is a symptom. The present study areas are endemic for malaria since a long time and that might be the reason behind higher level of knowledge among common people.

In the present study, only 19.96% and 13.82% participants believed that malaria can be prevented by early detection and prompt treatment and by spraying insecticides, respectively. So, the knowledge level of the population in this aspect should be improved through proper Behaviour Change Communication (BCC) campaigning which will help malaria control programme. Majority of the respondents knew that stagnated water is a breeding site of malaria vector mosquitoes. Similar findings have been reported from other parts of India and abroad[12, 24–25]. Among the study participants, 87.94% knew that malaria can be prevented by using LLINs. But only 29.82% had correct knowledge about the washing frequency of LLINs. Similar findings were reported from southern Rwanda by Habimana *et al*. 2020[26].

In the present study it was observed that 100% household received free LLINs and presently 97.37% households possessed at least one LLIN. Similar findings were also reported by Raghavendra *et al*. 2017[27] and Chourasia *et al*. 2017[28]. About 80% households were using LLINs during previous night of the day of the survey. In contrast lower coverage of LLIN and lower utilization of LLIN were reported by Mukhopadhyay *et al*. 2016[15] from the same district. In contrast to the finding of Raghavendra *et al*. 2017[27], a higher proportion (85.6%)

of children under 5 years of age were using LLIN which was similar to the findings of Chourasia *et al*. 2017[28]. A significant proportion (more than 20%) of another vulnerable group were not using LLINs properly, which is a matter of concern regarding malaria elimination. It should be improved by improving the health seeking education of this group. One of the most cost-effective measures for prevention and control of malaria in endemic countries is the use of LLINs[5]. In this study, LQAS method was used to evaluate the LLIN mass distribution by using three different indicators to identify the underperforming areas. It was found that 88.59% of the study respondents had good knowledge on malaria which is well above the target set for this study. But out of the 24 lots, 3 (12.5%) were under-performing regarding the knowledge about malaria. Though the overall ownership of LLIN was high (97.37%) but 2 lots were underperforming in this aspect. The study population showed usage of LLINs among 78.95% study respondents which was slightly lower than the target level (80%). Four lots were underperforming with respect to the use of LLINs in the study areas. These results are in agreement with other extensive studies from central India[27], Enugu in Nigeria[29], and Ethiopia[30]. Effort should be given to improve the health seeking behaviour in underperforming lots as determined by LQAS method. Similar studies in other malaria endemic areas are highly suggested.

CONCLUSION

The study population had a good knowledge about malaria. In spite of a good coverage of LLIN distribution, the use of LLINs was not up to the mark. LQAS analysis showed that few lots were underperforming with respect to knowledge about malaria, ownership of LLIN and its use. So, IEC and BCC activities should be continued in the study areas for better performance of LLIN usage. The IEC and BCC activities about benefit of proper use of LLINs should not be limited to only the high-risk groups like pregnant mothers and children under 5 years but also to all household members to achieve the impact of this intervention at the community level.

Conflict of interest: None

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Correspondence to: Dr. Pabitra Saha, Protozoology Unit, Dept. of Microbiology, Calcutta School of Tropical Medicine, 108, C. R. Avenue, Kolkata 700073, West Bengal, India.
E-mail: pabitra.saha82@gmail.com

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