Original article

A COMMUNITY LEVEL KAP STUDY ON MOSQUITO CONTROL IN JAMNAGAR DISTRICT

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ABSTRACT

Background: The vectors borne diseases poses an immense public health concern and are major impediments in the path of socio-economic development.

Objective: To assess domestic environment as well as community level KAP on mosquito control measures in Jamnagar district.

Methods & statistics: It was a cross-sectional survey of 450 household by a pre-tested proforma analyzed by Microsoft excel office 2007. It was carried out in urban, urban slum and rural areas of Jamnagar district.

Results: Rural domestic environment was favorable for mosquito breeding. Most of the respondents were unaware about the places where mosquito bred. The knowledge regarding vector, routes and symptoms of malaria was good, while majority were unaware about types of malaria and other mosquito borne diseases. Active malaria surveillance activity was totally lacking in urban area (94%), while it was very poor in rural and slum area. The preferred treatment providers in the community neither screened malaria nor imparted health education about mosquito control. 56% of the respondents were practicing at least one personal protective and larvae control measure, but less efficient one.

Conclusion: Community participation in term of KAP regarding vector control is deficient at places & needs to be addressed for effective mosquito control.

Key words: Community participation, Breeding, active surveillance, personal protection, larvae control

INTRODUCTION

India contributes 77% of the malaria in Southeast Asia.[1] Around 1.5 million laboratory confirmed cases of malaria are annually reported in India. Among them 50% of the cases are of P. falciparum as a consequence of chloroquine resistance.[2] In 1995, the expert committee on malaria identified urban areas as high-risk areas because of man-made vector breeding sites. It was expected that anti-larval measures along with personal protection measures would control the malaria transmission in urban areas. The situation was made more complicated by the rapid development, construction activities, unplanned rapid expansion of urban areas, industrialization without proper drainage facilities and development of supporting infrastructures like rail and roads without keeping in mind the natural flow of surface water. Slums in towns & its periphery are the worst affected because of lack of water management and appropriate anti-larval operations. Around 10% of malaria cases are reported from the urban areas.[3] National Health Policy (2002) has set the goal of reduction in mortality of malaria and other vector borne diseases by 50% by 2010 and control of morbidity.[4]

To achieve best results in malaria control it is imperative to have active community participation. Community participation in turn depends on people's knowledge and attitude towards the disease. There is a need to know the existing knowledge and attitudes of population regarding malaria as a disease, its treatment and control. Most organized vector control strategies require public support of one kind or another and the extent of people's cooperation can determine the success or failure of the entire campaign.[5] There is little information on the Knowledge, Attitude, & Practice (KAP) components of the community in relation to the mosquitoes and their control in India.[6] Therefore, we thought it would be a worthwhile endeavor to conduct a cross-sectional study in Jamnagar area to find out the knowledge, current practices and treatment seeking behavior of the urban and rural population of a district, regarding prevention and management of malaria as well as awareness regarding anti-malaria activities and to assess the extent of community participation for the anti-malaria activities and study the various factors associated with it.

METHODS

It was a cross-sectional study conducted in a coastal district of west Gujarat during period from June 2007 to December 2007. It is spread over 10 blocks with 754 villages.

The present study was conducted in one urban slum area, one urban non-slum area and one rural area of the district. Urban slum area selected for present study was Navagam, a typical urban slum having enough houses for study purpose. Rural area selected for present study was Aliabada village because of easy transport facility and enough houses. Patel colony was selected as a typical modern urban area.

Sample size: For estimating a population proportion with specified relation precision, formula $\mathbf{n=Z^2_{1-\alpha/2}\ (1-P)P/\varepsilon^2}$ was used where n=Sample size, 1-α = confidence level, $Z_{1-\alpha/2}$ = Represent the number of standard errors from the mean, a function of confidence level, P= anticipated population proportion, ε= Relating precision.[7]

Since P value from previous studies on the topic of present study is not available an anticipated P value of prevalent knowledge regarding mosquito is taken as (50%).[7] At p= 0.50 (50%) & ε = 10%, a sample size of 384 would be needed. To improve the precision further, sample size was taken 450 household respondents instead of 440 including 15% of sample loss. Total sample divided in to three equal parts of 150 to have a fair representation from different strata of the rural, urban and slum areas of a district. Sampling unit of the study was kept a household and one adult female respondent of more than 15 years from each household was selected for interview and for our convenience the every tenth household was selected in urban & slum area, while every fifth household was selected in rural area. The choice of the first house was guided by multipurpose health workers in their respected areas.

Data collection & analysis: Pre-tested and semi-structured questionnaire was used for collecting data. Subjects were interviewed through house to house visits and one adult female respondent of more than 15 was interviewed from each household. In unavailability of female, male respondent was interviewed. Questionnaire included information regarding socio-demographic characteristics, physical environment of household, Knowledge, attitude and practice on malaria control and treatment seeking behavior of the family. Intra-domestic water containers were examined in every house for presence of mosquito larvae by removing the cover on it if any, followed by naked eye observation (for small containers & overhead tanks). While for underground tanks we collected water in a bucket followed by throwing light of torch through water. The Larvae which remain parallel to water surface in container or in sampled water were identified as tribe anophilini larvae while those which made angle to surface of water were identified as tribe culicini one.[8] Consent of the participants was taken after explaining the purpose of the study and knowing their willingness to share the information. Data entry and analysis was done by using Microsoft Excel 2007 sheet.

RESULTS

In the study total 450 families were interviewed, each 150 family taken from urban area, urban slum and rural area of Jamnagar district. In urban and rural community proportion of joint family is higher (65%) than slum community (24%). Majority of the respondents (84%) were Hindu and rest were from Muslim religion. Only up to 20% of the respondents were illiterate in the study sample. Proportion of illiterate respondent was more in rural area (33%) than slum (28%). There was no any illiterate respondent in

urban area. Observed difference in educational level was statistically significance (p<0.0001) (Table-1). Majority of the respondent were young females and occupied in household work because we preferred female respondent (Table-1).

As much as more than 30% of housing was not pucca mainly in slum and rural area favoring endophilic behavior of mosquitoes (Table-1). Para-domestic drain facility was there in most of all interviewed houses (97%), while it was not found in 3% houses. As much as 38% of the houses had open para-domestic drainage system, while 58% drains were closed type. In rural area most of all drainage systems were open, while in slum and urban areas most of the drainage systems were closed type (Table-1).

Table-1 Socio-demographic profile of respondent

Variable	Urban (n=150)	Rural (n=150)	Slum (n=150)	X^2 (df), P value
Gender				
Male	23 (15.33)	33(22)	30 (20)	2.27 (2), 0.3214
Female	127(84.67)	117(78)	120 (80)	
Age group				
15-25	21(14.00)	26 (17.33)	36 (24.00)	
25-35	69 (46.00)	60 (40.00)	72 (48.00)	
35-45	46 (30.67)	37 (24.67)	18 (12.00)	22 (6), < 0.001
45-60	14 (9.33)	27 (18.00)	24 (16.00)	
Mean (SD)	35.20 (8.6)	35.88 (10.28)	33.80 (11.17)	
Education				
Illiterate	0 (0.0)	50 (33.33)	42 (28.00)	248 (6), < 0.0001
School	26 (17.33)	74 (49.33)	102 (68.00)	
High school	32 (21.33)	9 (6.00)	6 (4.00)	
College	92 (68.33)	17 (11.34)	0 (0.0)	
Occupation				
Service	27 (18.00)	5 (3.33)	6 (4.00)	60 (8), < 0.0001
Farming	9 (6.00)	9 (6.00)	0 (0.00)	
Housewife	105 (70.00)	107 (71.33)	120 (80.0)	
Study	9 (6.00)	4 (2.67)	6 (0.00)	
Laborer	0 (0.00)	25 (16.67)	18 (12.00)	
Housing				
Pucca	145 (96.67)	101 (67.33)	78 (52.00)	77 (4), <0.0001
Mix	5 (3.33)	44 (29.33)	66 (44.00)	
Kutcha	0 (0.00)	5 (3.33)	6 (4.00)	
Para domestic drain				
Open	5 (3.33)	131 (87.33)	36 (24.00)	267 (2), <0.0001
Closed	145 (96.67)	10 (6.67)	108 (72.00)	
No drain	0 (0.00)	9 (6.00)	6 (4.00)	

Figures in parentheses indicate percentage

Table-2 Mosquito breeding found in houses during the survey

Breeding places	Urban	Rural	Urban slum	Total	X^2 (df), P value
Total houses	150 (100)	150 (100)	150 (100)	450 (100)	79 (2), <0.0001*
Positive	30 (20.0)	78 (52)	12 (8.0)	120 (26.67)	
Total water container found &examined	574 (100)	1029 (100)	414 (100)	2017 (100)	37 (2), <0.0001*
Positive containers	34 (5.9)	122 (11.86)	12 (2.9)	168 (8.33)	
Anopheles	34 (100)	37 (30.33)	0 (0.0)	71 (42.26)	86 (4), <0.0001*
Culicini**	0 (0.0)	50 (40.98)	0 (0.0)	50 (29.76)	
Mix	0 (0.0)	35 (28.96)	12 (100)	47 (27.98)	

*=statistically highly significant; **= Culicini tribe of mosquitoes like Culex, Ades etc.; Figure in parenthesis indicate percentage

During the survey, larval breeding was observed in 27% houses in total 168 (8%) containers. House Index (number of houses infested *100/number of houses inspected) was (27%), Container Index (number of container positive for larvae *100/number of containers examined) was (8%), while Breteau Index (number of containers positive for larvae *100/number of houses inspected) was (37%).[8] Highest proportion of positive containers was observed in rural area (52% houses and 12% containers, X^2=79,DF=2, p<0.0001 and X^2=37, DF=2, p<0.0001 respectively). Positive houses for larval breeding showed mostly Anophelini type, while culicini were found only in 30% of the positive houses (X^2=86, DF=4, p<0.0001). Mix type of larva found in 28% of the houses. In urban area all breeding places were of the Anopheles mosquito larvae, while in slum it was of the mix type of the larvae. In rural area the predominant type was the Culicini (41% of positive), followed by Anophelini (30%) and mix type (29%) (Table-2).

About half of the respondents (50%) did not know the medium and the places where mosquito lays its eggs. While less than half (42%) answered the place is water. In addition, as much as 25% respondents had wrong idea about mosquito breeding places i.e. sand, mud, garbage, and the wall surface. 10% of respondent also answered the hanging objects as a place where mosquitoes can lay the eggs. Controversially, three quarters of total respondents (76%) had knowledge about larvae (local word -"PORA") and had seen it in the water (Table-3).

Table-3 Knowledge of respondents on various aspect of mosquito behavior

Variable	Urban (n=150)	Rural (n=150)	Slum (n=150)	Total (n=450)
Places of mosquito breeding*				
Water	87 (58.0)	73 (48.67)	30 (20.0)	190 (42.22)
On hanging object	18 (12.0)	4 (2.67)	24 (16.0)	46 (10.22)
Sand	13 (8.67)	5 (3.33)	0 (0.0)	18 (4.00)
Mud	19 (12.17)	12 (8.00)	12 (8.0)	43 (9.56)
Garbage	14 (9.33)	4 (2.67)	6 (4.0)	24 (5.33)
On the wall	10 (6.67)	5 (3.33)	12 (8.0)	27 (6.00)
Don't know	63 (42.0)	73 (48.67)	90 (60.0)	226 (50.22)
Respondents who have seen larvae ("PORA") in water				
Yes	127 (84.67)	106 (70.67)	108 (72.0)	341 (75.78)
No	23 (15.33)	44 (29.33)	42 (28.0)	109 (24.22)
Other routes of malaria transmission*				
Blood	150 (100.0)	94 (62.67)	108 (72.0)	352 (78.22)
Food	63 (42.0)	14 (9.33)	36 (24.0)	113 (25.11)
Unsafe water	53 (35.33)	46 (30.67)	48 (32.0)	147 (32.67)
Airborne	4 (2.67)	17 (11.33)	24 (16.0)	45 (10.0)
Contagious	0 (0.0)	10 (6.67)	6 (4.0)	16 (3.56)
Don't know	0 (0.0)	22 (14.67)	30 (20.0)	52 (11.56)
Diseases transmitted by mosquitoes*				
Malaria	150 (100)	138 (92.00)	120 (80.0)	408 (90.67)
Chikunguniya	58 (38.67)	83 (55.33)	36 (24.0)	177 (39.33)
Typhoid	32 (21.33)	45 (30.00)	30 (20.0)	107 (23.78)
Dengue	56 (37.33)	23 (15.33)	6 (4.0)	85 (18.89)
Filariasis	27 (18.00)	5 (3.33)	6 (4.0)	38 (8.44)
Other	17 (11.33)	0 (0.00)	18 (12.0)	35 (7.78)
Don't know	0 (0.00)	8 (5.33)	30 (20.0)	38 (8.44)
Symptoms of malaria*				
Fever with rigor	142 (94.67)	121 (80.67)	120 (80.00)	383 (85.11)
Headache	41 (27.33)	66 (44.00)	18 (12.00)	125 (27.78)
Vomiting	14 (9.33)	17 (11.33)	18 (12.00)	49 (10.89)
Bodyache	62 (41.33)	38 (25.33)	30 (20.00)	130 (28.89)
Jaundice	0 (0.00)	0 (0.00)	6 (4.00)	6 (1.33)
Other	4 (2.67)	9 (6.00)	12 (8.00)	25 (5.56)
Don't know	8 (5.33)	24 (16.00)	30 (20.00)	62 (13.78)
Types of malaria	52 (34.67)	40 (26.67)	12 (8.00)	104 (23.11)

* = Multiple responses; Figure in parenthesis indicate percentage

Table-4 Community perception about malaria control programme and participation

Activities	Urban (n=150)	Rural (n=150)	Slum (n=150)	Total (n=450)
Regularity of active malaria surveillance				
Regularly, every 15 days	0 (0.00)	25 (16.67)	24 (16.00)	49 (10.89)
Irregularly	5 (3.33)	40 (26.67)	66 (44.00)	111 (24.67)
Only during fever season	4 (2.67)	21 (14.00)	6 (4.00)	31 (6.89)
Nobody comes at all	141(94.00)	64 (42.66)	54 (36.00)	259 (57.55)
Does the worker sees water container for larval breeding				
Yes	0 (0.00)	37 (43.02)	30 (31.25)	67 (35.08)
Total (n)	9 (100)	86 (100.0)	66 (100.0)	191 (100.0)
Total fever episodes and blood testing in surveyed houses in last year				
No. of fever episode	22 (2.63)	83 (9.53)	48 (7.27)	153 (6.46)
n=Surveyed population	838 (100)	871 (100)	660 (100)	2369 (100)
Malaria blood test done	8 (36.36)	53 (63.86)	12 (25.0)	73 (47.71)
Advised mosquito control	8 (36.36)	26 (31.33)	0 (0.00)	34 (22.22)
Health seeking behavior of the respondents for treatment of fever				
General Practitioner	13 (59.09)	47 (56.63)	24 (50.00)	84 (54.90)
PHC/CHC	5 (22.73)	31 (37.35)	6 (12.50)	42 (27.45)
Physician	4 (18.18)	5 (6.02)	18 (37.50)	27 (17.65)
Personal protective measure practiced by the community*				
All-out (Mats)	127(84.67)	46 (30.67)	78 (52.00)	251(55.78)
Mosquito coils	48 (32.00)	39 (26.00)	48 (32.00)	135 (30.00)
Mosquito nets	30 (20.00)	18 (12.00)	48 (32.00)	96 (21.33)
Odomos	29 (19.33)	0 (0.00)	6 (4.00)	35 (7.78)
Smokes & Dhoop	5 (3.33)	10 (6.67)	6 (4.00)	21 (4.67)
Insecticide spraying	0 (0.00)	15 (10.00)	0 (0.00)	15 (3.33)
Screening of house	4 (2.67)	0 (0.00)	0 (0.00)	4 (0.89)
Not using any method	0 (0.00)	46 (30.67)	30 (20.00)	76 (16.89)
Intra-domestic anti-larval activities practiced by people*				
Scrubbing of containers	43 (28.67)	90 (60.00)	90 (60.00)	223 (49.56)
General cleanness	14 (9.33)	5 (3.33)	6 (4.00)	25 (5.56)
Larvivorous fishes	0 0.00)	4 (2.67)	0 (0.00)	4 (0.89)
Edible oil application	5 (3.33)	25 (16.67)	0 (0.00)	30 (6.67)
Chlorine tablet	31 (20.67)	31 (20.67)	6 (4.00)	68 (15.11)
Covering the containers	71 (47.33)	4 (2.67)	6 (4.00)	81 (18.00)
Don't know	36 (24.00)	19 (12.67)	48 (32.00)	103 (22.89)

* = Multiple responses; Figure in parenthesis indicate percentage

Al most all the respondents were knowing that the mosquito bites and blood route are the main mode of malaria transmission. Most common mosquito borne diseases known by the respondents were Malaria (91%), Chikunguniya (39%), Dengue (19%) and Filariasis (8%). In addition, one quarter of respondents had incorrect belief that contaminated water, food and air, touching a malaria patient can cause malarial illness and similarly 30% respondents had also accounted Typhoid and other non mosquito borne diseases as mosquito borne diseases. This type of wrong believes were more prevalent in slum and rural respondents as compared to urban one (Table-3). According to the respondents fever with rigor (85%) was the most common symptom of malarial illness, while headache (28%), vomiting (10%), Bodyache (29%), jaundice (1%) and other symptoms like diarrhea, cold etc. (6%) were viewed as possible symptoms of malaria (Table-3). Thus, the overall knowledge regarding the mosquito and mosquito borne diseases was more precise among urban and rural respondents than among urban slum respondents (table-3). As much as three quarters of the respondents (77%) did not know about different types of malaria. Out of remaining 23% who knows the types of malaria, majority of them were from urban city area (52/104) and rural area (40/104). Thus, the overall knowledge regarding the mosquito and mosquito borne diseases was more precise among urban and rural respondents than among urban slum respondents (table-3).Active malaria surveillance activity was totally lacking in majority of surveyed houses (58%), while it was regular only in 11%, irregular in 24% and seasonal in 7% of surveyed houses. The houses in which active surveillance was found, health workers had never checked water containers for larval breeding in 65% of household (Table-4). Overall

annual fever episode in surveyed population was 6.46% during the period from June 2006 to may 2007. More fever incidence observed in rural area (9.53%). Majority of the fever cases (55%) consulted General Practitioner as first line treatment provider, while 28% of them went to the government hospital or PHC (Primary Health Centre), but half of them (53%) of them were neither screened for malaria parasite nor got any blood test. Out of total 153 fever treatment occasion, in only 22% occasions the patients and their family member are given health education by the treatment providers about mosquito control (Table-4).

About half of the respondents (56%) were using at least one personal protective measure to prevent mosquito bite i.e. All-out (56%), Mosquito coils (30%), Odomos (8%), Smokes, Dhoops (5%) etc., while less than one quarter of them used mosquito nets (21%), Insecticide spraying etc.(Table-4). Nearly half (50%) of households were practicing one or more efficient larvae control measures i.e. regular scrubbing of water storage container (50%), air-tight covering of storage container (18%), application of edible oil (6.67%), but rest of them either not using any measure (23%) or using the measures irregularly that produces false sense of larvae control i.e. chlorine tablets (15%)(Table-4).

DISCUSSION

Since malaria is a water related disease, we selected adult female respondent in current study because they are key person in management of water and general sanitary measures in household and sleeping arrangement of all family member. They are also care taker of children & sick persons in the family.

Yang TH (1985), Geneva, stated that environmental negligence, stagnated water collections due to mismanagement of water, lack of drainage and sanitation promote the breeding of Anopheles mosquitoes and further increase the chances of spread of malaria.[9] Usually in urban housing water drainage, ventilation and lighting is taken care of before construction and is also less liable to both dampness and mosquito resting & breeding. As far as domestic physical environment is concerned statistically significant difference was observed in the present study regarding the type of housing between urban areas and rural with slum areas. As much as more than 30% of housing was not pucca mainly in slum and rural area favoring endophilic behavior of mosquitoes (Table-1). In a survey conducted by National Council of Applied Economic Research (NCAER) during May-July 2000 in 32 slum clusters spread over Delhi. It reported that only 16.1 percent of the sample households had proper drainage system either underground or pucca.[10] M.K. Aggarwal et al in their study found 85.3 percent households had open drains in front of their and 2.3 percent households had no drainage system in Delhi slum.[9] In the present study most of all drainage systems of the rural area were open and not properly constructed, while in slum and urban areas most of them were closed type. Thus, more prevalence of mosquito breeding and higher larvae indices (52% houses, 12% containers and 81% breteau index) in rural area than urban areas was justified. In a similar study of P. Pukhan in a high risk rural area of Kamrup district Assam, 92% of tribal and 70% of non-tribal households had no proper drainage system and stated that relation of proper water management has been found to be associated with malaria occurrence. Also this study suggested some bio-environmental vector control methods which are more environmentally – friendly are: improved drainage systems, filling and leveling sites with standing water, improved water management systems, improved housing and better access to health facilities.[11]

Community knowledge regarding mosquito breeding habitat was not only poor (50%) but also misleading at places (>15%), particularly in slum respondents (60% didn't know and 20% misleading). In the similar studies conducted by Wakgari Deressa et al in Ethiopia, S. Kannathasana et al in Sri Lanka, S Matta et al in New Delhi and Muninarayana C et al in Koral district the percentage of respondents not knowing about places of mosquito egg laying were as few as 20%, 4%, 20% and 17% respectively and respondent telling other places than water body were 8%, 26%, 5% and 23% respectively.[6,12,13,14] On the other hand, most of the respondents had seen presence PORA in non potable intra-domestic water many times similar to finding of Wakgari Deressa et al and Daddi Jima et al, but they didn't know them as progenies of the mosquito and view them as biological pollution in water.[12,15] This type of ignorance may not necessitate larvae control behavior among the community.

A sizeable proportion of the respondents were knowing about most common routes of malaria

transmission and symptoms of malarial infection, but less than one third knew about various prevalent types of malaria, presentation of complicated malaria (i.e. jaundice) and other less common but dangerous diseases transmitted by mosquitoes (dengue, chikunguniya). K. Ravikumar et al in their study in Karnataka stated that regarding mosquito-borne diseases other than malaria, viz. dengue, Japanese encephalitis and Lymphatic Filariasis, the majority of the people had no idea of transmission of this disease.[16] Active surveillance is most reliable method for control and prevention of not only in malaria but in any communicable diseases. Both quantity-wise & quality-wise, we found the alarming status of active malaria surveillance, particularly in urban areas. This type of poor active surveillance for malaria in urban area may expose potential risk of epidemic, as observed in study of HC Srivastava et al during 2000 in Gujarat, but easy availability of other passive agency for fever treatment in urban area seems to be preventing such forth coming situation.[17]

Since a considerable proportion of people are seen to go to general practitioners, the competency of these practitioners needs to be strengthened for management of fever cases and for imparting health education to patients/family members, because more than half of interviewed fever cases were not screened for malaria nor imparted health education for mosquito control by treatment provider. There is also a need to improve the health-seeking behaviour of the community, family and care-givers so that they can recognize signs of severe illness and seek appropriate care when referral is indicated.

However, a considerable number (17%) was not using any preventive measures against mosquito bite at household level and there was clearly observed difference in the proportion of the use of different methods in urban, slum and rural area i.e. 100%, 80% and 69% were using at least one method respectively in above areas, similar to findings of K. Ravikumar et al.[16] Proportion of mosquito nets users (21%) was similar to study of S. Matta et al (20.2%) in Delhi, while it is more than the study of M.K. Aggarwal et al (1.7%) and K. Ravikumar et al study (8.7%).[9,14,16] In a study of Padmawati Tyagi et al in semi-rural area of Delhi, high usage of commercially available mosquito repellents (mats and coils) by urban respondents and low in rural respondents partially explained the impact of socioeconomic conditions on the selection of protection means in communities, similar to finding of a study by Pukhan P. regarding vector control & personal protection among tribal and nontribal communities in a high risk malarial rural area of Kamrup district of Assam.[11,18]

The practice of anti-larval activities was not being used in sizeable proportion of households (23%) and whatever methods were practiced by community, was a part of general sanitation in the household. S. Matta et al in a hospital based study in New Delhi observed that about 15% of sampled respondents said that they check breeding containers and among them 41.0% had changed the water, 16.2% who had cleaned the containers thoroughly and 43.2 % who added Kerosene oil.[14]

CONCLUSION

Knowledge and awareness regarding mosquito as a vector of disease is good, while the same regarding places where mosquito breeds poor and faulty in the community. Most of respondents were using personal protection against mosquito, but the prevalent use of methods adopted by NVBDCP as integrated vector control methods; i.e. ITMN (Insecticide Treated Mosquito Nets), LLIN (Long Lasting Insecticidal Nets), source reduction, larvicidal oils or chemical, biological measures, indoor residual spray etc., was negligible. Active malaria surveillance and fever treatment by private general practitioner needs to be re-addressed and strengthened by training, supervision and legislative measures.

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